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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | Q122244 2640US.C2 |

**CONFIRMATION NO. 6523**

26158
WOMBLE BOND DICKINSON (US) LLP
ATTN: IP DOCKETING
P.O. Box 570489
ATLANTA, GA 30357-0037

**POA ACCEPTANCE LETTER**

*OC00000074733233*

Date Mailed: 07/02/2024

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/19/2024.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/lvongxay/



SAMSUNG 1002

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 |

**CONFIRMATION NO. 6523**

158747
LADAS & PARRY
E-MAIL
4525 WILSHIRE BOULEVARD
SUITE 240
LOS ANGELES, CA 90010

**POWER OF ATTORNEY NOTICE**

Date Mailed: 07/02/2024

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/19/2024.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/lvongxay/

PTO/AIA/96 (11-23)
Approved for use through 05/31/2024. OMB 0651-0031
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# STATEMENT UNDER 37 CFR 3.73(c)

First Named Inventor/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: 11470595 Filed/Issue Date: 2022-10-11

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

SK TELECOM CO., LTD., a CORPORATION

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 058666, Frame 0001, or for which a copy thereof is attached*.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.



A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0031. Public burden for this form is estimated to average 12 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

PTO/AIA/96 (11-23)
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## STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ *As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

| | |
|---|---|
| /Young Seok Koo 76255/ | 2024/06/19 |
| Signature | Date |
| Young Seok Koo | 76255 |
| Printed or Typed Name | Title or Registration Number |

[Page 2 of 2]

# Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013). https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;

2) a federal, state, local, or international agency, in response to its request;

3) a contractor of the USPTO having need for the information in order to perform a contract;

4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;

5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;

6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;

7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;

8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));

9) the Office of Personnel Management (OPM) for personnel research purposes; and

10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
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# TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

| | |
|---|---|
| Application Number | 16/868,525 |
| Filing Date | 2020-05-06 |
| First Named Inventor | Juhyung SON |
| Title | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL WHICH USE DISCONTINUOUS CHANNEL |
| Art Unit | 2464 |
| Examiner Name | STEPHEN NICHOLAS STEINER |
| Attorney Docket Number | Q122244 2640US.C2 |

**SIGNATURE of Applicant or Patent Practitioner**

| | | | |
|---|---|---|---|
| Signature | /Young Seok Koo 76255/ | Date (Optional) | 2024/06/19 |
| Name | Young Seok Koo | Registration Number | 76255 |
| Title (if Applicant is a juristic entity) | | | |
| Applicant Name (if Applicant is a juristic entity) | | | |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 2 forms are submitted.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0035. Public burden for this form is estimated to average 3 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.** If filing this completed form by mail, send to: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Corresponding to PTO/AIA/82B (07/13)

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|---|---|
| | |

(Note: The boxes above may be left blank in information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

26158

**Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:**

☒ The address associated with the above-mentioned Customer Number:

**OR**

☐ The address associated with the Customer Number:

**OR**

| | | |
|---|---|---|
| ☐ Firm or individual name | | |
| Address | | |
| City | State | Zip |
| Country | | |
| Telephone | Email | |

The undersigned Applicant hereby authorizes the U.S. attorneys and agents of Womble Bond Dickinson (US) LLP, to accept and follow instructions from QUS INTERNATIONAL PATENT & LAW FIRM as to any action to be taken in the Patent and Trademark Office regarding US patent applications of the undersigned Applicant without direct communication between the U.S. attorney or agent and the undersigned Applicant. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned Applicant.

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

☐ Inventor or Joint Inventor (title not required below)
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

**SIGNATURE of Applicant for Patent**

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

| | |
|---|---|
| Signature | Date (Optional) May 7, 2024 |
| Name JIN SAM KWAK | Telephone |
| Title CEO | |

Note: Signature – This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

Corresponding to PTO/AIA/82B (07/13)

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|---|---|
| | |

(Note: The boxes above may be left blank in information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

26158

**Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:**

☒ The address associated with the above-mentioned Customer Number:

**OR**

☐ The address associated with the Customer Number:

**OR**

☐ Firm or individual name

Address

| City | State | Zip |
|---|---|---|
| | | |

Country

| Telephone | Email |
|---|---|
| | |

The undersigned Applicant hereby authorizes the U.S. attorneys and agents of Womble Bond Dickinson (US) LLP, to accept and follow instructions from QUS INTERNATIONAL PATENT & LAW FIRM as to any action to be taken in the Patent and Trademark Office regarding US patent applications of the undersigned Applicant without direct communication between the U.S. attorney or agent and the undersigned Applicant. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned Applicant.

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

SK TELECOM CO., LTD.

☐ Inventor or Joint Inventor (title not required below)
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

**SIGNATURE of Applicant for Patent**

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

| | |
|---|---|
| Signature Chanho Yun | Date (Optional) May 7, 2024 |
| Name Chahho Yun | Telephone |
| Title Director of IPR Team | |

Note: Signature – This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

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Alexandria, VA 22313 - 1450
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# ELECTRONIC ACKNOWLEDGEMENT RECEIPT

| APPLICATION # | RECEIPT DATE / TIME | ATTORNEY DOCKET # |
|---|---|---|
| **16/868,525** | **06/19/2024 01:23:23 PM Z ET** | **B-9493CON1 632642-0** |

## Title of Invention

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

## Application Information

| | | | |
|---|---|---|---|
| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | 11470595 |
| CONFIRMATION # | 6523 | FILED BY | Trexo Global |
| PATENT CENTER # | 66030973 | FILING DATE | 05/06/2020 |
| CUSTOMER # | 158747 | FIRST NAMED INVENTOR | Juhyung SON |
| CORRESPONDENCE ADDRESS | - | AUTHORIZED BY | Young Seok Koo |

## Documents

**TOTAL DOCUMENTS: 3**

| DOCUMENT | PAGES | DESCRIPTION | SIZE (KB) |
|---|---|---|---|
| Q122244 2640US.C2_3.73_1.pdf | 3 | Assignee showing of ownership per 37 CFR 3.73 | 220 KB |
| Q122244 2640US.C2_3.73_2.pdf | 3 | Assignee showing of ownership per 37 CFR 3.73 | 220 KB |
| Q122244 2640US.C2_POA.pdf | 3 | Power of Attorney | 677 KB |

## Digest

| DOCUMENT | MESSAGE DIGEST(SHA-512) |
|---|---|

| | |
|---|---|
| Q122244 2640US.C2_3.73_1.pdf | 0167AEBC58048A1704FFB2AEE483889E7DA0C245917A77FF7A806C2058F8FD1CDFD2D4F20E03F3205BC4AD19F3D52E32A84CDF5EFEA76B473E703B67A04BD767 |
| Q122244 2640US.C2_3.73_2.pdf | 448C018B48330192AB23402A3D4E9D1918C7AC858D288C66CD0EF2D35175D047F6FEB2B331E1F124DCF0B6C026CE38A90BB680939ED80537FB5C4FDBB81236FC |
| Q122244 2640US.C2_POA.pdf | E30E080A3F24DB32041B5CFD8B58212CA50D74184AA26420CD32C643F4CA3423D7F6FE9E64CDF7904D1C6E5774E55D3F5744711E9C11B68049EB074CEFCD7554 |

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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# STATEMENT UNDER 37 CFR 3.73(c)

First Named Inventor/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: 11470595 Filed/Issue Date: 2022-10-11

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., a INSTITUTE

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   SK TELECOM CO., LTD.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 058666, Frame 0001, or for which a copy thereof is attached*.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.



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*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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## STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ *As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

| | |
|---|---|
| /Young Seok Koo 76255/ | 2024/06/19 |
| Signature | Date |
| Young Seok Koo | 76255 |
| Printed or Typed Name | Title or Registration Number |

[Page 2 of 2]

# Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013). https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;

2) a federal, state, local, or international agency, in response to its request;

3) a contractor of the USPTO having need for the information in order to perform a contract;

4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;

5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;

6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;

7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;

8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));

9) the Office of Personnel Management (OPM) for personnel research purposes; and

10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 10/11/2022 | 11470595 | B-9493CON1 632642-0 | 6523 |

158747 7590 09/21/2022

LADAS & PARRY
E-MAIL
4525 WILSHIRE BOULEVARD
SUITE 240
LOS ANGELES, CA 90010

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 73 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Juhyung SON, Gyeonggi-do, KOREA, REPUBLIC OF;
Jinsam KWAK, Gyeonggi-do, KOREA, REPUBLIC OF;
Geonjung KO, Gyeonggi-do, KOREA, REPUBLIC OF;
Woojin AHN, Seoul, KOREA, REPUBLIC OF;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., Gyeonggi-do, KOREA, REPUBLIC OF;
SK TELECOM CO., LTD., Seoul, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IR103 (Rev. 10/09)

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

158747 7590 07/22/2022
LADAS & PARRY
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SUITE 240
LOS ANGELES, CA 90010

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

| (Typed or printed name) |
|---|
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $1200 | $0.00 | $0.00 | $1200 | 10/24/2022 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| STEINER, STEPHEN NICHOLAS | 2464 | 370-311000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Ladas & Parry, LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

| (A) NAME OF ASSIGNEE | (B) RESIDENCE: (CITY and STATE OR COUNTRY) |
|---|---|
| 1. WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. | GYEONGGI-DO, REPUBLIC OF KOREA |
| 2. SK TELECOM CO., LTD. | SEOUL, REPUBLIC OF KOREA |

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 12-0415

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Young Seok Koo 76,255/ Date September 6, 2022

Typed or printed name Young Seok Koo Registration No. 76,255

| Electronic Patent Application Fee Transmittal | | | | |
|---|---|---|---|---|
| **Application Number:** | 16868525 | | | |
| **Filing Date:** | 06-May-2020 | | | |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | | | |
| **First Named Inventor/Applicant Name:** | Juhyung SON | | | |
| **Filer:** | Young Seok Koo/Lianne Herbert | | | |
| **Attorney Docket Number:** | B-9493CON1 632642-0 | | | |
| Filed as Large Entity | | | | |
| **Filing Fees for Utility under 35 USC 111(a)** | | | | |
| **Description** | **Fee Code** | **Quantity** | **Amount** | **Sub-Total in USD($)** |
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| UTILITY APPL ISSUE FEE | 1501 | 1 | 1200 | 1200 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **1200** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 46559060 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo/Lianne Herbert |
| **Filer Authorized By:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 06-SEP-2022 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 16:53:13 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $1200 |
| RAM confirmation Number | E202296G55131338 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Issue Fee Payment (PTO-85B) | 632642-IssueFee-Transmittal.pdf | 127844<br>df82c30efc243f73b517488642eca2d36c4aee32 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 38105<br>76875f9e07060858102079ecfdf5629e57a26b87 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 165949 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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# NOTICE OF ALLOWANCE AND FEE(S) DUE

158747 7590 07/22/2022

LADAS & PARRY
E-MAIL
4525 WILSHIRE BOULEVARD
SUITE 240
LOS ANGELES, CA 90010

| EXAMINER |
|---|
| STEINER, STEPHEN NICHOLAS |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2464 | |

DATE MAILED: 07/22/2022

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $1200 | $0.00 | $0.00 | $1200 | 10/24/2022 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.**

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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| (Typed or printed name) |
|---|
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $1200 | $0.00 | $0.00 | $1200 | 10/24/2022 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| STEINER, STEPHEN NICHOLAS | 2464 | 370-311000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

158747 7590 07/22/2022

LADAS & PARRY
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LOS ANGELES, CA 90010

| EXAMINER | |
|---|---|
| STEINER, STEPHEN NICHOLAS | |
| **ART UNIT** | **PAPER NUMBER** |
| 2464 | |

DATE MAILED: 07/22/2022

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Notice of Allowability | Application No. 16/868,525 | Applicant(s) SON et al. | |
|---|---|---|---|
| | Examiner STEPHEN STEINER | Art Unit 2464 | AIA (FITF) Status Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--*

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to communications filed 06/12/2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 19-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☑ All b) ☐ Some* c) ☐ None of the:

   1. ☑ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | /RICKY Q NGO/<br>Supervisory Patent Examiner, Art Unit 2464 |
|---|---|

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

***1.*** The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### *Priority*

2. The present application is a continuation of application 16016520 filed 06/22/2018.

3. Receipt is acknowledged of certified copies of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

a. Certified copy of application KR10-2015-018671 was received in parent application 16016520 on 08/01/2018.

b. Certified copy of application KR10-2016-0004471 was received in parent application 16016520 on 08/31/2018.

c. Certified copy of application KR10-2016-0005835 was received in parent application 16016520 on 08/01/2018.

d. Certified copy of application KR10-2016-0026683 was received in parent application 16016520 on 08/01/2018.

e. Certified copy of application KR10-2016-0030006 was received in parent application 16016520 on 08/01/2018.

f. Certified copy of application KR10-2016-0059182 was received in parent application 16016520 on 08/01/2018.

g. Certified copy of application KR10-2016-0062422 was received in parent application 16016520 on 08/01/2018.

h. Certified copy of application KR10-2016-0083756 was received on was received in parent application 16016520 on 08/01/2018.

***Continued Examination Under 37 CFR 1.114***

4. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/13/2022 has been entered.

***Response to Arguments/Amendments***

**5. Regarding the prior art rejection**, the Applicant's arguments relating to the newly amended claims have been fully considered, and are persuasive. See section 7 below for details.

***REASONS FOR ALLOWANCE***

**6. Claims 19 - 30 are allowed.**

***Reasons For Allowance Over Prior Art***

7. The following is an examiner's statement of reasons for allowance:

The independent claims are directed towards the idea of obtaining information about unassigned resource units, information which indicates whether the center 2Mhz chunk (a 26 tone RU) in an 80Mhz or greater block is allocated to a user, using a particular configuration of information in HE-SIG-A and HE-SIG-B fields of HEW communication. HEW communication is known in the art, and the general idea of indicating unassigned RUs using HE-SIG-A and HE-SIG-B fields is also known (see e.g. Chen (US 20160330058 A1) at paragraph [0093] and Fig. 14). It is also known in the art that some for blocks (20Mhz, 80Mhz, and 80+80Mhz), the center 2Mhz chunk may need to be allocated separately (see Hedayat (US 10219271 B1) Col. 18 Lines 40 – 50), while for example the 40Mhz block does not have the center RU. The independent claims have been specifically amended to require that the claimed process of indication and allocation only be performed on 80Mhz or greater PPDUs, and not the 20Mhz PPDU indicated by Hedayat. The Examiner does not believe one of ordinary skill in the art would have found it obvious to modify Hedayat to exclude performing the claimed process on 20Mhz PPDUs, as Hedayat teaches directly away from this, and would result in an inferior system. The Examiner believes that the cited prior art, Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1), is the best available, and believes that one of ordinary skill in the art would not have found it obvious to combine with another reference(s) such that the independent claims would be taught.

Therefore **claims 19 - 30 are allowed**.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN STEINER whose telephone number is (571)272-9825. The examiner can normally be reached M - R 08:00 - 16:00; F 08:00 - 12:00.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 5712723139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO

Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S.S./
Examiner, Art Unit 2464

/RICKY Q NGO/
Supervisory Patent Examiner, Art Unit 2464

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | **Examiner** | **Art Unit** |
| | STEPHEN STEINER | 2464 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H04W | / | 72 | / | 042 | F | 2013-01-01 |
| H04W | / | 74 | / | 08 | I | 2013-01-01 |
| H04W | / | 84 | / | 12 | I | 2013-01-01 |
| H04L | / | 27 | / | 26 | I | 2013-01-01 |
| H04L | / | 5 | / | 0094 | I | 2013-01-01 |
| H04L | / | 5 | / | 0041 | I | 2013-01-01 |
| H04W | / | 74 | / | 00 | I | 2013-01-01 |
| H04L | / | 1 | / | 00 | I | 2013-01-01 |
| H04L | / | 65 | / | 40 | I | 2013-01-01 |
| H04L | / | 5 | / | 0007 | A | 2013-01-01 |
| Y02D | / | 30 | / | 70 | A | 2020-08-01 |
| H04W | / | 52 | / | 0229 | A | 2013-01-01 |
| H04W | / | 72 | / | 0453 | A | 2013-01-01 |

| CPC Combination Sets | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | / | | / | | | | | |

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | 15 July 2022 | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 12 | |
| /RICKY Q NGO/<br>Supervisory Patent Examiner, Art Unit 2464 | 18 July 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 19 | 35 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | **Examiner** | **Art Unit** |
| | STEPHEN STEINER | 2464 |

| INTERNATIONAL CLASSIFICATION | | | | |
|---|---|---|---|---|
| **CLAIMED** | | | | |
| H04W72/04 | / | 72 | / | 04 |
| H04W74/08 | / | 74 | / | 08 |
| H04W84/12 | / | 84 | / | 12 |
| H04L27/26 | / | 27 | / | 26 |
| H04L5/00 | / | 5 | / | 00 |
| H04W74/00 | / | 74 | / | 00 |
| H04L1/00 | / | 1 | / | 00 |
| H04L65/40 | / | 65 | / | 40 |
| H04W52/02 | / | 52 | / | 02 |

| NON-CLAIMED | | | | |
|---|---|---|---|---|
| | / | | / | |

| US ORIGINAL CLASSIFICATION | |
|---|---|
| **CLASS** | **SUBCLASS** |
| | |

| CROSS REFERENCES(S) | | | | | | |
|---|---|---|---|---|---|---|
| **CLASS** | **SUBCLASS (ONE SUBCLASS PER BLOCK)** | | | | | |
| | | | | | | |

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | 15 July 2022 | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 12 | |
| /RICKY Q NGO/<br>Supervisory Patent Examiner, Art Unit 2464 | 18 July 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 19 | 35 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | **Examiner** | **Art Unit** |
| | STEPHEN STEINER | 2464 |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

**CLAIMS**

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 10 | 1 | 19 | 10 | 28 | | | | | | | | |
| | 2 | | 11 | 2 | 20 | 11 | 29 | | | | | | | | |
| | 3 | | 12 | 3 | 21 | 12 | 30 | | | | | | | | |
| | 4 | | 13 | 4 | 22 | | | | | | | | | | |
| | 5 | | 14 | 5 | 23 | | | | | | | | | | |
| | 6 | | 15 | 6 | 24 | | | | | | | | | | |
| | 7 | | 16 | 7 | 25 | | | | | | | | | | |
| | 8 | | 17 | 8 | 26 | | | | | | | | | | |
| | 9 | | 18 | 9 | 27 | | | | | | | | | | |

| | | | |
|---|---|---|---|
| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | 15 July 2022 | **Total Claims Allowed:** | |
| (Assistant Examiner) | (Date) | 12 | |
| /RICKY Q NGO/<br>Supervisory Patent Examiner, Art Unit 2464 | 18 July 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 19 | 35 |

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| CPC - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 | 09/10/2021 | SS |

| CPC Combination Sets - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| | | |

| US Classification - Searched* | | | |
|---|---|---|---|
| **Class** | **Subclass** | **Date** | **Examiner** |
| | | | |

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |
|---|---|

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| Search Notes | | |
|---|---|---|
| **Search Notes** | **Date** | **Examiner** |
| Inventor Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Assignee Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| CPC Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| EAST Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Text Search (see attached) | 09/10/2021 | SS |
| EAST Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 02/28/2022 | SS |
| Text Search (see attached) | 02/28/2022 | SS |
| PE2E Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 07/15/2022 | SS |
| Text Search (see attached) | 07/15/2022 | SS |
| Interference Search (USPAT) | 07/15/2022 | SS |

| Interference Search | | | |
|---|---|---|---|
| **US Class/CPC Symbol** | **US Subclass/CPC Group** | **Date** | **Examiner** |
| All | All | 07/15/2022 | SS |

| | |
|---|---|
| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |

## Supplementary Search History (Application 16868525)

| Date | Site | Search String | References |
|---|---|---|---|
| 07/15/22 | Ip.com | <text of independent claim> | 37 (5+*) |
| 07/15/22 | Ip.com | <text of independent claim> excluding assignee | 0 (5+*) |
| 07/15/22 | Patents.google.com | ((HEW) OR (high energy wireless lan)) (he-sig-a) (he-sig-b) ((resource allocation) OR (ru allocation)) ((sta id) OR (station id)) (unassigned resource) | 385 |
| 07/15/22 | Patents.google.com | ((HEW) OR (high energy wireless lan)) (he-sig-a) (he-sig-b) ((resource allocation) OR (ru allocation)) ((sta id) OR (station id)) (unassigned resource) before:priority:20160101 | 217 |

## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 647 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | (USPAT) | OR | OFF | OFF | 2019/09/17 11:10 AM |
| L2 | 349 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | (US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:10 AM |
| L3 | 159125 | H04W52/0229.cpc. OR H04W72/042.cpc. OR H04W74/08.cpc. OR H04W84/12.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:11 AM |
| L4 | 791 | HE-SIG-A AND HE-SIG-B | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:11 AM |
| L5 | 1 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:12 AM |
| L6 | 7 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned NEAR5 (resource OR channel OR band)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:15 AM |
| L7 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L8 | 81 | L7 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L9 | 59 | L8 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L10 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:27 PM |
| L11 | 115 | L10 AND ((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:27 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OR tone)) | | | | | |
| L12 | 38 | L10 AND (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:28 PM |
| L13 | 19466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L14 | 732 | L13 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L15 | 662 | L14 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L16 | 417 | L15 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:31 PM |
| L17 | 0 | "L8" AND H04W/7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L18 | 100 | "L8" AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L19 | 323 | L16 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L20 | 19466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L21 | 732 | L20 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L22 | 662 | L21 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L23 | 417 | L22 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L24 | 323 | L23 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L25 | 2 | L24 AND (NULL ADJ | (US-PGPUB; USPAT; | OR | OFF | OFF | 2019/09/20 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | STA ADJ ID) | FPRS; EPO; JPO; DERWENT) | | | | 11:16 AM |
| L26 | 3 | ("20150334708"\|"20150349995"\|"20190124657").PN. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2019/09/20 04:25 PM |
| L27 | 20381 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L28 | 832 | L27 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L29 | 756 | L28 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L30 | 452 | L29 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L31 | 352 | L30 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L32 | 62 | L31 AND (bandwidth ADJ field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L33 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource ADJ allocation ADJ field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L34 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource NEAR3 allocation ADJ field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L35 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L36 | 0 | L31 AND ((bandwidth ADJ field) SAME (RU NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L37 | 2 | L31 AND ((bandwidth ADJ field) SAME (allocation NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L38 | 4 | L31 AND ((bandwidth ADJ field) SAME2 (allocation NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L39 | 209 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 04:42 PM |
| L40 | 86 | L39 AND (HE-SIG-A | (US-PGPUB; USPAT; | OR | OFF | OFF | 2020/01/15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OR SIG-A OR HE-SIG-B OR SIG-B) | FPRS; EPO; JPO; DERWENT) | | | | 04:42 PM |
| L41 | 62 | L40 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 04:42 PM |
| L43 | 250 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L44 | 95 | L43 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L45 | 68 | L44 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L46 | 1370 | "HE-SIG-A" AND "HE-SIG-B" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:46 AM |
| L47 | 8 | L46 AND (unassigned ADJ (resource OR RU)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:46 AM |
| L48 | 293 | "HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 11:42 AM |
| L49 | 114 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 11:43 AM |
| L50 | 55 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L51 | 112 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L52 | 29 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L53 | 3 | "20160330058" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 02:35 PM |
| L54 | 8 | ("8582592"\|"10219271"\|"20150334708"\|"20150349995"\|"20160366666"\|"20170006608"\|"20180302858"\|"20190124657").PN. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/27 08:23 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L55 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/28 06:35 PM |
| L56 | 1 | L55 AND [EMPTY_COLLECTION] | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:36 PM |
| L57 | 7 | "C26" AND HEW | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:36 PM |
| L58 | 6 | L55 AND center SAME (bandwidth OR tone) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:37 PM |
| L59 | 16 | "L4" and (CONTENT adj CHANNEL) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L60 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L61 | 2 | L60 and (CONTENT adj CHANNEL) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L62 | 89 | "HE-SIG-B" SAME2 (content ADJ channel) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:59 PM |
| L63 | 562305 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:56 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L64 | 1387 | L63 AND "HE-SIG-B" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:57 PM |
| L65 | 13 | L63 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:57 PM |
| L66 | 563039 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/09 02:11 PM |
| L67 | 13 | L66 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/09 02:11 PM |
| L68 | 801 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | (USPAT) | OR | OFF | OFF | 2021/09/10 01:07 PM |
| L69 | 589 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | (US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:07 PM |
| L70 | 320052 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |
| L71 | 0 | "L3" AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L72 | 11 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |
| L73 | 11 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/02/28 12:22 PM |
| L74 | 12 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/06/14 04:28 PM |
| L75 | 12 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/06/30 04:48 PM |
| L76 | 3 | "HE-SIG-B".clm. AND "HE-SIG-A".clm. AND "C26".clm. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/06/30 04:48 PM |
| L77 | 3 | "HE-SIG-B".clm. AND "HE-SIG-A".clm. AND "C26".clm. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/07/15 02:13 PM |

## PE2E SEARCH - Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| N42 | 7 | (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B).clm. AND ((RU OR (resource ADJ unit)) NEAR2 field).clm. | (USPAT) | OR | OFF | OFF | 2020/01/18 12:31 PM |
| N43 | 3 | "HE-SIG-B".clm. AND "HE-SIG-A".clm. AND "C26".clm. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2022/07/15 02:13 PM |

PTO/SB/30 (11-17)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

# Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

| | |
|---|---|
| Application Number | 16/868,525 |
| Filing Date | May 6, 2020 |
| First Named Inventor | Juhyung SON |
| Art Unit | 2464 |
| Examiner Name | STEINER, STEPHEN NICHOLAS |
| Attorney Docket Number | B-9493CON1 632642-0 |

**This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.**
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 12-0415 .

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

   d. ■ Payment by EFS-Web

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

***SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED***

| | | | |
|---|---|---|---|
| Signature | /Young Seok Koo 76255/ | Date | June 13, 2022 |
| Name (Print/Type) | Young Seok Koo | Registration No. | 76,255 |

***CERTIFICATE OF MAILING OR TRANSMISSION***

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office (USPTO), deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the USPTO on the date shown below.

| | | | |
|---|---|---|---|
| Signature | /Azatuhi Chinaryan/ | | |
| Name (Print/Type) | Azatuhi Chinaryan | Date | June 13, 2022 |

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| First Named Inventor: | Juhyung SON | ) Examiner: | Steiner, Stephen Nicholas |
| Application No.: | 16/868,525 | ) Confirmation No.: | 6523 |
| Filing Date: | May 6, 2020 | ) Group Art Unit: | 2464 |
| Title: | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | ) Attorney Docket: | B-9493CON1 632642-0 |
| | | ) Date: | June 13, 2022 |
| | | ) Re: | **Response to Final Office Action of March 11, 2022** |

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

**RESPONSE TO OFFICE ACTION**

Sir:

This paper is timely submitted in response to the Final Office Action mailed on March 11, 2022 for the subject application, and in conjunction with a Request for Continued Examination (hereinafter "RCE"). Please amend the application as follows and consider the Remarks set forth below.

**Amendments to the Claims** begin on page 2 of this paper.
**Remarks** begin on page 6 of this paper.

All Amendments and Remarks are made without prejudice or disclaimer.

## AMENDMENTS TO THE CLAIMS

Please amend the claims to read as indicated in the following list of claims:

**Listing of claims**

1-18. (Canceled).

19. (Currently Amended) A wireless communication terminal, the terminal comprising:

a processor;

wherein the processor is configured to:

receive a wireless packet including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field,

obtain bandwidth information indicated via a bandwidth field included in the HE-SIG-A field,

obtain information of an unassigned resource unit via at least one subfield included in the HE-SIG-B field,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and is used to obtain the information of the unassigned resource unit, and

decode a data of the received wireless packet based on the bandwidth information and the information of the unassigned resource unit,

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and

wherein ~~when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more,~~ the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz.

20. (Previously Presented) The wireless communication terminal of claim 19,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

21. (Previously Presented) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

22. (Previously Presented) The wireless communication terminal of claim 21, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

23. (Previously Presented) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

24. (Previously Presented) The wireless communication terminal of claim 23,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

25. (Currently Amended) A wireless communication method of a wireless communication terminal, the method comprising:

receiving a wireless packet including an high efficiency(HE)-signal(SIG)-A and HE-SIG-B;

obtaining bandwidth information indicated via a bandwidth field included in the HE-SIG-A;

obtaining information of an unassigned resource unit via at least one subfield included in the HE-SIG-B,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and

wherein the bandwidth field of HE-SIG-A is used to obtain the information of the unassigned resource unit; and

decoding a data of the received wireless packet based on the total bandwidth information and the information of the unassigned resource unit,

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and

wherein ~~when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more,~~ the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz.

26. (Previously Presented) The wireless communication method of claim 25,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

27. (Previously Presented) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content

channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

28. (Previously Presented) The wireless communication method of claim 27, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

29. (Previously Presented) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

30. (Previously Presented) The wireless communication method of claim 29,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

## REMARKS/ARGUMENTS

The following Remarks/Arguments are in response to the Final Office Action mailed on March 11, 2022 (hereinafter "Office Action") for the subject application. Pending in the application are claims 19-30.

In the Office Action, claims 19 and 25 stand rejected under 35 U.S.C. §103 as allegedly being obvious over U.S. Patent Application Publication No. 2016/0330058 (hereinafter "Chen") in view of U.S. Patent No. 10,219,271 (hereinafter "Hedayat"). Claims 20-24 and 26-30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat and U.S. Patent Application Publication No. 2017/0041929 (hereinafter "Noh").

In this response, claims 19 and 25 are amended. No new matter is presented as a result of these amendments. No claim is added or canceled. Claims 1-18 were previously canceled. Accordingly, the claims pending in this application after entry of this response are claims 19-30.

For at least the following reasons, this application should be considered in condition for allowance and passed to issuance.

### *Claim Rejections – 35 U.S.C. §103*

In the Office Action, claims 19 and 25 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat (See Office Action: item 7 at page 4). Claims 20-24 and 26-30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat and Noh (See Office Action: item 8 at page 9). These rejections are hereby traversed, and reconsideration and withdrawal are respectfully requested.

**Claim 19**

Claim 19 recites:

> *A wireless communication terminal, the terminal comprising:*
> *a processor;*
> *wherein the processor is configured to:*
> *receive a wireless packet including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field,*
> *obtain bandwidth information indicated via a bandwidth field included in the HE-SIG-A field,*
> *obtain information of an unassigned resource unit via at least one subfield included in the HE-SIG-B field,*

> *wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and is used to obtain the information of the unassigned resource unit, and*
>
> *decode a data of the received wireless packet based on the bandwidth information and the information of the unassigned resource unit,*
>
> *wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and*
>
> *wherein the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz.*

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claim 19 is amended to recite that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz*". (emphasis added).

A. Neither Chen nor Hedayat discloses, teaches or suggests that "*the **unassigned** resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** **and** the at least one **subfield***" as recited in claim 19 (emphasis added).

The Office Action indicates that:

> The Applicant argues that the previously cited prior art, Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1), does not teach the newly amended limitation regarding explicitly indicating the unassigned RU. The Examiner disagrees, and points to paragraph [0090], which states that one alternative for RU assignment is to explicitly indicate the non-allocated RU in the HE-SIG-B field.

(Office Action: pages 3-4).

Paragraph [0090] of Chen teaches "[i]f one STA wants to further derive its RU assignment, … explicitly indicat[ing] the non-allocated RU in the common part of the HE-SIG-B" (emphasis added). However, in claim 19, **both** "*the **bandwidth field** **and** the at least one **subfield***" are based for explicitly indicating the unassigned resource unit by reciting that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** **and** the at least one **subfield***" (emphasis added). The Chen's operation of "[i]f one STA

wants to further derive its RU assignment, … explicitly indicat[ing] the non-allocated RU in the common part of the HE-SIG-B" is not a specific disclosure, teaching or suggestion that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** **and** the at least one **subfield***" as recited in claim 19 (emphasis added).

Furthermore, in Chen, for performing the alternative (ii) taught in paragraph [0090] of Chen (i.e. If one STA wants to further derive its RU assignment, there are two alternatives: … (ii) explicitly indicate the non-allocated RU in the common part of the HE-SIG-B), "[i]f one RU is not allocated or is skipped, AP 110 may assign a special (e.g., **blank or null)** PAID which is **not decodable by or known to** any of the scheduled STA" (Chen: paragraph [0092]; emphasis added). Accordingly, Chen indicates "[i]f one RU is not allocated or is skipped" based on **one field** which is "a special (e.g., blank or null) PAID which is not decodable by or known to any of the scheduled STA". However, as discussed above, in claim 19, **both** "*the **bandwidth field** **and** the at least one **subfield***" are based for explicitly indicating the unassigned resource unit by reciting that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** **and** the at least one **subfield***" (emphasis added).

Additionally, Chen teaches that "[i]f one RU is not allocated or is skipped, AP 110 may assign a special (e.g., blank or null) PAID which is not decodable by or known to any of the scheduled STA" (Chen: paragraph [0092]; emphasis added), and therefore, even if a special value (e.g., blank or null) PAID is allocated by the AP, the STA may recognize that the allocated resource is not allocated or is skipped if it is not recognized or decoded due to an error. However, claim 19 can avoid this issue by the feature that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** **and** the at least one **subfield***" (emphasis added).

In addition, paragraphs [0098] and [0103] of Chen cited by the Examiner teach that "a RU pattern may be determined based at least in part on the number of STA and the channel bandwidth" and "the RU allocation may be determined based at least in part on the PAID, channel bandwidth, and the HE-SIG-B" (emphasis added). However, neither "a RU pattern" nor "the RU allocation" mentioned in paragraphs [0098] and [0103] of Chen is a ***specific*** disclosure, teaching or suggestion of "*the **unassigned** resource unit [of claim 19] … explicitly indicated with the information of the*

*unassigned resource unit based on the bandwidth field and the at least one subfield*" (emphasis added).

Hence, Chen fails to disclose, teach or suggest that "*the **unassigned** resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field and** the at least one **subfield***" as recited in claim 19 (emphasis added).

The Office Action does not contend that Hedayat discloses, teaches or suggests that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield*" as recited in claim 19.

B. Chen and Hedayat do not disclose, teach or suggest that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the **bandwidth field being 80 MH or more, not 20 MHz or 40 MHz***" as recited in claim 19 (emphasis added).

The Office Action does not show that Chen discloses, teaches or suggests the limitation of claim 19 that "the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz", and acknowledges that "Chen does not explicitly disclose the remainder of the claim" (See Office Action: page 6). Accordingly, Chen fails to disclose, teach or suggest that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz*" as recited in claim 19.

Hedayat does not cure Chen's failure of teaching or suggesting that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet indicated by the **bandwidth field being 80 MH or more, not 20 MHz or 40 MHz***" as recited in claim 19 (emphasis added). The Office Action states that:

> Hedayat discloses subject matter relating to HEW PPDU creation. Specifically, Hedayat discloses:
>
> the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available; see Col. 18 Lines 24 – 50)

(Office Action: page 6). Column 18, lines 29-50 of Hedayat teaches that:

> FIG. 11A is a flow chart of a process 1100 for a hierarchical encoding of a bandwidth allocation, according to an embodiment. The process 1100 produces a variable length sequence of bits (i.e., a bit string) that conveys which RUs of a 20 MHz bandwidth are allocated to respective stations. In an embodiment, the variable-length bit-stream is incorporated into a SIG-B field (such as an HE-SIG-B field) of a PPDU to be transmitted. At S1102, the process 1100 clears the bit string by setting the length of the bit string to zero.
>
> At S1104, the process 1100 appends to the bit string a first bit indicating whether a center 2 MHz (26-subcarrier) RU is allocated to a station. When the center RU is allocated to a station, the first bit has a first value (here, a 1). When the center RU is not allocated to a station, the first bit has a second value (here, a zero). The process 1100 is performed for the PPDUs with bandwidth that have a middle RU in their structure, such as 20 MHz PPDUs and 80 MHz PPDUs and 80+80 MHz PPDUs. For 40 MHz PPDUs, where there does not exist a middle 26-tone RU the process of 1100 is not performed.

(emphasis added). Accordingly, Hedayat simply teaches that 20MHz, 80MHz and 80+80 MHz PPDUs have a middle 26-tone RU which is indicated through a **first bit**, and therefore, in Hedayat, the AP indicates the middle 26-ton RU using the same bit regardless of the bandwidth. However, claim 19 requires that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet* ***indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz***" (emphasis added). Hence, Hedayat fails to make up the deficiency of Chen with respect to the limitation of claim 19 that "*the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz upon the bandwidth related to a transmission of the received wireless packet* ***indicated by the bandwidth field being 80 MH or more, not 20 MHz or 40 MHz***" (emphasis added).

* * *

For at least the foregoing reasons, the Applicant respectfully submits that claim 19 is not

obvious over Chen in view of Hedayat, and requests reconsideration and withdrawal of §103 rejection of claim 19.

**Claim 25**

The Applicant respectfully submits that arguments similar to the arguments set forth for claim 19 can be used, *mutatis mutandis*, to show that that claim 25 is not obvious over Chen in view of Hedayat, and requests reconsideration and withdrawal of the §103 rejection of claim 25.

**Claims 20-24 and 26-30**

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). The Office Action does not contend that the deficiencies of Chen and Hedayat discussed above with respect to claims 19 and 25 are cured by Noh, and therefore claims 19 and 25 are not obvious over Chen in view of Hedayat and Noh. Claims 20-24 and 26-30 depend from claim 19 or 25. Accordingly, the Applicant respectfully submits that claims 20-24 and 26-30 are patentable under 35 U.S.C. §103 at least by way of their dependencies from claim 19 or 25, and requests reconsideration and withdrawal of the §103 rejections of claims 20-24 and 26-30.

## CONCLUSION

It is believed that all of the grounds of rejection have been properly traversed, accommodated, or rendered moot. The Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (323) 934-2300.

The Commissioner is authorized to charge any additional fees which may be required or credit overpayment to deposit account no. 12-0415. In particular, if this response is not timely filed, then the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136 (a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 12-0415.

I hereby certify that this document is being transmitted electronically to the United States Patent and Trademark Office via electronic filing.

June 13, 2022
(Date of Transmission)

Young Seok Koo
(Name of Person Transmitting)

/ Young Seok Koo /
(Signature)

Respectfully submitted,

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| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 16868525 |
| **Filing Date:** | 06-May-2020 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Filer:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| Filed as Large Entity | |
| **Filing Fees for Utility under 35 USC 111(a)** | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| RCE- 1ST REQUEST | 1801 | 1 | 1360 | 1360 |
| | | **Total in USD ($)** | | **1360** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45945232 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 13-JUN-2022 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 23:23:55 |
| **Application Type:** | Utility under 35 USC 111(a) |

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|---|---|---|---|---|---|
| 1 | Request for Continued Examination (RCE) | 632642_RCE_Transmittal.pdf | 202668<br>97ea7896f2ee138bf9f30df18150ef9768f62242 | no | 2 |
| **Warnings:** | | | | | |
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| 2 | | Response632642.pdf | 259540<br>f279843b689a8004ea41e98b787999db6dd33e7c | yes | 12 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Response After Final Action | 1 | 1 |
| | Claims | 2 | 5 |
| | Applicant Arguments/Remarks Made in an Amendment | 6 | 12 |

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| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 37990<br>57138747bb7446b3a6591fe084f0b3acfc02fca3 | no | 2 |
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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>16/868,525 | Filing Date<br>05/06/2020 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☑ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED - PART I

| FOR | (Column 1)<br>NUMBER FILED | (Column 2)<br>NUMBER EXTRA | | RATE ($) | FEE ($) |
|---|---|---|---|---|---|
| ☐ BASIC FEE<br>(37 CFR 1.16(a), (b), or (c)) | N/A | N/A | | N/A | |
| ☐ SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m)) | N/A | N/A | | N/A | |
| ☐ EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q)) | N/A | N/A | | N/A | |
| TOTAL CLAIMS<br>(37 CFR 1.16(i)) | minus 20 = | * | | x $100 = | |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h)) | minus 3 = | * | | x $460 = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | | TOTAL | |

## APPLICATION AS AMENDED - PART II

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | 06/13/2022 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * 12 | Minus | ** 20 | = 0 | | x $100 = | 0 |
| | Independent<br>(37 CFR 1.16(h)) | * 2 | Minus | *** 3 | = 0 | | x $480 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | 0 |

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * | Minus | ** | = | | x $0 = | |
| | Independent<br>(37 CFR 1.16(h)) | * | Minus | *** | = | | x $0 = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | |

| | |
|---|---|
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. | SLIE |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". | /ADRIENE D. SELLMAN/ |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". | |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. | |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

158747 7590 03/11/2022

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| EXAMINER | |
|---|---|
| STEINER, STEPHEN NICHOLAS | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2464 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/11/2022 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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LA_MAIL@la.ladas.com
achinaryan@la.ladas.com
ykoo@la.ladas.com

| *Office Action Summary* | **Application No.** 16/868,525 | **Applicant(s)** SON et al. | |
|---|---|---|---|
| | **Examiner** STEPHEN STEINER | **Art Unit** 2464 | **AIA (FITF) Status** Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☑ Responsive to communication(s) filed on 12/17/2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5) ☑ Claim(s) 19-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 19-30 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 05/06/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

***1.*** The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### *Priority*

2. The present application is a continuation of application 16016520 filed 06/22/2018.

3. Receipt is acknowledged of certified copies of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

a. Certified copy of application KR10-2015-018671 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0004471 was received in parent application 16016520 on 08/31/2018.

a. Certified copy of application KR10-2016-0005835 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0026683 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0030006 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0059182 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0062422 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0083756 was received on was received in parent application 16016520 on 08/01/2018.

***Response to Arguments/Amendments***

**4. Regarding the claim interpretation in light of 35 U.S.C. §112(f) (see section 4 of the Office Action dated 09/17/2021)**, the Applicant's amendments have removed the presumption that the claim language invokes 35 U.S.C. §112(f).

**5. Regarding the 35 U.S.C. §112(b) rejection of claims 25 - 30 (see section 5 of the Office Action dated 09/17/2021)**, the Applicant's amendments have removed the grounds for rejection under 35 U.S.C. §112(b); the rejection is withdrawn.

**6. Regarding the Applicant's arguments (see pp. 7 - 11 of the Applicant's Remarks dated 12/17/2021) related to the prior art rejection (see sections 6 - 7 of the Office Action dated 09/17/2021)**, the arguments put forth have been have been fully considered, but are not persuasive. The Applicant argues that the previously cited prior art, Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1), does not teach the newly amended limitation regarding

explicitly indicating the unassigned RU. The Examiner disagrees, and points to paragraph [0090], which states that one alternative for RU assignment is to explicitly indicate the non-allocated RU in the HE-SIG-B field.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

**7. Claims 19 and 25 are rejected under 35 U.S.C. 103 as being unpatentable over Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1)**

**Regarding claim 19,** Chen discloses subject matter relating to RU allocation in HEW devices. Specifically, Chen discloses a wireless communication terminal (*device*; see Fig. 3), the terminal comprising:

a processor (*processor*; see paragraph [0068] and Fig. 3), wherein the processor is configured to:

receive a wireless packet (*PPDU with preamble is sent to STA*; see paragraph [0101] and Fig. 17) including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field (*preamble incl. HE-SIG-A and HE-SIG-B fields*; see paragraph [0076] and Fig. 4),

obtain bandwidth information indicated by a bandwidth field included in the HE-SIG-A field (*HE-SIG-A indicates total BW*; see paragraph [0061])

obtain information of an unassigned resource unit via at least one subfield included in the HE-SIG- B field (*HE-SIG-B incl. RU allocation index*; see paragraph [0088] and Fig. 10; *RU allocation field*; see paragraphs [0090 – 0091] and Fig. 12; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14)

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted (*HE-SIG-A indicates total BW used for transmission*; see paragraph [0061]), and is used to obtain the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14), and

decode a data of the received wireless packet (*data is received based on the PPDU*; see paragraph [0021]) based on the bandwidth information and the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14, wherein

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit (*non-allocated RU is explicitly indicated*; see paragraph [0090]) based on the bandwidth field and the at least one subfield (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *RU allocation is explicitly indicated in HE-SIG-B (i.e. subfield)*; see paragraph [0090]), and

when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more (*80Mhz*; see paragraph [0102]),

Chen does not explicitly disclose the remainder of the claim.

However, Hedayat discloses subject matter relating to HEW PPDU creation. Specifically, Hedayat discloses:

the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (*He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available*; see Col. 18 Lines 24 – 50)

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the disclosure of Chen with Hedayat by incorporating the bit indicating the allocation of the center tone, in a case in which 80Mhz or 80+80Mhz is available. One of ordinary skill in the art would do so in order to fully allocate all available bandwidth. Further, doing so would have been a use of a technique known in the art

to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claim 25**, Chen discloses a wireless communication method of a wireless communication terminal (*device*; see Fig. 3), the method comprising:

receiving a wireless packet (*PPDU with preamble is sent to STA*; see paragraph [0101] and Fig. 17) including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field (*preamble incl. HE-SIG-A and HE-SIG-B fields*; see paragraph [0076] and Fig. 4),

obtaining bandwidth information indicated by a bandwidth field included in the HE-SIG-A (*HE-SIG-A indicates total BW*; see paragraph [0061])

obtaining information of an unassigned resource unit via at least one subfield included in the HE- SIG-B (*HE-SIG-B incl. RU allocation index*; see paragraph [0088] and Fig. 10; *RU allocation field*; see paragraphs [0090 – 0091] and Fig. 12; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14)

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted (*HE-SIG-A indicates total BW used for transmission*; see paragraph [0061]), and

wherein the bandwidth field of HE-SIG-A is used to obtain the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14), and

decoding a data of the received wireless packet (*data is received based on the PPDU*; see paragraph [0021]) based on the bandwidth information and the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14,

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit (*non-allocated RU is explicitly indicated*; see paragraph [0090]) based on the bandwidth field and the at least one subfield (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *RU allocation is explicitly indicated in HE-SIG-B (i.e. subfield)*; see paragraph [0090]), and

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more (*80Mhz*; see paragraph [0102]),

Chen does not explicitly disclose the remainder of the claim.

However, Hedayat discloses subject matter relating to HEW PPDU creation. Specifically, Hedayat discloses:

the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (*He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available*; see Col. 18 Lines 24 – 50)

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the disclosure of Chen with Hedayat by incorporating the bit indicating the allocation of the center tone, in a case in which 80Mhz or 80+80Mhz is available. One of ordinary skill in the art would do so in order to fully allocate all available bandwidth. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**8. Claims 20 – 24, and 26 - 30 are rejected under 35 U.S.C. 103 as being unpatentable over Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1) and in further view of Noh (US 20170041929 A1)**

**Regarding claims 20 and 26**, Chen and Hedayat teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 20 and 26.

Noh discloses subject matter relating to HEW transmissions. Specifically, Noh discloses:

wherein the HE-SIG-B field comprises HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz (*HE-SIG-B content channels 1 and 2 in 20Mhz*; see paragraph [0111] and Fig. 10), and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE- SIG-B content channel 2 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the teaching of Chen and Hedayat with Noh by incorporating the two content channels and signaling the center 26 tone RU on both HE-SIG-Bs. One of ordinary skill in the art would have found it obvious to do so, as dividing up the content channels allows greater control of transmissions, and signaling the same HE-SIG-B allows for redundancy in signaling. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 21 and 27**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen further discloses:

wherein when the received wireless packet is transmitted in a total bandwidth of 80Mhz (*80Mhz*; see paragraph [0102])

Chen does not explicitly disclose the remainder of the claim.

However, Noh discloses:

both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether the center 26-tone resource unit in the bandwidth of 80 MHz is assigned to the user, when the bandwidth is 80 MHz (*both channels can carry indication of whether the center 26 tone RU belongs to the STA, incl. in the case when the channel BW is 80Mhz*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh specifying that the center RU indicator carried on both channels can operate in a scenario where the channel BW is 80Mhz. One of ordinary skill in the art would have found it obvious to do so, as this would allow the system to operate in a scenario in which the channel BW is 80Mhz. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 22 and 28**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 22 and 28.

However, Noh discloses:

wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit (*indication of whether the center 26 tone RU belongs to the STA (i.e. user)*; see

paragraphs [0125 – 0128]), a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1 (*resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128]).

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that the user field corresponding to the center tone is carried in a user specific field of the HE-SIG-B control channel 1. One of ordinary skill in the art would have found it obvious to do so, as this would allow the device to easily receive this information. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 23 and 29**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 23 and 29.

However, Noh further discloses:

wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz (*80+80 or 160Mhz transmission*; see paragraph [0123]), the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth (*2 80Mhz bands*; see

paragraph [0123]), a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE- SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth (*each 80Mhz band has center 26 RU*; see paragraph [0123]; *HE-SIG-B content channels 1 and 2 in 20Mhz*; see paragraph [0111] and Fig. 10; *resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128]).

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that, in the case of 160/80+80Mhz transmission, the center 26 RU allocation for the first and second 80Mhz bands should be done in the first and second content channels. One of ordinary skill in the art would have found it obvious to do so, as it does not particularly matter where the allocation occurs, as long as the STAs know where to find the allocation. Further, the claim would have been obvious because the substitution of one known element for another, yielding predictable results, has been determined by the Supreme Court (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)) to be obvious to one of ordinary skill in the art at the time of the invention.

**Regarding claims 24 and 30**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 24 and 30.

However, Noh further discloses:

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128]; *resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128]), and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128]; *resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that the center 26 RUs can be indicated in user specific fields of the HE-SIG-B in separate content channels. One of ordinary skill in the art would have found it obvious to do so, as this would allow the STAs to easily determine whether the particular RU is allocated to them or not. Further, the claim would have been obvious because the substitution of one known element for another, yielding predictable results, has been determined by the

Supreme Court (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)) to be obvious to one of ordinary skill in the art at the time of the invention.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN STEINER whose telephone number is (571)272-9825. The examiner can normally be reached M - R 08:00 - 16:00; F 08:00 - 12:00.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 5712723139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S.S./
Examiner, Art Unit 2464

/RICKY Q NGO/
Supervisory Patent Examiner, Art Unit 2464

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| CPC - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 | 09/10/2021 | SS |

| CPC Combination Sets - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| | | |

| US Classification - Searched* | | | |
|---|---|---|---|
| **Class** | **Subclass** | **Date** | **Examiner** |
| | | | |

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

| Search Notes | | |
|---|---|---|
| **Search Notes** | **Date** | **Examiner** |
| Inventor Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Assignee Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| CPC Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| EAST Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Text Search (see attached) | 09/10/2021 | SS |
| EAST Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 02/28/2022 | SS |
| Text Search (see attached) | 02/28/2022 | SS |

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |
|---|---|

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| Interference Search | | | |
|---|---|---|---|
| US Class/CPC Symbol | US Subclass/CPC Group | Date | Examiner |
| | | | |

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| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |

October 6, 2021

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE<br>May 6, 2020 |
| | | GROUP NO.<br>2464 |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT |
|---|---|---|
| | 1. | Office Action dated September 2, 2021 for US Patent Application No. 16/868,536 |

| *EXAMINER* | *DATE CONSIDERED* |
|---|---|
| /STEPHEN N STEINER/ | 02/28/2022 |

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.**



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.S./

## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 647 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | (USPAT) | OR | OFF | OFF | 2019/09/17 11:10 AM |
| L2 | 349 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | (US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:10 AM |
| L3 | 159125 | H04W52/0229.cpc. OR H04W72/042.cpc. OR H04W74/08.cpc. OR H04W84/12.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:11 AM |
| L4 | 791 | HE-SIG-A AND HE-SIG-B | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:11 AM |
| L5 | 1 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:12 AM |
| L6 | 7 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned NEAR5 (resource OR channel OR band)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 11:15 AM |
| L7 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L8 | 81 | L7 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L9 | 59 | L8 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/17 04:36 PM |
| L10 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:27 PM |
| L11 | 115 | L10 AND ((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:27 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OR tone)) | | | | | |
| L12 | 38 | L10 AND (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:28 PM |
| L13 | 19466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L14 | 732 | L13 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L15 | 662 | L14 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 12:44 PM |
| L16 | 417 | L15 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:31 PM |
| L17 | 0 | "L8" AND H04W/7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L18 | 100 | "L8" AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L19 | 323 | L16 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/19 01:32 PM |
| L20 | 19466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L21 | 732 | L20 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L22 | 662 | L21 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L23 | 417 | L22 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L24 | 323 | L23 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2019/09/20 11:16 AM |
| L25 | 2 | L24 AND (NULL ADJ | (US-PGPUB; USPAT; | OR | OFF | OFF | 2019/09/20 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | STA ADJ ID) | FPRS; EPO; JPO; DERWENT) | | | | 11:16 AM |
| L26 | 3 | ("20150334708"\|"20150349995"\|"20190124657").PN. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2019/09/20 04:25 PM |
| L27 | 20381 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L28 | 832 | L27 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L29 | 756 | L28 AND H04W$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L30 | 452 | L29 AND @ay<="2016" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L31 | 352 | L30 AND H04W7$.cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:50 PM |
| L32 | 62 | L31 AND (bandwidth ADJ field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L33 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource ADJ allocation ADJ field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L34 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource NEAR3 allocation ADJ field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:53 PM |
| L35 | 0 | L31 AND ((bandwidth ADJ field) SAME (resource NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L36 | 0 | L31 AND ((bandwidth ADJ field) SAME (RU NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L37 | 2 | L31 AND ((bandwidth ADJ field) SAME (allocation NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L38 | 4 | L31 AND ((bandwidth ADJ field) SAME2 (allocation NEAR3 field)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 03:54 PM |
| L39 | 209 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 04:42 PM |
| L40 | 86 | L39 AND (HE-SIG-A | (US-PGPUB; USPAT; | OR | OFF | OFF | 2020/01/15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OR SIG-A OR HE-SIG-B OR SIG-B) | FPRS; EPO; JPO; DERWENT) | | | | 04:42 PM |
| L41 | 62 | L40 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2020/01/15 04:42 PM |
| L43 | 250 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L44 | 95 | L43 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L45 | 68 | L44 AND CCA | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:39 AM |
| L46 | 1370 | "HE-SIG-A" AND "HE-SIG-B" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:46 AM |
| L47 | 8 | L46 AND (unassigned ADJ (resource OR RU)) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 09:46 AM |
| L48 | 293 | "HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 11:42 AM |
| L49 | 114 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 11:43 AM |
| L50 | 55 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L51 | 112 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L52 | 29 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) SAME2 ((resource OR RU) ADJ allocat$4) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 12:56 PM |
| L53 | 3 | "20160330058" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/27 02:35 PM |
| L54 | 8 | ("8582592"\|"10219271"\|"20150334708"\|"20150349995"\|"20160366666"\|"20170006608"\|"20180302858"\|"20190124657").PN. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/27 08:23 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L55 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/28 06:35 PM |
| L56 | 1 | L55 AND [EMPTY_COLLECTION] | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:36 PM |
| L57 | 7 | "C26" AND HEW | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:36 PM |
| L58 | 6 | L55 AND center SAME (bandwidth OR tone) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 06:37 PM |
| L59 | 16 | "L4" and (CONTENT adj CHANNEL) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L60 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L61 | 2 | L60 and (CONTENT adj CHANNEL) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:58 PM |
| L62 | 89 | "HE-SIG-B" SAME2 (content ADJ channel) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 07:59 PM |
| L63 | 562305 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:56 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L64 | 1387 | L63 AND "HE-SIG-B" | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:57 PM |
| L65 | 13 | L63 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/08/28 08:57 PM |
| L66 | 563039 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/09 02:11 PM |
| L67 | 13 | L66 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/09 02:11 PM |
| L68 | 801 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | (USPAT) | OR | OFF | OFF | 2021/09/10 01:07 PM |
| L69 | 589 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | (US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:07 PM |
| L70 | 320052 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12).cpc. | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |
| L71 | 0 | "L3" AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L72 | 11 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2021/09/10 01:16 PM |
| L73 | 11 | L70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | OR | OFF | OFF | 2022/02/28 12:22 PM |

## PE2E SEARCH - Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| N42 | 7 | (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B).clm. AND ((RU OR (resource ADJ unit)) NEAR2 field).clm. | (USPAT) | OR | OFF | OFF | 2020/01/18 12:31 PM |

## Supplementary Search History (Application 16868525)

**Site: patents.google.com:**

- ((HEW) OR (high energy wireless lan)) (he-sig-a) (he-sig-b) ((resource allocation) OR (ru allocation)) ((sta id) OR (station id)) (unassigned resource) before:priority:20160101

**Site: ip.com:**

- <text of independent claim>

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| First Named Inventor: | Juhyung SON | Examiner: | Steiner, Stephen Nicholas |
| Application No.: | 16/868,525 | Confirmation No.: | 6523 |
| Filing Date: | May 6, 2020 | Group Art Unit: | 2464 |
| Title: | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | Attorney Docket: | B-9493CON1 632642-0 |
| | | Date: | December 17, 2021 |
| | | Re: | **Response to Non-Final Office Action of September 17, 2021** |

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

**RESPONSE TO OFFICE ACTION**

Sir:

This paper is timely submitted in response to the non-Final Office Action mailed on September 17, 2021 for the subject application. Please amend the application as follows and consider the Remarks set forth below.

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks** begin on page 6 of this paper.

All Amendments and Remarks are made without prejudice or disclaimer.

## AMENDMENTS TO THE CLAIMS

Please amend the claims to read as indicated in the following list of claims:

### Listing of claims

1-18. (Canceled).

19. (Currently Amended) A wireless communication terminal, the terminal comprising:

a processor; [[~~and~~]]

~~a communication unit,~~

wherein the processor is configured to:

receive a wireless packet including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field, ~~through the communication unit,~~

obtain bandwidth information indicated via a bandwidth field included in the HE-SIG-A field,

obtain information of an unassigned resource unit via at least one subfield included in the HE-SIG-B field,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and is used to obtain the information of the unassigned resource unit, and

decode a data of the received wireless packet based on the bandwidth information and the information of the unassigned resource unit,

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more, the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz.

20. (Previously Presented) The wireless communication terminal of claim 19,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

21. (Previously Presented) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

22. (Previously Presented) The wireless communication terminal of claim 21, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

23. (Previously Presented) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

24. (Previously Presented) The wireless communication terminal of claim 23,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

25. (Currently Amended) A wireless communication method of a wireless communication terminal, the method comprising:

receiving a wireless packet including an high efficiency(HE)-signal(SIG)-A and HE-SIG-B; ~~through the communication unit;~~

obtaining bandwidth information indicated via a bandwidth field included in the HE-SIG-A;

obtaining information of an unassigned resource unit via at least one subfield included in the HE-SIG-B,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and

wherein the bandwidth field of HE-SIG-A is used to obtain the information of the unassigned resource unit; and

decoding a data of the received wireless packet based on the total bandwidth information and the information of the unassigned resource unit,

wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more, the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz.

26. (Previously Presented) The wireless communication method of claim 25,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

27. (Previously Presented) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

28. (Previously Presented) The wireless communication method of claim 27, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

29. (Previously Presented) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

30. (Previously Presented) The wireless communication method of claim 29,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

## REMARKS/ARGUMENTS

The following Remarks/Arguments are in response to the non-Final Office Action mailed on September 17, 2021 (hereinafter "Office Action") for the subject application. Pending in the application are claims 19-30.

In the Office Action, claims 25-30 stand rejected under 35 U.S.C. §112(b) as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor regards as the invention. Claims 19 and 25 stand rejected under 35 U.S.C. §103 as allegedly being obvious over U.S. Patent Application Publication No. 2016/0330058 (hereinafter "Chen") in view of U.S. Patent No. 10,219,271 (hereinafter "Hedayat"). Claims 20-24 and 26-30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat and U.S. Patent Application Publication No. 2017/0041929 (hereinafter "Noh").

In this response, claims 19 and 25 are amended. No new matter is presented as a result of these amendments. No claim is added or canceled. Claims 1-18 were previously canceled. Accordingly, the claims pending in this application after entry of this response are claims 19-30.

For at least the following reasons, this application should be considered in condition for allowance and passed to issuance.

### *Claim Interpretation – 35 U.S.C. §112(f)*

In the Office Action, the Examiner opines that:

> This application includes one or more claim limitations that do not use the word "means," but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier.
> Such claim limitation(s) is/are:
> "communication unit" in claims 19 and 25.

(Office Action: page 5). The limitation of "*communication unit*" is deleted from claims 19 and 25. Therefore, the Applicant respectfully submits that claims 19 and 25 do not include any limitation which is interpreted under 35 U.S.C. §112(f).

***Claim Rejections – 35 U.S.C. §112***

In the Office Action, claims 25-30 stand rejected under 35 U.S.C. §112(b) as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor regards as the invention (See Office Action: item 5 at page 6). The Office Action opines that there is insufficient antecedent basis for the limitation of "*the communication unit*" in claim 25 (See Office Action: item 5 at page 6). In response to this opinion, the limitation of "*the communication unit*" is removed from claim 25. Accordingly, the Applicant respectfully submits that claim 25 as amended is not indefinite, and requests reconsideration and withdrawal of the §112 rejections of claims 25-30.

***Claim Rejections – 35 U.S.C. §103***

In the Office Action, claims 19 and 25 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat (See Office Action: item 6 at page 7). Claims 20-24 and 26-30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Chen in view of Hedayat and Noh (See Office Action: item 7 at page 11). These rejections are hereby traversed, and reconsideration and withdrawal are respectfully requested.

**Claim 19**

Claim 19 recites:

> *A wireless communication terminal, the terminal comprising:*
> *a processor;*
> *wherein the processor is configured to:*
> *receive a wireless packet including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field,*
> *obtain bandwidth information indicated via a bandwidth field included in the HE-SIG-A field,*
> *obtain information of an unassigned resource unit via at least one subfield included in the HE-SIG-B field,*
> *wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and is used to obtain the information of the unassigned resource unit, and*
> *decode a data of the received wireless packet based on the bandwidth information and the information of the unassigned resource unit,*

> *wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield, and*
>
> *wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more, the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz.*

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claim 19 is amended to add the limitation of "*wherein the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the bandwidth field and the at least one subfield*".

Neither Chen nor Hedayat discloses, teaches or suggests that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added).

Firstly, nothing in Chen discloses, teaches or suggest that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added). Paragraph [0092] of Chen teaches that:

> If one RU is not allocated or is skipped, AP 110 may assign a special (e.g., **blank or null) PAID** which is **not decodable by or known to** any of the scheduled **STA**. As a result, all of the STAs 140 will skip that RU. FIG. 13 depicts a datagram illustrating an example HE-SIG-B 1300 portion indicating a sequence of RU allocation information with an unallocated RU, in accordance with example embodiments of the disclosure.

(emphasis added). Because "a special (e.g., blank or null) PAID [of Chen] is **not decodable by or known to** any of the scheduled **STA**" (Chen: paragraph [0092]; emphasis added), the STAs 140 of Chen can **implicitly** recognize that the RU was unallocated or skipped if the PAID is not decodable or known. Accordingly, in Chen, even if the information explicitly indicating the unassigned resource unit is allocated by the AP, the STA may recognize that the allocated resource is not allocated or is skipped if it is not recognized or decoded due to an error. By way of contrast, claim 19 recites that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the bandwidth field and the at least one subfield*" (emphasis added). Accordingly, "assign[ing] a special (e.g., **blank or null) PAID** which is **not**

**decodable by or known to** any of the scheduled **STA**" in an **implicit** method in Chen is not a disclosure, teaching or suggestion that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the bandwidth field and the at least one subfield*" as recited in claim 19 (emphasis added).

Further, Chen fails to disclose that the "a special (e.g., blank or null) PAID" of Chen is indicated "*based on the **bandwidth field** and the at least one **subfield***". Therefore, Chen fails to disclose that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added). Therefore, Chen does not disclose, teach or suggest that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added).

Thus, there is no disclosure, teaching or suggestion in Chen that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added).

Hedayat does not cure Chen's failure of teaching that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added). The Office Action states that "Hedayat discloses: the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (*He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available*; see Col. 18 Lines 24-50)" (Office Action: page 11). Column 18, lines 29-50 of Hedayat states that:

> FIG. 11A is a flow chart of a process 1100 for a hierarchical encoding of a bandwidth allocation, according to an embodiment. The process 1100 produces a variable length sequence of bits (i.e., a bit string) that conveys which RUs of a 20 MHz bandwidth are allocated to respective stations. In an embodiment, the variable-length bit-stream is incorporated into a SIG-B field (such as an HE-SIG-B field) of a PPDU to be transmitted. At S1102, the process 1100 clears the bit string by setting the length of the bit string to zero.
> At S1104, the process 1100 appends to the bit string a first bit indicating whether a center 2 MHz (26-subcarrier) RU is allocated to a station. When the center RU is allocated to a station, the **first bit has a first value (here, a 1).** When the center RU is not allocated to a

> station, the first bit has a second value (here, a zero). The process 1100 is performed for the PPDUs with bandwidth that have a middle RU in their structure, such as 20 MHz PPDUs and 80 MHz PPDUs and 80+80 MHz PPDUs. For 40 MHz PPDUs, where there does not exist a middle 26-tone RU the process of 1100 is not performed.

(emphasis added). Accordingly, Hedayat simply teaches that the allocation of the center RU is indicated by "the **first bit** ha[ving] a **first value** (here, a **1**)" (See Hedayat: column 18, lines 42-43). However, allocating the center RU by "the **first bit** ha[ving] a **first value** (here, a **1**)" in Hedayat is not a disclosure, teaching or suggestion that "*the unassigned resource unit is explicitly indicated with the information of the unassigned resource unit based on the **bandwidth field and** the at least one **subfield***" as recited in claim 19 (emphasis added).

Hence, Hedayat fails to make up the deficiency of Chen with respect to the limitation of claim 19 that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" (emphasis added).

Accordingly, Chen and Hedayat, individually or in combination, do not disclose, teach or suggest that "*the unassigned resource unit is **explicitly** indicated with the **information of the unassigned resource unit** based on the **bandwidth field** and the at least one **subfield***" as recited in claim 19 (emphasis added).

For at least the foregoing reasons, the Applicant respectfully submits that claim 19 is not obvious over Chen in view of Hedayat, and requests reconsideration and withdrawal of §103 rejection of claim 19.

**Claim 25**

The Applicant respectfully submits that arguments similar to the arguments set forth for claim 19 can be used, *mutatis mutandis*, to show that that claim 25 is not obvious over Chen in view of Hedayat, and requests reconsideration and withdrawal of the §103 rejection of claim 25.

**Claims 20-24 and 26-30**

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). The

Office Action does not contend that the deficiencies of Chen and Hedayat discussed above with respect to claims 19 and 25 are cured by Noh, and therefore claims 19 and 25 are not obvious over Chen in view of Hedayat and Noh. Claims 20-24 and 26-30 depend from claim 19 or 25. Accordingly, the Applicant respectfully submits that claims 20-24 and 26-30 are patentable under 35 U.S.C. §103 at least by way of their dependencies from claim 19 or 25, and requests reconsideration and withdrawal of the §103 rejections of claims 20-24 and 26-30.

## CONCLUSION

It is believed that all of the grounds of rejection have been properly traversed, accommodated, or rendered moot. The Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (323) 934-2300.

The Commissioner is authorized to charge any additional fees which may be required or credit overpayment to deposit account no. 12-0415. In particular, if this response is not timely filed, then the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136 (a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 12-0415.

I hereby certify that this document is being transmitted electronically to the United States Patent and Trademark Office via electronic filing.

December 17, 2021
(Date of Transmission)

Young Seok Koo
(Name of Person Transmitting)

/ Young Seok Koo /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 44554698 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 17-DEC-2021 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 23:50:45 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | Response632642.pdf | 96270<br>91759e8fe64743c2dbe30d0470650799f1169937 | yes | 12 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Amendment/Req. Reconsideration-After Non-Final Reject | 1 | 1 |
| | Claims | 2 | 5 |
| | Applicant Arguments/Remarks Made in an Amendment | 6 | 12 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 96270 | |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>16/868,525 | Filing Date<br>05/06/2020 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☑ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED - PART I

| FOR | (Column 1)<br>NUMBER FILED | (Column 2)<br>NUMBER EXTRA | | RATE ($) | FEE ($) |
|---|---|---|---|---|---|
| ☐ BASIC FEE<br>(37 CFR 1.16(a), (b), or (c)) | N/A | N/A | | N/A | |
| ☐ SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m)) | N/A | N/A | | N/A | |
| ☐ EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q)) | N/A | N/A | | N/A | |
| TOTAL CLAIMS<br>(37 CFR 1.16(i)) | minus 20 = | * | | x $100 = | |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h)) | minus 3 = | * | | x $460 = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | | TOTAL | |

## APPLICATION AS AMENDED - PART II

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | 12/17/2021 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * 12 | Minus | ** 20 | = 0 | | x $100 = | 0 |
| | Independent<br>(37 CFR 1.16(h)) | * 2 | Minus | *** 3 | = 0 | | x $480 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | 0 |

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * | Minus | ** | = | | x $0 = | |
| | Independent<br>(37 CFR 1.16(h)) | * | Minus | *** | = | | x $0 = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | |

| | |
|---|---|
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. | LIE |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". | /DORIS M KING/ |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". | |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. | |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE<br>May 6, 2020 |
| | | GROUP NO.<br>2464 |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT |
|---|---|---|
| | 1. | Office Action dated September 2, 2021 for US Patent Application No. 16/868,536 |

| *EXAMINER* | *DATE CONSIDERED* |
|---|---|
| | |

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.**

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 43968668 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo/Azatuhi Chinaryan |
| **Filer Authorized By:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 07-OCT-2021 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 15:05:16 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Other Reference-Patent/App/Search documents | Ref_US16868536_1stOA_9-2-2021.pdf | 521069<br>3f501efafcedfff79b4502c58ef88315b988c8d2 | no | 17 |

**Warnings:**

| Information: | | | | | |
|---|---|---|---|---|---|
| 2 | | 2021-10-06_632642_IDS.pdf | 212704<br>f020cfabc6f62fe75fb7294079064fde27c0d215 | yes | 4 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 3 |
| | Information Disclosure Statement (IDS) Form (SB08) | 4 | 4 |

| Warnings: | |
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| **Information:** | |
| **Total Files Size (in bytes):** | 733773 |

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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | Examiner: Steiner, Stephen Nicholas |
| Serial No.: 16/868,525 | Art Unit: 2464 |
| Filing Date: May 6, 2020 | Conf. No.: 6523 |
| For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" | Our Ref: B-9493CON1 632642-0 |
| Date: October 6, 2021 | Re: ***Information Disclosure Statement*** |

**INFORMATION DISCLOSURE STATEMENT**

**Mail Stop Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

*Timing and Fees*

This IDS is being filed:

[ ] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[ ] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

---

[x] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

- [ ] accompanied by the fee set forth in § 1.17(p), or
- [x] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

---

[ ] After the periods described above, and is accompanied by the fee set forth in § 1.17(p), and is

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

*Items Disclosed*

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

[ ] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

*Additional Information*

[ ] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[ ] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on May 6, 2020 and therefore are not submitted in this IDS.

[ ] Other:

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

October 6, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 | 6523 |

158747 7590 09/17/2021

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| EXAMINER | |
|---|---|
| STEINER, STEPHEN NICHOLAS | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2464 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 09/17/2021 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

LA_MAIL@la.ladas.com
achinaryan@la.ladas.com
ykoo@la.ladas.com

| *Office Action Summary* | Application No. 16/868,525 | Applicant(s) SON et al. | |
|---|---|---|---|
| | Examiner STEPHEN STEINER | Art Unit 2464 | AIA (FITF) Status Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☑ Responsive to communication(s) filed on 05/06/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5) ☑ Claim(s) 19-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 19-30 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 05/06/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

***1.*** The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### *Priority*

2. The present application is a continuation of application 16016520 filed 06/22/2018.

3. Receipt is acknowledged of certified copies of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

a. Certified copy of application KR10-2015-018671 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0004471 was received in parent application 16016520 on 08/31/2018.

a. Certified copy of application KR10-2016-0005835 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0026683 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0030006 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0059182 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0062422 was received in parent application 16016520 on 08/01/2018.

a. Certified copy of application KR10-2016-0083756 was received on was received in parent application 16016520 on 08/01/2018.

***Claim Interpretation***

The following is a quotation of 35 U.S.C. 112(f):

> (f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The claims in this application are given their broadest reasonable interpretation using the plain meaning of the claim language in light of the specification as it would be understood by one of ordinary skill in the art. The broadest reasonable interpretation of a claim element (also commonly referred to as a claim limitation) is limited by the description in the specification when 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is invoked.

As explained in MPEP § 2181, subsection I, claim limitations that meet the following three-prong test will be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph:

(A) the claim limitation uses the term "means" or "step" or a term used as a substitute for "means" that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function;

(B) the term "means" or "step" or the generic placeholder is modified by functional language, typically, but not always linked by the transition word "for" (e.g., "means for") or another linking word or phrase, such as "configured to" or "so that"; and

(C) the term "means" or "step" or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Use of the word "means" (or "step") in a claim with functional language creates a rebuttable presumption that the claim limitation is to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites sufficient structure, material, or acts to entirely perform the recited function.

Absence of the word "means" (or "step") in a claim creates a rebuttable presumption that the claim limitation is not to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is not interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation

recites function without reciting sufficient structure, material or acts to entirely perform the recited function.

Claim limitations in this application that use the word "means" (or "step") are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action. Conversely, claim limitations in this application that do not use the word "means" (or "step") are not being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action.

This application includes one or more claim limitations that do not use the word "means," but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier.

**Such claim limitation(s) is/are:**

**4. "communication unit" in claims 19 and 25.**

Because this/these claim limitation(s) is/are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, it/they is/are being interpreted to cover the corresponding structure described in the specification as performing the claimed function, and equivalents thereof.

If applicant does not intend to have this/these limitation(s) interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation(s) recite(s) sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

***Claim Rejections - 35 USC § 112***

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**5. Claims 25 – 30 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite** for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. Claim 25 recites the limitation "the communication unit". There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

**6. Claims 19 and 25 are rejected under 35 U.S.C. 103 as being unpatentable over Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1)**

**Regarding claim 19,** Chen discloses subject matter relating to RU allocation in HEW devices. Specifically, Chen discloses a wireless communication terminal (*device*; see Fig. 3), the terminal comprising:

a processor (*processor*; see paragraph [0068] and Fig. 3); and

a communication unit, wherein the processor is configured to (*transceiver*; see paragraph [0068] and Fig. 3):

receive a wireless packet (*PPDU with preamble is sent to STA*; see paragraph [0101] and Fig. 17) including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field through the communication unit (*preamble incl. HE-SIG-A and HE-SIG-B fields*; see paragraph [0076] and Fig. 4),

obtain bandwidth information indicated by a bandwidth field included in the HE-SIG-A field (*HE-SIG-A indicates total BW*; see paragraph [0061])

obtain information of an unassigned resource unit by a subfield included in the HE-SIG-B field (*HE-SIG-B incl. RU allocation index*; see paragraph [0088] and Fig. 10; *RU allocation field*; see paragraphs [0090 – 0091] and Fig. 12; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14)

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted (*HE-SIG-A indicates total BW used for transmission*; see paragraph [0061]), and is used to obtain the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14), and

decode a data of the received wireless packet (*data is received based on the PPDU*; see paragraph [0021]) based on the bandwidth information and the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14, wherein

when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more (*80Mhz*; see paragraph [0102]),

Chen does not explicitly disclose the remainder of the claim.

However, Hedayat discloses subject matter relating to HEW PPDU creation. Specifically, Hedayat discloses:

the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (*He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available*; see Col. 18 Lines 24 – 50)

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the disclosure of Chen with Hedayat by incorporating the bit indicating the allocation of the center tone, in a case in which 80Mhz or 80+80Mhz is available. One of ordinary skill in the art would do so in order to fully allocate all available bandwidth. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claim 25**, Chen discloses a wireless communication method of a wireless communication terminal (*device*; see Fig. 3), the method comprising:

receiving a wireless packet (*PPDU with preamble is sent to STA*; see paragraph [0101] and Fig. 17) including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field through the communication unit (*preamble incl. HE-SIG-A and HE-SIG-B fields*; see paragraph [0076] and Fig. 4),

obtaining bandwidth information indicated by a bandwidth field included in the HE-SIG-A (*HE-SIG-A indicates total BW*; see paragraph [0061])

obtaining information of an unassigned resource unit by a subfield included in the HE-SIG-B (*HE-SIG-B incl. RU allocation index*; see paragraph [0088] and Fig. 10; *RU allocation field*; see paragraphs [0090 – 0091] and Fig. 12; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14)

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted (*HE-SIG-A indicates total BW used for transmission*; see paragraph [0061]), and

wherein the bandwidth field of HE-SIG-A is used to obtain the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14), and

decoding a data of the received wireless packet (*data is received based on the PPDU*; see paragraph [0021]) based on the bandwidth information and the information of the unassigned resource unit (*RU pattern is determined by channel BW (i.e. BW field) in conjunction with the other fields*; see paragraphs [0098] and [0103]; *unassigned RUs can be not allocated by using RU allocation field*; see paragraph [0093] and Fig. 14, wherein

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more (*80Mhz*; see paragraph [0102]),

Chen does not explicitly disclose the remainder of the claim.

However, Hedayat discloses subject matter relating to HEW PPDU creation. Specifically, Hedayat discloses:

the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz (*He-SIG-B includes bit (i.e. field) indicating whether the center 2Mhz tone is allocated to a user, in the case where 80Mhz or 80+80Mhz is available*; see Col. 18 Lines 24 – 50)

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the disclosure of Chen with Hedayat by incorporating the bit indicating the allocation of the center tone, in a case in which 80Mhz or 80+80Mhz is available. One of ordinary skill in the art would do so in order to fully allocate all available bandwidth. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**7. Claims 20 – 24, and 26 - 30 are rejected under 35 U.S.C. 103 as being unpatentable over Chen (US 20160330058 A1) in view of Hedayat (US 10219271 B1) and in further view of Noh (US 20170041929 A1)**

**Regarding claims 20 and 26**, Chen and Hedayat teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 20 and 26.

Noh discloses subject matter relating to HEW transmissions. Specifically, Noh discloses:

wherein the HE-SIG-B field comprises HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz (*HE-SIG-B content channels 1 and 2 in 20Mhz*; see paragraph [0111] and Fig. 10), and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE- SIG-B content channel 2 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to combine the teaching of Chen and Hedayat with Noh by incorporating the two content channels and signaling the center 26 tone RU on both HE-SIG-Bs. One of ordinary skill in the art would have found it obvious to do so, as dividing up the content channels allows greater control of transmissions, and signaling the same HE-SIG-B allows for redundancy in signaling. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 21 and 27**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen further discloses:

wherein when the received wireless packet is transmitted in a total bandwidth of 80Mhz (*80Mhz*; see paragraph [0102])

Chen does not explicitly disclose the remainder of the claim.

However, Noh discloses:

both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether the center 26-tone resource unit in the bandwidth of 80 MHz is assigned to the user, when the bandwidth is 80 MHz (*both channels can carry indication of whether the center 26 tone RU belongs to the STA, incl. in the case when the channel BW is 80Mhz*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh specifying that the center RU indicator carried on both channels can operate in a scenario where the channel BW is 80Mhz. One of ordinary skill in the art would have found it obvious to do so, as this would allow the system to operate in a scenario in which the channel BW is 80Mhz. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 22 and 28**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 22 and 28.

However, Noh discloses:

wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit (*indication of whether the center 26 tone RU belongs to the STA (i.e. user)*; see paragraphs [0125 – 0128]), a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1 (*resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128]).

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that the user field corresponding to the center tone is carried in a user specific field of the HE-SIG-B control channel 1. One of ordinary skill in the art would have found it obvious to do so, as this would allow the device to easily receive this information. Further, doing so would have been a use of a technique known in the art to improve a similar device, with predictable results, which has been determined by the Supreme Court to be obvious (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)).

**Regarding claims 23 and 29**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 23 and 29.

However, Noh further discloses:

wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz (*80+80 or 160Mhz transmission*; see paragraph [0123]), the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth (*2 80Mhz bands*; see paragraph [0123]), a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE- SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth (*each 80Mhz band has center 26 RU*; see paragraph [0123]; *HE-SIG-B content channels 1 and 2 in 20Mhz*; see paragraph [0111] and Fig. 10; *resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128]).

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that, in the case of 160/80+80Mhz transmission, the center 26 RU allocation for the first and second 80Mhz bands should be done in the first and second content channels. One of ordinary skill in the art would have found it obvious to do so, as it does not particularly matter where the allocation occurs, as long as the STAs know where to find the

allocation. Further, the claim would have been obvious because the substitution of one known element for another, yielding predictable results, has been determined by the Supreme Court (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)) to be obvious to one of ordinary skill in the art at the time of the invention.

**Regarding claims 24 and 30**, Chen, Hedayat, and Noh teach the subject matter of the parent claim(s), as noted above. Chen does not explicitly disclose the limitations of claims 24 and 30.

However, Noh further discloses:

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128]; *resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128]), and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2 (*resource allocation for center 26 tone RU is carried in HE-SIG-B in either/both channels*; see paragraphs [0125 – 0128];

*resource allocation of the 26 tone center RU is carried in a STA-specific (i.e. user specific) subfield of the HE-SIG-B in any HE-SIG-B coding block*; see paragraphs [0125 – 0128])

It would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to further combine the teaching of Chen, Hedayat, and Noh with Noh by specifying that the center 26 RUs can be indicated in user specific fields of the HE-SIG-B in separate content channels. One of ordinary skill in the art would have found it obvious to do so, as this would allow the STAs to easily determine whether the particular RU is allocated to them or not. Further, the claim would have been obvious because the substitution of one known element for another, yielding predictable results, has been determined by the Supreme Court (see KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007)) to be obvious to one of ordinary skill in the art at the time of the invention.

***Conclusion***

***8.*** The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a) Yang – US 20160366666 A1 – HEW Preambles

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN STEINER whose telephone number is (571)272-9825. The examiner can normally be reached on M - R 08:00 - 16:00; F 08:00 - 12:00.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 5712723139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S.S./
Examiner, Art Unit 2464

/RICKY Q NGO/
Supervisory Patent Examiner, Art Unit 2464

| Notice of References Cited | Application/Control No. 16/868,525 | Applicant(s)/Patent Under Reexamination SON et al. | |
|---|---|---|---|
| | Examiner STEPHEN STEINER | Art Unit 2464 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-20160330058-A1 | 11-2016 | Chen; Xiaogang | H04L27/2602 | 1/1 |
| * | B | US-10219271-B1 | 02-2019 | Hedayat; Ahmad Reza | H04L5/0055 | 1/1 |
| * | C | US-20170041929-A1 | 02-2017 | NOH; Yujin | H04L5/0007 | 1/1 |
| * | D | US-20160366666-A1 | 12-2016 | Yang; Rongzhen | H04W72/042 | 1/1 |
| | E | | | | | |
| | F | | | | | |
| | G | | | | | |
| | H | | | | | |
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**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
| | O | | | | | |
| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| CPC - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 | 09/10/2021 | SS |

| CPC Combination Sets - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| | | |

| US Classification - Searched* | | | |
|---|---|---|---|
| **Class** | **Subclass** | **Date** | **Examiner** |
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* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

| Search Notes | | |
|---|---|---|
| **Search Notes** | **Date** | **Examiner** |
| Inventor Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Assignee Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| CPC Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| EAST Search (US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT) | 09/10/2021 | SS |
| Text Search (see attached) | 09/10/2021 | SS |

| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |
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| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 16/868,525 | SON et al. |
| | Examiner | Art Unit |
| | STEPHEN STEINER | 2464 |

| Interference Search | | | |
|---|---|---|---|
| US Class/CPC Symbol | US Subclass/CPC Group | Date | Examiner |
| | | | |

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| /STEPHEN N STEINER/<br>Examiner, Art Unit 2464 | |

## Supplementary Search History (Application 16868525)

**Site: patents.google.com:**

- ((HEW) OR (high energy wireless lan)) (he-sig-a) (he-sig-b) ((resource allocation) OR (ru allocation)) ((sta id) OR (station id)) (unassigned resource) before:priority:20160101

**Site: ip.com:**

- <text of independent claim>

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S1 | 647 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | USPAT | OR | OFF | 2019/09/17 11:10 |
| S2 | 349 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 11:10 |
| S3 | 159,125 | H04W52/0229.cpc. OR H04W72/042.cpc. OR H04W74/08.cpc. OR H04W84/12.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 11:11 |
| S4 | 791 | HE-SIG-A AND HE-SIG-B | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 11:11 |
| S5 | 1 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned ADJ resource) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 11:12 |
| S6 | 7 | (HE-SIG-A OR HE-SIG-B) SAME (unassigned NEAR5 (resource OR channel OR band)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 11:15 |
| S7 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 16:36 |
| S8 | 81 | S7 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 16:36 |

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| S9 | 59 | S8 AND CCA | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/17 16:36 |
| S10 | 196 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:27 |
| S11 | 115 | S10 AND ((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:27 |
| S12 | 38 | S10 AND (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:28 |
| S13 | 19,466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:44 |
| S14 | 732 | S13 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:44 |
| S15 | 662 | S14 AND H04W$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 12:44 |
| S16 | 417 | S15 AND @ay<="2016" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 13:31 |
| S17 | 0 | "L8" AND H04W/7$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 13:32 |
| S18 | 100 | "L8" AND H04W7$.cpc. | US-PGPUB; USPAT; FPRS; EPO; | OR | OFF | 2019/09/19 13:32 |

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| | | | JPO; DERWENT | | | |
| S19 | 323 | S16 AND H04W7$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/19 13:32 |
| S20 | 19,466 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S21 | 732 | S20 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S22 | 662 | S21 AND H04W$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S23 | 417 | S22 AND @ay<="2016" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S24 | 323 | S23 AND H04W7$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S25 | 2 | S24 AND (NULL ADJ STA ADJ ID) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2019/09/20 11:16 |
| S26 | 3 | ("20150334708" \| "20150349995" \| "20190124657").PN. | US-PGPUB; USPAT | OR | OFF | 2019/09/20 16:25 |
| S27 | 20,381 | (((assign$2 OR allocat$4 OR unassign$2 OR unallocat$4) NEAR5 (RU OR resource OR bandwidth OR carrier OR tone)) SAME field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:50 |
| S28 | 832 | S27 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; | OR | OFF | 2020/01/15 15:50 |

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| | | | JPO; DERWENT | | | |
| S29 | 756 | S28 AND H04W$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:50 |
| S30 | 452 | S29 AND @ay<="2016" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:50 |
| S31 | 352 | S30 AND H04W7$.cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:50 |
| S32 | 62 | S31 AND (bandwidth ADJ field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:53 |
| S33 | 0 | S31 AND ((bandwidth ADJ field) SAME (resource ADJ allocation ADJ field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:53 |
| S34 | 0 | S31 AND ((bandwidth ADJ field) SAME (resource NEAR3 allocation ADJ field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:53 |
| S35 | 0 | S31 AND ((bandwidth ADJ field) SAME (resource NEAR3 field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:54 |
| S36 | 0 | S31 AND ((bandwidth ADJ field) SAME (RU NEAR3 field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:54 |
| S37 | 2 | S31 AND ((bandwidth ADJ field) SAME (allocation NEAR3 field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:54 |

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| S38 | 4 | S31 AND ((bandwidth ADJ field) SAME2 (allocation NEAR3 field)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 15:54 |
| S39 | 209 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 16:42 |
| S40 | 86 | S39 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 16:42 |
| S41 | 62 | S40 AND CCA | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2020/01/15 16:42 |
| S43 | 250 | ((HEW OR (high ADJ efficiency)) NEAR2 (wireless ADJ LAN)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 09:39 |
| S44 | 95 | S43 AND (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 09:39 |
| S45 | 68 | S44 AND CCA | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 09:39 |
| S46 | 1,370 | "HE-SIG-A" AND "HE-SIG-B" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 09:46 |
| S47 | 8 | S46 AND (unassigned ADJ (resource OR RU)) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 09:46 |
| S48 | 293 | "HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID) | US-PGPUB; USPAT; FPRS; EPO; | OR | OFF | 2021/08/27 11:42 |

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| | | | JPO; DERWENT | | | |
| S49 | 114 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 11:43 |
| S50 | 55 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 12:56 |
| S51 | 112 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) SAME2 ((resource OR RU) ADJ allocat$4) SAME2 ((resource OR RU) ADJ allocat$4) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 12:56 |
| S52 | 29 | ("HE-SIG-A" AND "HE-SIG-B" AND ((STA OR station) ADJ ID)) AND (bandwidth ADJ field) SAME2 ((resource OR RU) ADJ allocat$4) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 12:56 |
| S53 | 3 | "20160330058" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/27 14:35 |
| S54 | 8 | ("8582592" \| "10219271" \| "20150334708" \| "20150349995" \| "20160366666" \| "20170006608" \| "20180302858" \| "20190124657").PN. | US-PGPUB; USPAT | OR | OFF | 2021/08/27 20:23 |
| S55 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | US-PGPUB; USPAT | OR | OFF | 2021/08/28 18:35 |
| S56 | 1 | S55 AND C26 | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 18:36 |
| S57 | 7 | "C26" AND HEW | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 18:36 |

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|---|---|---|---|---|---|---|
| S58 | 6 | S55 AND center SAME (bandwidth OR tone) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 18:37 |
| S59 | 16 | "L4" and (CONTENT adj CHANNEL) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 19:58 |
| S60 | 11 | (US-20180048427-$ or US-20160366666-$ or US-20190124657-$ or US-20150349995-$ or US-20150334708-$ or US-20160330718-$ or US-20170230981-$ or US-20160330058-$ or US-20180302858-$ or US-20170006608-$).did. or (US-10219271-$).did. | US-PGPUB; USPAT | OR | OFF | 2021/08/28 19:58 |
| S61 | 2 | S60 and (CONTENT adj CHANNEL) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 19:58 |
| S62 | 89 | "HE-SIG-B" SAME2 (content ADJ channel) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 19:59 |
| S63 | 562,305 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 20:56 |
| S64 | 1,387 | S63 AND "HE-SIG-B" | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 20:57 |
| S65 | 13 | S63 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/08/28 20:57 |
| S66 | 563,039 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR | US-PGPUB; USPAT; FPRS; EPO; | OR | OFF | 2021/09/09 14:11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | H04W74/08 OR H04W84/12 OR Y02D30/70 OR H04L5/0007 OR H04W72/0453).cpc. | JPO; DERWENT | | | |
| S67 | 13 | S66 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/09/09 14:11 |
| S68 | 801 | ((("WILUS") near3 ("INSTITUTE") near3 ("OF") near3 ("STANDARDS") near3 ("AND") near3 ("TECHNOLOGY") near3 ("INC")) OR (("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM. | USPAT | OR | OFF | 2021/09/10 13:07 |
| S69 | 589 | ((("SON") near3 ("Juhyung")) OR (("KWAK") near3 ("Jinsam")) OR (("KO") near3 ("Geonjung")) OR (("AHN") near3 ("Woojin"))).INV. | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | OFF | 2021/09/10 13:07 |
| S70 | 320,052 | (H04W52/0229 OR H04L1/00 OR H04L5/0041 OR H04L5/0094 OR H04L27/26 OR H04L29/08 OR H04W72/042 OR H04W74/00 OR H04W74/08 OR H04W84/12).cpc. | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/09/10 13:16 |
| S71 | 0 | "L3" AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/09/10 13:16 |
| S72 | 11 | S70 AND "HE-SIG-B" AND ((unassigned OR unallocated) ADJ resource) | US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT | OR | OFF | 2021/09/10 13:16 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S42 | 7 | (HE-SIG-A OR SIG-A OR HE-SIG-B OR SIG-B).clm. AND ((RU OR (resource ADJ unit)) NEAR2 field).clm. | USPAT | OR | OFF | 2020/01/18 12:31 |

9/11/2021 12:03:00 PM
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May 5, 2020

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>~~N/A~~ 16868525 |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE OR 371 (C) DATE<br>Concurrently Herewith<br>05/06/2020 |
| | | GROUP NO.<br>~~N/A~~ 2464 |

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| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
|---|---|---|---|---|---|---|---|
| | 1. | 10,219,271 | Feb. 26, 2019 | Hedayat et el. | | | |
| | 2. | 2017/0006608 | Jan. 5, 2017 | Josiam et al. | | | |
| | 3. | 2016/0366666 | Dec. 15, 2016 | Yang et al. | | | |
| | 4. | 2015/0349995 | Dec. 3, 2015 | ZHANG et al. | | | |
| | 5. | 2019/0124657 | Apr. 25, 2019 | KIM et al. | | | |
| | 6. | 2015/0334708 | Nov. 19, 2015 | LEE et al. | | | |
| | 7. | 2018/0302858 | Oct. 18, 2018 | SON et al. | | | |

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| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
|---|---|---|---|---|---|---|---|
| | 8. | 10-2015-0143748 | Dec. 23, 2015 | KR | | | KIPRIS |
| | 9. | 10-2015-0035569 | Apr. 6, 2015 | KR | | | KIPRIS |
| | 10. | 10-2014-0070528 | Jun. 10, 2014 | KR | | | KIPRIS |
| | 11. | 10-2015-0044875 | Apr. 27, 2015 | KR | | | KIPRIS |
| | 12. | 10-2012-0097514 | Sep. 4, 2012 | KR | | | KIPRIS |
| | 13. | 2017/111567 | Jun. 29, 2017 | WO | | | Espacenet |
| | 14. | 2015/119374 | Aug. 13, 2015 | WO | | | Espacenet |
| | 15. | 2015-527780 | Sep. 17, 2015 | JP | | | Espacenet |
| | 16. | 2014-511651 | May 15, 2014 | JP | | | Espacenet |

**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT |
|---|---|---|
| | 17. | International Search Report for PCT/KR2016/015297 mailed on April 13, 2017 and its English translation from WIPO (published as WO 2017/111567) |
| | 18. | Written Opinion of the International Searching Authority for PCT/KR2016/015297 mailed on April 13, 2017 and its English from WIPO (published as WO 2017/111567) |
| | 19. | International Preliminary Report on Patentability for PCT/KR2016/015297 issued on June 26, 2018 and its English translation from WIPO (published as WO 2017/111567) |



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.S./

May 5, 2020

| | | |
|---|---|---|
| | 20. | Office Action dated June 11, 2019 for Japanese Patent Application No. 2018-553036 and its English translation provided by Applicant's foreign council |
| | 21. | Communication dated June 24, 2019 for EP Application No. 16879434.5 |
| | 22. | ROBERT STACEY, "Specification Framework for TGax", doc.: IEEE 802.11-15/0132r13, December 7, 2015, pp. 1-38. |
| | 23. | SUNGHO MOON, et al., "Supported Resource Allocations in SIG-B", doc.: IEEE 802.11-15/1304r1, November 9, 2015, slides 1-15. |
| | 24. | KATSUO YUNOKI, et al., "Considerations on HE-SIG-A/B", doc.: IEEE 802.11-15/827r2, July 15, 2015, slides 1-14 |
| | 25. | YOUNG HOON KWON, et al., "SIG-B Field for HEW PPDU", doc.: IEEE 802.11-15/0805r2, July 13, 2015, slides 1-11 |
| | 26. | Notice of Allowance dated February 5, 2020 for U.S. Patent Application No. 16/016.520 (now published as U.S. 2018/0302858) |
| | 27. | Non-Final Office Action dated September 27, 2019 for U.S. Patent Application No. 16/016.520 (now published as U.S. 2018/0302858) |

| ***EXAMINER*** | ***DATE CONSIDERED*** |
|---|---|
| /STEPHEN N STEINER/ | 09/11/2021 |

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. sInclude copy of this form with next communication to applicant.**



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July 8, 2021

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE OR 371 © DATE<br>May 6, 2020 |
| | | GROUP NO.<br>~~OPAP~~ 2464 |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
|---|---|---|---|---|---|---|---|
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**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT |
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| | 1. | Office Action dated August 11, 2020 for Japanese Patent Application No. 2019-193365 and its English translation provided by Applicant's foreign counsel |
| | 2. | Shahrnaz Azizi et al.: "OFDMA Numerology and Structure", IEEE 802.11-15/0330r5, March 13, 2015, slides 1-50. |
| | 3. | Notice of Allowance dated October 1, 2020 for European Patent Application No. 16 879 434.5 |
| | 4. | Office Action dated November 27, 2020 for Korean Patent Application No. 10-2020-7021451 and its English translation provided by Applicant's foreign counsel |
| | 5. | Office Action dated November 27, 2020 for Korean Patent Application No. 10-2020-7021450 and its English translation provided by Applicant's foreign counsel |
| | 6. | Extended European Search Report dated April 8, 2021 for European Patent Application No. 21155498.5 |
| | 7. | Young Hoon Kwon et al.: "SIG Field Design Principle for 11ax", IEEE 802.11-15/0344R2, March 9, 2015, see slides 1-18. |

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August 11, 2020

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE OR 371 (C) DATE<br>May 6, 2020 |
| | | GROUP NO.<br>2462 2464 |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
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| | 1. | 8,582,592 | Nov. 12, 2013 | Gorokhov et al. | | | |

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| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
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| | 2. | 105165055 | Dec. 16, 2015 | CN | | | Espacenet |
| | 3. | 105120520 | Dec. 2, 2015 | CN | | | Espacenet |
| | 4. | 105122754 | Dec. 2, 2015 | CN | | | Espacenet |
| | 5. | 102835061 | Dec. 19, 2012 | CN | | | Espacenet |
| | 6. | 104995982 | Oct. 21, 2015 | CN | | | Espacenet |

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| | 9. | Office Action dated June 30, 2020 for Chinese Patent Application No. 201680076119.4 and its English translation provided by Applicant's foreign counsel |
| | 10. | Chai et al. "A Novel Time Interpolation Channel Estimation for IEEE802.11ac System", 2015, IEEE Xplore (SIG and IEEE802.11), pp. 722-725 |

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# Bibliographic Data

Application No: 16/868,525

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /STEPHEN N STEINER/ Examiner's Signature | Initials

Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

| FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 05/06/2020 | 370 | 2464 | |
| RULE | | | |

**APPLICANTS**

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., Gyeonggi-do, KOREA, REPUBLIC OF

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Geonjung KO, Gyeonggi-do, KOREA, REPUBLIC OF

Woojin AHN, Seoul, KOREA, REPUBLIC OF

**CONTINUING DATA**

This application is a CON of 16016520 06/22/2018 PAT 10687281

16016520 is a CON of PCT/KR2016/015297 12/26/2016

**FOREIGN APPLICATIONS**

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KOREA, REPUBLIC OF KR10-2016-0083756 07/01/2016

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05/13/2020

**STATE OR COUNTRY**

KOREA, REPUBLIC OF

**ADDRESS**

**FILING FEE RECEIVED**

$2,120

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
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| | | GROUP NO.<br>OPAP |

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| | | | | | | | |

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| | 3. | Notice of Allowance dated October 1, 2020 for European Patent Application No. 16 879 434.5 |
| | 4. | Office Action dated November 27, 2020 for Korean Patent Application No. 10-2020-7021451 and its English translation provided by Applicant's foreign counsel |
| | 5. | Office Action dated November 27, 2020 for Korean Patent Application No. 10-2020-7021450 and its English translation provided by Applicant's foreign counsel |
| | 6. | Extended European Search Report dated April 8, 2021 for European Patent Application No. 21155498.5 |
| | 7. | Young Hoon Kwon et al.: "SIG Field Design Principle for 11ax", IEEE 802.11-15/0344R2, March 9, 2015, see slides 1-18. |

| *EXAMINER* | *DATE CONSIDERED* |
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| | |

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | Examiner: Central, Docket |
| | Art Unit: OPAP |
| Serial No.: 16/868,525 | Conf. No.: 6523 |
| Filing or 371 (c) Date: May 6, 2020 | Our Ref: B-9493CON1 632642-0 |
| For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" | Re: ***Information Disclosure Statement*** |
| Date: July 8, 2021 | |

**INFORMATION DISCLOSURE STATEMENT**

**Mail Stop Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

*Timing and Fees*

This IDS is being filed:

[ ] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[x] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

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[ ] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

[ ] accompanied by the fee set forth in § 1.17(p), or

[ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

[ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

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[ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

[ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56© more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

*Items Disclosed*

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

[ ] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

*Additional Information*

[x] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[x] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on May 6, 2020 and therefore are not submitted in this IDS.

[ ] Other:

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

July 8, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76255 /

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| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 43204490 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo/Azatuhi Chinaryan |
| **Filer Authorized By:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 08-JUL-2021 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 22:48:53 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 2021-07-08_632642_IDS.pdf | 155463<br>8a86695d92a8dac40000c9f006d6e2616697a989 | yes | 4 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | **Document Description** | **Start** | **End** | | |
| | Information Disclosure Statement (IDS) Form (SB08) | 4 | 4 | | |
| | Transmittal Letter | 1 | 3 | | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | Ref2_IEEE_802_11-15_0330r5.pdf | 3871974<br>adf39cce8a15f3344e213544cb89c46de9f6eeb7 | no | 50 |
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| **Information:** | | | | | |
| 3 | Other Reference-Patent/App/Search documents | Ref3_EP168794345_2ndNOA_10-1-2020.pdf | 441254<br>886a21cb4cc9dd42db218962ceaa8bda2b76e4c1 | no | 7 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Other Reference-Patent/App/Search documents | Ref4_KR10-2020-7021451_OA_11-27-2020.pdf | 112998<br>8c386f1da30ff5d80d1dc3d4d9b1092ad584ac3b | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Other Reference-Patent/App/Search documents | Ref5_KR10-2020-7021450_OA_11-27-2020.pdf | 131683<br>07d2b8232cd3530f706c7733ee021f772f5d9062 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Other Reference-Patent/App/Search documents | Ref6_EP211554985_ESSR_4-8-2021.pdf | 319747<br>daa5e06948c53199d098d34055590b4e2683a79f | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Non Patent Literature | Ref7_802_11-15-0344r2.pdf | 1308883<br>8b1fff51bc4619546cc24ba91c5be23bf5c292e5 | no | 18 |
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| **Information:** | | | | | |
| 8 | Other Reference-Patent/App/Search documents | Ref1_JP2019-193365_OA_8-11-2020.pdf | 255356<br>9ed39bfa29032ea73560eac690c289c03ae1f269 | no | 4 |
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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 16/868,525 | 05/06/2020 | Juhyung SON | B-9493CON1 632642-0 |

**CONFIRMATION NO. 6523**

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

**PUBLICATION NOTICE**




**Title:**WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

**Publication No.**US-2020-0267653-A1
**Publication Date:**08/20/2020

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>16/868,525 |
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| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE OR 371 (C) DATE<br>May 6, 2020 |
| | | GROUP NO.<br>2462 |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
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| | 1. | 8,582,592 | Nov. 12, 2013 | Gorokhov et al. | | | |

**FOREIGN PATENT DOCUMENTS**

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|---|---|---|---|---|---|---|---|
| | 2. | 105165055 | Dec. 16, 2015 | CN | | | Espacenet |
| | 3. | 105120520 | Dec. 2, 2015 | CN | | | Espacenet |
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| | 9. | Office Action dated June 30, 2020 for Chinese Patent Application No. 201680076119.4 and its English translation provided by Applicant's foreign counsel |
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Espacenet

## Bibliographic data: CN105165055 (A) — 2015-12-16

# Systems and methods for aggregation of physical protocol data units on wireless network

**Inventor(s):** VERMANI SAMEER; TIAN BIN; TANDRA RAHUL ± (VERMANI SAMEER, ; TIAN BIN, ; TANDRA RAHUL)

**Applicant(s):** QUALCOMM INC ± (QUALCOMM, INCORPORATED)

**Classification:** - international: ***H04W28/06***
- cooperative: **H04L69/323 (US); H04W28/065 (EP, US);** H04L27/2613 (EP, US); H04L5/0007 (EP, US)

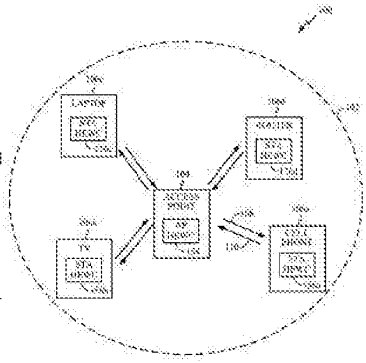
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Abstract of CN105165055 (A)

Systems and methods for aggregation of multiple physical protocol data units are disclosed. In one aspect, a method of transmitting a physical layer packet to a plurality of wireless devices is disclosed. The method includes generating a physical layer packet, the packet including a plurality of payloads, wherein at least one of the payloads comprises first data addressed to a first device and second data addressed to a second device, and wherein each payload is preceded by at least a signal field in the physical layer packet, and transmitting the physical layer packet.



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## CLAIMS CN105165055A

1.

A method for transmitting physical layer packets to multiple wireless devices includes:

Generate a physical layer packet to include a first signaling field, a first payload following the first signaling field, a first training field following the first payload, and a first training field following the first training field And a second payload following the second signaling field, wherein at least one of these payloads includes the first data addressed to the first device and the second data addressed to the second device Data; and

The physical layer packet is transmitted.

2.

The method of claim 1, wherein the physical layer packet is generated to include a second training field between the first training field and the second signaling field.

3.

5. The method of claim 1, further comprising indicating a transmission schedule associated with the plurality of loads in the physical layer packet.

4.

The method of claim 3, further comprising indicating the transmission schedule in a duration field of the first signaling field.

5.

The method of claim 1, further comprising generating the first signaling field to indicate whether the first payload uses single-user transmission, multi-user multiple-input multiple-output (MU-MIMO) transmission Or one of Orthogonal Frequency Division Multiple Access (OFDMA) transmission.

6.

The method of claim 5, further comprising:

Generating the first payload to include a subband, the subband including third data and fourth data, wherein the third data and the fourth data are addressed to different devices; and

The first payload is transmitted using OFDMA.

7.

7. The method of claim 6, further comprising separating the transmission of the third data and the fourth data in time by a signature in the subband.

8.

The method of claim 6, further comprising: performing a modulation and coding scheme (MCS) of a destination device of the third data and a modulation and coding scheme (MCS) of a destination device of the fourth data. The transmission of the third data and the fourth data is sorted.

9.

A device for transmitting physical layer packets to multiple wireless devices includes:

A processor configured to generate a physical layer packet, the packet including a first signaling field, a first payload following the first signaling field, and a first training field following the first payload , A second signaling field following the first training field, and a second payload following the second signaling field, wherein at least one of these payloads includes a first device addressed to the first device Data and second data addressed to the second device; and

A transmitter configured to transmit the physical layer packet.

10.

9. The apparatus of claim 9, wherein the processor is further configured to generate the physical layer packet to include a second training field between the first training field and the second signaling field Field.

11.

The apparatus of claim 9, wherein the processor is further configured to generate the physical layer packet to indicate a transmission schedule associated with the plurality of loads.

12.

The apparatus of claim 11, wherein the processor is further configured to indicate the transmission schedule in a duration field of a signaling field before the plurality of loads.

13.

The device of claim 9, wherein the processor is further configured to generate the packet to include a signaling field before the first load in the plurality of loads to indicate whether the first load is tl is transmitted using one of single-user transmission, multi-user multiple-input multiple-output transmission (MU-MIMO) transmission, or orthogonal frequency division multiple access (OFDMA) transmission.

14.

The device of claim 13, wherein:

The processor is further configured to generate the first payload to include a subband, the subband including third data and fourth data, wherein the third data and the fourth data are addressed to different devices; and

The transmitter is further configured to use OFDMA to transmit the first payload.

15.

The apparatus of claim 14, wherein the processor is further configured to be based on the modulation and coding scheme (MCS) of the destination device of the third data and the modulation and coding scheme (MCS) of the destination device of the fourth data ( MCS) to sort the transmission of the third data and the fourth data.

16.

A method for receiving high-efficiency physical data packets from a wireless network, the method comprising:

Receive physical layer packets from the wireless network;

Decode the packet to identify the first field;

Decoding the first field to identify a first payload from the packet, the first payload including first data addressed to the first device and second data addressed to the second device;

Decode the packet to identify the second field; and

Decoding the second field to identify a second payload, the second payload including third data addressed to at least one of the first device, the second device, or the third device.

17.

The method of claim 16, further comprising:

The packet is decoded to identify a signature that separates the first and second payloads in the physical layer packet, the decoding is based on the signature, and the signature includes a short training field, a long training field, and a signaling field. One or more of; and

The second payload is decoded based on the identified signature.

18.

The method of claim 16, further comprising decoding the physical layer packet to determine the transmission schedule associated with the first and second loads.

19.

The method of claim 18, further comprising decoding the duration field in the corresponding signaling field to determine the transmission schedule of the payload.

20.

The method of claim 16, further comprising decoding the signaling field before the payload to determine whether the payload is via single-user transmission, multi-user multiple input multiple output (MU-MIMO) transmission or normal Frequency division multiple access (OFDMA) transmission to receive.

21.

The method of claim 16, further comprising receiving the first payload via OFDMA, and decoding the subband of the OFDMA payload to determine that the third data and the fourth data are addressed to different devices.

22.

22. The method of claim 21, further comprising decoding data in the subband based on a group identifier.

23.

The method of claim 21, further comprising decoding a signaling field before the payload to determine the number of frequency

subbands in the payload including data transmitted to the at least two different devices Instructions.

24.

A device for receiving high-efficiency physical data packets from a wireless network, the device comprising:

A receiver configured to receive physical layer packets from the wireless network,

The processor, which is configured to:

Decode the packet to identify the first field;

Decoding the first field to identify a first payload from the packet, the first payload including first data addressed to the first device and second data addressed to the second device;

Decode the packet to identify the second field; and

Decoding the second field to identify a second payload, the second payload including third data addressed to at least one of the first device, the second device, or the third device.

25.

The apparatus of claim 24, wherein the processor is further configured to:

The packet is decoded to identify a signature that separates the first and second payloads in the physical layer packet, and the decoding is based on the signature. The signature includes the short training field, the long training field, and the signaling field. One or more; and

The second payload is decoded based on the identified signature.

26.

The apparatus of claim 24, wherein the processor is further configured to decode the physical layer packet to determine a transmission schedule associated with the first and second loads.

27.

The apparatus of claim 26, wherein the processor is further configured to decode the duration field in the corresponding signaling field to determine the transmission schedule of the payload.

28.

The apparatus of claim 24, wherein the processor is further configured to decode the signaling field before the payload to determine whether the payload is transmitted via single-user transmission, multi-user multiple-input multiple-output transmission (MU- MIMO) transmission or orthogonal frequency division multiple access (OFDMA) transmission to receive.

29.

The device of claim 24, wherein the processor is further configured to receive the first payload via OFDMA, and to identify a part of the device addressed to the device in the OFDMA subband of the first payload data.

30.

The apparatus of claim 29, wherein the processor is further configured to decode data in the subband based on a group identifier.

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## DESCRIPTION CN105165055A

A system and method for the aggregation of multiple physical protocol units are disclosed. In one aspect, a method of transmitting physical layer packets to multiple wireless devices is disclosed. The method includes generating a physical layer packet, the packet including a plurality of payloads, wherein at least one payload includes first data addressed to a first device and second data addressed to a second device, and wherein each of the physical layer packets There is at least a signaling field before the payload and the physical layer packet is transmitted.

System and method for aggregation of physical protocol data units on wireless network

background

field

This application relates generally to wireless communications, and more specifically to systems, methods, and devices for aggregation of PPDUs within a single wireless packet.

Background technique

In many telecommunications systems, communication networks are used to exchange messages between several spatially separated interactive devices. Networks can be classified according to geographic areas, which may be, for example, urban areas, local areas, or personal areas. Such networks can be designated as wide area networks (WAN), metropolitan area networks (MAN), local area networks (LAN), wireless local area networks (WLAN), or personal area networks (PAN), respectively. The network also depends on the switching/routing technology used to interconnect various network nodes and devices (for example, circuit switching vs. packet switching), the type of physical medium used for transmission (for example, wired vs. wireless), and the The communication protocol set (for example, Internet Protocol Set, SONET (Synchronous Optical Networking), Ethernet, etc.) is different.

When network elements are mobile and thus have dynamic connectivity requirements, or when the network architecture is formed in an ad hoc topology instead of a fixed topology, wireless networks are often preferred. Wireless networks use electromagnetic waves in radio, microwave, infrared, optical and other frequency bands to use invisible physical media in an unguided propagation mode. When compared with fixed wired networks, wireless networks advantageously facilitate user mobility and rapid on-site deployment.

However, multiple wireless networks may exist in the same building, in adjacent buildings, and/or in the same outdoor area. The ubiquity of multiple wireless networks can cause interference, reduced throughput (e.g., because each wireless network operates in the same area and/or frequency spectrum), and/or prevent specific devices from communicating. Therefore, improved systems, methods, and devices for communicating when wireless networks are densely populated are desirable.

Overview

The systems, methods, and devices of the present invention each have several aspects, of which no single aspect is responsible for its desired attributes. Without limiting the scope of the invention as expressed by the appended claims, some

features will now be discussed briefly. After considering this discussion, and especially after reading the section entitled "Detailed Description", one will understand how the features of the present invention provide advantages including improved communication between access points and stations in a wireless network of.

One aspect disclosed is a method or apparatus for transmitting physical layer packets to multiple wireless devices. Another aspect is a computer-readable storage medium that stores instructions to perform the method. The method includes generating a physical layer packet to include a plurality of payloads, where at least one payload includes first data addressed to a first device and second data addressed to a second device, and wherein each payload in the physical layer packet At least there is a signaling field; and the physical layer packet is transmitted. Some aspects of the method also include generating a physical layer packet to separate the loads in the physical layer packet by one or more of a short training field, a long training field, and a signaling field. Some aspects of the method include generating the physical layer packet to indicate a transmission schedule associated with the plurality of loads. Some aspects of the method include indicating the transmission schedule in a duration field of a signaling field before the plurality of payloads.

In some aspects, the method further includes generating the packet to include a signaling field before the first payload of the plurality of payloads to indicate whether the first payload is using single-user transmission, multi-user multiple-input multiple-output transmission (MU- MIMO) transmission or Orthogonal Frequency Division Multiple Access (OFDMA) transmission. In some aspects, the method further includes generating the first payload to include a subband, the subband including third data and fourth data, wherein the third data and the fourth data are addressed to different devices; and transmitting the first payload using OFDMA Load.

In some aspects, the transmission of the third data and the fourth data is separated in time by a signature in the subband. In some aspects, the method further includes ordering the transmission of the third and fourth data based on the modulation and coding scheme (MCS) of the destination device of the third data and the modulation and coding scheme (MCS) of the destination device of the fourth data .

Another aspect disclosed is a method and apparatus for receiving high-efficiency physical data packets from a wireless network. Another aspect is a computer-readable storage medium that stores instructions that, when executed, cause a processor to perform the method. The method includes receiving a physical layer packet from a wireless network; decoding the packet to identify a first signaling field; decoding the first signaling field to identify a first payload from the packet, the first payload including a packet addressed to a first device First data and second data addressed to the second device; decode the packet to identify the second signaling field; and decode the second signaling field to identify the second payload, the second payload including addressing to the first device, Third data of at least one of the second device or the third device.

In some aspects, the method further includes identifying a signature separating the first and second payloads in the physical layer packet, where the signature is one or more of a short training field, a long training field, and a signaling field. In some aspects, the method further includes decoding the physical layer packet to determine the transmission schedule associated with the first and second payloads. In some aspects, the method further includes decoding the duration field in the corresponding signaling field to determine the transmission schedule of the payload. In some aspects, the method further includes decoding the signaling field before the payload to determine whether the payload is via single-user transmission, multi-user multiple-input multiple-output (MU-MIMO) transmission, or orthogonal frequency division multiple access (OFDMA) transmission To deliver. In some aspects of the method, the first payload is received via OFDMA, and wherein the subband of the OFDMA payload includes third data and fourth data, wherein the third data and the fourth data are addressed to different devices. In some aspects of the method, the method includes decoding the data in the subband based on the group identifier. In some aspects of the method, the method further includes decoding a signaling field before the payload to determine that the payload includes an indication of the number of frequency subbands of data transmitted to the at least two different devices.

Brief description of the drawings

Figure 1 shows an exemplary wireless communication system in which aspects of the present disclosure may be employed.

FIG. 2A shows a wireless communication system in which multiple wireless communication networks exist.

FIG. 2B shows another wireless communication system in which multiple wireless communication networks exist.

Fig. 3 shows a frequency reuse technique that can be used in the wireless communication system of Figs. 1 and 2B.

FIG. 4 shows a functional block diagram of an exemplary wireless device that can be employed in the wireless communication system of FIGS. 1, 2B, and 3.

Figure 5A illustrates an exemplary structure of physical layer packets that can be used in high-efficiency WiFi implementations.

Figure 5B shows a part of the high efficiency grouping.

Figure 5C shows another implementation of high efficiency grouping.

Figure 5C shows an exemplary implementation of high efficiency grouping.

Figure 5E shows an exemplary implementation of high efficiency payload and high efficiency signaling fields.

Figure 6 is a flowchart of a process for transmitting high-efficiency packets on a wireless network.

Figure 7 is a flowchart of a process for receiving high-efficiency packets on a wireless network.

A detailed description

The various aspects of the novel system, apparatus, and method are described more fully below with reference to the accompanying drawings. However, the present disclosure can be implemented in many different forms and should not be construed as being limited to any specific structure or function given throughout the present disclosure. Rather, these aspects are provided so that the present disclosure will be thorough and complete, and they will fully convey the scope of the present disclosure to those skilled in the art. Based on the teachings herein, those skilled in the art should appreciate that the scope of the present disclosure is intended to cover any aspect of these novel systems, devices, and methods disclosed herein, regardless of whether they are implemented independently or in conjunction with any other aspects of the present invention. Realized by the combination of aspects. For example, any number of aspects set forth herein can be used to implement a device or practice method. In addition, the scope of the present invention is intended to cover devices or methods practiced using other structures, functions, or structures and functions that complement or differ from the various aspects of the present invention described herein. It should be understood that any aspect disclosed herein can be implemented by one or more elements of the claims.

Although specific aspects are described herein, numerous variations and permutations of these aspects fall within the scope of this disclosure. Although some benefits and advantages of the preferred aspects are mentioned, the scope of the present disclosure is not intended to be limited to specific benefits, uses, or goals. On the contrary, the various aspects of the present disclosure are intended to be widely applicable to different wireless technologies, system configurations, networks, and transmission protocols, some of which are illustrated in the drawings and the following description of preferred aspects by way of example. The detailed description and the drawings merely illustrate the present disclosure rather than limit the present disclosure, and the scope of the present disclosure is defined by the appended claims and their equivalent technical solutions.

Popular wireless network technologies may include various types of wireless local area networks (WLAN). WLAN can be used to interconnect nearby devices using widely used networking protocols. The various aspects described herein can be applied to any communication standard, such as a wireless protocol.

In some aspects, orthogonal frequency division multiplexing (OFDM), direct sequence spread spectrum (DSSS) communication, a combination of OFDM and DSSS communication, or other schemes may be used to transmit wireless signals according to the high efficiency 802.11 protocol. The implementation of the high-efficiency 802.11 protocol can be used for Internet access, sensors, metering, smart grid, or other wireless applications. Advantageously, aspects of a particular device that uses the technology disclosed herein to implement high-efficiency 802.11 protocols may include additional peer-to-peer services (for example, Miracast, WiFiDirect services, social WiFi, etc.) in the same area, and support for each additional Users require minimum throughput, support more users, provide improved outdoor coverage and stability, and/or consume less power than devices that implement other wireless protocols.

In some implementations, the WLAN includes various devices as components that access the wireless network. For example, there may be two types of devices: access points ("AP") and clients (also called stations or "STA"). Generally speaking, the AP can be used as the hub or base station of the WLAN, and the STA is used as the user of the WLAN. For example, the STA may be a laptop computer, personal digital assistant (PDA), mobile phone, or the like. In an example, the STA connects to the AP via a wireless link that complies with WiFi (eg, IEEE 802.11 protocol) to obtain general connectivity to the Internet or to other wide area networks. In some implementations, STAs can also be used as APs.

An access point ("AP") may also include, be implemented as, or be referred to as a Node B, a radio network controller ("RNC"), an evolved Node B, a base station controller ("BSC"), a base transceiver station ("BTS"), base station ("BS"), transceiver function ("TF"), radio router, radio transceiver, or some other term.

A station ("STA") may also include, be implemented as, or be referred to as an access terminal ("AT"), subscriber station, subscriber unit, mobile station, remote station, remote terminal, user terminal, user agent, user equipment , User equipment, or

some other term. In some implementations, access terminals may include cellular phones, cordless phones, Session Initiation Protocol ("SIP") phones, wireless local loop ("WLL") stations, personal digital assistants ("PDAs"), and wireless connection capabilities Handheld device, or some other suitable processing device connected to a wireless modem. Therefore, one or more aspects taught herein can be incorporated into phones (e.g., cellular phones or smart phones), computers (e.g., laptop devices), portable communication devices, handsets, portable computing devices (e.g., personal Data assistant), entertainment equipment (for example, music or video equipment, or satellite radio), gaming equipment or systems, global positioning system equipment, or any other suitable equipment configured to communicate via a wireless medium.

As discussed above, certain devices described herein may implement, for example, the high efficiency 802.11 standard. Such devices (whether used as STA or AP or other devices) can be used for smart metering or in smart grids. Such devices can provide sensor applications or be used in home automation. These devices can be used instead or in addition in health care environments, for example for personal health care. These devices can also be used for supervision to enable extended range of Internet connectivity (for example, for use with hotspots), or to enable machine-to-machine communication.

Figure 1 shows an exemplary wireless communication system 100 in which aspects of the present disclosure may be employed. The wireless communication system 100 may operate in accordance with a wireless standard, such as a high-efficiency 802.11 standard. The wireless communication system 100 may include an AP 104 that communicates with STAs 106a-d.

Various procedures and methods can be used for the transmission between the AP 104 and the STAs 106a-d in the wireless communication system 100. For example, signals can be transmitted and received between AP 104 and STA 106 according to OFDM/OFDMA technology. If this is the case, the wireless communication system 100 may be referred to as an OFDM/OFDMA system. Alternatively, signals can be sent and received between AP104 and STA106a-d according to code division multiple access (CDMA) technology. If this is the case, the wireless communication system 100 may be referred to as a CDMA system.

The communication link that facilitates the transmission from the AP 104 to one or more STAs 106 may be referred to as the downlink (DL) 108, and the communication link that facilitates the transmission from the one or more STAs 106 to the AP 104 may be referred to as the uplink (UL) 110. Alternatively, the downlink 108 may be referred to as the forward link or forward channel, and the uplink 110 may be referred to as the reverse link or reverse channel.

The AP 104 can act as a base station and provide wireless communication coverage in a basic service area (BSA) 102. The AP 104 together with the STAs 106 that are associated with the AP 104 and use the AP 104 to communicate may be referred to as a basic service set (BSS). It should be noted that the wireless communication system 100 may not have a central AP 104, but may function as a peer-to-peer network between STAs 106. Accordingly, the functions of the AP 104 described herein may alternatively be performed by one or more STAs 106.

In some aspects, the STA 106 may be required to associate with the AP 104 to send communications to and/or receive communications from the AP 104. In one aspect, the information used for association is included in the broadcast made by the AP 104. In order to receive such a broadcast, for example, the STA 106 may perform a wide coverage search on the coverage area. For example, the search may also be performed by the STA 106 by scanning the coverage area in a beacon manner. After receiving the information for association, the STA 106 may transmit a reference signal, such as an association probe or request, to the AP 104. In some aspects, the AP 104 may use backhaul services, for example, to communicate with a larger network, such as the Internet or the public switched telephone network (PSTN).

In one embodiment, the AP 104 includes an AP high efficiency wireless component (HEWC) 154. APHEWC 154 may perform some or all of the operations described herein to enable the use of high-efficiency 802.11 protocols to communicate between AP 104 and STA 106. The functionality of APHEWC 154 is described in more detail below with reference to at least FIGS. 2B, 3 and 4.

Alternatively or in addition, STA106 may include STAHEWC156. STAHEWC 156 may perform some or all of the operations described herein to enable communication between STA 106 and AP 104 using the high frequency 802.11 protocol. The functionality of STAHEWC156 is described in more detail below with reference to at least FIGS. 2B, 3, and 4.

In some environments, one BSA may be located near other BSAs. For example, FIG. 2A shows a wireless communication system 200 in which multiple wireless communication networks exist. As illustrated in Figure 2A, BSA 202A, 202B, and 202C may be physically adjacent to each other. Although BSA202A-C is in close proximity, AP204A-C and/or STA206A-H can each communicate using the same frequency spectrum. Therefore, if a device in BSA 202C (for example, AP204C) is transmitting data, a device outside of BSA 202C (for example, AP204A-B or STA206A-F) can listen to the communication on the medium.

Generally speaking, wireless networks using conventional 802.11 protocols (e.g., 802.11a, 802.11b, 802.11g, 802.11n, etc.) operate under a carrier sense multiple access (CSMA) mechanism for medium access. According to CSMA, the device listens

to the medium and only transmits when the medium is sensed to be idle. Therefore, if AP204A-C and/or STA206A-H are operating according to the CSMA mechanism and a device in BSA202C (for example, AP204C) is transmitting data, AP204A-B and/or STA206A-F other than BSA202C cannot be on the medium Transmit even if these APs and/or STAs are part of a different BSA.

Figure 2A illustrates this scenario. As illustrated in Figure 2A, AP204C is transmitting on the medium. This transmission is heard by STA206G in the same BSA202C as AP204C, and by STA206A in a different BSA from AP204C. Although the transmission can be addressed to STA206G and/or only STAs in BSA202C, STA206A may not be able to transmit or receive communications (for example, to or from AP204A until AP204C (and any other device) is no longer transmitting on the medium). ). Although not shown, the same applies to STA206D-F in BSA202B and/or STA206B-C in BSA202A (for example, if AP204C transmits stronger so that other STAs can listen to the transmission on the medium ).

Therefore, the use of the CSMA mechanism causes inefficiency, because some APs or STAs outside a BSA may be able to transmit data without interfering with the transmission performed by the APs or STAs in the BSA. As the number of active wireless devices continues to grow, this type of inefficiency may begin to significantly affect network latency and throughput. For example, significant network latency issues may occur in apartment buildings, where each apartment unit may include access points and associated stations. In fact, each apartment unit can include multiple access points, because residents can have wireless routers, video game consoles with wireless media center capabilities, TVs with wireless media center capabilities, and devices that can work like personal hotspots. Cellular phones, and/or the like. Therefore, correcting such inefficiencies of the CSMA mechanism will be crucial to avoid latency and throughput issues and overall user dissatisfaction.

These waiting time and throughput issues may not even be limited to residential areas. For example, multiple access points may be located in airports, subway stations, and/or other crowded public spaces. Currently, WiFi access can be provided in these public spaces, but charges apply. If such inefficiencies caused by the CSMA mechanism are not corrected, wireless network operators may lose customers due to charges and lower service quality that begin to outweigh any benefits.

Therefore, the high-efficiency 802.11 protocol described herein may allow devices to operate under a modified mechanism that minimizes these inefficiencies and increases network throughput. This mechanism is described below with reference to FIGS. 2B, 3, and 4. Additional aspects of the high efficiency 802.11 protocol are described below with reference to Figures 5-7.

FIG. 2B shows a wireless communication system 250 in which multiple wireless communication networks exist. Unlike the wireless communication system 200 of FIG. 2A, the wireless communication system 250 can operate in accordance with the high efficiency 802.11 standards discussed herein. The wireless communication system 250 may include AP254A, AP254B, and AP254C. AP254A can communicate with STA256A-C, AP254B can communicate with STA256D-F, and AP254C can communicate with STA256G-H.

Various procedures and methods can be used for transmission between AP254A-C and STA256A-H in the wireless communication system 250. For example, it is possible to transmit and receive signals between AP254A-C and STA256A-H according to OFDM/OFDMA technology or CDMA technology.

AP254A can act as a base station and provide wireless communication coverage in BSA252A. AP254B can act as a base station and provide wireless communication coverage in BSA252B. AP254C can act as a base station and provide wireless communication coverage in BSA252C. It should be noted that each BSA 252A, 252B, and/or 252C may not have a central AP 254A, 254B, or 254C, but may allow peer-to-peer communication between one or more of these STAs 256A-H. Accordingly, the functions of AP254A-C described herein may alternatively be performed by one or more of these STAs256A-H.

In an embodiment, AP254A-C and/or STA256A-H include high-efficiency wireless components. As described herein, high-efficiency wireless components can enable the use of high-efficiency 802.11 protocols to communicate between APs and STAs. Specifically, high-efficiency wireless components can enable AP254A-C and/or STA256A-H to use a modified mechanism that minimizes the inefficiency of the CSMA mechanism (e.g., enables In case of concurrent communication on the medium). The high-efficiency wireless components are described in more detail below with reference to FIG. 4.

As illustrated in Figure 2B, BSA252A-C are physically adjacent to each other. When, for example, AP254A and STA256B are communicating with each other, the communication can be intercepted by other devices in BSA252B-C. However, this communication may only interfere with certain devices, such as STA256F and/or STA256G. Under CSMA, AP254B will not be allowed to communicate with STA256E, even if this communication does not interfere with the communication between AP254A and STA256B. Thus, the high-efficiency 802.11 protocol operates under a modified mechanism that distinguishes between devices that can communicate concurrently and devices that cannot communicate concurrently. This device classification can be performed by high-efficiency wireless components in AP254A-C and/or STA256A-H.

In an embodiment, the determination of whether a device can concurrently communicate with other devices is based on the location of the device. For example, an STA located near the edge of the BSA may be in a state or condition that prevents the STA from communicating with other devices concurrently. As shown in FIG. 2B, STAs 206A, 206F, and 206G may be devices in a state or condition in which they cannot concurrently communicate with other devices. Similarly, an STA located near the center of the BSA may be in a state or condition that enables the STA to communicate with other devices. As illustrated in FIG. 2, STAs 206B, 206C, 206D, 206E, and 206H may be devices in a state or condition in which they can communicate with other devices concurrently. Note that device classification is not permanent. A device can transition between being in a state or condition that enables it to communicate concurrently and a state or condition that prevents it from being able to communicate concurrently (for example, the device can be in motion, when it is associated with a new AP, Change the state or condition when disassociating, etc.).

In addition, devices can be configured to have different behaviors based on whether they are devices in a state or condition of concurrently communicating with other devices. For example, devices in a state or condition that enable them to communicate concurrently can communicate in the same frequency spectrum. However, a device in a state or condition that prevents it from communicating concurrently may adopt certain techniques (such as spatial multiplexing or frequency domain multiplexing) to communicate on the medium. The control of device behavior can be performed by high-efficiency wireless components in AP254A-C and/or STA256A-H.

In one embodiment, devices that are in a state or condition that prevents them from communicating concurrently use spatial multiplexing techniques to communicate on the medium. For example, power and/or other information may be embedded in the preamble of a packet transmitted by another device. When a packet is heard on the medium, a device in a state or condition that prevents it from communicating concurrently can analyze the preamble and decide whether to transmit based on the rule set.

In another embodiment, devices in a state or condition that prevents them from communicating concurrently use frequency domain multiplexing technology to communicate on the medium. FIG. 3 shows a frequency reuse technique that can be used in the wireless communication system 100 of FIG. 1 and the wireless communication system 250 of FIG. 2B. As shown in FIG. 3, APs 304A, 304B, 304C, and 304D may exist in the wireless communication system 300. Each of the APs 304A, 304B, 304C, and 304D can be associated with a different BSA and include the high-efficiency wireless components described herein.

As an example, the bandwidth of the communication medium may be 80 MHz. Under the conventional 802.11 protocol, each of APs 304A, 304B, 304C, and 304D and the STAs associated with each corresponding AP try to use the entire bandwidth for communication, which can reduce throughput. However, under the high-efficiency 802.11 protocol using frequency domain multiplexing, the bandwidth can be divided into four 20 MHz segments 308, 310, 312, and 314 (for example, channels), as illustrated in FIG. 3. AP304A can be associated with segment 308, AP304B can be associated with segment 310, AP304C can be associated with segment 312, and AP304D can be associated with segment 314.

In one embodiment, when one or more APs in AP304A-D and STAs in a state or condition capable of concurrently communicating with other devices (for example, STAs near the center of the BSA) are communicating with each other, Then each AP304A-D and each of these STAs can use a part of the 80 MHz medium or the entire 80 MHz medium for communication. Because AP and STA do not interfere with each other, they can effectively share the common part of the available bandwidth.

When one or more of AP304A-D and STAs in a state or condition that cannot communicate with other devices concurrently (for example, STAs near the edge of BSA) are communicating with each other, then AP304A and its STA use 20MHz Segment 308 for communication, AP304B and its STAs use 20MHz segment 310 for communication, AP304C and its STAs use 20MHz segment 312 for communication, and AP304D and its STAs use 20MHz segment 314 for communication. Because segments 308, 310, 312, and 314 represent different parts of the communication medium, the first transmission using the first segment will not interfere with the second transmission using the second segment.

Thus, using the bandwidth division scheme shown in Figure 3, APs and/or STAs including high-efficiency wireless components (including those in a state or condition that cannot communicate with other devices concurrently) may be able to communicate with other APs Communicate concurrently with the STA without interference. Accordingly, the throughput of the wireless communication system 300 can be increased compared to a communication system that includes the same equipment but does not divide the wireless medium into multiple bandwidth segments.

In the case of apartment buildings or crowded public spaces, APs and/or STAs using high-efficiency wireless components can even experience reduced waiting times and increased network throughput when the number of active wireless devices increases, thereby improving users Experience.

FIG. 4 shows an exemplary functional block diagram of a wireless device 402 that can be employed in the wireless communication systems 100, 250, and/or 300 of FIGS. 1, 2B, and 3. The wireless device 402 is an example of a device that can be configured to implement the various methods described herein. For example, the wireless device 402 may include one of AP104, one of STA106, one of AP254a-c, one of STA256a-h, and/or one of AP304a-d.

The wireless device 402 may include a processor 402 that controls the operation of the wireless device 404. The processor 404 may also be referred to as a central processing unit (CPU). The memory 406, which may include both read-only memory (ROM) and random access memory (RAM), may provide instructions and data to the processor 404. A part of the memory 406 may also include non-volatile random access memory (NVRAM). The processor 404 usually executes logic and arithmetic operations based on program instructions stored in the memory 406. The instructions in the memory 406 may be executable to implement the methods described herein.

The processor 404 may include or be a component of a processing system implemented with one or more processors. The one or more processors can use general-purpose microprocessors, microcontrollers, digital signal processors (DSP), field programmable gate arrays (FPGA), programmable logic devices (PLD), controllers, state machines, options it is implemented by any combination of logic, discrete hardware components, dedicated hardware finite state machines, or any other suitable entities capable of performing calculations or other manipulations on information.

The processing system may also include a machine-readable medium for storing software. Software should be interpreted broadly to mean any type of instruction, whether it is called software, firmware, middleware, microcode, hardware description language, or other. Instructions may include code (e.g., in source code format, binary code format, executable code format, or any other suitable code format). These instructions, when executed by the one or more processors, cause the processing system to perform the various functions described herein.

The wireless device 402 may also include a housing 408, which may contain a transmitter 410 and/or a receiver 412 to allow transmission and reception of data between the wireless device 402 and a remote location. The transmitter 410 and the receiver 412 may be combined into a transceiver 414. The antenna 416 may be attached to the housing 408 and electrically coupled to the transceiver 414. The wireless device 402 may also include (not shown) multiple transmitters, multiple receivers, multiple transceivers, and/or multiple antennas.

The wireless device 402 may also include a signal detector 416 that may be used to attempt to detect and quantify the signal level received by the transceiver 414. The signal detector 418 can detect signals such as total energy, energy per subcarrier per symbol, power spectral density, and other signals. The wireless device 402 may also include a digital signal processor (DSP) 420 for processing signals. The DSP 420 may be configured to generate packets for transmission. In some aspects, the packet may include a physical layer data unit (PPDU).

In some aspects, the wireless device 402 may further include a user interface 422. The user interface 422 may include a keypad, a microphone, a speaker, and/or a display. The user interface 422 may include any element or component that communicates information to a user of the wireless device 402 and/or receives input from the user.

In certain aspects, the wireless device 402 may further include a high-efficiency wireless component 424. The high efficiency wireless component 424 may include a classifier unit 428 and a transmission controller unit 430. As described herein, the high-efficiency wireless component 424 can enable the AP and/or STA to use a modified mechanism that minimizes the inefficiency of the CSMA mechanism (e.g., enables the Concurrent communication on the medium).

This modified mechanism can be implemented by the classifier unit 428 and the emission control unit 430. In an embodiment, the classifier unit 428 determines which devices are in a state or condition that enables them to communicate with other devices concurrently, and which devices are in a state or condition that prevents them from communicating with other devices concurrently. In an embodiment, the emission control unit 430 controls the behavior of the device. For example, the transmission control unit 430 may allow certain devices to transmit concurrently on the same medium, and allow other devices to transmit using spatial multiplexing or frequency domain multiplexing technology. The emission control unit 430 may control the behavior of the device based on the determination made by the classifier unit 428.

The various components of the wireless device 402 may be coupled together by the bus system 426. The bus system 426 may include, for example, a data bus, as well as a power bus, a control signal bus, and a status signal bus in addition to the data bus. Those skilled in the art will appreciate that the components of the wireless device 402 may be coupled together or use some other mechanism to accept or provide input from each other.

Although several separate components are illustrated in FIG. 4, those skilled in the art will recognize that one or more of these components can be combined or implemented together. For example, the processor 404 may be used to implement not only the

functionality described above with respect to the processor 404, but also the functionality described above with respect to the signal detector 418 and/or DSP 420. In addition, each component illustrated in FIG. 4 can be implemented using multiple separate elements.

The wireless device 402 may include AP104, STA106, AP254, STA256, and/or AP304, and may be used to transmit and/or receive communications. That is, any one of AP104, STA106, AP254, STA256, or AP304 can be used as a transmitter or receiver device. Certain aspects contemplate that the signal detector 418 is used by software running on the memory 406 and the processor 404 to detect the presence of a transmitter or receiver.

Figure 5A illustrates an exemplary structure of physical layer packets that can be used in high-efficiency WiFi implementations. The high efficiency packet 500a may be used, for example, to transfer multiple loads to different destination devices. For example, the first, second, and third loads may be transferred to the first, second, and third devices, respectively.

The high-efficiency packet 500a includes an old-style preamble 502a, a high-efficiency (he) indication 504a, an old-style payload 506a, a high-efficiency signaling field 508a, an optional long training field and/or short training field 509a, a high-efficiency payload field 510a, The long training field and/or the short training field 511a, the high-efficiency signaling field 512a, and the high-efficiency payload field 514a are optional. In some aspects, the high efficiency indication field 504a may indicate that the packet 500a includes one or more of the he signaling field 508a, the he payload 510a, the he signaling field 512a, and the he payload field 514a.

The high-efficiency packet 500a can provide for aggregating multiple messages destined for different wireless devices into one physical layer wireless packet. For example, the high efficiency packet 500a includes he load 510a and he load 514a. The number of high-efficiency payload fields in various aspects of the high-efficiency packet 500a may be different from what is explained. For example, the high-efficiency packet 500a may contain only one high-efficiency load in some aspects. In some other aspects, the high efficiency group 500a may include, for example, 3, 4, 5, 6, 7, 8, 9, or 10 high efficiency loads.

By aggregating multiple messages or payloads, the communication system using the packet 500a can provide reduced overhead and increased throughput in a wireless network compared to a communication system that individually transmits each of multiple messages or payloads. For example, by transmitting packet 500a-the packet 500a may include multiple messages such as he payload 510c and he payload 514c, at least some of which are addressed to different devices, the overhead associated with transmitting the preamble 502a of packet 500a it can be allocated to the multiple messages. Additionally, by transmitting one longer packet instead of multiple smaller packets (such as each message included in packet 500a has one smaller packet), the transmitting device may only need to contend for the wireless medium before sending packet 500a once. Conversely, if each message in the packet 500a is transmitted in a separate wireless message, the transmitting device may be required to contend for the medium for each separate wireless message. In some scenarios, one or more of those additional transmissions may cause packet collisions. As a result, the transmitting device may be required to perform an additional carrier sensing medium access conflict resolution process before attempting to retransmit the message. The CDMA process can include back-off procedures, resulting in additional potential loss of bandwidth on the wireless medium. The additional overhead associated with the transmission of the multiple messages can be reduced by transmitting the multiple messages within one packet 500a.

FIG. 5B shows a portion 520 of the high efficiency packet 500a. Specifically, part 520 shows an implementation with a part of the old preamble 502a and the high efficiency indicator 504a. The grouping part 520 explains that the old-style preamble 502a may include a short training field 522, a long training field 524, and an old-style signaling field 526. In some aspects, the legacy preamble signaling field 526 may include a duration indication (not shown). In some aspects of the high efficiency packet 500a, the duration indication of the legacy preamble signaling field 526 may indicate the duration of the entire high efficiency packet. For example, in the example of the high efficiency packet 500a of FIG. 5A, this duration will include all the explained fields up to (and including) the he payload 514a. The he indication field 504a follows the old preamble signaling field 526. In some aspects, the he indicator field 504a may include three symbols 505a-c. In some aspects, these symbols may be modulated using Q-BPSK rotation to provide an indication of the high efficiency load following the he indication 504a. In some aspects, one or more characteristics of the he indicator field 504a may be included in the he signaling fields 508a-c and/or 512a-c, some of which are described below.

The aspect of providing the old-style preamble 502a as part of a high-efficiency packet can enable old-style equipment to continue to properly yield to packets that include the old-style preamble 502a. These legacy devices can rely on the use of legacy signaling fields to determine when to yield. For example, this can be particularly useful in some wireless networks, such as 802.11ac networks that utilize mixed-mode preambles.

Figure 5C shows another implementation of high efficiency grouping 500b. In this implementation of packet 500b, he indicates

that field 504a does not appear. In this implementation, the high-efficiency packet 500b may be distinguished from the old-style packet based on one or more fields of the old-style preamble 502b. For example, in one aspect, one or more of the legacy signaling fields (such as the legacy signaling field 526) discussed above with respect to FIG. 5B can distinguish high efficiency packets from legacy packets. On the other hand, the reserved state or field of the two-symbol VHT-SIG-A field can be used to distinguish between high-efficiency packets and legacy packets. In some aspects, the two-symbol VHT-SIG-A field may be included in one or more of the he signaling fields 508a-c, and/or 512a/c, some of which are described below.

Figure 5D shows an exemplary implementation of high efficiency grouping. Similar to FIG. 5A, the high efficiency packet 500c includes the old part of the preamble 502c, the high efficiency indication 504c, the old data field 506c, the high efficiency signaling field 508c, the high efficiency load field 510c, the high efficiency signaling field 512c, and the high efficiency Efficiency load field 514c. The high efficiency load field 510c may be modulated using multi-user MIMO (MU-MIMO) to one or more receiving devices, and the high efficiency load field 514c may be modulated using OFDMA to one or more receiving devices. Note that the illustration of the packet 500c does not show that the packet 500c includes short and/or long training fields, for example, before the signaling field 508c or the signaling field 512c. However, despite this explanation, in some aspects of packet 500c, one or more long and/or short training fields are included at least in legacy data 506c and signaling field 508c, and/or he payload 510c, and signaling Between fields 512c.

Figure 5D shows a high efficiency payload field 514c modulated using three subbands 515a-c. The data modulated by the first subband 515a to a single device ("Device 1") has a duration of the high efficiency payload field 514c. Similarly, the subband 515c also modulates the data for a single device ("Device 3") for the duration of the high efficiency payload field 514c. The subband 515b modulates data for two different devices ("Device 2A" and "Device 2B"). As shown in Figure 5D, data for multiple devices can be transmitted in a single subband by overloading the group identifiers of two devices. For example, if two devices are in the he signaling field 512c (corresponding to the payload 514c) The signaled group id has the same user location. For example, as shown in FIG. 5D, the device 2A and the device 2B may have the same position within the GID signaled by the he signaling field 512c.

As further described below with respect to FIG. 5E, the subband allocation field of the high efficiency signaling field 512c may indicate the number of destination devices for the data modulated in each subband 515a-c.

In some aspects, in the subband modulating the data for multiple devices, the data of the multiple devices may be delimited or separated by one or more symbol signatures 516. The signature(s) 516 may enable the receiving device to identify when the data for the specific device starts in the specific subchannel. In some aspects, a signature (such as signature 516) that delimits or separates the data of two different devices within a subband may include a signaling field, a short training field, and/or a long training field. The signaling field may indicate one or more of modulation and coding scheme (MCS), coding, number of spatial streams (Nss), or space-time block coding (STBC) of the data following the signaling field in the packet. In some aspects, the signature 516 may include a specific sequence of bit values that have been pre-assigned to indicate the transition from data destined for the first device or group of devices to data destined for the second device or group of devices.

FIG. 5E shows an exemplary implementation of the high efficiency payload 560 and at least a part of the preceding signaling field 508. The high efficiency signaling field part 508 includes a transmission type indicator 552, a load end indicator 554, a frequency subband allocation field 556, and a last load indicator 558. In some implementations, the high efficiency signaling fields 508a-c and 512a-c (shown in FIGS. 5A, 5C, and 5D) may conform to the format of the high efficiency signaling field 508 shown in FIG. 5E or at least include One or more fields described.

In one aspect, the transmission type indication 552 indicates whether the payload field 560 is modulated using single-user MIMO, multi-user MIMO, or orthogonal frequency division multiple access (OFDMA). For example, in some aspects, the modulation type indicator may include one bit. In some aspects, if the bit is zero, the Nsts field (not shown) in the high efficiency signaling field 508 is interpreted as providing several spatial streams for each user in the assigned subband. In these respects, if this bit is set, it can indicate that the Nsts field (also not shown) in the high efficiency header field 508 is interpreted as providing the number of spatial streams for each device across the entire bandwidth. In some aspects, the transmission type indication field 552 may not be provided in the high efficiency signaling field 508. In these aspects, the modulation type of the payload 560 can be indicated using other unused state information of any field in the high efficiency signaling field 508.

In some aspects, the end of payload indication field 554 indicates the length or duration of the high efficiency payload 560. On the other hand, the duration of the load may be fixed, and therefore the end of load indication 554 may not be included in the high efficiency signaling field 508.

The frequency subband allocation field 556 may indicate how the frequency subband of the OFDMA payload field 560 is allocated to data destined for different devices. For example, in some aspects, the frequency subband allocation field 556 may

indicate the number of subbands used to transmit data for multiple devices. For example, in an aspect, the frequency subband allocation field 556 being zero may indicate that each frequency subband of the OFDMA payload field 560 is used exclusively for data destined for a single device. In some aspects, the frequency subband allocation field 556 having a value of one (1) may indicate that the payload 560 includes data for at least two users included in the first subband of the transmitted data. In one aspect, a frequency subband allocation field with a value of two (2) may indicate that the data 560 is transmitted such that there are at least two users in the first and second subbands of the transmitted data. In one aspect, a frequency subband allocation field having a value of three (3) may indicate that the data 560 is transmitted such that there are at least two users in the first, second, and third subbands of the transmitted data. In some aspects, a frequency subband allocation field having a value of four (4) may indicate that the data 560 is transmitted such that there are at least two users in the first, second, third, and fourth subbands of the transmitted data.

In some aspects, the frequency subband allocation field 556 with a value of seven (7) indicates that the he payload field 560 is transmitted using SU-MIMO or MU-MIMO. In some aspects, the frequency subband allocation field 556 is one, two, or three bits in length. In some other aspects, the frequency subband allocation field 556 may also include the function of the transmission type indication field 552 discussed above. In these aspects, the transmission type indication field 552 may not be included in the high efficiency signaling field 506.

Figure 6 is a flowchart of a process for transmitting high-efficiency packets on a wireless network. The packet transmitted by the following process 600 may include multiple payloads, at least some of which include data addressed to different devices. Therefore, data destined for multiple different devices can be transmitted using a single packet. This is in contrast to the current scheme that requires (at least when the data is unicast) a separate packet transmission for each group of data destined for a unique device.

Using the method proposed below, some data in the transmitted packet can be addressed to the first device (but at least in some aspects not addressed to the second device), and some data in this transmitted packet can be at least addressed To the second device (but at least not addressed to the first device in some ways). For example, if the access point has data queued for three different stations, using the method proposed below, the access point may be able to transmit a single packet including separate data for each of the three different stations .

When compared to a scheme of transmitting three separate packets, where each packet includes data addressed to a specific device, the method 600 discussed below can provide reduced communication network overhead. For example, the following network overhead associated with the packet header information of the transmitted packet can be amortized over a larger amount of data transmitted for the first and second (and potentially third) devices. This is beneficial compared to a scheme that would require the transmission of two or three separate packet headers, where each packet transmitted to each of the first, second, and third devices has one packet header.

In some aspects, process 600 may be performed by an access point or station. In some aspects, the process 600 may be performed by the wireless device 402. For example, one or more of the processor 404, the transmitter 410, and the receiver 412 of the device 402 may be configured by instructions stored in the memory 406 to perform the blocks of the process 600 described below.

In block 602, a physical layer packet is generated. In some aspects, block 602 may be performed by processor 404. The physical layer packet is generated to include multiple payloads. Each of the multiple payloads may include data and addressing information about the data. The addressing information indicates one or more destination devices for the data. In some aspects, the payload discussed with reference to FIG. 6 may be equivalent to a PLCP protocol data unit (PPDU). In some of these aspects, the payload may be equivalent to multiple STAPPDUs.

At least one of these loads includes first and second data. The at least one payload also includes addressing information indicating that the first and second data are addressed to different destination devices.

In some aspects, the packet is generated such that in the physical packet, the multiple payloads are separated by one or more of a short training field, a long training field, and/or a signaling field.

In some aspects, in the physical layer packet, there is a signaling field before each payload. In some of these aspects, the signaling field of each payload indicates the number of frequency subbands within the payload that include data to be transmitted to at least two different devices. For example, the signaling field(s) may substantially conform to the signaling field format 508 shown in FIG. 5E. In some aspects, the packet may be generated to include the frequency subband allocation field(s) 556 in one or more signaling fields included in the packet.

In some aspects, the signaling field of the payload includes a transmission mode indication for the payload. For example, as

discussed above, the mode indication may indicate whether the data in the payload is being transmitted using MU-MIMO, single-user transmission, or OFDMA transmission. In some aspects, the signaling field of the payload may indicate the duration of the payload. For example, it may indicate the total time required to transfer all the data included in the payload.

In some other aspects, the signaling field may indicate a transmission schedule for the load. For example, the transmission schedule may indicate which device will receive data during which part of the load. The transmission scheduling can enable the device receiving the load to selectively ignore the parts of the packet that are not destined for them. This can reduce the processing overhead associated with the reception of packets in some ways.

In some aspects, the signaling field may indicate whether its corresponding payload included in the packet immediately following the signaling field is the last payload in the packet. For example, as shown in FIG. 5E, the signaling field included in the packet may substantially conform to the format of the signaling field 508 in some respects.

In some aspects, physical layer packets are generated to include high efficiency indications. In some respects, this high efficiency indicator indicates whether high efficiency loads (such as he load 510c and/or he load 514c of FIG. 5D) are present in the packet. In some aspects, this high efficiency indicator indicates whether the packet includes at least first data and second data, where the first and second data are addressed to different destination devices. In some aspects, high efficiency indications are included in the old preamble. For example, the legacy signaling field included in the legacy preamble may include a high efficiency indication. In some aspects, the legacy signaling field 526 shown in Figure 5B can provide an efficient indication.

In some other aspects, the high efficiency indication is included in the first high efficiency signaling field. In some aspects, the first high-efficiency signaling field may be in a different format from any high-efficiency signaling fields that follow in the packet. For example, in some aspects, the first high-efficiency signaling field may include three symbols, and the subsequent high-efficiency signaling field may include more than three symbols. In some aspects, the high-efficiency signaling field is modulated using Q-BPSK rotation.

In some other aspects, the first high efficiency signaling field has a similar format to the subsequent high efficiency signaling field. For example, in some aspects, the first high efficiency signaling field may substantially conform to the high efficiency signaling fields 508a, 508b, and 508c shown in FIGS. 5A, 5C, and 5D, respectively.

In some aspects, both the first data and the second data can be transmitted using MU-MIMO. Alternatively, the first and second data may be transmitted using OFDMA. In this packet, the first and second data may be separated by a signature field (such as the signature field 516 discussed above with respect to Figure 5D). In some aspects, the packet may be further generated to include a second payload, the second payload including third and fourth data. The third and fourth data may be transmitted using the same or different modulation scheme as the first and second data. For example, if the first data and the second data are transmitted using MU-MIMO, the third and fourth data may be transmitted using, for example, MU-MIMO or OFDMA. In some aspects, the third and fourth data are addressed to different devices. In some aspects, within the packet, the third and fourth data are separated by a signature (such as signature field 516). The signature may include one or more of a short training field, a long training field, and/or a special bit sequence indicating the signature. In some aspects, the first and second devices may have the same group identifier.

In some aspects, the duration of the transmission of the first and second data may be fixed or variable. If the duration is fixed, the duration field may not be associated with the load carrying the first and second data in the generated packet. Similarly, the duration of the third and fourth data can also be fixed or variable.

In some aspects, the packet is generated such that the data within the payload is sorted based on the MCS of the destination of the third data and/or the fourth data. For example, in some aspects, in the packet, data for a destination with a lower MCS is included before data for a destination with a higher MCS value.

In some aspects, the packet is generated to include a payload that includes data that is only transmitted to a single device.

In some aspects, the packet is generated to include the old-style preamble and the old-style payload. For example, in some aspects, the legacy preamble 502a may be included in the packet. The old-style payload may include old-style data parts. In some aspects, the legacy payload can be formatted as the legacy data field 506a.

On the other hand, the old-style preamble includes the VHT-SIG-A field, and the VHT-SIG-A field includes the high efficiency indication. In some aspects, the high efficiency indication can be signaled by the reserved state of the two-symbol VHT-SIG-A field.

In block 604, the physical layer packet is transmitted. In some aspects, the physical layer packet includes an old-style preamble and/or an old-style data portion, and/or a high-efficiency indicator, and/or a signaling field, all of which are discussed above. In

some aspects, the transmitted physical layer packets may incorporate one or more of the aspects discussed above with reference to Figures 5A-5E. In some aspects, block 604 may be performed by transmitter 410 or processor 404.

Figure 7 is a flowchart of a process for receiving high-efficiency packets on a wireless network. The received high efficiency packet may include multiple payloads, at least some of which include data addressed to different devices. Therefore, part of receiving a high-efficiency packet may include scanning the packet to identify data addressed to the receiving device, while selectively discarding data that is not addressed to the receiving device. This is in contrast to current solutions that usually address the entire packet to a specific device (or, in the case of multicast/broadcast, to specific devices). Using these current solutions, the entire packet can either be discarded or received.

For example, using the method proposed below, some data can be addressed to the first device (but not addressed to the second device in at least some aspects), and some data can be addressed to at least the second device (but at least in some aspects is not addressed to the first device). The device for executing the method 700 below may be the first device, the second device, or the third device. Therefore, the following method can selectively discard the data that is not addressed to it, and receive and more completely process the portion of the packet addressed to it as discussed above.

When compared to a scheme that uses two separate packets to transmit the same data, where each packet includes data addressed to a specific device, the method 700 discussed below may, for example, provide reduced communication network overhead. For example, the network overhead associated with the packet header information of the packets discussed below can be amortized over a larger amount of data transmitted for both the first and second devices. This is advantageous compared to a scheme that would require the transmission of two separate packet headers, with one packet header for each packet transmitted to each of the first and second devices.

In some aspects, process 700 may be performed by an access point or station. In some aspects, process 700 may be performed by device 402 of FIG. 4.

At block 702, a physical layer packet is received from the wireless network. In some aspects, block 702 may be performed by receiver 412 and/or processor 404.

At block 702, the packet is decoded to identify the first field. In some aspects, the first field may be an efficient section of the old preamble. In some aspects, the first field may be a signaling field.

At block 706, the first field is decoded to identify the first payload. The first payload includes at least first data addressed to the first device and at least second data addressed to the second device. The first device is different from the second device.

In some aspects, in the first payload, the first data and the second data may be separated by a signature. The signature may include short and/or long training fields, signaling fields, and/or predetermined bit value sequences. In some aspects, the signature is scanned in the payload. In some aspects, the start of the signature may only occur before every Nth OFDM symbol. This can reduce the overhead associated with scanning signatures.

Once the signature is identified, the first data and the second data can be identified. For example, in a packet, the first data can be before the signature, and the second data can come after the signature. In some respects, the signature may be similar to the signature 516 discussed above. In some aspects, one or more of blocks 704 and 706 may be performed by the processor 404 in some aspects.

The first field may include a transmission mode indication, which indicates whether the first data and/or the second data are transmitted using a single-user transmission mode, MU-MIMO, or OFDMA. In some aspects, the first field is a high-efficiency signaling field, such as the he signaling fields 508a and 512a of FIG. 5A, or the fields 508b or 512b of FIG. 5c, or the fields 508c or 512c of FIG. 5D. In some respects, the payload discussed with reference to FIG. 7 may be equivalent to a physical layer convergence protocol (PLCP) protocol data unit (PPDU). In some of these aspects, the payload may be equivalent to multiple STAPPDUs.

At block 708, the packet is decoded to identify the second field. The second field may be a signaling field. The second field can be preceded by the second signature. The second signature may include one or more of a short or long training field, or a predetermined bit value sequence. The second field can be identified by scanning the second signature in the packet. In some aspects, the start of the second signature may only occur before every Nth OFDM symbol. This can reduce the overhead associated with scanning the second signature. Note that if the first field discussed above is a signaling field, it can also be a signature before it (similar to the second signature).

In block 710, the second field is decoded to identify the second payload. The packet may include multiple loads, the multiple loads including the first and second loads, but may also include additional loads. Each payload can include data and addressing

information about the data. In some aspects, one or more of blocks 708 and 710 may be executed by the processor 404 in some aspects.

In some aspects, at least two of the plurality of payloads in the packet received in process 700 may be received using different transmission modes. For example, the first payload can be received using SU-MIMO and the second payload can be received using OFDMA. Another load of the plurality of loads may be received via single user transmission. In some aspects, the received packet may be in a format as described by one or more of Figures 5A-E.

If the payload is received via OFDMA, the subband of OFDMA transmission of the payload may include data destined for at least two different devices. For example, the subband may include third data destined for the third device, and fourth data destined for the fourth device.

These payloads are processed based on the signaling fields before these payloads in the packet. In some aspects, the process 700 may determine the end of the physical layer packet based on the last load indication in the signaling field. For example, in some aspects, the last load indication field 558 may be utilized to determine the end of the physical layer packet. Some aspects of the process 700 include determining that the reception of the packet received in block 702 is complete when the last efficient load indication (as may be indicated in field 558) is received, and the reception of the load corresponding to the indication has also been completed .

In some aspects, the received packet is decoded to identify the transmission schedule for one or more of these payloads. In some aspects, the transmission schedule can be included in the channel field or the duration field that precedes the scheduled loads.

In some aspects, the receipt of each load included in the received physical packet may be based on the end determined for each load. The end of each load may be determined in some respects based on the end of load indication field (such as the end of load indication field 554 shown in FIG. 5E). In some other aspects, the end of each load can be determined based on the fixed load duration.

The payload of the multiple payloads can be decoded based on the transmission mode indicated in the previous signaling field. In some aspects, OFDMA can be used to receive one or more payloads. In some aspects, the frequency subband of one or more of these OFDMA payloads may include data for at least two devices, for example as shown in the high efficiency payload 514c of FIG. 5D. In these aspects, block 704 may decode the data in the subband based on the group identifier of the device performing process 700.

If the received packet includes OFDMA payload, the frequency subband allocation field can be decoded from the signaling field that precedes the OFDMA payload. The frequency subband allocation field in the received packet can perform the function described above with reference to FIG. 5E and the frequency subband allocation field 556. The receiving device may determine how to decode the data in the OFDMA subband of the received payload based on the frequency subband allocation field.

As used herein, the term "determine" encompasses various actions. For example, "determining" may include calculation, calculation, processing, derivation, research, search (for example, search in a table, database, or other data structure), detection, and the like. Also, "determining" may include receiving (for example, receiving information), accessing (for example, accessing data in a memory), and the like. Moreover, "determining" can also include analysis, selection, selection, establishment and similar actions. In addition, the "channel width" as used herein may cover some aspects or may also be referred to as bandwidth.

As used herein, a phrase quoting "at least one" of a list of items refers to any combination of these items, including individual members. As an example, "at least one of a, b, or c" is intended to cover: a, b, c, a-b, a-c, b-c, and a-b-c.

The various operations of the methods described above may be performed by any suitable device capable of performing these operations, such as various hardware and/or software components, circuits, and/or modules. Generally speaking, any operation illustrated in the drawings can be performed by a corresponding functional device capable of performing these operations.

The various illustrative logical blocks, modules, and circuits described in conjunction with the present disclosure can be designed to perform general-purpose processors, digital signal processors (DSP), application-specific integrated circuits (ASICs), and field programmable gate arrays that perform the functions described herein. Signal (FPGA) or other programmable logic device (PLD), discrete gate or transistor logic, discrete hardware components, or any combination thereof. The general purpose processor may be a microprocessor, but in the alternative, the processor may be any commercially available processor, controller, microcontroller, or state machine. The processor may also be implemented as a combination of computing devices, such as a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in cooperation

with a DSP core, or any other such configuration.

In one or more aspects, the described functions may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, each function can be stored on a computer-readable medium or transmitted through it as one or more instructions or codes. Computer-readable media includes both computer storage media and communication media, including any media that facilitates the transfer of a computer program from one place to another. The storage medium may be any available medium that can be accessed by a computer. By way of example and not limitation, such computer-readable media may include RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or can be used to carry or store instructions or data in the form of a structure Any other medium with program code that can be accessed by a computer is desired. Any connection is also properly called a computer-readable medium. For example, if the software is transmitted from a web site, server, or other remote source using coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave , The coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of media. Disks and discs as used in this article include compact discs (CD), laser discs, optical discs, digital versatile discs (DVD), floppy discs and Blu-ray discs, among which disks often reproduce data in a magnetic manner and discs (disc) Use laser to optically reproduce data. Thus, in some aspects, computer-readable media may include non-transitory computer-readable media (e.g., tangible media). In addition, in some aspects, computer-readable media may include transitory computer-readable media (e.g., signals). Combinations of the above should also be included in the scope of computer-readable media.

Therefore, some aspects may include a computer program product for performing the operations presented herein. For example, such a computer program product may include a computer-readable medium having instructions stored (and/or encoded) thereon, and these instructions can be executed by one or more processors to perform the operations described herein. For some aspects, the computer program product may include packaging materials.

The methods disclosed herein include one or more steps or actions for achieving the described methods. These method steps and/or actions can be interchanged with each other without departing from the scope of the claims. In other words, unless a specific order of steps or actions is specified, the order and/or use of specific steps and/or actions may be modified without departing from the scope of the claims.

Software or instructions can also be transmitted on a transmission medium. For example, if the software is transmitted from a web site, server, or other remote source using coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, The coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of transmission media.

In addition, it should be appreciated that the modules and/or other appropriate devices used to implement the methods and techniques described in this document can be downloaded and/or obtained in other ways by the user terminal and/or base station where applicable. For example, such a device can be coupled to a server to facilitate the transfer of means for performing the methods described herein. Alternatively, the various methods described herein can be provided via a storage device (for example, RAM, ROM, physical storage media such as a compact disc (CD) or floppy disk, etc.), so that once the storage device is coupled to or provided to The user terminal and/or base station, the device can obtain various methods. In addition, any other suitable technique suitable for providing the methods and techniques described herein to a device may be utilized.

It will be understood that the claims are not limited to the precise configurations and components explained above. Various changes, replacements and deformations can be made in the layout, operation and details of the method and equipment described above without departing from the scope of the claims.

Although the foregoing is directed to various aspects of the present disclosure, other and further aspects of the present disclosure can be devised without departing from its basic scope, and its scope is determined by the appended claims.

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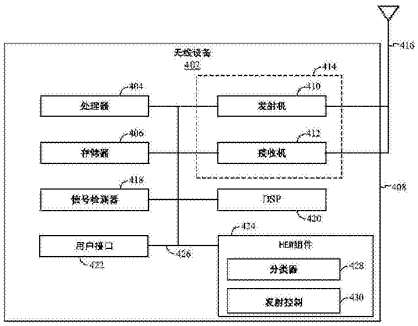
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(54)发明名称

用于无线网络上物理协议数据单元的聚集的系统和方法

(57)摘要

公开了用于多个物理协议单元的聚集的系统和方法。在一方面，公开了向多个无线设备传送物理层分组的方法。该方法包括生成物理层分组，该分组包括多个载荷，其中至少一个载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据，并且其中在该物理层分组中每个载荷之前至少有信令字段，以及传送该物理层分组。




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1. 一种向多个无线设备传送物理层分组的方法，包括：

生成物理层分组以包括第一信令字段、跟随在所述第一信令字段之后的第一载荷、跟随在所述第一载荷之后的第一训练字段、跟随在所述第一训练字段之后的第二信令字段，以及跟随在所述第二信令字段之后的第二载荷，其中这些载荷中的至少一者包括定址到第一设备的第一数据和定址到第二设备的第二数据；以及

传送所述物理层分组。

2. 如权利要求 1 所述的方法，其特征在于，所述物理层分组被生成以包括在所述第一训练字段与所述第二信令字段之间的第二训练字段。

3. 如权利要求 1 所述的方法，其特征在于，进一步包括指示与所述物理层分组中的这多个载荷相关联的传输调度。

4. 如权利要求 3 所述的方法，其特征在于，进一步包括在所述第一信令字段的历时字段中指示所述传输调度。

5. 如权利要求 1 所述的方法，其特征在于，进一步包括生成所述第一信令字段以指示所述第一载荷是否是使用单用户传输、多用户多输入多输出传输 (MU-MIMO) 传输或正交频分多址 (OFDMA) 传输中的一者来传送的。

6. 如权利要求 5 所述的方法，其特征在于，进一步包括：

生成所述第一载荷以包括子带，所述子带包括第三数据和第四数据，其中第三数据和第四数据被定址到不同设备；以及

使用 OFDMA 来传送所述第一载荷。

7. 如权利要求 6 所述的方法，其特征在于，进一步包括在所述子带内由签名来在时间上分隔第三数据和第四数据的传输。

8. 如权利要求 6 所述的方法，其特征在于，进一步包括基于第三数据的目的地设备的调制和编码方案 (MCS) 以及第四数据的目的地设备的调制和编码方案 (MCS) 来对第三数据和第四数据的传输进行排序。

9. 一种向多个无线设备传送物理层分组的装置，包括：

处理器，其被配置成生成物理层分组，所述分组包括第一信令字段、跟随在所述第一信令字段之后的第一载荷、跟随在所述第一载荷之后的第一训练字段、跟随在所述第一训练字段之后的第二信令字段，以及跟随在所述第二信令字段之后的第二载荷，其中这些载荷中的至少一者包括定址到第一设备的第一数据和定址到第二设备的第二数据；以及

发射机，其被配置成传送所述物理层分组。

10. 如权利要求 9 所述的装置，其特征在于，所述处理器被进一步配置成生成所述物理层分组以包括在所述第一训练字段与所述第二信令字段之间的第二训练字段。

11. 如权利要求 9 所述的装置，其特征在于，所述处理器进一步配置成生成所述物理层分组以指示与这多个载荷相关联的传输调度。

12. 如权利要求 11 所述的装置，其特征在于，所述处理器进一步配置成在所述多个载荷之前的信令字段的历时字段中指示所述传输调度。

13. 如权利要求 9 所述的设备，其特征在于，所述处理器进一步配置成生成所述分组以包括在这多个载荷中的第一载荷之前的信令字段以指示所述第一载荷是否是使用单用户传输、多用户多输入多输出传输 (MU-MIMO) 传输或正交频分多址 (OFDMA) 传输中的一者来

传送的。

14.如权利要求13所述的装置，其特征在于，

所述处理器进一步配置成生成所述第一载荷以包括子带，所述子带包括第三数据和第四数据，其中第三数据和第四数据被定址到不同设备；以及

所述发射机进一步配置成使用OFDMA来传送所述第一载荷。

15.如权利要求14所述的装置，其特征在于，所述处理器进一步配置成基于第三数据的目的地设备的调制和编码方案(MCS)以及第四数据的目的地设备的调制和编码方案(MCS)来对第三数据和第四数据的传输进行排序。

16.一种用于从无线网络接收高效率物理数据分组的方法，所述方法包括：

从无线网络接收物理层分组；

解码所述分组以标识第一字段；

解码所述第一字段以从所述分组标识第一载荷，所述第一载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据；

解码所述分组以标识第二字段；以及

解码所述第二字段以标识第二载荷，所述第二载荷包括定址到所述第一设备、所述第二设备、或第三设备中的至少一者的第三数据。

17.如权利要求16所述的方法，其特征在于，进一步包括：

解码所述分组以标识在所述物理层分组中分隔所述第一和第二载荷的签名，所述解码基于所述签名，所述签名包括短训练字段、长训练字段、和信令字段中的一者或多者；以及

基于所标识出的签名来解码所述第二载荷。

18.如权利要求16所述的方法，其特征在于，进一步包括解码所述物理层分组以确定与第一和第二载荷相关联的传输调度。

19.如权利要求18所述的方法，其特征在于，进一步包括解码对应信令字段中的历时字段以确定所述载荷的传输调度。

20.如权利要求16所述的方法，其特征在于，进一步包括解码在载荷之前的信令字段以确定所述载荷是否是经由单用户传输、多用户多输入多输出传输(MU-MIMO)传输或正交频分多址(OFDMA)传输来接收的。

21.如权利要求16所述的方法，其特征在于，进一步包括经由OFDMA接收所述第一载荷，并且解码所述OFDMA载荷的子带来确定第三数据和第四数据被定址到不同设备。

22.如权利要求21所述的方法，其特征在于，进一步包括基于群标识符来解码所述子带中的数据。

23.如权利要求21所述的方法，其特征在于，进一步包括解码在所述载荷之前的信令字段来确定所述载荷中的包括传送给所述至少两个不同设备的数据的频率子带的数目的指示。

24.一种用于从无线网络接收高效率物理数据分组的设备，所述装置包括：

配置成从无线网络接收物理层分组的接收机，

处理器，其被配置成：

解码所述分组以标识第一字段；

解码所述第一字段以从所述分组标识第一载荷，所述第一载荷包括定址到第一设备的

第一数据和定址到第二设备的第二数据；

解码所述分组以标识第二字段；以及

解码所述第二字段以标识第二载荷，所述第二载荷包括定址到所述第一设备、所述第二设备、或第三设备中的至少一者的第三数据。

25. 如权利要求 24 所述的装置，其特征在于，所述处理器被进一步配置成：

解码所述分组以标识在所述物理层分组中分隔所述第一和第二载荷的签名，所述解码基于所述签名，所述签名包括短训练字段、长训练字段、信令字段中的一者或多者；以及

基于所标识的签名来解码所述第二载荷。

26. 如权利要求 24 所述的装置，其特征在于，所述处理器进一步配置成解码所述物理层分组以确定与所述第一和第二载荷相关联的传输调度。

27. 如权利要求 26 所述的装置，其特征在于，所述处理器进一步配置成解码对应信令字段中的历时字段以确定所述载荷的传输调度。

28. 如权利要求 24 所述的装置，其特征在于，所述处理器进一步配置成解码在载荷之前的信令字段以确定所述载荷是否是经由单用户传输、多用户多输入多输出传输 (MU-MIMO) 传输或正交频分多址 (OFDMA) 传输来接收的。

29. 如权利要求 24 所述的装置，其特征在于，所述处理器进一步配置成经由 OFDMA 来接收所述第一载荷，并且在所述第一载荷的 OFDMA 子带中标识定址到所述装置的一部分数据。

30. 如权利要求 29 所述的装置，其特征在于，所述处理器进一步配置成基于群标识符来解码所述子带中的数据。

# 用于无线网络上物理协议数据单元的聚集的系统和方法

[0001] 背景

[0002] 领域

[0003] 本申请一般涉及无线通信，且更具体地涉及用于单个无线分组内诸 PPDU 的聚集的系统、方法和设备。

## 背景技术

[0004] 在许多电信系统中，通信网络被用于在若干个空间上分开的交互设备之间交换消息。网络可根据地理范围来分类，该地理范围可以例如是城市区域、局部区域、或者个人区域。此类网络可分别被指定为广域网 (WAN)、城域网 (MAN)、局域网 (LAN)、无线局域网 (WLAN)、或个域网 (PAN)。网络还根据用于互连各种网络节点和设备的交换 / 路由技术（例如，电路交换相对于分组交换）、用于传输的物理介质的类型（例如，有线相对于无线）、和所使用的通信协议集（例如，网际协议套集、SONET（同步光学联网）、以太网等）而有所不同。

[0005] 当网络元件是移动的并由此具有动态连通性需求时，或者在网络架构以自组织 (ad hoc) 拓扑结构而非固定拓扑结构来形成的情况下，无线网络往往是优选的。无线网络使用无线电、微波、红外、光等频带中的电磁波以非制导传播模式来采用无形的物理介质。在与固定的有线网络相比较时，无线网络有利地促成用户移动性和快速的现场部署。

[0006] 然而，多个无线网络可存在于同一建筑物内、邻近建筑物内和 / 或同一室外区域内。多个无线网络的普遍存在可导致干扰、降低的吞吐量（例如，因为每个无线网络都在同一区域和 / 或频谱内操作）和 / 或阻碍特定设备进行通信。因此，用于在无线网络密布时进行通信的改进型系统、方法和设备是期望的。

[0007] 概述

[0008] 本发明的系统、方法和设备各自具有若干方面，其中并非仅靠任何单一方面来负责其期望属性。在不限制如由所附权利要求所表达的本发明的范围的情况下，现在将简要地讨论一些特征。在考虑此讨论后，并且尤其是在阅读题为“详细描述”的章节之后，将理解本发明的特征是如何提供包括无线网络中的接入点和站之间的改进的通信在内的优点的。

[0009] 所公开的一个方面是用于向多个无线设备传送物理层分组的方法或装置。另一方面是存储执行该方法的指令的计算机可读存储介质。该方法包括生成物理层分组以包括多个载荷，其中至少一个载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据，并且其中在该物理层分组中每个载荷之前至少有信令字段；以及传送该物理层分组。该方法的一些方面还包括生成物理层分组以由短训练字段、长训练字段、和信令字段中的一者或多者来分隔该物理层分组中的诸载荷。该方法的一些方面包括生成该物理层分组以指示与该多个载荷相关联的传输调度。该方法的一些方面包括在该多个载荷之前的信令字段的历时字段中指示该传输调度。

[0010] 在一些方面，该方法还包括生成该分组以包括在该多个载荷的第一载荷之前的信令字段以指示该第一载荷是否是正使用单用户传输、多用户多输入多输出传输 (MU-MIMO)

传输或正交频分多址 (OFDMA) 传输中的一者来传送的。在一些方面，该方法还包括生成该第一载荷以包括子带，该子带包括第三数据和第四数据，其中第三数据和第四数据定址到不同设备；以及使用 OFDMA 传送该第一载荷。

[0011] 在一些方面，第三数据和第四数据的传输在子带内由签名来在时间上分隔。在一些方面，该方法还包括基于第三数据的目的地设备的调制和编码方案 (MCS) 以及第四数据的目的地设备的调制和编码方案 (MCS) 来排序第三和第四数据的传输。

[0012] 所公开的另一方面是用于从无线网络接收高效率物理数据分组的方法和装置。另一方面是存储当被执行时使得处理器执行该方法的指令的计算机可读存储介质。该方法包括从无线网络接收物理层分组；解码该分组以标识第一信令字段；解码该第一信令字段以标识来自该分组的第一载荷，该第一载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据；解码该分组以标识第二信令字段；以及解码该第二信令字段以标识第二载荷，该第二载荷包括定址到第一设备、第二设备或第三设备中的至少一者的第三数据。

[0013] 在一些方面，该方法还包括标识在该物理层分组中分隔第一和第二载荷的签名，其中该签名是短训练字段、长训练字段、和信令字段中的一者或多者。在一些方面，该方法还包括解码该物理层分组以确定与第一和第二载荷相关联的传输调度。在一些方面，该方法还包括解码对应信令字段中的历时字段以确定载荷的传输调度。在一些方面，该方法还包括解码在载荷之前的信令字段以确定该载荷是经由单用户传输、多用户多输入多输出传输 (MU-MIMO) 传输还是正交频分多址 (OFDMA) 传输来传送的。在该方法的一些方面，第一载荷经由 OFDMA 接收，并且其中该 OFDMA 载荷的子带包括第三数据和第四数据，其中第三数据和第四数据被定址到不同设备。在该方法的一些方面，该方法包括基于群标识符来解码该子带中的数据。在该方法的一些方面，该方法还包括解码在该载荷之前的信令字段来确定该载荷中包括传送给该至少两个不同设备的数据的频率子带数目的指示。

[0014] 附图简述

[0015] 图 1 示出了其中可采用本公开的各方面的示例性无线通信系统。

[0016] 图 2A 示出了其中存在多个无线通信网络的无线通信系统。

[0017] 图 2B 示出了其中存在多个无线通信网络的另一无线通信系统。

[0018] 图 3 示出了可以在图 1 和 2B 的无线通信系统内采用的频率复用技术。

[0019] 图 4 示出了可在图 1、2B 和 3 的无线通信系统内采用的示例性无线设备的功能框图。

[0020] 图 5A 解说了可以被用在高效率 WiFi 实现中的物理层分组的示例性结构。

[0021] 图 5B 示出了高效率分组的一部分。

[0022] 图 5C 示出了高效率分组的另一实现。

[0023] 图 5C 示出了高效率分组的示例性实现。

[0024] 图 5E 示出了高效率载荷和高效率信令字段的示例性实现。

[0025] 图 6 是用于在无线网络上传送高效率分组的过程的流程图。

[0026] 图 7 是用于在无线网络上接收高效率分组的过程的流程图。

[0027] 详细描述

[0028] 以下参照附图更全面地描述本新颖系统、装置和方法的各种方面。然而，本公开可用许多不同形式来实施并且不应解释为被限定于本公开通篇给出的任何具体结构或功能。

确切而言，提供这些方面是为了使本公开将是透彻和完整的，并且其将向本领域技术人员完全传达本公开的范围。基于本文中的教导，本领域技术人员应领会到，本公开的范围旨在覆盖本文中公开的这些新颖的系统、装置和方法的任何方面，不论其是独立实现的还是与本发明的任何其他方面组合实现的。例如，可以使用本文所阐述的任何数目的方面来实现装置或实践方法。另外，本发明的范围旨在覆盖使用作为本文中所阐述的本发明各种方面的补充或者与之不同的其他结构、功能性、或者结构及功能性来实践的装置或方法。应当理解，本文披露的任何方面可以由权利要求的一个或多个要素来实施。

[0029] 尽管本文描述了特定方面，但这些方面的众多变体和置换落在本公开的范围之内。尽管提到了优选方面的一些益处和优点，但本公开的范围并非旨在被限定于特定益处、用途或目标。相反，本公开的各方面旨在宽泛地适用于不同的无线技术、系统配置、网络、和传输协议，其中一些藉由示例在附图和以下对优选方面的描述中解说。详细描述和附图仅仅解说本公开而非限定本公开，本公开的范围由所附权利要求及其等效技术方案来定义。

[0030] 流行的无线网络技术可包括各种类型的无线局域网 (WLAN)。WLAN 可被用于采用广泛使用的联网协议来将近旁设备互连在一起。本文中所描述的各个方面可应用于任何通信标准，诸如无线协议。

[0031] 在一些方面，可使用正交频分复用 (OFDM)、直接序列扩频 (DSSS) 通信、OFDM 与 DSSS 通信的组合、或其他方案来根据高效率 802.11 协议传送无线信号。高效率 802.11 协议的实现可被用于因特网接入、传感器、计量、智能电网或其它无线应用。有利地，使用此处所公开的技术来实现高效率 802.11 协议的特定设备的各方面可包括允许在同一区域内增加的对等服务（例如，Miracast、WiFi Direct 服务、社交 WiFi 等）、支持增加的每用户最低吞吐量要求、支持更多用户、提供改善的室外覆盖和稳定性、和 / 或消耗比实现其它无线协议的设备更少的功率。

[0032] 在一些实现中，WLAN 包括作为接入无线网络的组件的各种设备。例如，可以存在两种类型的设备 :接入点（“AP”）和客户端（也称为站或“STA”）。一般而言，AP 可用作 WLAN 的中枢或基站，而 STA 用作 WLAN 的用户。例如，STA 可以是膝上型计算机、个人数字助理 (PDA)、移动电话等。在一示例中，STA 经由遵循 WiFi（例如，IEEE 802.11 协议）的无线链路连接到 AP 以获得到因特网或到其它广域网的一般连通性。在一些实现中，STA 也可被用作 AP。

[0033] 接入点 (“AP”) 还可包括、被实现为或被称为 B 节点、无线电网络控制器 (“RNC”)、演进型 B 节点、基站控制器（“BSC”）、基收发机站（“BTS”）、基站（“BS”）、收发机功能（“TF”）、无线电路由器、无线电收发机或其他某个术语。

[0034] 站（“STA”）还可包括、被实现为、或被称为接入终端（“AT”）、订户站、订户单元、移动站、远程站、远程终端、用户终端、用户代理、用户设备、用户装备或其他某个术语。在一些实现中，接入终端可包括蜂窝电话、无绳电话、会话发起协议（“SIP”）话机、无线本地环路（“WLL”）站、个人数字助理（“PDA”）、具有无线连接能力的手持式设备、或连接至无线调制解调器的其他某种合适的处理设备。因此，本文所教导的一个或多个方面可被纳入到电话（例如，蜂窝电话或智能电话）、计算机（例如，膝上型设备）、便携式通信设备、手持机、便携式计算设备（例如，个人数据助理）、娱乐设备（例如，音乐或视频设备、或卫星无线电）、游戏设备或系统、全球定位系统设备、或被配置成经由无线介质通信的任何其他合适

的设备中。

[0035] 如以上所讨论的，本文中所描述的某些设备可实现例如高效率802.11标准。此类设备（无论是用作STA还是AP还是其他设备）可被用于智能计量或者用在智能电网中。此类设备可提供传感器应用或者用在家庭自动化中。这些设备可取而代之或者附加地用在健康护理环境中，例如用于个人健康护理。这些设备也可被用于监督以启用扩展范围的因特网连通性（例如，供与热点联用）、或者实现机器对机器通信。

[0036] 图1示出了其中可采用本公开的各方面的示例性无线通信系统100。无线通信系统100可按照无线标准（例如高效率802.11标准）来操作。无线通信系统100可包括与STA 106a-d通信的AP 104。

[0037] 可以将各种过程和方法用于无线通信系统100中在AP 104与STA 106a-d之间的传输。例如，可以根据OFDM/OFDMA技术在AP 104与STA 106之间发送和接收信号。如果是这种情形，则无线通信系统100可以被称为OFDM/OFDMA系统。替换地，可以根据码分多址(CDMA)技术在AP 104与STA 106a－d之间发送和接收信号。如果是这种情形，则无线通信系统100可被称为CDMA系统。

[0038] 促成从AP 104至一个或多个STA 106的传输的通信链路可被称为下行链路(DL)108，而促成从一个或多个STA 106至AP 104的传输的通信链路可被称为上行链路(UL)110。替换地，下行链路108可被称为前向链路或前向信道，而上行链路110可被称为反向链路或反向信道。

[0039] AP 104可充当基站并提供基本服务区域(BSA)102中的无线通信覆盖。AP 104连同与该AP 104相关联并使用该AP 104来通信的诸STA 106一起可被称为基本服务集(BSS)。应注意，无线通信系统100可以不具有中央AP 104，而是可以作为STA 106之间的对等网络起作用。相应地，本文中所描述的AP 104的功能可替换地由一个或多个STA 106来执行。

[0040] 在一些方面，STA 106可能被要求与AP 104进行关联以向该AP 104发送通信和/或从该AP 104接收通信。在一个方面，用于关联的信息被包括在由AP 104作出的广播中。为了接收此种广播，例如，STA 106可在覆盖区划上执行宽覆盖搜索。举例而言，搜索还可由STA 106通过以灯塔方式扫过覆盖区划来执行。在接收到用于关联的信息之后，STA 106可向AP 104传送参考信号，诸如关联探测或请求。在一些方面，AP 104可使用回程服务例如以与更大的网络（诸如因特网或公共交换电话网(PSTN)）通信。

[0041] 在一实施例中，AP 104包括AP高效率无线组件(HEWC)154。AP HEWC 154可执行本文描述的操作中的一些或全部以使得能够使用高效率802.11协议来在AP 104与STA 106之间进行通信。AP HEWC 154的功能性以下至少参考图2B、3和4来更详细地描述。

[0042] 替换地或补充地，STA 106可包括STA HEWC 156。STA HEWC 156可执行本文描述的操作中的一些或全部以使得能够使用高频率802.11协议来在STA 106和AP 104之间进行通信。STA HEWC 156的功能性以下至少参考图2B、3和4来更详细地描述。

[0043] 在某些环境中，一BSA可位于其他BSA附近。例如，图2A示出了其中存在多个无线通信网络的无线通信系统200。如图2A所解说，BSA 202A、202B和202C可以物理地彼此邻近。尽管BSA 202A-C紧邻，但是AP 204A-C和/或STA 206A-H可以各自使用相同的频谱来通信。因此，如果BSA 202C中的设备（例如，AP 204C）正在传送数据，则在BSA 202C

以外的设备（例如，AP 204A-B 或 STA 206A-F）可以侦听到介质上的通信。

[0044] 一般而言，使用常规 802.11 协议（例如，802.11a、802.11b、802.11g、802.11n 等）的无线网络在用于介质接入的载波侦听多址（CSMA）机制下操作。根据 CSMA，设备侦听介质并且只在介质被侦听到为空闲时进行传送。因此，如果 AP 204A-C 和 / 或 STA 206A-H 正根据 CSMA 机制来操作并且 BSA 202C 中的设备（例如，AP 204C）正在传送数据，则在 BSA 202C 以外的 AP 204A-B 和 / 或 STA 206A-F 不可在介质上进行传输，即使这些 AP 和 / 或 STA 是一不同 BSA 的一部分。

[0045] 图 2A 解说了这一情景。如图 2A 所解说，AP 204C 正在介质上进行传送。该传输被与 AP 204C 在相同 BSA 202C 中的 STA 206G 侦听到，并被与 AP 204C 在不同的 BSA 中的 STA 206A 侦听到。虽然该传输可被定址到 STA 206G 和 / 或仅仅 BSA 202C 中的 STA，但 STA 206A 却可能直到 AP 204C（以及任何其他设备）不再在介质上进行传送才能够传送或接收通信（例如，去往或来自 AP 204A）。尽管未示出，但同样情况也可适用于 BSA 202B 中的 STA 206D-F 和 / 或 BSA 202A 中的 STA 206B-C（例如，如果 AP 204C 进行的传输更强以使得其他 STA 能够侦听到介质上的该传输）。

[0046] 于是对 CSMA 机制的使用造成低效，因为在一 BSA 以外的一些 AP 或 STA 可能能够在不干扰由该 BSA 中的 AP 或 STA 进行的传输的情况下传送数据。随着活跃无线设备的数量持续增长，这类低效可能开始显著地影响网络等待时间和吞吐量。例如，显著的网络等待时间问题可能出现在公寓楼内，其中每个公寓单元都可包括接入点及相关联的站。事实上，每个公寓单元都可包括多个接入点，因为住户可拥有无线路由器、具有无线媒体中心能力的视频游戏控制台、具有无线媒体中心能力的电视机、能够像个人热点那样工作的蜂窝电话、和 / 或类似物。于是纠正 CSMA 机制的此类低效对于避免等待时间和吞吐量问题和总体用户不满而言会是至关重要的。

[0047] 这些等待时间和吞吐量问题甚至可能不限于居住区域。例如，多个接入点可位于机场、地铁站、和 / 或其他人群密集的公共空间。当前，可以在这些公共空间中提供 WiFi 接入，但要收费。如果不纠正由 CSMA 机制造成的此类低效，则无线网络的运营商可能由于收费和较低的服务质量开始超过任何益处而失去客户。

[0048] 因此，本文描述的高效率 802.11 协议可允许设备在经修改的机制下操作，此经修改的机制使这些低效得以最小化并增加网络吞吐量。这一机制以下参考图 2B、3 和 4 来描述。高效率 802.11 协议的附加方面以下参考图 5-7 来描述。

[0049] 图 2B 示出了其中存在多个无线通信网络的无线通信系统 250。不像图 2A 的无线通信系统 200，无线通信系统 250 可以按照本文讨论的高效率 802.11 标准来操作。无线通信系统 250 可包括 AP 254A、AP 254B 和 AP 254C。AP 254A 可以与 STA 256A-C 进行通信，AP 254B 可以与 STA 256D-F 进行通信，而 AP 254C 可以与 STA 256G-H 进行通信。

[0050] 可以将各种过程和方法用于无线通信系统 250 中在 AP 254A-C 与 STA 256A-H 之间的传输。例如，可以根据 OFDM/OFDMA 技术或 CDMA 技术来在 AP 254A-C 和 STA 256A-H 之间发送和接收信号。

[0051] AP 254A 可充当基站并提供 BSA 252A 中的无线通信覆盖。AP 254B 可充当基站并提供 BSA 252B 中的无线通信覆盖。AP 254C 可充当基站并提供 BSA 252C 中的无线通信覆盖。应当注意，每个 BSA 252A、252B 和 / 或 252C 可以不具有中央 AP 254A、254B 或 254C，而

是可允许这些 STA 256A-H 中的一个或多个 STA 之间的对等通信。相应地，本文中所描述的 AP 254A-C 的功能可替换地由这些 STA 256A-H 中的一个或多个 STA 来执行。

[0052] 在一实施例中，AP 254A-C 和 / 或 STA 256A-H 包括高效率无线组件。如此处所描述的，高效率无线组件可使得能够使用高效率 802.11 协议来在 AP 和 STA 之间进行通信。具体而言，高效率无线组件可使得 AP 254A-C 和 / 或 STA 256A-H 能够使用经修改的机制，此经修改的机制使 CSMA 机制的低效最小化（例如，使得能够在不会发生干扰的情况下在介质上进行并发通信）。高效率无线组件以下参考图 4 来更详细地描述。

[0053] 如图 2B 所解说的，BSA 252A-C 物理地彼此邻近。当例如 AP 254A 和 STA 256B 正在彼此通信时，该通信可被 BSA 252B-C 中的其它设备侦听到。然而，该通信可能只干扰某些设备，诸如 STA 256F 和 / 或 STA 256G。在 CSMA 下，AP 254B 不会被允许与 STA 256E 进行通信，即使这种通信不会干扰 AP 254A 和 STA 256B 之间的通信。由此，高效率 802.11 协议在经修改的机制下操作，该经修改的机制对在能够并发地通信的设备和不能并发地通信的设备之间进行区分。这一设备归类可由 AP 254A-C 和 / 或 STA 256A-H 中的高效率无线组件来执行。

[0054] 在一实施例中，对设备是否能够与其它设备并发地通信的判断基于该设备的位置。例如，位于 BSA 边缘附近的 STA 可能处在使得该 STA 无法与其他设备并发地通信的状态或状况中。如图 2B 所示，STA 206A、206F 和 206G 可以是处在其中它们无法与其它设备并发地通信的状态或状况的设备。同样，位于 BSA 中心附近的 STA 可能处在使得该 STA 能够与其他设备进行通信的状态或状况中。如图 2 中所解说的，STA 206B、206C、206D、206E 和 206H 可以是处在其中它们能够与其他设备并发地通信的状态或状况中的设备。注意，设备分类不是永久的。设备可以在处在使其能够并发地通信的状态或状况与处在使其不能够并发地通信的状态或状况之间转变（例如，设备可以在运动中时、在与新 AP 进行关联时、在解除关联时等改变状态或状况）。

[0055] 此外，设备可被配置成基于它们是否是处在与其他设备并发地通信的状态或状况中的设备而有不同的行为。例如，处在使其能够并发地通信的状态或状况中的设备可以在相同的频谱内通信。然而，处在使其不能并发地通信的状态或状况中的设备可采用某些技术（诸如空间复用或频域复用）来在该介质上通信。对设备行为的控制可由 AP 254A-C 和 / 或 STA 256A-H 中的高效率无线组件来执行。

[0056] 在一实施例中，处在使其不能并发地通信的状态或状况的设备使用空间复用技术来在介质上通信。例如，功率和 / 或其它信息可以嵌入在由另一设备传送的分组的前置码内。当在介质上侦听到分组时，处在使其不能并发地通信的状态或状况的设备可以分析前置码，并基于规则集来决定是否要进行传输。

[0057] 在另一实施例中，处在使其不能并发地通信的状态或状况的设备使用频域复用技术来在介质上通信。图 3 示出了可以在图 1 的无线通信系统 100 和图 2B 的无线通信系统 250 内采用的频率复用技术。如图 3 所示，在无线通信系统 300 内可以存在 AP 304A、304B、304C 和 304D。AP 304A、304B、304C 和 304D 中的每一者都可以与不同的 BSA 相关联并且包括本文描述的高效率无线组件。

[0058] 作为示例，通信介质的带宽可以是 80MHz。在常规 802.11 协议下，AP 304A、304B、304C 和 304D 中的每一者以及与每一个相应 AP 相关联的 STA 尝试使用整个带宽来进行通

信，这可减少吞吐量。然而，在使用频域复用的高效率 802.11 协议下，带宽可被分成四个 20MHz 段 308、310、312 和 314（例如，信道），如图 3 所解说。AP 304A 可以与段 308 相关联，AP 304B 可以与段 310 相关联，AP 304C 可以与段 312 相关联，而 AP 304D 可以与段 314 相关联。

[0059] 在一实施例中，当 AP 304A-D 中的一个或多个 AP 以及处在能够与其它设备并发地通信的状态或状况中的 STA（例如，在 BSA 的中心附近的 STA）正在彼此通信时，则每一个 AP 304A-D 以及这些 STA 中的每一个 STA 可使用 80MHz 介质的一部分或整个 80MHz 介质来进行通信。因为 AP 和 STA 并不互相干扰，所以其可以有效地共享可用带宽的共用部分。

[0060] 当 AP 304A-D 中的一个或多个以及处在不能与其它设备并发地通信的状态或状况中的 STA（例如，在 BSA 的边缘附近的 STA）正在彼此通信时，则 AP 304A 及其 STA 使用 20MHz 段 308 来进行通信，AP 304B 及其 STA 使用 20MHz 段 310 来进行通信，AP 304C 及其 STA 使用 20MHz 段 312 来进行通信，而 AP 304D 及其 STA 使用 20MHz 段 314 来进行通信。因为段 308、310、312 和 314 代表通信介质的不同部分，所以使用第一段的第一传输不会干扰使用第二段的第二传输。

[0061] 由此，使用图 3 中所示的划分带宽方案，包括高效率无线组件的 AP 和 / 或 STA（包括那些处于不能够与其他设备并发地通信的状态或状况中的设备）可以能够与其他 AP 和 STA 并发地通信而不受干扰。相应地，相比于包括同样设备但不将无线介质划分成多个带宽段的通信系统而言，无线通信系统 300 的吞吐量可得以增加。

[0062] 在公寓楼或人群密集的公共空间的情况下，使用高效率无线组件的 AP 和 / 或 STA 甚至可以在活跃无线设备的数量增加时经历减少的等待时间和增加的网络吞吐量，由此改善用户体验。

[0063] 图 4 示出了可在图 1、2B 和 3 的无线通信系统 100、250 和 / 或 300 内采用的无线设备 402 的示例性功能框图。无线设备 402 是可被配置成实现本文描述的各种方法的设备的示例。例如，无线设备 402 可包括 AP 104、STA 106 之一、AP 254a-c 之一、STA 256a-h 之一和 / 或 AP 304a-d 之一。

[0064] 无线设备 402 可包括控制无线设备 404 的操作的处理器 402。处理器 404 也可被称为中央处理单元 (CPU)。可包括只读存储器 (ROM) 和随机存取存储器 (RAM) 两者的存储器 406 可以向处理器 404 提供指令和数据。存储器 406 的一部分还可包括非易失性随机存取存储器 (NVRAM)。处理器 404 通常基于存储器 406 内存储的程序指令来执行逻辑和算术运算。存储器 406 中的指令可以是可执行的以实现本文描述的方法。

[0065] 处理器 404 可包括用一个或多个处理器实现的处理系统或者可以是其组件。这一个或多个处理器可以用通用微处理器、微控制器、数字信号处理器 (DSP)、现场可编程门阵列 (FPGA)、可编程逻辑器件 (PLD)、控制器、状态机、选通逻辑、分立硬件组件、专用硬件有限状态机、或能够对信息执行演算或其他操纵的任何其他合适实体的任何组合来实现。

[0066] 处理系统还可包括用于存储软件的机器可读介质。软件应当被宽泛地解释成意指任何类型的指令，无论其被称作软件、固件、中间件、微代码、硬件描述语言、或是其他。指令可包括代码（例如，呈源代码格式、二进制代码格式、可执行代码格式、或任何其他合适的代码格式）。这些指令在由该一个或多个处理器执行时使处理系统执行本文描述的各种功能。

[0067] 无线设备 402 还可包括外壳 408，该外壳 408 可内含发射机 410 和 / 或接收机 412 以允许在无线设备 402 与远程位置之间进行数据的传送和接收。发射机 410 和接收机 412 可被组合成收发机 414。天线 416 可被附连至外壳 408 并且电耦合至收发机 414。无线设备 402 还可包括（未示出）多个发射机、多个接收机、多个收发机、和 / 或多个天线。

[0068] 无线设备 402 还可包括可被用于力图检测和量化由收发机 414 接收到的信号电平的信号检测器 418。信号检测器 418 可检测诸如总能量、每副载波每码元能量、功率谱密度之类的信号以及其它信号。无线设备 402 还可包括用于处理信号的数字信号处理器 (DSP) 420。DSP 420 可被配置成生成分组以供传输。在一些方面，分组可包括物理层数据单元 (PPDU)。

[0069] 在一些方面，无线设备 402 可进一步包括用户接口 422。用户接口 422 可包括按键板、话筒、扬声器、和 / 或显示器。用户接口 422 可包括向无线设备 402 的用户传达信息和 / 或从该用户接收输入的任何元件或组件。

[0070] 在某些方面，无线设备 402 可进一步包括高效率无线组件 424。高效率无线组件 424 可包括分类器单元 428 和发射控制器单元 430。如此处所描述的，高效率无线组件 424 可使得 AP 和 / 或 STA 能够使用经修改的机制，此经修改的机制使 CSMA 机制的低效最小化（例如，使得能够在不会发生干扰的情况下在介质上进行并发通信）。

[0071] 此经修改机制可由分类器单元 428 和发射控制单元 430 来实现。在一实施例中，分类器单元 428 确定哪些设备处在使得它们能够与其他设备并发地通信的状态或状况中、以及哪些设备处在使得它们不能与其他设备并发地通信的状态或状况中。在一实施例中，发射控制单元 430 控制设备的行为。例如，发射控制单元 430 可允许某些设备在相同介质上并发地传送，并且允许其他设备使用空间复用或频域复用技术来传送。发射控制单元 430 可基于由分类器单元 428 做出的确定来控制设备的行为。

[0072] 无线设备 402 的各种组件可由总线系统 426 耦合在一起。总线系统 426 可包括例如数据总线，以及除了数据总线之外还有电源总线、控制信号总线、和状态信号总线。本领域技术人员将领会，无线设备 402 的各组件可耦合在一起或者使用某种其他机制来接受或提供彼此的输入。

[0073] 尽管图 4 中解说了数个分开的组件，但本领域技术人员将认识到，这些组件中的一个或多个组件可被组合或者共同地实现。例如，处理器 404 可被用于不仅实现以上关于处理器 404 描述的功能性，而且还实现以上关于信号检测器 418 和 / 或 DSP 420 描述的功能性。另外，图 4 中解说的每个组件可使用多个分开的元件来实现。

[0074] 无线设备 402 可包括 AP 104、STA 106、AP 254、STA 256 和 / 或 AP 304，并且可用于传送和 / 或接收通信。即，AP 104、STA 106、AP 254、STA 256 或 AP 304 任一者均可用作发射机或接收机设备。某些方面构想了信号检测器 418 由在存储器 406 和处理器 404 上运行的软件用来检测发射机或接收机的存在。

[0075] 图 5A 解说了可以被用在高效率 WiFi 实现中的物理层分组的示例性结构。高效率分组 500a 可以被用来例如向不同目的地设备传送多个载荷。例如，第一、第二和第三载荷可以分别被传送给第一、第二和第三设备。

[0076] 高效率分组 500a 包括旧式前同步码 502a、高效率 (he) 指示 504a、旧式载荷 506a、高效率信令字段 508a、可任选长训练字段和 / 或短训练字段 509a、高效率载荷字段 510a、

可任选长训练字段和/或短训练字段511a、高效率信令字段512a和高效率载荷字段514a。在一些方面，高效率指示字段504a可指示分组500a包括he信令字段508a、he载荷510a、he信令字段512a和he载荷字段514a中的一者或多者。

[0077] 高效率分组500a可以提供将以不同无线设备为目的地的多个消息聚集到一个物理层无线分组中。例如，高效率分组500a包含he载荷510a和he载荷514a。高效率分组500a的各种方面中的高效率载荷字段的数目可以与所解说的有所不同。例如，高效率分组500a可以在一些方面仅包含一个高效率载荷。在一些其他方面，高效率分组500a可包含例如3、4、5、6、7、8、9或10个高效率载荷。

[0078] 通过聚集多个消息或载荷，利用分组500a的通信系统可以提供无线网络中的、与个体地发送多个消息或载荷中的每一个的通信系统相比而言降低的开销和增加的吞吐量。例如，通过传送分组500a——该分组500a可包括诸如he载荷510c和he载荷514c的多个消息，其中至少有一些是定址到不同设备的，与传送分组500a的前置码502a相关联的开销就可以被分摊在该多个消息上。附加地，通过传送一个较长分组而非多个较小分组（诸如被包括在分组500a中的每个消息都有一个较小分组），传送设备在发送分组500a前可能仅需要争用无线介质一次。相反，若分组500a内的每个消息在单独的无线消息中被传送，则可能要求传送设备要为每个单独的无线消息争用介质。在一些情境中，那些附加传输中的一个或多个传输可能会导致分组冲突。结果，可能要求传送设备在尝试重传该消息之前要执行附加的载波侦听介质接入冲突解决过程。CDMA过程可以包括退避规程，结果导致无线介质上附加的潜在损耗带宽。与该多个消息的传输相关联的附加开销可以通过在一个分组500a内传送该多个消息而得以降低。

[0079] 图5B示出了高效率分组500a的一部分520。具体地，部分520示出了具有一部分旧式前置码502a以及高效率指示504a的一个实现。分组部分520解说了旧式前置码502a可包括短训练字段522、长训练字段524和旧式信令字段526。在一些方面，旧式前置码信令字段526可包括历时指示（未示出）。在高效率分组500a的一些方面，旧式前置码信令字段526的历时指示可以指示整个高效率分组的历时。例如，在图5A的高效率分组500a的示例中，此历时将包括直到（并包括）he载荷514a的所有所解说的字段。he指示字段504a跟随在旧式前置码信令字段526之后。在一些方面，he指示字段504a可包括三个码元505a-c。在一些方面，这些码元可以使用Q-BPSK旋转来调制以提供对跟随在he指示504a之后的高效率载荷的指示。在一些方面，he指示字段504a的一个或多个特征可以被包括在he信令字段508a-c和/或512a-c中，其中的一些在以下描述。

[0080] 将旧式前置码502a作为高效率分组的一部分来提供的方面可以使得旧式设备能继续恰当地退让于包括旧式前置码502a的分组。这些旧式设备可以依靠旧式信令字段的使用来确定何时要退让。例如，这在一些无线网络中可以特别有用，诸如在利用混合模式前置码的802.11ac网络中。

[0081] 图5C示出了高效率分组500b的另一实现。在分组500b的该实现中，he指示字段504a并未出现。在该实现中，高效率分组500b可以基于旧式前置码502b的一个或多个字段而区别于旧式分组。例如，在一方面，以上针对图5B所讨论的旧式信令字段（诸如旧式信令字段526）的一个或多个字段可以将高效率分组与旧式分组区别开来。在另一方面，两码元的VHT-SIG-A字段的保留状态或字段可以被用来在高效率分组与旧式分组之间进

行区分。在一些方面，此两码元 VHT-SIG-A 字段可以被包括在 he 信令字段 508a-c、和 / 或 512a/c 中的一者或多者中，其中的一些在以下描述。

[0082] 图 5D 示出了高效率分组的示例性实现。类似于图 5A，高效率分组 500c 包括前置码 502c 的旧式部分、高效率指示 504c、旧式数据字段 506c、高效率信令字段 508c、高效率载荷字段 510c、高效率信令字段 512c、和高效率载荷字段 514c。高效率载荷字段 510c 可以使用去往一个或多个接收设备的多用户 MIMO(MU-MIMO) 来调制，而高效率载荷字段 514c 可以使用去往一个或多个接收设备的 OFDMA 来调制。注意，分组 500c 的解说并不示出分组 500c 例如在信令字段 508c 或信令字段 512c 之前包括短和 / 或长训练字段。然而，尽管该解说是如此，但在分组 500c 的一些方面，一个或多个长和 / 或短训练字段被至少包括在旧式数据 506c 和信令字段 508c、和 / 或 he 载荷 510c、及信令字段 512c 之间。

[0083] 图 5D 示出了使用三个子带 515a-c 调制的高效率载荷字段 514c。第一子带 515a 调制给单个设备（“设备 1”）的数据长达高效率载荷字段 514c 的历时。类似地，子带 515c 也调制给单个设备（“设备 3”）的数据长达高效率载荷字段 514c 的历时。子带 515b 调制给两个不同设备（“设备 2A”和“设备 2B”）的数据。如图 5D 中所示，给多个设备的数据可以通过过载两个设备的群标识符来在单个子带内被传送例如，若两个设备在 he 信令字段 512c（对应于载荷 514c）中信令通知的群 id 内具有相同用户位置。例如，如图 5D 中所示，设备 2A 和设备 2B 可以在由 he 信令字段 512c 信令通知的 GID 内具有相同的位置。

[0084] 如以下针对图 5E 所进一步描述的，高效率信令字段 512c 的子带分配字段可以为在每个子带 515a-c 内调制的数据指示目的地设备的数目。

[0085] 在一些方面，在调制要给多个设备的数据的子带中，该多个设备的数据可以由一个或多个码元签名 516 来划界或分隔。该（诸）签名 516 可以使得接收设备能标识给特定设备的数据在特定子信道内何时开始。在一些方面，在子带内划界或分隔两个不同设备的数据的签名（诸如签名 516）可包括信令字段、短训练字段和 / 或长训练字段。信令字段可指示跟随在分组中的信令字段之后的数据的调制编码方案 (MCS)、编码、空间流数目 (Nss)、或空时块编码 (STBC) 中的一者或多者。在一些方面，签名 516 可包括已经被预指派以指示从以第一设备或设备群为目的地的数据转换到以第二设备或设备群为目的地的数据的特定位值序列。

[0086] 图 5E 示出了高效率载荷 560 以及在前的信令字段 508 的至少一部分的示例性实现。高效率信令字段部分 508 包括传输类型指示 552、载荷结束指示 554、频率子带分配字段 556、和最末载荷指示 558。在一些实现中，高效率信令字段 508a-c 和 512a-c（图 5A、5C 和 5D 中所示）可以符合图 5E 中所示的高效率信令字段 508 的格式或者至少包括针对图 5E 所描述的一个或多个字段。

[0087] 在一方面，传输类型指示 552 指示载荷字段 560 是否是使用单用户 MIMO、多用户 MIMO、或正交频分多址 (OFDMA) 来调制的。例如，在一些方面，调制类型指示可包括一位。在一些方面，若该位为零，则高效率信令字段 508 中的 Nsts 字段（未示出）被解读为在所指派的子带内为每个用户提供数个空间流。在这些方面，若该位被设置，则其可以指示高效率报头字段 508 中的 Nsts 字段（也未示出）被解读为跨整个带宽为每个设备提供该数个空间流。在一些方面，传输类型指示字段 552 可以不在高效率信令字段 508 中提供。在这些方面，载荷 560 的调制类型可以使用高效率信令字段 508 中任何字段的其他未使用状态信

息来指示。

[0088] 在一些方面，载荷结束指示字段 554 指示了高效率载荷 560 的长度或历时。在另一方面，载荷的历时可以是固定的，并且因此载荷结束指示 554 可以不被包括在高效率信令字段 508 之中。

[0089] 频率子带分配字段 556 可指示 OFDMA 载荷字段 560 的频率子带是如何分配给以不同设备为目的地的数据的。例如，在一些方面，频率子带分配字段 556 可以表示用来为多个设备传送数据的子带的数目。例如，在一方面中，频率子带分配字段 556 为零可指示 OFDMA 载荷字段 560 的每个频率子带被排他地用于以单个设备为目的地的数据。在一些方面，具有值一 (1) 的频率子带分配字段 556 可以指示载荷 560 包括在所传送的数据的第一子带内包括给至少两个用户的数据。在一方面，具有值二 (2) 的频率子带分配字段可以指示数据 560 被如此传送，从而在所传送的数据的第一和第二子带内至少有两个用户。在一方面，具有值三 (3) 的频率子带分配字段可以指示数据 560 被如此传送，从而所传送的数据的第一、第二和第三子带内至少有两个用户。在一些方面，具有值四 (4) 的频率子带分配字段可以指示数据 560 被如此传送，从而所传送的数据的第一、第二、第三和第四子带内至少有两个用户。

[0090] 在一些方面，具有值七 (7) 的频率子带分配字段 556 指示 he 载荷字段 560 是使用 SU-MIMO 或 MU-MIMO 来传送的。在一些方面，频率子带分配字段 556 长度为一、二或三位。在一些其他方面，频率子带分配字段 556 也可以包括以上所讨论的传输类型指示字段 552 的功能。在这些方面，传输类型指示字段 552 可以不被包括在在高效率信令字段 508 中。

[0091] 图 6 是用于在无线网络上传送高效率分组的过程的流程图。由以下的过程 600 所传送的分组可包括多个载荷，其中至少一些载荷包括定址到不同设备的数据。因此，以多个不同设备为目的地的数据可以使用单个分组来传送。这与要求（至少在数据为单播时）为以唯一性设备为目的地的每组数据有单独分组传输的当前方案形成对比。

[0092] 使用以下所提议的方法，所传送分组中的一些数据可被定址到第一设备（但至少在一些方面中不被定址到第二设备），并且此所传送分组中的一些数据可以至少被定址到第二设备（但是至少在一些方面不被定址到第一设备）。例如，若接入点具有给三个不同站的数据在排队，则使用以下所提议的方法，该接入点可以能够传送包括给这三个不同站中的每一者的分别数据的单个分组。

[0093] 当与传送三个分别的分组，其中每个分组包括定址到一特定设备的数据的方案相比较时，以下所讨论的方法 600 可以提供降低的通信网络开销。例如，以下与所传送的分组的分组报头信息相关联的网络开销可以被分摊在更大量的为第一和第二（以及潜在可能为第三）设备传送的数据上。这与将要求传送两个或三个分别的分组报头，其中传送给第一、第二和第三设备中的每一者的每个分组有一个分组报头的方案相比而言是有益的。

[0094] 在一些方面，过程 600 可由接入点或站来执行。在一些方面，过程 600 可由无线设备 402 来执行。例如，设备 402 的处理器 404、发射机 410、以及接收机 412 中的一者或多者可以由存储在存储器 406 中的指令来配置以执行以下所描述的过程 600 的框。

[0095] 在框 602 中，生成物理层分组。在一些方面，框 602 可由处理器 404 执行。物理层分组被生成以包括多个载荷。这多个载荷中的每一个可以包括数据和关于该数据的定址信息。该定址信息指示了该数据的一个或多个目的地设备。在一些方面，参考图 6 所讨论的

载荷可以等效于PLCP协议数据单元(PPDU)。在这些方面中的一些方面中，载荷可以等效于多STA PPDU。

[0096] 这些载荷中至少有一个载荷包括第一和第二数据。该至少一个载荷还包括指示第一和第二数据定址到不同目的地设备的定址信息。

[0097] 在一些方面，该分组被如此生成，从而在物理分组中，该多个载荷由短训练字段、长训练字段、和/或信令字段中的一者或多者来分隔。

[0098] 在一些方面，在物理层分组中，每个载荷之前有信令字段。在这些方面中的一些方面中，每个载荷的信令字段指示该载荷内的包括要传送给至少两个不同设备的数据的频率子带的数目。例如，该(些)信令字段可以实质上符合图5E中所示的信令字段格式508。在一些方面，该分组可以被生成以将(诸)频率子带分配字段556包括在分组中所包括的一个或多个信令字段中。

[0099] 在一些方面，载荷的信令字段包括针对该载荷的传输模式指示。例如，如以上所讨论的，模式指示可以指示该载荷中的数据是在使用MU-MIMO、单用户传输、还是OFDMA传输来传送的。在一些方面，载荷的信令字段可以指示该载荷的历时。例如，其可以指示传送被包括在该载荷中的所有数据所要求的总时间。

[0100] 在一些其他方面，信令字段可以指示为针对载荷的传输调度。例如，该传输调度可以指示哪个设备将在该载荷的哪个部分期间接收数据。该传输调度可以使得接收该载荷的设备能选择性地忽视该分组中的不以它们为目的地的诸部分。这可以在一些方面降低与分组的接收相关联的处理开销。

[0101] 在一些方面，信令字段可以指示其对应的、被包括在该分组中紧随该信令字段的载荷是否是该分组中的最末载荷。例如，如图5E中所示，被包括在分组中的信令字段可以实质上在一些方面符合信令字段508的格式。

[0102] 在一些方面，物理层分组被生成以包括高效率指示。在一些方面呢，此高效率指示指示了高效率载荷(诸如图5D的he载荷510c和/或he载荷514c)是否出现在该分组中。在一些方面，此高效率指示指示了该分组是否至少包括第一数据和第二数据，其中第一和第二数据被定址到不同目的地设备。在一些方面，高效率指示被包括在旧式前置码中。例如，被包括在旧式前置码中的旧式信令字段可包括高效率指示。在一些方面，图5B中所示的旧式信令字段526可以提供高效率指示。

[0103] 在一些其他方面，高效率指示被包括在第一高效率信令字段中。在一些方面，第一高效率信令字段可以是与该分组中跟随其后的任何高效率信令字段不同的格式。例如，在一些方面，第一高效率信令字段可以包括三个码元，而后续的高效率信令字段包含三个以上码元。在一些方面，高效率信令字段是使用Q-BPSK旋转来调制的。

[0104] 在一些其他方面，第一高效率信令字段具有与后续高效率信令字段类似的格式。例如，在一些方面，第一高效率信令字段可以分别实质上符合图5A、5C和5D中所示的高效率信令字段508a、508b和508c。

[0105] 在一些方面，第一数据和第二数据二者可以使用MU-MIMO来传送。替换地，第一和第二数据可以使用OFDMA来传送。在该分组中，第一和第二数据可以由签名字段(诸如以上针对图5D所讨论的签名字段516)分隔。在一些方面，该分组可以进一步被生成为包括第二载荷，该第二载荷包括第三和第四数据。第三和第四数据可以使用与第一和第二数据

相同或不同的调制方案来传送。例如，若第一数据和第二数据是使用 MU-MIMO 来传送的，则第三和第四数据可以使用例如 MU-MIMO 或 OFDMA 来传送。在一些方面，第三和第四数据被定址到不同设备。在一些方面，在该分组内，第三和第四数据由签名（诸如签名字段 516）来分隔。该签名可包括短训练字段、长训练字段、和 / 或指示该签名的特殊位序列中的一者或多者。在一些方面，第一和第二设备可以具有相同的群标识符。

[0106] 在一些方面，第一和第二数据的传输的历时可以是固定的或可变的。若该历时是固定的，那么历时字段可以不与在所生成的分组中携带第一和第二数据的载荷相关联。类似地，第三和第四数据的历时也可以是固定或可变的。

[0107] 在一些方面，该分组被如此生成，从而载荷内的数据基于第三数据和 / 或第四数据的目的地的 MCS 来被排序。例如，在一些方面，在该分组中，给具有较低 MCS 的目的地的数据被包括在给具有较高 MCS 值的目的地的数据之前。

[0108] 在一些方面，该分组被生成为包括载荷，该载荷包括仅传送给单个设备的数据。

[0109] 在一些方面，该分组被生成为包括旧式前置码和旧式载荷。例如，在一些方面，旧式前置码 502a 可以被包括在该分组中。旧式载荷可包括旧式数据部分。在一些方面，旧式载荷可以被格式化为旧式数据字段 506a。

[0110] 在另一方面，旧式前置码包括 VHT-SIG-A 字段，并且 VHT-SIG-A 字段包括高效率指示。在一些方面，高效率指示可以由两码元 VHT-SIG-A 字段的保留状态来信令通知。

[0111] 在框 604 中，传送该物理层分组。在一些方面，该物理层分组包括旧式前置码和 / 或旧式数据部分、和 / 或高效率指示、和 / 或信令字段，所有这些均在上文讨论。在一些方面，所传送的物理层分组可纳入以上参考图 5A-5E 所讨论的一个或多个方面。在一些方面，框 604 可以由发射机 410 或处理器 404 来执行。

[0112] 图 7 是用于在无线网络上接收高效率分组的过程的流程图。所接收到的高效率分组可包括多个载荷，其中至少一些载荷包括定址到不同设备的数据。因此，接收高效率分组的一部分可以包括扫描该分组以标识定址到接收设备的数据，而又选择性地丢弃并非定址到该接收设备的数据。这与当前通常将整个分组定址给特定设备（或在多播 / 广播情形中，给特定的诸设备）的方案形成对比。使用这些当前的方案，整个分组可以要么被丢弃，要么被接收。

[0113] 例如，使用以下所提议的方法，一些数据可被定址到第一设备（但至少在一些方面不被定址到第二设备），并且一些数据可以至少被定址到第二设备（但是至少在一些方面不被定址到第一设备）。以下执行方法 700 的装置可以是第一设备、第二设备或第三设备。因此，以下方法可以选择性地丢弃并非定址到它的数据，而又如以上所讨论地接收并更完整地处理该分组中定址到它的那部分。

[0114] 当与利用两个分别的分组来传送同样数据，其中每个分组包括定址到一特定设备的数据的方案相比较时，以下所讨论的方法 700 可以例如提供降低的通信网络开销。例如，与以下所讨论的分组的分组报头信息相关联的网络开销可以被分摊在更大量的为第一和第二设备两者传送的数据上。这与将要求传送两个分别的分组报头，其中传送给第一和第二设备中的每一者的每个分组有一个分组报头的方案相比是有益的。

[0115] 在一些方面，过程 700 可由接入点或站来执行。在一些方面，过程 700 可由图 4 的设备 402 执行。

[0116] 在框 702，从无线网络接收物理层分组。在一些方面，框 702 可以由接收机 412 和 / 或处理器 404 执行。

[0117] 在框 702，该分组被解码以标识第一字段。在一些方面，该第一字段可以是旧式前置码的高效率区段。在一些方面，第一字段可以是信令字段。

[0118] 在框 706，第一字段被解码以标识第一载荷。该第一载荷包括至少定址到第一设备的第一数据和至少定址到第二设备的第二数据。该第一设备不同于第二设备。

[0119] 在一些方面，在第一载荷中，第一数据和第二数据可以由签名分隔。该签名可以包括短和 / 或长训练字段、信令字段、和 / 或预定的位值序列。在一些方面，在该载荷中扫描签名。在一些方面，签名的开始可以仅在每第 N 个 OFDM 码元之前发生。这可以降低与扫描签名相关联的开销。

[0120] 一旦标识出签名，第一数据和第二数据就能被标识。例如，在分组中，第一数据可以在该签名之前，而第二数据可以在该签名之后到来。在一些方面，该签名可以类似于以上所讨论的签名 516。在一些方面，框 704 和 706 中的一者或多者可以在一些方面中由处理器 404 执行。

[0121] 第一字段可包括传输模式指示，其指示第一数据和 / 或第二数据是使用单用户传输模式、MU-MIMO、还是 OFDMA 来传送的。在一些方面，第一字段是高效率信令字段，诸如图 5A 的 he 信令字段 508a 和 512a、或者图 5c 的字段 508b 或 512b、或者图 5D 的字段 508c 或 512c。在一些方面，参考图 7 所讨论的载荷可以等效于物理层汇聚协议 (PLCP) 协议数据单元 (PPDU)。在这些方面中的一些方面中，载荷可以等效于多 STA PPDU。

[0122] 在框 708，该分组被解码以标识第二字段。第二字段可以是信令字段。第二字段之前可以是第二签名。第二签名可以包括短或长训练字段、或者预定的位值序列中的一者或多者。该第二字段可以通过在分组中扫描第二签名来标识。在一些方面，第二签名的开始可以仅在每第 N 个 OFDM 码元之前发生。这可以降低与扫描第二签名相关联的开销。注意，若以上讨论的第一字段是信令字段，那么其之前也可以是签名（类似于第二签名）。

[0123] 在框 710 中，第二字段被解码以标识第二载荷。该分组可包括多个载荷，该多个载荷包括第一和第二载荷，但还可包括附加载荷。每个载荷可包括数据和关于该数据的定址信息。在一些方面，框 708 和 710 中的一者或多者可以在一些方面由处理器 404 执行。

[0124] 在一些方面，在过程 700 中接收到的分组中的该多个载荷中的至少两个载荷可以使用不同传输模式接收。例如，第一载荷可以使用 SU-MIMO 来接收而第二载荷可以使用 OFDMA 来接收。该多个载荷中的另一载荷可以经由单用户传输来接收。在一些方面，所接收的分组可以是如由图 5A-E 中的一者或多者所描述的格式。

[0125] 若载荷经由 OFDMA 接收，则该载荷的 OFDMA 传输的子带可包括以至少两个不同设备为目的地的数据。例如，该子带可包括以第三设备为目的地的第三数据、和以第四设备为目的地的第四数据。

[0126] 这些载荷基于该分组中在这些载荷之前的信令字段来被处理。在一些方面，过程 700 可基于信令字段中的最末载荷指示来确定物理层分组的结束。例如，在一些方面，最末载荷指示字段 558 可以被利用来确定物理层分组的结束。过程 700 的一些方面包括当接收到最末高效率载荷指示（如可以在字段 558 中指示的）时确定框 702 中接收的分组的接收完成，并且对应于该指示的载荷的接收也已被完成。

[0127] 在一些方面，接收到的分组被解码以标识针对这些载荷中的一者或多者的传输调度。在一些方面，该传输调度可以被包括在居于这些经调度的载荷之前的信道字段或历时字段中。

[0128] 在一些方面，被包括在接收到的物理分组中的每个载荷的收到可以基于对每个载荷所确定的结束。每个载荷的结束可以在一些方面基于载荷结束指示字段（诸如图 5E 中所示的载荷结束指示字段 554）来确定。在一些其他方面，每个载荷的结束可以基于固定载荷历时来确定。

[0129] 该多个载荷中的载荷可以基于在之前的信令字段中所指示的传输模式来被解码。在一些方面，可以使用 OFDMA 接收一个或多个载荷。在一些方面，这些 OFDMA 载荷中的一者或多者的频率子带可以包括给至少两个设备的数据，例如如图 5D 的高效率载荷 514c 中所示的。在这些方面，框 704 可以基于执行过程 700 的设备的群标识符来解码子带中的数据。

[0130] 若接收到的分组包括 OFDMA 载荷，则频率子带分配字段可以从居于 OFDMA 载荷之前的信令字段来解码。接收到的分组中的频率子带分配字段可以起到以上参考图 5E 和频率子带分配字段 556 所描述的功能。接收设备可以确定如何基于频率子带分配字段来解码接收到的载荷的 OFDMA 子带内的数据。

[0131] 如本文所使用的，术语“确定”涵盖各种各样的动作。例如，“确定”可包括演算、计算、处理、推导、研究、查找（例如，在表、数据库或其他数据结构中查找）、探知及诸如此类。而且，“确定”可包括接收（例如，接收信息）、访问（例如，访问存储器中的数据）及诸如此类。而且，“确定”还可包括解析、选择、选取、确立及类似动作。另外，如本文中所使用的“信道宽度”可在某些方面涵盖或者还可称为带宽。

[0132] 如本文中所使用的，引述一列项目中的“至少一个”的短语是指这些项目的任何组合，包括单个成员。作为示例，“a、b 或 c 中的至少一个”旨在涵盖：a、b、c、a-b、a-c、b-c、以及 a-b-c。

[0133] 上面描述的方法的各种操作可由能够执行这些操作的任何合适的装置来执行，诸如各种硬件和 / 或软件组件、电路、和 / 或模块。一般而言，在附图中所解说的任何操作可由能够执行这些操作的相对应的功能性装置来执行。

[0134] 结合本公开所描述的各种解说性逻辑框、模块、以及电路可用设计成执行本文所描述功能的通用处理器、数字信号处理器 (DSP)、专用集成电路 (ASIC)、现场可编程门阵列信号 (FPGA) 或其他可编程逻辑器件 (PLD)、分立的门或晶体管逻辑、分立的硬件组件或其任何组合来实现或执行。通用处理器可以是微处理器，但在替换方案中，该处理器可以是任何市售的处理器、控制器、微控制器或状态机。处理器还可以被实现为计算设备的组合，例如 DSP 与微处理器的组合、多个微处理器、与 DSP 核心协同的一个或多个微处理器、或任何其它此类配置。

[0135] 在一个或多个方面中，所描述的功能可在硬件、软件、固件或其任何组合中实现。如果在软件中实现，则各功能可以作为一条或多条指令或代码存储在计算机可读介质上或藉其进行传送。计算机可读介质包括计算机存储介质和通信介质两者，包括促成计算机程序从一地向另一地转移的任何介质。存储介质可以是能被计算机访问的任何可用介质。作为示例而非限定，这样的计算机可读介质可包括 RAM、ROM、EEPROM、CD-ROM 或其他光盘存储、磁盘存储或其他磁存储设备、或能被用来携带或存储指令或数据结构形式的期望程序

代码且能被计算机访问的任何其他介质。任何连接也被正当地称为计算机可读介质。例如，如果软件是使用同轴电缆、光纤电缆、双绞线、数字订户线 (DSL)、或诸如红外、无线电、以及微波之类的无线技术从 web 网站、服务器、或其它远程源传送而来，则该同轴电缆、光纤电缆、双绞线、DSL、或诸如红外、无线电、以及微波之类的无线技术就被包括在介质的定义之中。如本文中所使用的盘和碟包括压缩碟 (CD)、激光碟、光碟、数字通用碟 (DVD)、软盘和蓝光碟，其中盘 (disk) 往往以磁的方式再现数据而碟 (disc) 利用激光以光学方式再现数据。因此，在一些方面，计算机可读介质可包括非暂态计算机可读介质（例如，有形介质）。另外，在一些方面，计算机可读介质可包括暂态计算机可读介质（例如，信号）。上述的组合应当也被包括在计算机可读介质的范围内。

[0136] 因此，一些方面可包括用于执行本文中给出的操作的计算机程序产品。例如，此种计算机程序产品可包括其上存储（和 / 或编码）有指令的计算机可读介质，这些指令能由一个或多个处理器执行以执行本文中所描述的操作。对于一些方面，计算机程序产品可包括包装材料。

[0137] 本文所公开的方法包括用于实现所描述的方法的一个或多个步骤或动作。这些方法步骤和 / 或动作可以彼此互换而不会脱离权利要求的范围。换言之，除非指定了步骤或动作的特定次序，否则具体步骤和 / 或动作的次序和 / 或使用可以改动而不会脱离权利要求的范围。

[0138] 软件或指令还可以在传输介质上传送。例如，如果软件是使用同轴电缆、光纤电缆、双绞线、数字订户线 (DSL)、或诸如红外、无线电、以及微波等无线技术从 web 站点、服务器或其它远程源传送而来的，则该同轴电缆、光纤电缆、双绞线、DSL、或诸如红外、无线电以及微波等无线技术就被包括在传输介质的定义里。

[0139] 此外，应当领会，用于执行本文中所描述的方法和技术的模块和 / 或其它恰适装置能由用户终端和 / 或基站在适用的场合下载和 / 或以其他方式获得。例如，此类设备能被耦合至服务器以促成用于执行本文中所描述的方法的装置的转移。替换地，本文所述的各种方法能经由存储装置（例如，RAM、ROM、诸如压缩碟 (CD) 或软盘等物理存储介质等）来提供，以使得一旦将该存储装置耦合至或提供给用户终端和 / 或基站，该设备就能获得各种方法。此外，可利用适于向设备提供本文中所描述的方法和技术的任何其他合适的技术。

[0140] 将理解，权利要求并不被限定于以上所解说的精确配置和组件。可在以上所描述的方法和设备的布局、操作和细节上作出各种改动、更换和变形而不会脱离权利要求的范围。

[0141] 尽管上述内容针对本公开的各方面，然而可设计出本公开的其他和进一步的方面而不会脱离其基本范围，且其范围是由所附权利要求来确定的。

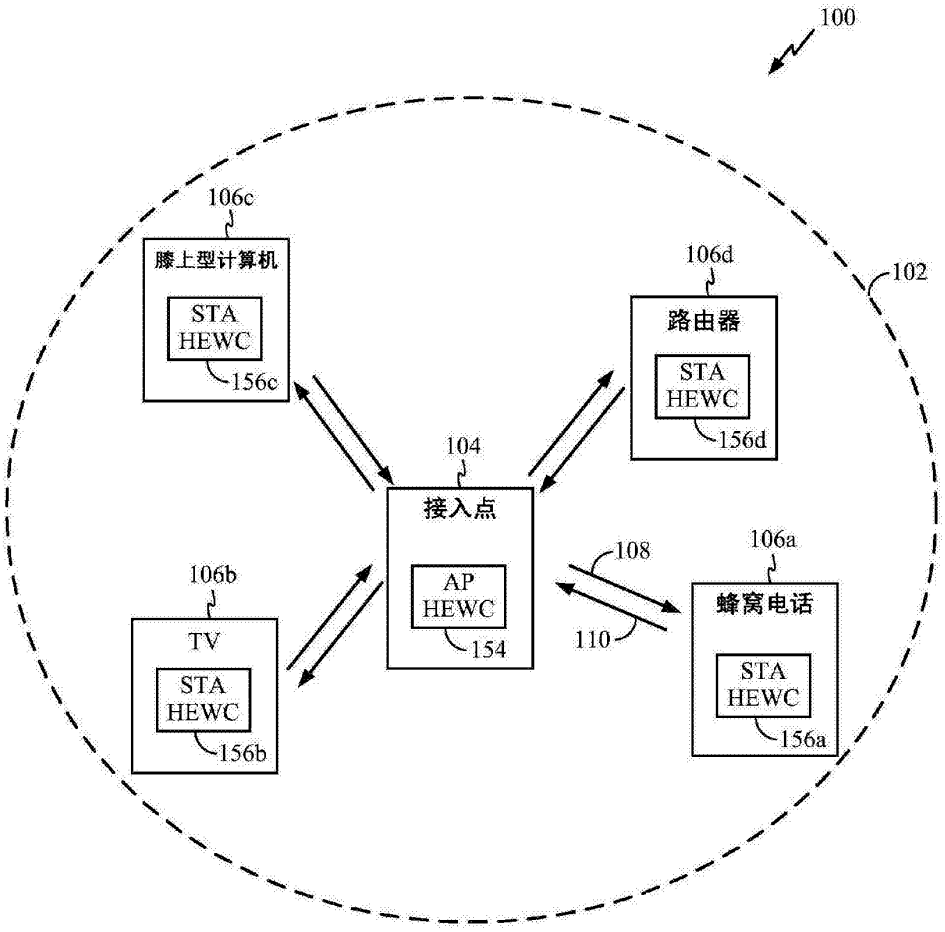

100
102
106c
膝上型计算机
STA
HEWC
156c
106d
路由器
STA
HEWC
156d
104
接入点
AP
HEWC
154
106b
TV
STA
HEWC
156b
108
110
106a
蜂窝电话
STA
HEWC
156a

图 1

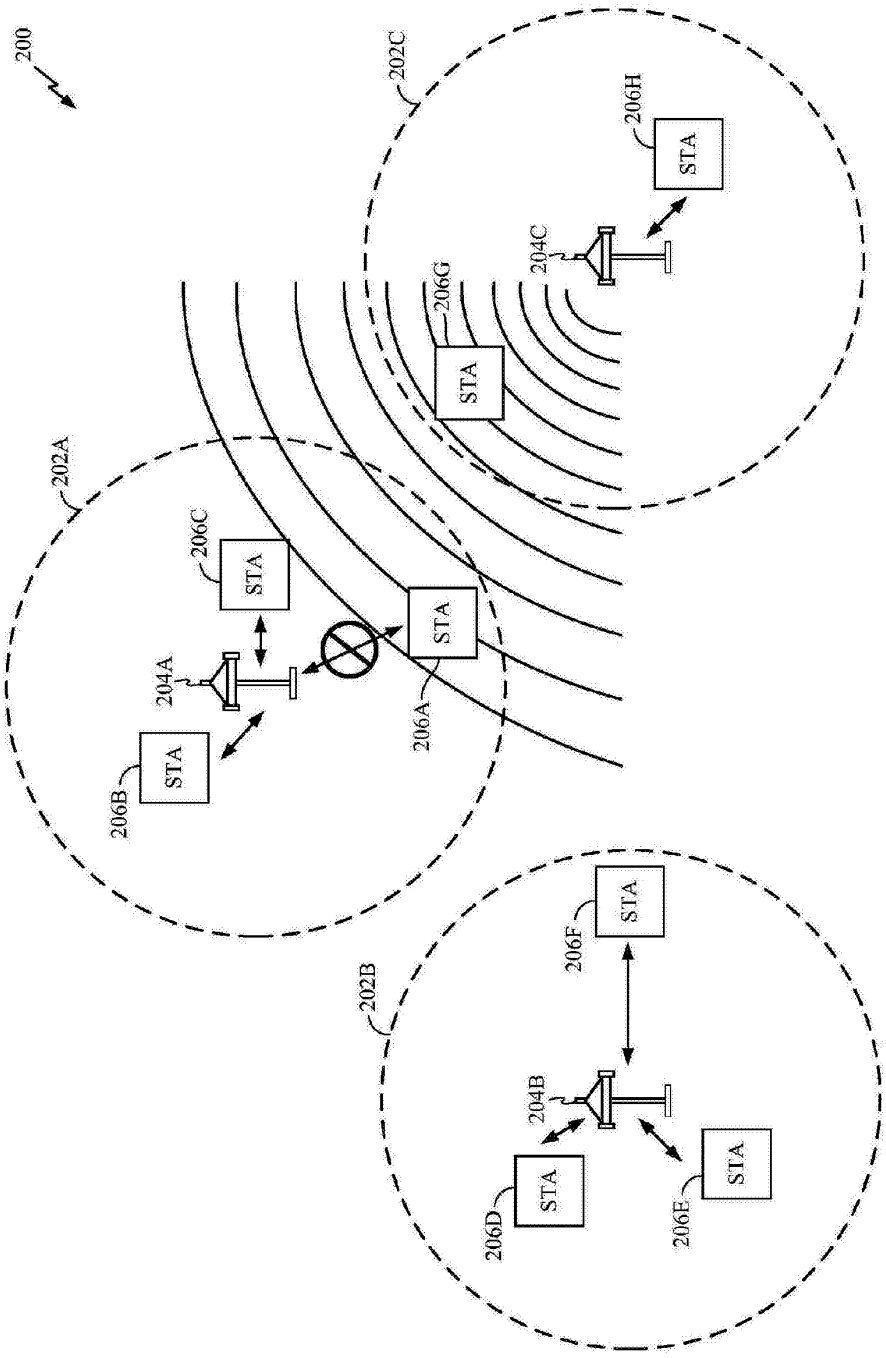

200
202C
206H
STA
204C
206G
STA
202A
206C
STA
204A
206A
STA
206B
STA
202B
206F
STA
204B
206D
STA
206E
STA

图 2A

22

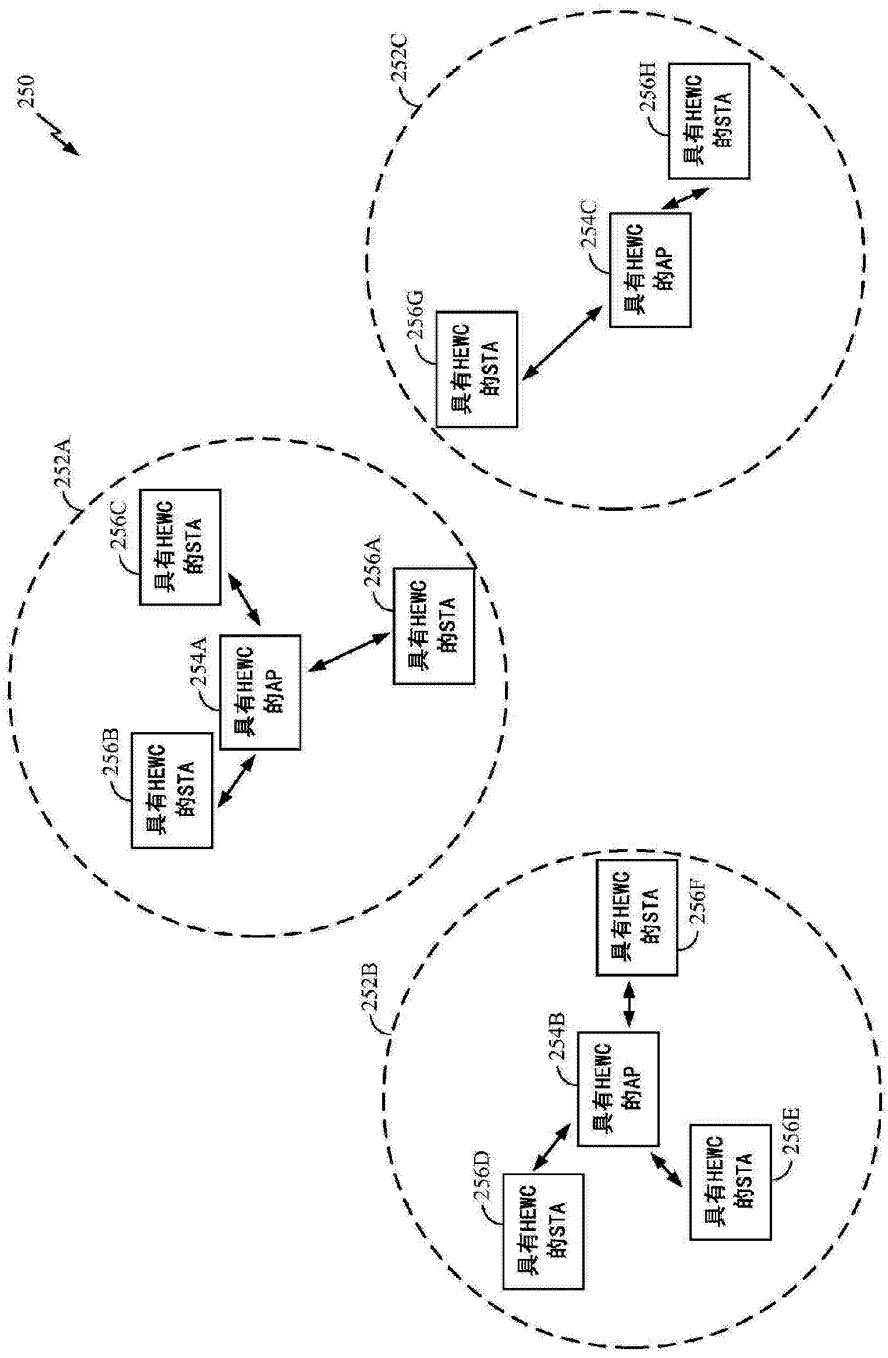

250
252A
252B
252C
254A
具有HEWC的AP
254B
具有HEWC的AP
254C
具有HEWC的AP
256A
具有HEWC的STA
256B
具有HEWC的STA
256C
具有HEWC的STA
256D
具有HEWC的STA
256E
具有HEWC的STA
256F
具有HEWC的STA
256G
具有HEWC的STA
256H
具有HEWC的STA

图 2B

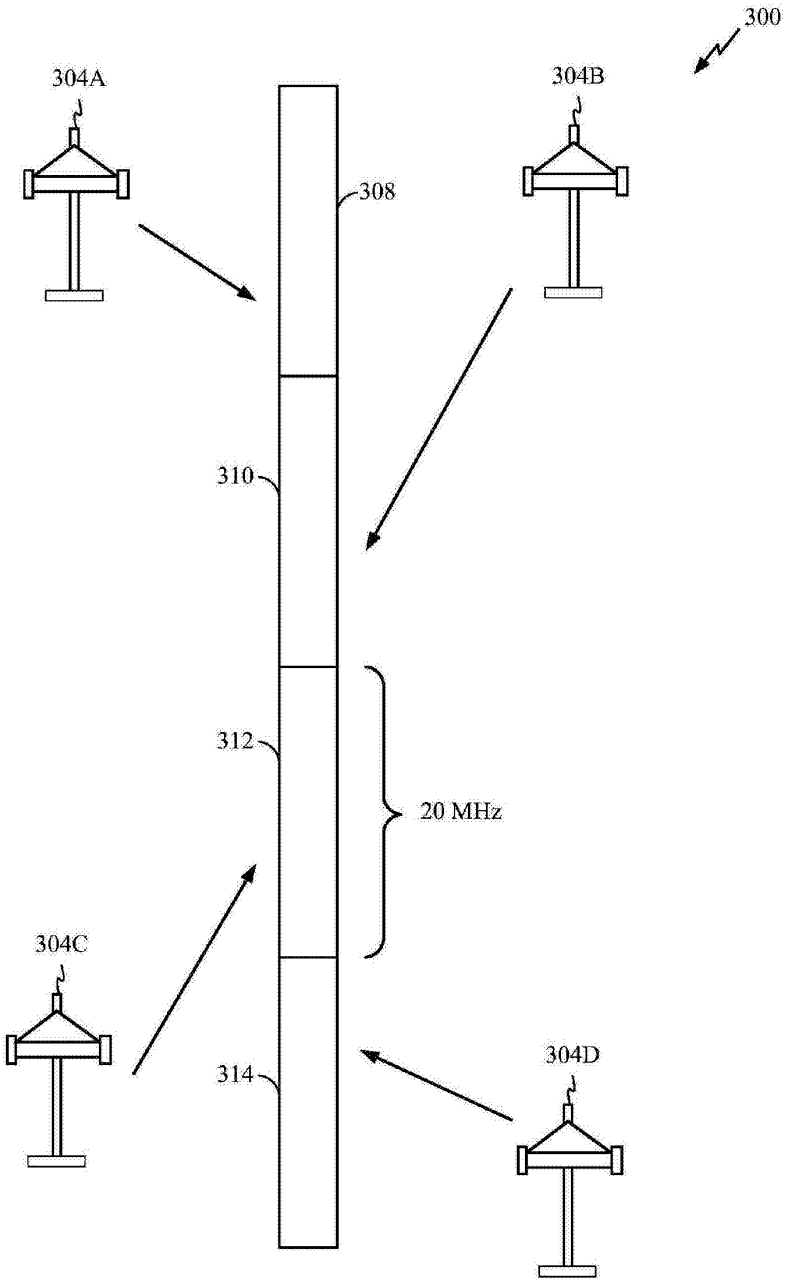



图 3

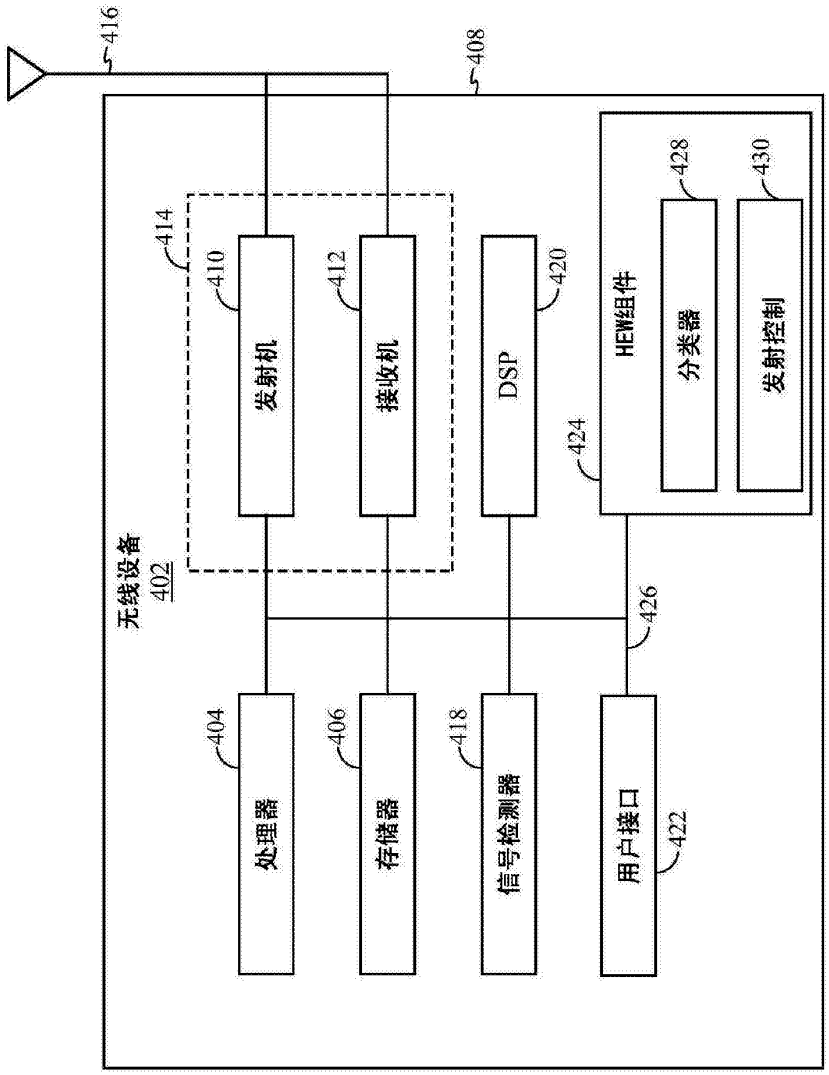

416
408
414
410
发射机
412
接收机
DSP
420
HEW组件
428
分类器
430
发射控制
424
无线设备
402
426
404
处理器
406
存储器
418
信号检测器
用户接口
422

图 4

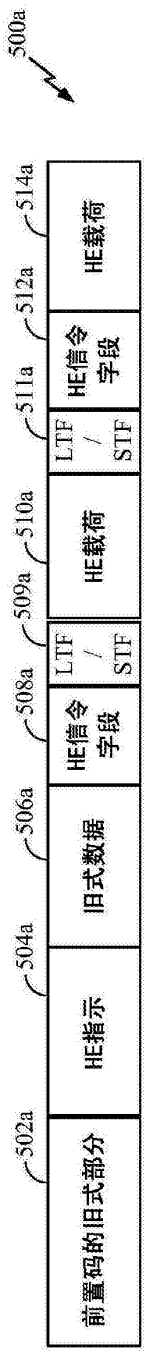

500a
514a
HE载荷
512a
HE信令字段
511a
LTF / STF
510a
HE载荷
509a
LTF / STF
508a
HE信令字段
506a
旧式数据
504a
HE指示
502a
前置码的旧式部分

图 5A

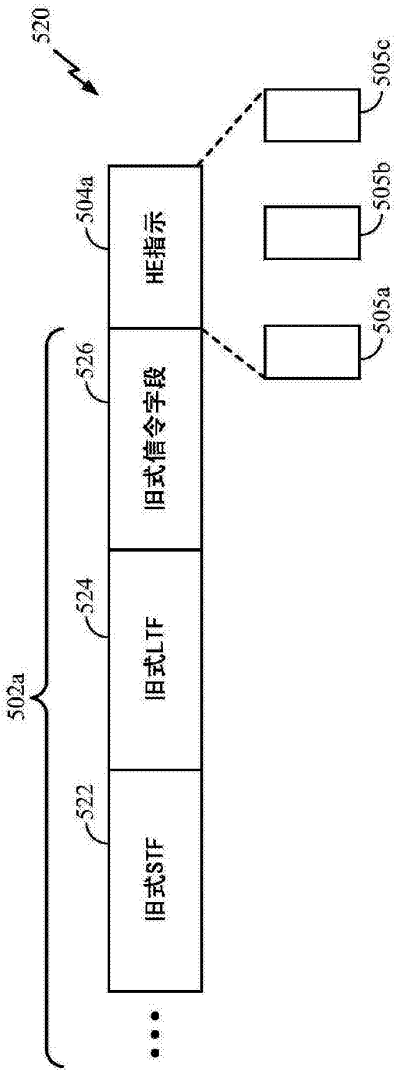

520
505c
505b
505a
504a
HE指示
526
旧式信令字段
524
旧式LTF
522
旧式STF
502a

图 5B

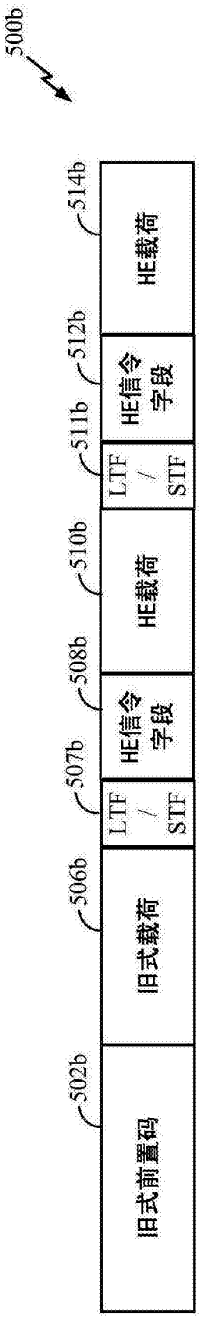

500b
514b
HE载荷
512b
HE信令字段
511b
LTF / STF
510b
HE载荷
508b
HE信令字段
507b
LTF / STF
506b
旧式载荷
502b
旧式前置码

图 5C

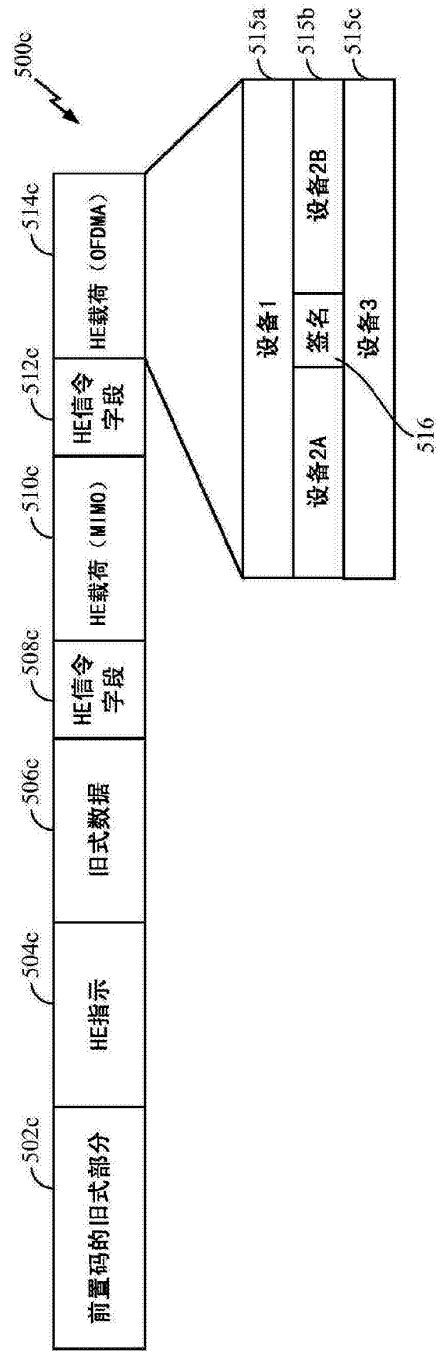

500c
502c
前置码的旧式部分
504c
HE指示
506c
旧式数据
508c
HE信令字段
510c
HE载荷（MIMO）
512c
HE信令字段
514c
HE载荷（OFDMA）
515a
设备1
515b
设备2A
签名
设备2B
515c
设备3
516

图 5D

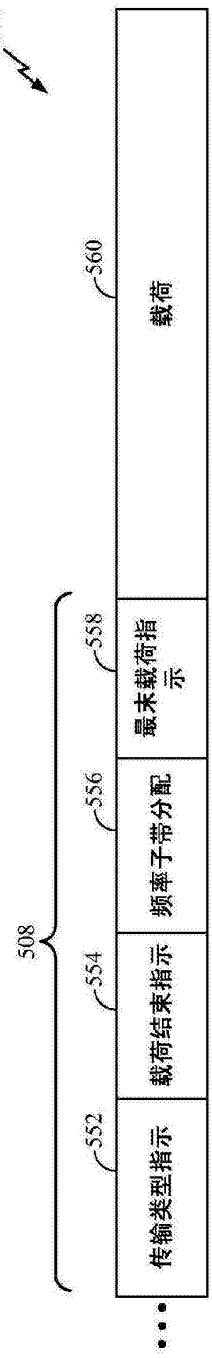

550
560
载荷
508
552
传输类型指示
554
载荷结束指示
556
频率子带分配
558
最末载荷指示

图 5E

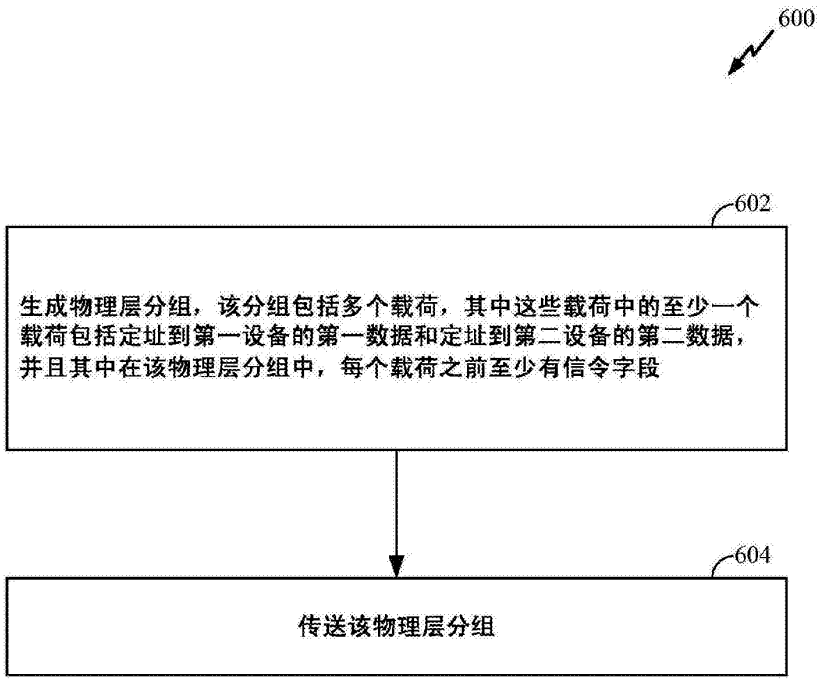

600
602
生成物理层分组，该分组包括多个载荷，其中这些载荷中的至少一个载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据，并且其中在该物理层分组中，每个载荷之前至少有信令字段
604
传送该物理层分组

图 6

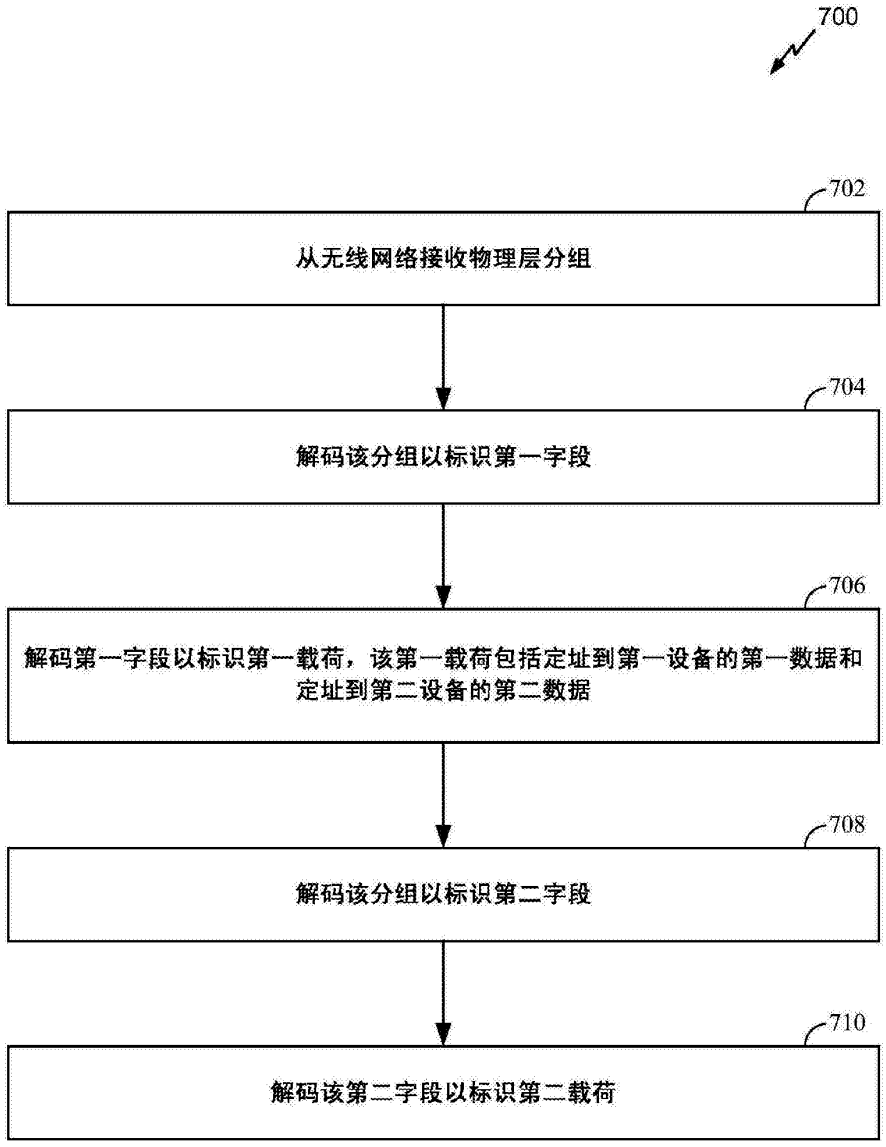

700
702
从无线网络接收物理层分组
704
解码该分组以标识第一字段
706
解码第一字段以标识第一载荷，该第一载荷包括定址到第一设备的第一数据和定址到第二设备的第二数据
708
解码该分组以标识第二字段
710
解码该第二字段以标识第二载荷

图 7

Espacenet

## Bibliographic data: CN105120520 (A) — 2015-12-02

# Method and equipment for data transmission in wireless local area network

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**Classification:** **- international:** ***H04W72/04***
**- cooperative:** **H04W72/0446 (CN)**

**Application number:** CN201510425539 20150717 Global Dossier

**Priority number(s):** CN201510425539 20150717

**Also published as:** CN105120520 (B)

Abstract of CN105120520 (A)

The embodiment of the invention provides a method and equipment for data transmission in a wireless local area network. The method comprises the steps of generating a PLCP protocol data unit (PPDU), wherein the bandwidth of a channel bearing the PPDU is less than 20MHZ, the PPDU comprises M high-efficiency short training fields (HE-STFs) and a data field and does not comprises a legacy-short training field (L-STF) with a backward compatibility function, a legacy-long training field with the backward compatibility function or a legacy-signal (L-SIG) with the backward compatibility function; and sending the PPDU. The PPDU in the embodiment of the invention does not comprises the L-STF with the backward compatibility function, the L-LTF with the backward compatibility function or the L-SIG with the backward compatibility function, and the bit of the PPDU is reduced, thereby saving spectrum resources used for transmitting the PPDU, and improving the spectrum utilization ratio.

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## CLAIMS CN105120520A

1.

A method for data transmission in a wireless local area network, characterized in that it comprises:

Generate a physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M efficient short training subfields HE-STF and data subfields, excluding short training subfields with backward compatibility Domain L-STF, long training subdomain L-LTF with backward compatibility function, and signal field subdomain L-SIG with backward compatibility function;

Send the PPDU.

2.

The method according to claim 1, wherein:

The M is greater than or equal to 2.

3.

The method of claim 1 or 2, wherein:

The PPDU also includes the high efficiency long training subfield HE-LTF.

4.

The method of claim 3, wherein:

The PPDU also includes the high efficiency signal field subfield HE-SIG.

5.

The method according to any one of claims 1 to 4, characterized in that, before said generating a physical layer protocol data unit frame PPDU, further comprising:

Receive a sub-channel resource allocation trigger frame, the sub-channel resource allocation trigger frame is used to trigger the generation of the PPDU, the sub-channel resource allocation trigger frame includes a short training subfield L-STF with backward compatibility function, and a backward The long training subfield L-LTF with compatible function and the signal field subfield L-SIG with backward compatibility function, and the channel bandwidth that carries the subchannel resource allocation trigger frame is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

6.

A method for data transmission in a wireless local area network, characterized in that it comprises:

Sending the sub-channel resource allocation trigger frame, where the sub-channel resource allocation trigger frame is used to trigger the generation of a physical layer protocol data unit frame PPDU;

The receiving station triggers the PPDU sent by the frame according to the sub-channel resource allocation, and the channel bandwidth carrying the PPDU is less than 20 MHz. The PPDU includes M high-efficiency short training subfields HE-STF and data subfields, excluding those with backward The short training subfield L-STF with compatible functions, the long training subfield L-LTF with backward compatibility and the signal field subfield L-SIG with backward compatibility.

7.

The method of claim 6, wherein:

The M is greater than or equal to 2.

8.

The method of claim 6 or 7, wherein:

The PPDU also includes the high efficiency long training subfield HE-LTF.

9.

The method according to claim 8, wherein:

The PPDU also includes the high efficiency signal field subfield HE-SIG.

10.

The method according to any one of claims 6 to 9, characterized in that,

The sub-channel resource allocation trigger frame includes a short training subfield L-STF with backward compatibility, a long training subfield L-LTF with backward compatibility, and a signal field subfield L-SIG with backward compatibility. , The channel bandwidth carrying the sub-channel resource allocation trigger frame is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

11.

A device for data transmission in a wireless local area network, which is characterized in that it comprises:

The generating unit is used to generate the physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M efficient short training subfields HE-STF and data subfields, excluding backward compatibility The functional short training subfield L-STF, the long training subfield L-LTF with backward compatibility and the signal field subfield L-SIG with backward compatibility;

The sending unit is used to send the PPDU.

12.

The device of claim 11, wherein:

The M is greater than or equal to 2.

13.

The device according to claim 11 or 12, wherein:

The PPDU also includes the high efficiency long training subfield HE-LTF.

14.

The device according to claim 13, wherein:

The PPDU also includes the high efficiency signal field subfield HE-SIG.

15.

The device according to any one of claims 11 to 14, further comprising:

The receiving unit is configured to receive a sub-channel resource allocation trigger frame before the generating unit generates a physical layer protocol data unit frame PPDU, where the sub-channel resource allocation trigger frame is used to trigger the generation of the PPDU, and the sub-channel resource allocation The trigger frame includes the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility, which carries the sub-channel The channel bandwidth of the resource allocation trigger frame is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

16.

A device for data transmission in a wireless local area network, which is characterized in that it comprises:

A sending unit, configured to send the sub-channel resource allocation trigger frame, and the sub-channel resource allocation trigger frame is used to trigger the generation of a physical layer protocol data unit frame PPDU;

The receiving unit is configured to receive the PPDU sent by the station according to the subchannel resource allocation trigger frame, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M high-efficiency short training subfields HE-STF and data subfields, It does not include the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility.

17.

The device according to claim 16, wherein:

The M is greater than or equal to 2.

18.

The device according to claim 16 or 17, characterized in that:

The PPDU also includes the high efficiency long training subfield HE-LTF.

19.

The device according to claim 18, wherein:

The PPDU also includes the high efficiency signal field subfield HE-SIG.

20.

The device according to any one of claims 16 to 19, characterized in that:

The sub-channel resource allocation trigger frame includes a short training subfield L-STF with backward compatibility, a long training subfield L-LTF with backward compatibility, and a signal field subfield L-SIG with backward compatibility. , The channel bandwidth carrying the sub-channel resource allocation trigger frame is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

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# DESCRIPTION CN105120520A

The embodiment of the present invention provides a method and device for data transmission in a wireless local area network. The method includes: generating a physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M efficient short training sub-fields HE-STF and data subfields, excluding the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L- with backward compatibility. SIG; send PPDU. The PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility. The physical layer protocol data unit frame PPDU reduces the bits of the PPDU, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization.

Method and equipment for data transmission in wireless local area network

Technical field

The present invention relates to the field of communications, in particular to a method and equipment for data transmission in a wireless local area network.

Background technique

In May 2013, 802.11 established the next generation wireless fidelity (WirelessFidelity, Wi-Fi) technology research group High Efficiency Wireless Local Area Network (High Efficiency WLAN, HEW), the main research point is to improve higher than the existing Wi-Fi technology Throughput; improve the efficient use of spectrum and improve user experience (Quality of Experience, QoE). The existing Wi-Fi technology only improves the quality of service and adapts to a denser communication environment than the existing Wi-Fi technology.

In order to improve the efficiency of spectrum utilization, the 802.11ax (HEW) task group will use Orthogonal Frequency Division Multiple Access (OFDMA) technology for data transmission, and in the discussion of the standard formulation process, it is stipulated that the physics of 802.11ax under the 20MHz bandwidth The frame format of the layer protocol data unit frame, that is, the physical layer convergence procedure (PLCP) protocol data unit (PLCPProtocolDataUnit, PPDU) must include the short training subfield (Legacy-ShortTrainingField, L-STF) with backward compatibility, Long training subfield (Legacy-LongTrainingField, L-LTF) with backward compatibility function and signal field subfield (Legacy-Signal, L-SIG) with backward compatibility function. Among them, L-STF, L-LTF and The role of L-SIG is for backward compatibility.

In the existing standards, there is no definition for 802.11ax PPDUs that work with channel bandwidths below 20 MHz. If the existing PPDU format is used for data transmission, this is contrary to the vision of 802.11ax. Therefore, Therefore, it is necessary to provide a technology that can work in a channel with a bandwidth less than 20 MHz and can improve the spectrum utilization in wireless communication.

Summary of the invention

The embodiment of the present invention provides a communication method and communication equipment in a wireless local

area network, which can improve the spectrum utilization rate in wireless communication.

In the first aspect, a method for data transmission in a wireless local area network is provided, which includes: generating a physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M efficient short training subfields HE- STF and data subfields do not include the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility; Send the PPDU.

With reference to the first aspect, in the first possible implementation manner, the M is greater than or equal to 2.

In combination with the first aspect or the first possible implementation manner, in the second possible implementation manner, the PPDU further includes the high-efficiency long training subfield HE-LTF.

In combination with the second possible implementation manner, in the third possible implementation manner, the PPDU also includes the high efficiency signal field subfield HE-SIG.

With reference to the first aspect and any one of the first to third possible implementation manners, in the fourth possible implementation manner, before generating the physical layer protocol data unit frame PPDU, it further includes: Receive a sub-channel resource allocation trigger frame, the sub-channel resource allocation trigger frame is used to trigger the generation of the PPDU, the sub-channel resource allocation trigger frame includes a short training subfield L-STF with backward compatibility function, and a backward compatible function The long training subfield L-LTF and the signal field subfield L-SIG with backward compatibility function, the channel bandwidth that carries the subchannel resource allocation trigger frame is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

In a second aspect, a method for data transmission in a wireless local area network is provided, including: sending the sub-channel resource allocation trigger frame, the sub-channel resource allocation trigger frame being used to trigger the generation of a physical layer protocol data unit frame PPDU; and a receiving station The PPDU sent according to the subchannel resource allocation trigger frame. The channel bandwidth carrying the PPDU is less than 20MHZ. The PPDU includes M efficient short training subfields HE-STF and data subfields, excluding short training with backward compatibility Sub-field L-STF, long training sub-field L-LTF with backward compatibility function, and signal field sub-field L-SIG with backward compatibility function.

With reference to the second aspect, in the first possible implementation manner, the M is greater than or equal to 2.

With reference to the second aspect or the first possible implementation manner of the second aspect, in the second possible implementation manner, the PPDU further includes the high-efficiency long training subfield HE-LTF.

With reference to the second possible implementation manner of the second aspect, in a third possible implementation manner, the PPDU further includes the high efficiency signal field subfield HE-SIG.

With reference to the second aspect and any one of the first to third possible implementations of the second aspect, in the fourth possible implementation, the subchannel resource allocation trigger frame includes a The short training subfield L-STF with compatible function, the long training subfield L-LTF with backward compatibility and the signal field subfield L-SIG with backward compatibility, which carry the channel bandwidth of the sub-channel resource allocation trigger frame It is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

In a third aspect, a device for data transmission in a wireless local area network is provided, including: a generating unit for generating a physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, wherein the PPDU includes M high-efficiency Short training subfield HE-STF and data subfield, excluding short training subfield L-STF with backward compatibility function, long training subfield L-LTF with backward compatibility function and signal field with backward compatibility function Subdomain L-SIG; sending unit, used to send the PPDU.

With reference to the third aspect, in the first possible implementation manner, the M is greater than or equal to 2.

With reference to the third aspect or the first possible implementation manner of the second aspect, in the second possible implementation manner, the PPDU further includes the high-efficiency long training subfield HE-LTF.

With reference to the second possible implementation manner of the third aspect, in the third possible implementation manner, the PPDU further includes the high efficiency signal field subfield HE-SIG.

In combination with the third aspect and any one of the first to third possible implementation manners of the third aspect, in the fourth possible implementation manner, it further includes: a receiving unit configured to generate Before the unit generates the physical layer protocol data unit frame PPDU, it receives a sub-channel resource allocation trigger frame. The sub-channel

resource allocation trigger frame is used to trigger the generation of the PPDU. The sub-channel resource allocation trigger frame includes a short training sub-frame with backward compatibility. Domain L-STF, long training subdomain L-LTF with backward compatibility function, and signal field subdomain L-SIG with backward compatibility function. The channel bandwidth that carries the trigger frame of resource allocation of this subchannel is 20MHZ, 40MHZ, 80MHZ Or 160MHZ.

In a fourth aspect, a device for data transmission in a wireless local area network is provided, which is characterized by comprising: a sending unit, configured to send the sub-channel resource allocation trigger frame, and the sub-channel resource allocation trigger frame is used to trigger the generation of physical Layer protocol data unit frame PPDU; receiving unit, used to receive the PPDU sent by the station according to the sub-channel resource allocation trigger frame, the channel bandwidth carrying the PPDU is less than 20MHZ, where the PPDU includes M high-efficiency short training subfields HE-STF and The data subfield does not include the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility.

With reference to the fourth aspect, in the first possible implementation manner, the M is greater than or equal to 2.

With reference to the fourth aspect or the first possible implementation manner of the fourth aspect, in the second possible implementation manner, the PPDU further includes the high-efficiency long training subfield HE-LTF.

With reference to the second possible implementation manner of the fourth aspect, in a third possible implementation manner, the PPDU further includes the high efficiency signal field subfield HE-SIG.

With reference to the fourth aspect and any one of the first to third possible implementation manners of the fourth aspect, in the fourth possible implementation manner, the sub-channel resource allocation trigger frame includes a The short training subfield L-STF with compatible function, the long training subfield L-LTF with backward compatibility function and the signal field subfield L-SIG with backward compatibility function, which carry the channel bandwidth of the sub-channel resource allocation trigger frame It is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

Based on the above technical solution, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz, and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility, and has backward compatibility. The long training sub-domain L-LTF with compatible function and the signal field sub-domain L-SIG with backward compatibility function, the physical layer protocol data unit frame PPDU, saves spectrum resources and improves spectrum utilization.

Description of the drawings

In order to explain the technical solutions of the embodiments of the present invention more clearly, the following will briefly introduce the drawings needed in the embodiments of the present invention. Obviously, the drawings described below are only some embodiments of the present invention. For those of ordinary skill in the art, without creative work, other drawings can be obtained from these drawings.

Fig. 1 is a schematic flowchart of a data transmission method according to an embodiment of the present invention.

Fig. 2 is a schematic diagram of the structure of a PPDU according to an embodiment of the present invention.

Fig. 3 is a schematic diagram of a PPDU structure according to another embodiment of the present invention.

Fig. 4 is a schematic structural diagram of a PPDU according to another embodiment of the present invention.

Fig. 5 is a schematic flowchart of a data transmission method according to another embodiment of the present invention.

Fig. 6 is a schematic block diagram of a data transmission device according to an embodiment of the present invention.

Fig. 7 is a schematic block diagram of a data transmission device according to another embodiment of the present invention.

detailed description

The technical solutions in the embodiments of the present invention will be clearly and completely described below in conjunction with the accompanying drawings in the embodiments of the present invention. Obviously, the described embodiments are part of the embodiments of the present invention, rather than all of them. Based on the embodiments of the present invention, all other embodiments obtained by those of ordinary skill in the art without creative work shall fall within the protection scope of the present invention.

It should be understood that the station (Station, STA) in the embodiment of the present invention may also be referred to as a user station, system, user unit, access terminal, mobile station, mobile station, remote station, remote terminal, mobile device,

user terminal, Terminal, wireless communication equipment, user agent, user equipment or user equipment (User Equipment, UE). The STA can be a cellular phone, a cordless phone, a Session Initiation Protocol (SIP) phone, a wireless local loop (Wireless Local Loop, WLL) station, a personal digital assistant (Personal Digital Assistant, PDA), and a wireless LAN (such as Wi-Fi) communication. Functional handheld device, computing device, or other processing device connected to a wireless modem.

It should also be understood that the access point (AccessPoint, AP) in the embodiment of the present invention can be a wireless switch used in a wireless network, and is also the core of the wireless network. It can be used to communicate with a site through a wireless local area network, and to transfer data from the site. Transmit to the network side, or transmit data from the network side to the access terminal.

Fig. 1 is a schematic flowchart of a data transmission method according to an embodiment of the present invention. The method shown in FIG. 1 may be executed by the sending end, for example, may be executed by a station. Specifically, the method shown in FIG. 1 includes:

110, Generate the physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, where the PPDU includes M efficient short training subfields HE-STF and data subfields, excluding the short training subfield L-STF with backward compatibility , The long training subfield L-LTF with backward compatibility function and the signal field subfield L-SIG with backward compatibility function;

120, Send PPDU.

Specifically, the site generation includes M efficient short training subfields HE-STF and data subfields, and does not include the short training subfield L-STF with backward compatibility and the long training subfield L with backward compatibility. -LTF and the PPDU of the signal field sub-domain L-SIG with backward compatibility function, and the channel bandwidth carrying the PPDU is less than 20MHZ, the station sends the PPDU to the access point so that the access point can parse the PPDU to obtain the target data.

Therefore, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz, and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility function, and the backward compatibility function Long training sub-field L-LTF and signal field sub-field with backward compatibility function L-SIG physical layer protocol data unit frame PPDU, reducing the number of PPDU bits, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization rate.

It should be understood that the subdomain in the embodiment of the present invention may also be referred to as a field, and the embodiment of the present invention is not limited thereto.

It should be understood that the M efficient short training subfields HE-STF in the embodiment of the present invention correspond to M subchannels. M can be greater than or equal to 1.

In other words, M can be 1 or greater than or equal to 2, which is not limited in the embodiment of the present invention. Wherein, when M is greater than or equal to 2, M identical high-efficiency short training subfields HE-STF can be used for time and frequency synchronization between different subchannels.

Fig. 2 is a schematic diagram of the structure of a PPDU according to an embodiment of the present invention. The PPDU shown in FIG. 2 includes M efficient short training subfields HE-STF and data subfields (Data).

Optionally, as another embodiment, the PPDU in the embodiment of the present invention may further include a High Efficiency Short Training field (HE-STF).

For example, the PPDU shown in FIG. 3 includes: M efficient short training subfields HE-STF, efficient long training subfield HE-LTF, and data subfields. Among them, HE-LTF is located after the M group of HE-STE and before the data field.

It should be understood that the position of each subdomain in FIG. 3 is not fixed, and the position of each subdomain can be adjusted appropriately, which is not limited in the embodiment of the present invention.

Further, as another embodiment, the PPDU in the embodiment of the present invention may further include a high efficiency signal field (High Efficiency Signal field, HE-SIG).

For example, the PPDU shown in FIG. 4 includes: M efficient short training subfields HE-STF, efficient long training subfields HE-LTF, efficient signal field subfields HE-SIG, and data subfields. Among them, the high efficiency signal field subfield HE-SIG includes High Efficiency Signal-Afield (HE-SIG-A) and High Efficiency Signal B field (HighEfficiencySignal-Bfield, HE-SIG-B),

and HE-SIG is located after HE-STF and before the data field.

It should be understood that the position of each subdomain in FIG. 4 is not fixed, and the position of each subdomain can be adjusted accordingly, which is not limited in the embodiment of the present invention.

It should be understood that the examples in FIGS. 2 to 4 are only to help those skilled in the art understand the embodiments of the present invention, and are not intended to limit the embodiments of the present invention to the specific numerical values or specific scenarios illustrated. Those skilled in the art can obviously make various equivalent modifications or changes based on the examples given in Figures 2 to 4. For example, they can adjust the position of the subdomains in Figures 2 to 4, etc., such modifications Or changes also fall within the scope of the embodiments of the present invention.

Optionally, as another embodiment, before 110, the method in the embodiment of the present invention may further include receiving a subchannel resource allocation trigger frame, the subchannel resource allocation trigger frame is used to trigger the generation of PPDU, and the subchannel resource allocation trigger frame includes The short training subfield L-STF with backward compatibility function, the long training subfield L-LTF with backward compatibility function and the signal field subfield L-SIG with backward compatibility function, which bear the channel of the sub-channel resource allocation trigger frame The bandwidth is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

Specifically, the station first receives information including the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility. Sub-channel resource allocation trigger frame. The sub-channel resource allocation trigger frame is used to trigger the generation of PPDU. After that, the station generates M high-efficiency short training sub-fields HE-STF and data sub-fields according to the sub-channel resource allocation trigger frame, and does not include The PPDU of the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility, and the channel bandwidth that carries the PPDU If it is less than 20MHZ, the station sends the PPDU to the access point so that the access point can parse the PPDU to obtain the target data.

Therefore, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz, and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility function, and the backward compatibility function Long training sub-field L-LTF and signal field sub-field with backward compatibility function L-SIG physical layer protocol data unit frame PPDU, reducing the number of PPDU bits, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization rate.

It should be understood that if there are stations that do not support the 802.11ax function in the entire BSS, and because the PPDU in 802.11ax does not have an L-SIG field, the station that does not support the 802.11ax function cannot parse the length of the PPDU, then These stations cannot correctly set their own network configuration vector (NAV), which is not conducive for these stations to enter the power saving mode during 802.11ax PPDU transmission, and it is not conducive for these stations to save power; however, due to the 802.11ax in the embodiment of the present invention The PPDU transmission is triggered by the sub-channel resource allocation trigger frame, and the sub-channel resource allocation trigger frame is transmitted in the 20MHZ channel bandwidth or above, so the trigger frame must have L-SIG, L-STF, L-LTF, because The L-SIG should include the time required for subsequent 802.11ax PPDU transmission, so that stations that do not support the 802.11ax function in the BSS can parse the L-SIG domain to obtain the time to transmit the PPDU, and then set their own NAV based on this time. Thereby, it can enter the dormant state during 802.11ax PPDU transmission to achieve the purpose of power saving.

It should also be understood that, in the embodiment of the present invention, the inter-frame interval IFS for sending PPDUs is smaller than the short inter-frame interval SIFS. For example, when the duration of SIFS is 10 us, the duration of IFS can be 5 us.

Specifically, for those stations that do not support the 802.11ax function that do not listen to the trigger frame, in order to avoid the interference of these stations to the entire data communication of the 802.11ax PPDU, an IFS (inter-framespace) can be defined in the embodiment of the present invention to replace the existing Some SIFS (shortinter-framespace), and set IFS to be smaller than SIFS. In this way, these stations that do not support the 802.11ax function cannot preempt the channel in the 802.11ax PPDU, avoid interference from other stations (stations that do not support the 802.11ax function), and ensure the communication of the 802.11ax PPDU.

It should also be understood that the data subfield in the PPDU in the embodiment of the present invention may include a Media Access Control (MAC) header, and the 6 bits of the MAC header are used to indicate the type of the PPDU.

In other words, 6 bits are used to indicate that working below 20MHZ channel bandwidth does not include the short training subfield L-STF with backward compatibility function, the long training subfield L-LTF with backward compatibility function and

the backward compatibility function. The PPDU of the signal field subfield L-SIG.

For example, as shown in Table 1, in the embodiment of the present invention, B3, B2, B7, B6, B5, and B4 in the Type and Subtype fields of the MAC header part can be used, and 6 bits represent the PPDU Type, for example, use "101101" to indicate the type of the PPDU, where the type value B3B2 is 10, the type description (Typedescription) is data (Data), the subtype value B7B6B5B4 is 1101, and the subtype description (Subtypedescription) is high-efficiency data (HE -data).

Table 1

[image]

In the foregoing, the data transmission method of the embodiment of the present invention is described from the station side with reference to FIGS. 1 to 4, and the data transmission method of the embodiment of the present invention is described from the access point side with reference to FIG. 5 below.

It should be understood that the method shown in FIG. 5 corresponds to the method shown in FIG. 1. The difference is that the method in FIG. 1 may be executed by the sending end, such as a station, and the method in FIG. 5 may be executed by the receiving end, such as an access point. carried out. For the related description of the structure of the PPDU and the structure of the subchannel resource allocation trigger frame involved in FIG. 5, reference may be made to the corresponding description in the method embodiment of FIG. 1 above. To avoid repetition, the detailed description is appropriately omitted here. Specifically, the method shown in FIG. 5 includes:

510， Send the sub-channel resource allocation trigger frame, which is used to trigger the generation of the physical layer protocol data unit frame PPDU;

520， The receiving station triggers the PPDU sent by the frame according to the subchannel resource allocation. The channel bandwidth carrying the PPDU is less than 20MHZ. The PPDU includes M efficient short training subfields HE-STF and data subfields, excluding short training subfields with backward compatibility. The domain L-STF, the long training subdomain L-LTF with backward compatibility function, and the signal field subdomain L-SIG with backward compatibility function.

Therefore, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz, and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility function, and the backward compatibility function Long training sub-field L-LTF and signal field sub-field with backward compatibility function L-SIG physical layer protocol data unit frame PPDU, reducing the number of PPDU bits, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization rate.

It should be understood that the subdomain in the embodiment of the present invention may also be referred to as a field, and the embodiment of the present invention is not limited thereto.

It should be understood that the M efficient short training subfields HE-STF in the embodiment of the present invention correspond to M subchannels. M can be greater than or equal to 1.

In other words, M can be 1 or greater than or equal to 2, which is not limited in the embodiment of the present invention. Wherein, when M is greater than or equal to 2, M identical high-efficiency short training subfields HE-STF can be used for time and frequency synchronization between different subchannels.

Fig. 2 is a schematic diagram of the structure of a PPDU according to an embodiment of the present invention. The PPDU shown in FIG. 2 includes M efficient short training subfields HE-STF and data subfields.

Optionally, as another embodiment, the PPDU in the embodiment of the present invention may also include the high-efficiency long training subfield HE-LTF.

For example, the PPDU shown in FIG. 3 includes: M efficient short training subfields HE-STF, efficient long training subfield HE-LTF, and data subfields. Among them, HE-LTF is located after the M group of HE-STE and before the data field.

It should be understood that the position of each subdomain in FIG. 3 is not fixed, and the position of each subdomain can be adjusted appropriately, which is not limited in the embodiment of the present invention.

Further, as another embodiment, the PPDU in the embodiment of the present invention may also include the high efficiency signal field subfield HE-SIG.

For example, the PPDU shown in FIG. 4 includes: M efficient short training subfields HE-STF, efficient long training subfields HE-LTF, efficient signal field subfields HE-SIG, and data subfields. Among them, the high efficiency signal field subfield HE-SIG

includes HE-SIG-A and HE-SIG-B, and HE-SIG is located after HE-STF and before the data field.

It should be understood that the position of each subdomain in FIG. 4 is not fixed, and the position of each subdomain can be adjusted accordingly, which is not limited in the embodiment of the present invention.

It should be understood that the examples in FIGS. 2 to 4 are only to help those skilled in the art understand the embodiments of the present invention, and are not intended to limit the embodiments of the present invention to the specific numerical values or specific scenarios illustrated. Those skilled in the art can obviously make various equivalent modifications or changes based on the examples given in Figures 2 to 4. For example, they can adjust the position of the subdomains in Figures 2 to 4, etc., such modifications Or changes also fall within the scope of the embodiments of the present invention.

Optionally, as another embodiment, the sub-channel resource allocation trigger frame is used to trigger the generation of PPDUs, and the sub-channel resource allocation trigger frame includes a short training subfield L-STF with a backward compatibility function and a long training subfield with a backward compatibility function. The training sub-field L-LTF and the signal field sub-field L-SIG with backward compatibility function, the channel bandwidth of the trigger frame bearing the sub-channel resource allocation is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

Specifically, the access point first sends to the station the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield with backward compatibility. L-SIG sub-channel resource allocation trigger frame. The sub-channel resource allocation trigger frame is used to trigger the generation of PPDU. After that, the station generates M high-efficiency short training sub-fields HE-STF and data sub-fields according to the sub-channel resource allocation trigger frame , And does not include the PPDU of the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility. The channel bandwidth of the PPDU is less than 20 MHz, and the access point receives the PPDU sent by the station, and then the access point parses the PPDU to obtain the target data.

Therefore, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz, and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility function, and the backward compatibility function Long training sub-field L-LTF and signal field sub-field with backward compatibility function L-SIG physical layer protocol data unit frame PPDU, reducing the number of PPDU bits, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization rate.

It should be understood that if there are stations that do not support the 802.11ax function in the entire BSS (Basisserviceset), and because the PPDU in 802.11ax does not have an L-SIG domain, the stations that do not support the 802.11ax function cannot parse the length of the PPDU. Yes, these stations cannot correctly set their own network configuration vector (Network Allocation Vector, NAV), which is not conducive for these stations to enter the power-saving mode during 802.11ax PPDU transmission, and it is not conducive to the power-saving of these stations; but because of the embodiment of the present invention The 802.11ax PPDU transmission is triggered by the sub-channel resource allocation trigger frame, and the sub-channel resource allocation trigger frame is transmitted in the 20MHZ channel bandwidth or above, so the trigger frame must have L-SIG, L-STF, L- LTF, because the L-SIG should contain the time required for subsequent 802.11ax PPDU transmission, so that stations that do not support the 802.11ax function in the BSS can parse the L-SIG domain to obtain the PPDU transmission time, and then can set themselves according to this time The NAV can thus enter the dormant state during 802.11ax PPDU transmission to achieve the purpose of power saving.

It should also be understood that, in the embodiment of the present invention, the inter-frame interval IFS for sending PPDUs by a station is smaller than the short inter-frame interval SIFS. For example, when the duration of SIFS is 10 us, the duration of IFS can be 5 us.

Specifically, for those stations that do not support the 802.11ax function that do not listen to the trigger frame, in order to avoid the interference of these stations to the entire data communication of the 802.11ax PPDU, an IFS (inter-framespace) can be defined in the embodiment of the present invention to replace the existing Some SIFS (shortinter-framespace), and set IFS to be smaller than SIFS. In this way, these stations that do not support the 802.11ax function cannot preempt the channel in the 802.11ax PPDU, avoid interference from other stations (stations that do not support the 802.11ax function), and ensure the communication of the 802.11ax PPDU.

It should also be understood that the data subfield in the PPDU in the embodiment of the present invention may include a MAC header part, and the 6 bits of the MAC header part are used to indicate the type of the PPDU.

In other words, 6 bits are used to indicate that working below 20MHZ channel bandwidth does not include the short training subfield L-STF with backward compatibility function, the long training subfield L-LTF with backward compatibility function and

the backward compatibility function. The PPDU of the signal field subfield L-SIG.

For example, as shown in Table 1, in the embodiment of the present invention, B3, B2, B7, B6, B5, and B4 in the Type and Subtype fields of the MAC header part can be used, and 6 bits represent the PPDU Type, for example, use "101101" to indicate the type of the PPDU, where the type value B3B2 is 10, the type description (Typedescription) is data (Data), the subtype value B7B6B5B4 is 1101, and the subtype description (Subtypedescription) is high-efficiency data (HE -data).

The data transmission method in the embodiment of the present invention is described in detail above with reference to FIGS. 1 to 5, and the data transmission device in the embodiment of the present invention is described in detail below with reference to FIGS. 6 and 7.

Fig. 6 is a schematic block diagram of a data transmission device according to an embodiment of the present invention. The device 600 shown in FIG. 6 may be a station. It should be understood that the device 600 shown in FIG. 6 corresponds to FIG. 1, and the device 600 can implement each process in the method embodiment in FIG. 1. For specific functions of the device 600, refer to the various processes in the method embodiment in FIG. 1, and to avoid repetition, details are not described herein again.

The device 600 shown in FIG. 6 includes: a generating unit 610 and a sending unit 620.

Specifically, the generating unit 610 is used to generate a physical layer protocol data unit frame PPDU, the channel bandwidth carrying the PPDU is less than 20MHZ, where the PPDU includes M high-efficiency short training subfields HE-STF and data subfields, excluding the backward compatibility function The short training subfield L-STF, the long training subfield L-LTF with backward compatibility and the signal field subfield L-SIG with backward compatibility;

The sending unit 620 is used to send PPDUs.

Therefore, because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield with backward compatibility. The L-SIG physical layer protocol data unit frame PPDU reduces the number of PPDU bits, thereby saving spectrum resources for transmitting the PPDU, and improving spectrum utilization.

Optionally, as another embodiment, M is greater than or equal to 2.

Optionally, as another embodiment, the PPDU further includes the high efficiency long training subfield HE-LTF.

Optionally, as another embodiment, the PPDU further includes the high efficiency signal field subfield HE-SIG.

Optionally, as another embodiment, the device 600 may further include: a receiving unit.

Specifically, the receiving unit is used to receive a sub-channel resource allocation trigger frame before the generating unit 610 generates a physical layer protocol data unit frame PPDU. The sub-channel resource allocation trigger frame is used to trigger the generation of PPDUs. The sub-channel resource allocation trigger frame includes The short training subfield L-STF with backward compatibility, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility, bear the channel bandwidth of the sub-channel resource allocation trigger frame It is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

Fig. 7 is a schematic block diagram of a data transmission device according to another embodiment of the present invention. The device 700 shown in FIG. 7 may be an access point. It should be understood that the device 700 shown in FIG. 7 corresponds to FIG. 5, and the device 700 can implement each process in the method embodiment of FIG. For specific functions of the device 700, refer to the various processes in the method embodiment in FIG. 5, and to avoid repetition, details are not described herein again.

The device 700 shown in FIG. 7 includes: a sending unit 710 and a receiving unit 720.

Specifically, the sending unit 710 is configured to send a sub-channel resource allocation trigger frame, and the sub-channel resource allocation trigger frame is used to trigger the generation of a physical layer protocol data unit frame PPDU;

The receiving unit 720 is used to receive the PPDU sent by the station according to the subchannel resource allocation trigger frame. The channel bandwidth carrying the PPDU is less than 20MHZ. The PPDU includes M high-efficiency short training subfields HE-STF and data subfields, excluding backward compatibility The functional short training subfield L-STF, the long training subfield L-LTF with backward compatibility, and the signal field subfield L-SIG with backward compatibility.

Therefore, the PPDU in the embodiment of the present invention can work in a channel with a bandwidth of less than 20 MHz,

and because the PPDU in the embodiment of the present invention does not include the short training subfield L-STF with backward compatibility function, and the backward compatibility function Long training sub-field L-LTF and signal field sub-field with backward compatibility function L-SIG physical layer protocol data unit frame PPDU, reducing the number of PPDU bits, thereby saving the spectrum resources for transmitting the PPDU and improving the spectrum utilization rate.

Optionally, as another embodiment, M is greater than or equal to 2.

Optionally, as another embodiment, the PPDU further includes the high efficiency long training subfield HE-LTF.

Optionally, as another embodiment, the PPDU further includes the high efficiency signal field subfield HE-SIG.

Optionally, as another embodiment, the sub-channel resource allocation trigger frame includes a short training subfield L-STF with backward compatibility function, a long training subfield L-LTF with backward compatibility function and backward compatibility function. The signal field sub-field L-SIG of the signal field, the channel bandwidth of the trigger frame of the bearer sub-channel resource allocation is 20MHZ, 40MHZ, 80MHZ or 160MHZ.

It should be understood that "one embodiment" or "an embodiment" mentioned throughout the specification means that a specific feature, structure, or characteristic related to the embodiment is included in at least one embodiment of the present invention. Therefore, the appearance of "in one embodiment" or "in an embodiment" in various places throughout the specification does not necessarily refer to the same embodiment. In addition, these specific features, structures or characteristics can be combined in one or more embodiments in any suitable manner. It should be understood that, in various embodiments of the present invention, the size of the sequence numbers of the foregoing processes does not imply the order of execution. The execution order of each process should be determined by its function and internal logic, and should not be used in the embodiments of the present invention. The implementation process constitutes any limitation.

In addition, the terms "system" and "network" in this article are often used interchangeably in this article. The term "and/or" in this article is only an association relationship describing the associated objects, which means that there can be three relationships, for example, A and/or B, which can mean: A alone exists, A and B exist at the same time, exist alone B these three situations. In addition, the character "/" in this text generally indicates that the associated objects before and after are in an "or" relationship.

It should be understood that in the embodiment of the present invention, "B corresponding to A" means that B is associated with A, and B can be determined according to A. However, it should also be understood that determining B according to A does not mean determining B only according to A, and B can also be determined according to A and/or other information.

A person of ordinary skill in the art may realize that the units and algorithm steps of the examples described in the embodiments disclosed herein can be implemented by electronic hardware, computer software, or a combination of the two, in order to clearly illustrate the hardware and software interchangeability. In the above description, the composition and steps of each example have been generally described in accordance with the function. Whether these functions are executed by hardware or software depends on the specific application and design constraint conditions of the technical solution. Professionals and technicians can use different methods for each specific application to implement the described functions, but such implementation should not be considered as going beyond the scope of the present invention.

Those skilled in the art can clearly understand that, for the convenience and conciseness of description, the specific working process of the system, device, and unit described above can refer to the corresponding process in the foregoing method embodiment, which is not repeated here.

In the several embodiments provided in this application, it should be understood that the disclosed system, device, and method may be implemented in other ways. For example, the device embodiments described above are merely illustrative, for example, the division of units is only a logical function division, and there may be other divisions in actual implementation, for example, multiple units or components can be combined or integrated. To another system, or some features can be ignored, or not implemented. In addition, the displayed or discussed mutual coupling or direct coupling or communication connection may be indirect coupling or communication connection through some interfaces, devices or units, and may also be electrical, mechanical or other forms of connection.

The units described as separate components may or may not be physically separate, and the components displayed as units may or may not be physical units, that is, they may be located in one place, or they may be distributed on multiple network units. Some or all of the units may be selected according to actual needs to achieve the objectives of the solutions of the embodiments of the present invention.

In addition, the functional units in the various embodiments of the present invention may be integrated into one processing unit,

or each unit may exist alone physically, or two or more units may be integrated into one unit. The above-mentioned integrated unit can be implemented in the form of hardware or software functional unit.

Through the description of the above embodiments, those skilled in the art can clearly understand that the present invention can be implemented by hardware, firmware, or a combination of them. When implemented by software, the above functions can be stored in a computer-readable medium or transmitted as one or more instructions or codes on the computer-readable medium. Computer-readable media include computer storage media and communication media, where communication media includes any media that facilitates the transfer of computer programs from one place to another. The storage medium may be any available medium that can be accessed by a computer. Take this as an example but not limited to: computer readable media may include RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage media or other magnetic storage devices, or can be used to carry or store instructions or data structures The desired program code and any other medium that can be accessed by the computer. In addition, Any connection can suitably become a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable , Fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, wireless and microwave are included in the fixing of the media. As used in the present invention, disks and discs include compact discs (CDs), laser discs, optical discs, digital versatile discs (DVD), floppy discs and Blu-ray discs, where discs usually copy data magnetically, while discs The laser is used to optically copy data. The above combination should also be included in the protection scope of the computer-readable medium.

In a word, the above descriptions are only preferred embodiments of the technical solutions of the present invention, and are not used to limit the protection scope of the present invention. Any modification, equivalent replacement, improvement, etc., made within the spirit and principle of the present invention shall be included in the protection scope of the present invention.

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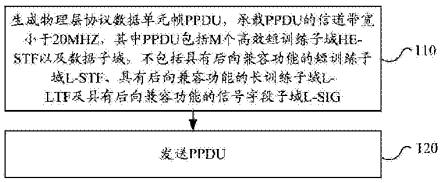
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(54)发明名称

无线局域网络中数据传输的方法和设备

(57)摘要

本发明实施例提供了一种无线局域网络中数据传输的方法和设备，该方法包括：生成物理层协议数据单元帧PPDU，承载PPDU的信道带宽小于20MHZ，其中PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG；发送PPDU。本发明实施例中的PPDU不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG物理层协议数据单元帧PPDU，减少了PPDU的比特，进而节省了传输该PPDU的频谱资源，提高了频谱利用率。




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1.一种无线局域网络中数据传输的方法，其特征在于，包括：

生成物理层协议数据单元帧PPDU，承载所述PPDU的信道带宽小于20MHZ，其中所述PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG；

发送所述PPDU。

2.根据权利要求1所述的方法，其特征在于，

所述M大于或等于2。

3.根据权利要求1或2所述的方法，其特征在于，

所述PPDU还包括高效长训练子域HE-LTF。

4.根据权利要求3所述的方法，其特征在于，

所述PPDU还包括高效信号字段子域HE-SIG。

5.根据权利要求1至4中任一项所述的方法，其特征在于，在所述生成物理层协议数据单元帧PPDU之前，还包括：

接收子信道资源分配触发帧，所述子信道资源分配触发帧用于触发生成所述PPDU，所述子信道资源分配触发帧包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG，承载所述子信道资源分配触发帧的信道带宽为20MHZ、40MHZ、80MHZ或160MHZ。

6.一种用于无线局域网的数据传输的方法，其特征在于，包括：

发送所述子信道资源分配触发帧，所述子信道资源分配触发帧用于触发生成物理层协议数据单元帧PPDU；

接收站点根据子信道资源分配触发帧发送的所述PPDU，承载所述PPDU的信道带宽小于20MHZ，其中所述PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG。

7.根据权利要求6所述的方法，其特征在于，

所述M大于或等于2。

8.根据权利要求6或7所述的方法，其特征在于，

所述PPDU还包括高效长训练子域HE-LTF。

9.根据权利要求8所述的方法，其特征在于，

所述PPDU还包括高效信号字段子域HE-SIG。

10.根据权利要求6至9中任一项所述的方法，其特征在于，

所述子信道资源分配触发帧包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG，承载所述子信道资源分配触发帧的信道带宽为20MHZ、40MHZ、80MHZ或160MHZ。

11.一种用于无线局域网的数据传输的设备，其特征在于，包括：

生成单元，用于生成物理层协议数据单元帧PPDU，承载所述PPDU的信道带宽小于20MHZ，其中所述PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能

的信号字段子域 L-SIG ;

发送单元,用于发送所述 PPDU。

12. 根据权利要求 11 所述的设备,其特征在于,

所述 M 大于或等于 2。

13. 根据权利要求 11 或 12 所述的设备,其特征在于,

所述 PPDU 还包括高效长训练子域 HE-LTF。

14. 根据权利要求 13 所述的设备,其特征在于,

所述 PPDU 还包括高效信号字段子域 HE-SIG。

15. 根据权利要求 11 至 14 中任一项所述的设备,其特征在于,还包括 :

接收单元,用于在所述生成单元生成物理层协议数据单元帧 PPDU 之前,接收子信道资源分配触发帧,所述子信道资源分配触发帧用于触发生成所述 PPDU,所述子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG,承载所述子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

16. 一种用于无线局域网的数据传输的设备,其特征在于,包括 :

发送单元,用于发送所述子信道资源分配触发帧,所述子信道资源分配触发帧用于触发生成物理层协议数据单元帧 PPDU ;

接收单元,用于接收站点根据子信道资源分配触发帧发送的所述 PPDU,承载所述 PPDU 的信道带宽小于 20MHZ,其中所述 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域,不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG。

17. 根据权利要求 16 所述的设备,其特征在于,

所述 M 大于或等于 2。

18. 根据权利要求 16 或 17 所述的设备,其特征在于,

所述 PPDU 还包括高效长训练子域 HE-LTF。

19. 根据权利要求 18 所述的设备,其特征在于,

所述 PPDU 还包括高效信号字段子域 HE-SIG。

20. 根据权利要求 16 至 19 中任一项所述的设备,其特征在于,

所述子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG,承载所述子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

# 无线局域网络中数据传输的方法和设备

## 技术领域

[0001] 本发明涉及通信领域，特别涉及一种无线局域网络中数据传输的方法和设备。

## 背景技术

[0002] 在2013年5月，802.11成立了下一代无线保真(Wireless Fidelity，Wi-Fi)技术的研究组高效无线局域网(High Efficiency WLAN，HEW)，主要的研究点是提高比现有Wi-Fi技术更高的吞吐量；提高频谱的有效利用效率、提高用户体验(Quality of Experience，QoE)，现有的Wi-Fi技术只是提高服务质量以及比现有的Wi-Fi技术适应更加密集的通信环境。

[0003] 为了提高频谱的利用效率，802.11ax(HEW)任务组将采用正交频分多址(Orthogonal Frequency Division Multiple Access，OFDMA)技术进行数据的传输，并且在标准制定过程的讨论中规定在20MHz带宽下802.11ax的物理层协议数据单元帧，也即物理层汇聚过程(physical layer convergence procedure，PLCP)协议数据单元(PLCP Protocol Data Unit，PPDU)的帧格式必须包含具有后向兼容功能的短训练子域(Legacy-Short Training Field，L-STF)、具有后向兼容功能的长训练子域(Legacy-Long Training Field，L-LTF)及具有后向兼容功能的信号字段子域(Legacy-Signal，L-SIG)，其中，L-STF、L-LTF及L-SIG的作用就是为了后向兼容。

[0004] 在现有的标准中，对于工作在20MHz以下的信道带宽的802.11ax PPDU没有进行定义，如果采用现有已经制定了的PPDU的格式进行数据传输，这与802.11ax所出处的愿景是相悖的，因此，需要提供一种技术能够在带宽小于20MHz的信道下工作，且能够提高无线通信中频谱利用率。

## 发明内容

[0005] 本发明实施例提供一种无线局域网中的通信方法和通信设备，能够提高无线通信中频谱利用率。

[0006] 第一方面，提供了一种无线局域网络中数据传输的方法，包括：生成物理层协议数据单元帧PPDU，承载该PPDU的信道带宽小于20MHZ，其中该PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG；发送该PPDU。

[0007] 结合第一方面，在第一种可能的实现方式中，该M大于或等于2。

[0008] 结合第一方面或第一种可能的实现方式，在第二种可能的实现方式中，该PPDU还包括高效长训练子域HE-LTF。

[0009] 结合第二种可能的实现方式，在第三种可能的实现方式中，该PPDU还包括高效信号字段子域HE-SIG。

[0010] 结合第一方面、第一至第三种可能的实现方式中的任一种可能的实现方式，在第四种可能的实现方式中，在该生成物理层协议数据单元帧PPDU之前，还包括：接收子信道

资源分配触发帧，该子信道资源分配触发帧用于触发生成该 PPDU，该子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载该子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0011] 第二方面，提供了一种用于无线局域网的数据传输的方法，包括：发送该子信道资源分配触发帧，该子信道资源分配触发帧用于触发生成物理层协议数据单元帧 PPDU；接收站点根据子信道资源分配触发帧发送的该 PPDU，承载该 PPDU 的信道带宽小于 20MHZ，其中该 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG。

[0012] 结合第二方面，在第一种可能的实现方式中，该 M 大于或等于 2。

[0013] 结合第二方面或第二方面的第一种可能的实现方式，在第二种可能的实现方式中，该 PPDU 还包括高效长训练子域 HE-LTF。

[0014] 结合第二方面的第二种可能的实现方式，在第三种可能的实现方式中，该 PPDU 还包括高效信号字段子域 HE-SIG。

[0015] 结合第二方面、第二方面的第一至第三种可能的实现方式中的任一种可能的实现方式，在第四种可能的实现方式中，该子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载该子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0016] 第三方面，提供了一种用于无线局域网的数据传输的设备，包括：生成单元，用于生成物理层协议数据单元帧 PPDU，承载该 PPDU 的信道带宽小于 20MHZ，其中该 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG；发送单元，用于发送该 PPDU。

[0017] 结合第三方面，在第一种可能的实现方式中，该 M 大于或等于 2。

[0018] 结合第三方面或第二方面的第一种可能的实现方式，在第二种可能的实现方式中，该 PPDU 还包括高效长训练子域 HE-LTF。

[0019] 结合第三方面的第二种可能的实现方式，在第三种可能的实现方式中，该 PPDU 还包括高效信号字段子域 HE-SIG。

[0020] 结合第三方面、第三方面的第一至第三种可能的实现方式中的任一种可能的实现方式，在第四种可能的实现方式中，还包括：接收单元，用于在该生成单元生成物理层协议数据单元帧 PPDU 之前，接收子信道资源分配触发帧，该子信道资源分配触发帧用于触发生成该 PPDU，该子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载该子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0021] 第四方面，提供了一种用于无线局域网的数据传输的设备，其特征在于，包括：发送单元，用于发送该子信道资源分配触发帧，该子信道资源分配触发帧用于触发生成物理层协议数据单元帧 PPDU；接收单元，用于接收站点根据子信道资源分配触发帧发送的该 PPDU，承载该 PPDU 的信道带宽小于 20MHZ，其中该 PPDU 包括 M 个高效短训练子域 HE-STF 以

及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG。

[0022] 结合第四方面，在第一种可能的实现方式中，该 M 大于或等于 2。

[0023] 结合第四方面或第四方面的第一种可能的实现方式，在第二种可能的实现方式中，该 PPDU 还包括高效长训练子域 HE-LTF。

[0024] 结合第四方面的第二种可能的实现方式，在第三种可能的实现方式中，该 PPDU 还包括高效信号字段子域 HE-SIG。

[0025] 结合第四方面、第四方面的第一至第三种可能的实现方式中的任一种可能的实现方式，在第四种可能的实现方式中，该子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载该子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0026] 基于上述技术方案，本发明实施例中的 PPDU 能够在带宽小于 20MHz 的信道下工作，并且由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU，节省了频谱资源，提高了频谱利用率。

## 附图说明

[0027] 为了更清楚地说明本发明实施例的技术方案，下面将对本发明实施例中所需要使用的附图作简单地介绍，显而易见地，下面所描述的附图仅仅是本发明的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

[0028] 图 1 是根据本发明一个实施例的数据传输的方法的示意流程图。

[0029] 图 2 是根据本发明一个实施例的 PPDU 的结构示意图。

[0030] 图 3 是根据本发明另一实施例的 PPDU 的结构示意图。

[0031] 图 4 是根据本发明另一实施例的 PPDU 的结构示意图。

[0032] 图 5 是根据本发明另一实施例的数据传输的方法的示意流程图。

[0033] 图 6 是根据本发明一个实施例的数据传输的设备示意框图。

[0034] 图 7 是根据本发明另一实施例的数据传输的设备示意框图。

## 具体实施方式

[0035] 下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述，显然，所描述的实施例是本发明的一部分实施例，而不是全部实施例。基于本发明中的实施例，本领域普通技术人员在没有做出创造性劳动的前提下所获得的所有其他实施例，都应属于本发明保护的范围。

[0036] 应理解，本发明实施例中的站点 (Station，STA)，也可以称为用户站点、系统、用户单元、接入终端、移动站、移动台、远方站、远程终端、移动设备、用户终端、终端、无线通信设备、用户代理、用户装置或用户设备 (User Equipment，UE)。该 STA 可以是蜂窝电话、无绳电话、会话启动协议 (Session Initiation Protocol，SIP) 电话、无线本地环路 (Wireless Local Loop，WLL) 站、个人数字助理 (Personal Digital Assistant，PDA)、具有无线局域网

(例如 Wi-Fi) 通信功能的手持设备、计算设备或连接到无线调制解调器的其它处理设备。

[0037] 还应理解,本发明实施例中的接入点 (Access Point, AP) 可以是用于无线网络的无线交换机,也是无线网络的核心,可以用于与站点通过无线局域网进行通信,并将站点的数据传输至网络侧,或将来自网络侧的数据传输至接入终端。

[0038] 图 1 是根据本发明一个实施例的数据传输的方法的示意流程图。图 1 所示的方法可以由发送端执行,例如可以由站点执行,具体地,如图 1 所示的方法,包括 :

[0039] 110,生成物理层协议数据单元帧 PPDU,承载 PPDU 的信道带宽小于 20MHZ,其中 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域,不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG ;

[0040] 120,发送 PPDU。

[0041] 具体而言,站点生成包括 M 个高效短训练子域 HE-STF 以及数据子域,且不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 的 PPDU,且承载 PPDU 的信道带宽小于 20MHZ,站点并向接入点发送该 PPDU,以便接入点解析该 PPDU 获得目标数据。

[0042] 因此,本发明实施例中的 PPDU 能够在带宽小于 20MHz 的信道下工作,并且由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU,减少了 PPDU 的比特数,进而节省了传输该 PPDU 的频谱资源,提高了频谱利用率。

[0043] 应理解,本发明实施例中的子域也可以称为字段,本发明实施例并不限于此。

[0044] 应理解,本发明实施例中的 M 个高效短训练子域 HE-STF 与 M 个子信道相对应。M 可以大于或等于 1。

[0045] 换句话说,M 可以为 1 也可以大于或等于 2,本发明实施例并不对此做限定。其中,当 M 大于或等于 2 时,M 个相同的高效短训练子域 HE-STF 可以用于不同子信道间的时间和频率的同步。

[0046] 图 2 是根据本发明一个实施例的 PPDU 的结构示意图。如图 2 所示的 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域 (Data)。

[0047] 可选地,作为另一实施例,本发明实施例中的 PPDU 还可以包括高效长训练子域 (High Efficiency Short Training field, HE-STF)。

[0048] 例如,如图 3 所示的 PPDU 包括 :M 个高效短训练子域 HE-STF、高效长训练子域 HE-LTF 以及数据子域。其中,HE-LTF 位于 M 组 HE-STE 之后,且位于数据字段之前。

[0049] 应理解,图 3 中各个子域的位置不是固定不变的,各个子域的位置可以进行适当的调整,本发明实施例并不对此做限定。

[0050] 进一步地,作为另一实施例,本发明实施例中的 PPDU 还可以包括高效信号字段子域 (High Efficiency Signal field, HE-SIG)。

[0051] 例如,如图 4 所示的 PPDU 包括 :M 个高效短训练子域 HE-STF、高效长训练子域 HE-LTF、高效信号字段子域 HE-SIG 以及数据子域。其中,高效信号字段子域 HE-SIG 包括高效率信令 A 子域 (High Efficiency Signal-A field, HE-SIG-A) 和高效率信令 B 子域 (High Efficiency Signal-B field, HE-SIG-B),且 HE-SIG 位于 HE-STF 之后,且位于数据

字段之前。

[0052] 应理解，图 4 中各个子域的位置不是固定不变的，各个子域的位置可以进行相应的调整，本发明实施例并不对此做限定。

[0053] 应理解，图 2- 图 4 的例子仅仅是为了帮助本领域技术人员理解本发明实施例，而非要将本发明实施例限于所例示的具体数值或具体场景。本领域技术人员根据所给出的图 2- 图 4 的例子，显然可以进行各种等价的修改或变化，例如，可以将图 2- 图 4 中的子域的位置调整等，这样的修改或变化也落入本发明实施例的范围内。

[0054] 可选地，作为另一实施例，在 110 之前，本发明实施例方法还可以包括接收子信道资源分配触发帧，子信道资源分配触发帧用于触发生成 PPDU，子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0055] 具体而言，站点首先接收包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 的子信道资源分配触发帧，子信道资源分配触发帧用于触发生成 PPDU，之后，站点根据该子信道资源分配触发帧生成包括 M 个高效短训练子域 HE-STF 以及数据子域，且不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 的 PPDU，且承载 PPDU 的信道带宽小于 20MHZ，站点并向接入点发送该 PPDU，以便接入点解析该 PPDU 获得目标数据。

[0056] 因此，本发明实施例中的 PPDU 能够在带宽小于 20MHz 的信道下工作，并且由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU，减少了 PPDU 的比特数，进而节省了传输该 PPDU 的频谱资源，提高了频谱利用率。

[0057] 应理解，如果在整个 BSS 中存在着不支持 802.11ax 功能的站点，又由于 802.11ax 中的 PPDU 无 L-SIG 域，则不支持 802.11ax 功能的站点是不能够解析出 PPDU 的长度的，那么这些站点不能够正确的设置自己的网络配置向量 (network allocation vector，NAV)，这样不利于这些站点在 802.11ax PPDU 传输时进入省电模式，不利于这些站点省电；但由于本发明实施例中的 802.11ax 的 PPDU 传输是由子信道资源分配触发帧所触发，而子信道资源分配触发帧是在 20MHZ 信道带宽或以上带宽传输的，所以触发帧肯定带有 L-SIG，L-STF、L-LTF，由于在 L-SIG 中应包含后续 802.11ax PPDU 传输所需的时长，这样对于在 BSS 中不支持 802.11ax 功能的站点可以解析 L-SIG 域获得传输 PPDU 的时间，进而可以根据该时间设置自己的 NAV，从而可在 802.11ax PPDU 传输时进入休眠状态，达到省电目的。

[0058] 还应理解，在本发明实施例中，发送 PPDU 的帧间间隔 IFS 小于短帧间间隔 SIFS。例如当 SIFS 的时长为 10us 时，则 IFS 的时长可以为 5us。

[0059] 具体而言，对于那些没有侦听到触发帧的不支持 802.11ax 功能的站点，为了避免这些站点对 802.11ax PPDU 整个数据通信的干扰，本发明实施例中可以定义 IFS(inter-frame space) 来替代现有的 SIFS(short inter-frame space)，并且设置 IFS 小于 SIFS。这样这些不支持 802.11ax 功能的站点在 802.11ax PPDU 不能够抢占到信道，避免了其他其他站点（不支持 802.11ax 功能的站点，）的干扰，保证了 802.11ax PPDU 的通信。

[0060] 还应理解，本发明实施例 PPDU 中的数据子域可以包括媒体接入控制 (Media Access Control，MAC) 头部分，且 MAC 头部分的 6 个比特用于表示 PPDU 的类型。

[0061] 换句话说用 6 个比特表示工作在 20MHZ 信道带宽以下不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 的 PPDU。

[0062] 例如，如表 1 所示，本发明实施例中可以使用 MAC 头部分的类型 (Type) 和子类型 (Subtype) 域中的 B3、B2、B7、B6、B5 和 B4，6 个比特表示该 PPDU 的类型，例如使用“101101”表示该 PPDU 的类型，其中，类型值 B3B2 为 10，类型描述 (Type description) 为数据 (Data)，子类型值 B7 B6 B5B4 为 1101，子类型描述 (Subtype description) 为高效数据 (HE-data)。

[0063] 表 1

[0064]

| 类型值 B3 B2 | 类型描述 | 子类型值 B7 B6 B5 B4 | 子类型描述 |
|---|---|---|---|
| 10 | 数据 | 1101 | 高效数据 |

[0065] 上文中，结合图 1 至图 4 从站点侧描述了本发明实施例的数据传输的方法，下面结合图 5 从接入点侧描述本发明实施例的数据传输的方法。

[0066] 应理解，图 5 所示的方法与图 1 所示的方法相对应，区别在于，图 1 的方法可以是由发送端，例如站点执行，图 5 的方法可以是由接收端，例如接入点执行。图 5 中涉及的 PPDU 的结构和子信道资源分配触发帧的结构的相关描述，可以参见上文中图 1 方法实施例中的相应描述，为了避免重复，此处适当省略详细描述。具体地，如图 5 所示的方法包括：

[0067] 510，发送子信道资源分配触发帧，子信道资源分配触发帧用于触发生成物理层协议数据单元帧 PPDU；

[0068] 520，接收站点根据子信道资源分配触发帧发送的 PPDU，承载 PPDU 的信道带宽小于 20MHZ，其中 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG。

[0069] 因此，本发明实施例中的 PPDU 能够在带宽小于 20MHz 的信道下工作，并且由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU，减少了 PPDU 的比特数，进而节省了传输该 PPDU 的频谱资源，提高了频谱利用率。

[0070] 应理解，本发明实施例中的子域也可以称为字段，本发明实施例并不限于此。

[0071] 应理解，本发明实施例中的 M 个高效短训练子域 HE-STF 与 M 个子信道相对应。M 可以大于或等于 1。

[0072] 换句话说，M 可以为 1 也可以大于或等于 2，本发明实施例并不对此做限定。其中，当 M 大于或等于 2 时，M 个相同的高效短训练子域 HE-STF 可以用于不同子信道间的时间和频率的同步。

[0073] 图 2 是根据本发明一个实施例的 PPDU 的结构示意图。如图 2 所示的 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域。

[0074] 可选地，作为另一实施例，本发明实施例中的PPDU还可以包括高效长训练子域HE-LTF。

[0075] 例如，如图3所示的PPDU包括：M个高效短训练子域HE-STF、高效长训练子域HE-LTF以及数据子域。其中，HE-LTF位于M组HE-STE之后，且位于数据字段之前。

[0076] 应理解，图3中各个子域的位置不是固定不变的，各个子域的位置可以进行适当的调整，本发明实施例并不对此做限定。

[0077] 进一步地，作为另一实施例，本发明实施例中的PPDU还可以包括高效信号字段子域HE-SIG。

[0078] 例如，如图4所示的PPDU包括：M个高效短训练子域HE-STF、高效长训练子域HE-LTF、高效信号字段子域HE-SIG以及数据子域。其中，高效信号字段子域HE-SIG包括HE-SIG-A和HE-SIG-B，且HE-SIG位于HE-STF之后，且位于数据字段之前。

[0079] 应理解，图4中各个子域的位置不是固定不变的，各个子域的位置可以进行相应的调整，本发明实施例并不对此做限定。

[0080] 应理解，图2-图4的例子仅仅是为了帮助本领域技术人员理解本发明实施例，而非要将本发明实施例限于所例示的具体数值或具体场景。本领域技术人员根据所给出的图2-图4的例子，显然可以进行各种等价的修改或变化，例如，可以将图2-图4中的子域的位置调整等，这样的修改或变化也落入本发明实施例的范围内。

[0081] 可选地，作为另一实施例，子信道资源分配触发帧用于触发生成PPDU，子信道资源分配触发帧包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG，承载子信道资源分配触发帧的信道带宽为20MHZ、40MHZ、80MHZ或160MHZ。

[0082] 具体而言，接入点首先向站点发送包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG的子信道资源分配触发帧，子信道资源分配触发帧用于触发生成PPDU，之后，站点根据该子信道资源分配触发帧生成包括M个高效短训练子域HE-STF以及数据子域，且不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG的PPDU，且承载PPDU的信道带宽小于20MHZ，接入点接收站点发送的该PPDU，之后接入点解析该PPDU获得目标数据。

[0083] 因此，本发明实施例中的PPDU能够在带宽小于20MHz的信道下工作，并且由于本发明实施例中的PPDU不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG物理层协议数据单元帧PPDU，减少了PPDU的比特数，进而节省了传输该PPDU的频谱资源，提高了频谱利用率。

[0084] 应理解，如果在整个BSS(Basis service set)中存在着不支持802.11ax功能的站点，又由于802.11ax中的PPDU无L-SIG域，则不支持802.11ax功能的站点是不能够解析出PPDU的长度的，那么这些站点不能够正确的设置自己的网络配置向量(network allocation vector,NAV)，这样不利于这些站点在802.11ax PPDU传输时进入省电模式，不利于这些站点省电；但由于本发明实施例中的802.11ax的PPDU传输是由子信道资源分配触发帧所触发，而子信道资源分配触发帧是在20MHZ信道带宽或以上带宽传输的，所以触发帧肯定带有L-SIG，L-STF、L-LTF，由于在L-SIG中应包含后续802.11ax PPDU传输所需

的时长，这样对于在 BSS 中不支持 802.11ax 功能的站点可以解析 L-SIG 域获得传输 PPDU 的时间，进而可以根据该时间设置自己的 NAV，从而可在 802.11ax PPDU 传输时进入休眠状态，达到省电目的。

[0085] 还应理解，在本发明实施例中，站点发送 PPDU 的帧间间隔 IFS 小于短帧间间隔 SIFS。例如当 SIFS 的时长为 10us 时，则 IFS 的时长可以为 5us。

[0086] 具体而言，对于那些没有侦听到触发帧的不支持 802.11ax 功能的站点，为了避免这些站点对 802.11ax PPDU 整个数据通信的干扰，本发明实施例中可以定义 IFS(inter-frame space) 来替代现有的 SIFS(short inter-frame space)，并且设置 IFS 小于 SIFS。这样这些不支持 802.11ax 功能的站点在 802.11ax PPDU 不能够抢占到信道，避免了其他其他站点（不支持 802.11ax 功能的站点，）的干扰，保证了 802.11ax PPDU 的通信。

[0087] 还应理解，本发明实施例 PPDU 中的数据子域可以包括 MAC 头部分，且 MAC 头部分的 6 个比特用于表示 PPDU 的类型。

[0088] 换句话说用 6 个比特表示工作在 20MHZ 信道带宽以下不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 的 PPDU。

[0089] 例如，如表 1 所示，本发明实施例中可以使用 MAC 头部分的类型 (Type) 和子类型 (Subtype) 域中的 B3、B2、B7、B6、B5 和 B4，6 个比特表示该 PPDU 的类型，例如使用“101101”表示该 PPDU 的类型，其中，类型值 B3B2 为 10，类型描述 (Type description) 为数据 (Data)，子类型值 B7 B6 B5B4 为 1101，子类型描述 (Subtype description) 为高效数据 (HE-data)。

[0090] 上文中结合图 1 至图 5 详细描述了本发明实施例中的数据传输的方法，下面结合图 6 和图 7 详细描述本发明实施例的数据传输的设备。

[0091] 图 6 是根据本发明一个实施例的数据传输的设备示意框图。图 6 所示的设备 600 可以为站点，应理解，图 6 所示的设备 600 与图 1 相对应，设备 600 能够实现图 1 方法实施例中的各个过程。设备 600 的具体功能可参见图 1 方法实施例中的各个过程，为避免重复，此处不再赘述。

[0092] 如图 6 所示的设备 600 包括：生成单元 610 和发送单元 620。

[0093] 具体地，生成单元 610 用于生成物理层协议数据单元帧 PPDU，承载 PPDU 的信道带宽小于 20MHZ，其中 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG；

[0094] 发送单元 620 用于发送 PPDU。

[0095] 因此，由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU，减少了 PPDU 的比特数，进而节省了传输该 PPDU 的频谱资源，提高了频谱利用率。

[0096] 可选地，作为另一实施例，M 大于或等于 2。

[0097] 可选地，作为另一实施例，PPDU 还包括高效长训练子域 HE-LTF。

[0098] 可选地，作为另一实施例，PPDU 还包括高效信号字段子域 HE-SIG。

[0099] 可选地，作为另一实施例，设备 600 还可以包括：接收单元。

[0100] 具体地，接收单元用于在生成单元 610 生成物理层协议数据单元帧 PPDU 之前，接收子信道资源分配触发帧，子信道资源分配触发帧用于触发生成 PPDU，子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0101] 图 7 是根据本发明另一实施例的数据传输的设备示意框图。图 7 所示的设备 700 可以为接入点，应理解，图 7 所示的设备 700 与图 5 相对应，设备 700 能够实现图 5 方法实施例中的各个过程。设备 700 的具体功能可参见图 5 方法实施例中的各个过程，为避免重复，此处不再赘述。

[0102] 如图 7 所示的设备 700 包括：发送单元 710 和接收单元 720。

[0103] 具体地，发送单元 710 用于发送子信道资源分配触发帧，子信道资源分配触发帧用于触发生成物理层协议数据单元帧 PPDU；

[0104] 接收单元 720 用于接收站点根据子信道资源分配触发帧发送的 PPDU，承载 PPDU 的信道带宽小于 20MHZ，其中 PPDU 包括 M 个高效短训练子域 HE-STF 以及数据子域，不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG。

[0105] 因此，本发明实施例中的 PPDU 能够在带宽小于 20MHz 的信道下工作，并且由于本发明实施例中的 PPDU 不包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG 物理层协议数据单元帧 PPDU，减少了 PPDU 的比特数，进而节省了传输该 PPDU 的频谱资源，提高了频谱利用率。

[0106] 可选地，作为另一实施例，M 大于或等于 2。

[0107] 可选地，作为另一实施例，PPDU 还包括高效长训练子域 HE-LTF。

[0108] 可选地，作为另一实施例，PPDU 还包括高效信号字段子域 HE-SIG。

[0109] 可选地，作为另一实施例，子信道资源分配触发帧包括具有后向兼容功能的短训练子域 L-STF、具有后向兼容功能的长训练子域 L-LTF 及具有后向兼容功能的信号字段子域 L-SIG，承载子信道资源分配触发帧的信道带宽为 20MHZ、40MHZ、80MHZ 或 160MHZ。

[0110] 应理解，说明书通篇中提到的“一个实施例”或“一实施例”意味着与实施例有关的特定特征、结构或特性包括在本发明的至少一个实施例中。因此，在整个说明书各处出现的“在一个实施例中”或“在一实施例中”未必一定指相同的实施例。此外，这些特定的特征、结构或特性可以任意适合的方式结合在一个或多个实施例中。应理解，在本发明的各种实施例中，上述各过程的序号的大小并不意味着执行顺序的先后，各过程的执行顺序应以其功能和内在逻辑确定，而不应对本发明实施例的实施过程构成任何限定。

[0111] 另外，本文中术语“系统”和“网络”在本文中常被可互换使用。本文中术语“和 / 或”，仅仅是一种描述关联对象的关联关系，表示可以存在三种关系，例如，A 和 / 或 B，可以表示：单独存在 A，同时存在 A 和 B，单独存在 B 这三种情况。另外，本文中字符“/”，一般表示前后关联对象是一种“或”的关系。

[0112] 应理解，在本发明实施例中，“与 A 相应的 B”表示 B 与 A 相关联，根据 A 可以确定 B。但还应理解，根据 A 确定 B 并不意味着仅仅根据 A 确定 B，还可以根据 A 和 / 或其它信息

确定 B。

[0113] 本领域普通技术人员可以意识到，结合本文中所公开的实施例描述的各示例的单元及算法步骤，能够以电子硬件、计算机软件或者二者的结合来实现，为了清楚地说明硬件和软件的可互换性，在上述说明中已经按照功能一般性地描述了各示例的组成及步骤。这些功能究竟以硬件还是软件方式来执行，取决于技术方案的特定应用和设计约束条件。专业技术人员可以对每个特定的应用来使用不同方法来实现所描述的功能，但是这种实现不应认为超出本发明的范围。

[0114] 所属领域的技术人员可以清楚地了解到，为了描述的方便和简洁，上述描述的系统、装置和单元的具体工作过程，可以参考前述方法实施例中的对应过程，在此不再赘述。

[0115] 在本申请所提供的几个实施例中，应该理解到，所揭露的系统、装置和方法，可以通过其它的方式实现。例如，以上所描述的装置实施例仅仅是示意性的，例如，单元的划分，仅仅为一种逻辑功能划分，实际实现时可以有另外的划分方式，例如多个单元或组件可以结合或者可以集成到另一个系统，或一些特征可以忽略，或不执行。另外，所显示或讨论的相互之间的耦合或直接耦合或通信连接可以是通过一些接口、装置或单元的间接耦合或通信连接，也可以是电的，机械的或其它的形式连接。

[0116] 作为分离部件说明的单元可以是或者也可以不是物理上分开的，作为单元显示的部件可以是或者也可以不是物理单元，即可以位于一个地方，或者也可以分布到多个网络单元上。可以根据实际的需要选择其中的部分或者全部单元来实现本发明实施例方案的目的。

[0117] 另外，在本发明各个实施例中的各功能单元可以集成在一个处理单元中，也可以是各个单元单独物理存在，也可以是两个或两个以上单元集成在一个单元中。上述集成的单元既可以采用硬件的形式实现，也可以采用软件功能单元的形式实现。

[0118] 通过以上的实施方式的描述，所属领域的技术人员可以清楚地了解到本发明可以用硬件实现，或固件实现，或它们的组合方式来实现。当使用软件实现时，可以将上述功能存储在计算机可读介质中或作为计算机可读介质上的一个或多个指令或代码进行传输。计算机可读介质包括计算机存储介质和通信介质，其中通信介质包括便于从一个地方向另一个地方传送计算机程序的任何介质。存储介质可以是计算机能够存取的任何可用介质。以此为例但不限于：计算机可读介质可以包括 RAM、ROM、EEPROM、CD-ROM 或其他光盘存储、磁盘存储介质或者其他磁存储设备、或者能够用于携带或存储具有指令或数据结构形式的期望的程序代码并能够由计算机存取的任何其他介质。此外。任何连接可以适当的成为计算机可读介质。例如，如果软件是使用同轴电缆、光纤光缆、双绞线、数字用户线 (DSL) 或者诸如红外线、无线电和微波之类的无线技术从网站、服务器或者其他远程源传输的，那么同轴电缆、光纤光缆、双绞线、DSL 或者诸如红外线、无线和微波之类的无线技术包括在所属介质的定影中。如本发明所使用的，盘 (Disk) 和碟 (disc) 包括压缩光碟 (CD)、激光碟、光碟、数字通用光碟 (DVD)、软盘和蓝光光碟，其中盘通常磁性的复制数据，而碟则用激光来光学的复制数据。上面的组合也应当包括在计算机可读介质的保护范围之内。

[0119] 总之，以上所述仅为本发明技术方案的较佳实施例而已，并非用于限定本发明的保护范围。凡在本发明的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本发明的保护范围之内。

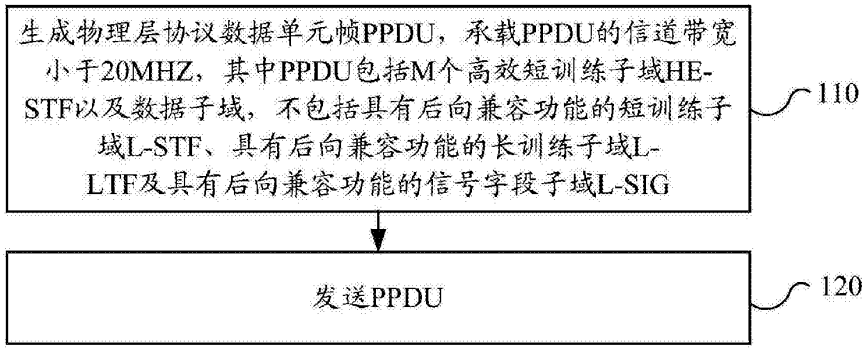

生成物理层协议数据单元帧PPDU，承载PPDU的信道带宽小于20MHZ，其中PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG
110
发送PPDU
120

图 1

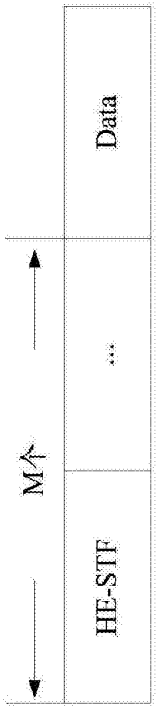

Data
...
M个
HE-STF

图 2

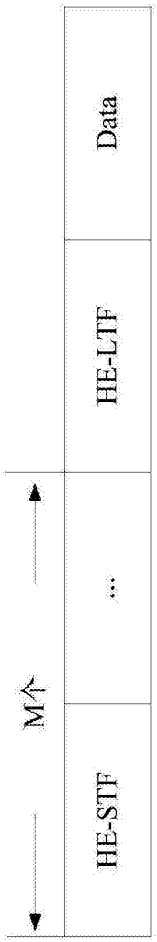



图 3

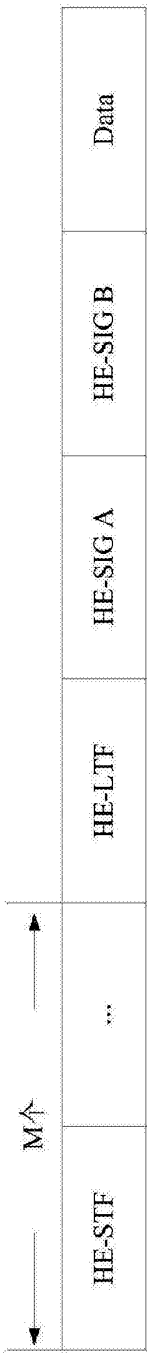



图 4

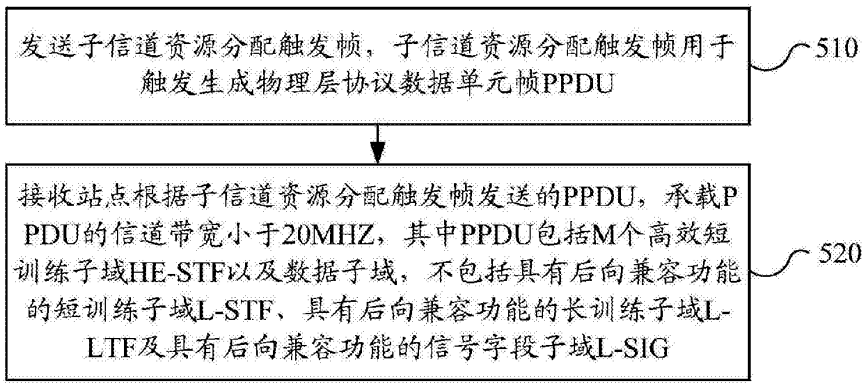

发送子信道资源分配触发帧，子信道资源分配触发帧用于触发生成物理层协议数据单元帧PPDU
510
接收站点根据子信道资源分配触发帧发送的PPDU，承载PPDU的信道带宽小于20MHZ，其中PPDU包括M个高效短训练子域HE-STF以及数据子域，不包括具有后向兼容功能的短训练子域L-STF、具有后向兼容功能的长训练子域L-LTF及具有后向兼容功能的信号字段子域L-SIG
520

图 5

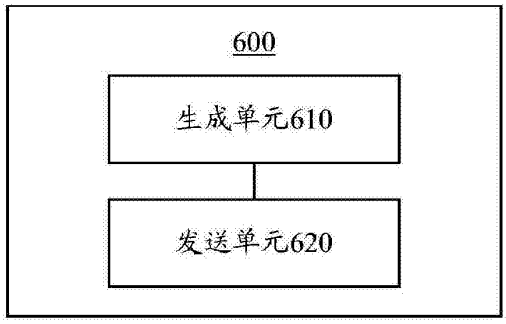

600
生成单元610
发送单元620

图 6

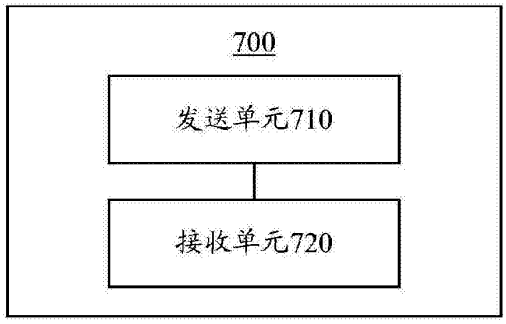

700
发送单元710
接收单元720

图 7

Espacenet

## Bibliographic data: CN105122754 (A) — 2015-12-02

Method for transmitting signal field and apparatus therefor

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**Classification:** - international: *H04L27/26*
- cooperative: **H04B7/0452 (US)**; **H04L1/1896 (EP)**; **H04L27/2042 (US)**; **H04L27/205 (EP, US)**; **H04L27/2602 (EP, US)**; **H04L5/0007 (US)**; **H04L5/0023 (EP, US)**; **H04L5/0053 (EP, US)**; **H04W84/12 (US)**; H04B7/0452 (RU); H04L27/18 (EP, RU, US); H04L27/2042 (RU); H04L5/0092 (EP, US)

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Abstract of CN105122754 (A)

The invention provides a method for transmitting a signal field in a wireless LAN along with an apparatus therefor. The method for transmitting a signal field in a wireless LAN includes the steps of: generating a signal field by a first STA (station); and transmitting the signal field to a second STA by the first STA in a first OFDM (orthogonal frequency division multiplexing) symbol, a second OFDM symbol and a third OFDM symbol, wherein at least one of a second binary phase shift keying used in the second OFDM symbol and a third binary phase shift keying used in the third OFDM symbol can be rotated in reference to the first binary phase shift keying used in the first OFDM symbol.

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## CLAIMS CN105122754A

1.

A method for transmitting signal fields in a wireless local area network (WLAN). The method includes the following steps:

The signal field is generated by the first station (STA); and

The first STA sends the signal field to the second STA on the first orthogonal frequency division multiplexing (OFDM) symbol, the second OFDM symbol, and the third OFDM symbol,

Wherein, at least one of the second constellation used in the second OFDM symbol and the third constellation used in the third OFDM symbol is rotated based on the first constellation used in the first OFDM symbol.

2.

The method according to claim 1, further comprising transmitting, by the first STA, a traditional signal (L-SIG) in a reference OFDM symbol,

Wherein, the reference OFDM symbol is before the first OFDM symbol, and

Wherein, the first constellation is the same as the reference constellation used in the reference OFDM symbol.

3.

According to the method of claim 1,

Wherein, the first constellation is a binary phase shift keying constellation,

Wherein one of the second constellation and the third constellation is a quadrature binary phase shift keying (QBPSK) constellation, and the other of the second constellation and the third constellation is a BPSK constellation, and

Wherein, based on the BPSK constellation, the QBPSK constellation is rotated 90 degrees counterclockwise.

4.

According to the method of claim 1,

Wherein, the signal field includes a channel allocation field for multiple STAs having the same group identifier (ID) as the group identifier (ID) of the second STA, and

Wherein, the channel allocation field includes information related to channels allocated for uplink transmission of each of the plurality of STAs at a specific time.

5.

According to the method of claim 4,

Wherein, the signal field further includes information related to the number of multiple input multiple output (MIMO) uplink space-time streams for the second STA.

6.

A station (STA) for transmitting signal fields in a wireless local area network (WLAN), the STA includes:

A radio frequency (RF) unit configured to send and receive radio signals; and

A processor, the processor is operatively connected to the RF unit and is configured to:

Generate the signal field; and

Sending the signal field to the second STA on the first orthogonal frequency division multiplexing (OFDM) symbol, the second OFDM symbol and the third OFDM symbol,

Wherein, at least one of the second constellation used in the second OFDM symbol and the third constellation used in the third OFDM symbol is rotated based on the first constellation used in the first OFDM symbol.

7.

The STA according to claim 6,

Wherein, the processor is further configured to send a traditional signal (L-SIG) in a reference OFDM symbol,

Wherein, the reference OFDM symbol is before the first OFDM symbol, and

Wherein, the first constellation is the same as the reference constellation used in the reference OFDM symbol.

8.

The STA according to claim 6,

Wherein, the first constellation is a binary phase shift keying constellation,

Wherein one of the second constellation and the third constellation is a quadrature binary phase shift keying (QBPSK) constellation, and the other of the second constellation and the third constellation is a BPSK constellation, and

Wherein, based on the BPSK constellation, the QBPSK constellation is rotated 90 degrees counterclockwise.

9.

The STA according to claim 6,

Wherein, the signal field includes a channel allocation field for multiple STAs having the same group identifier (ID) as the group identifier (ID) of the second STA, and

Wherein, the channel allocation field includes information related to channels allocated for uplink transmission of each of the plurality of STAs at a specific time.

10.

The STA according to claim 9,

Wherein, the signal field further includes information related to the number of multiple input multiple output (MIMO) uplink space-time streams for the second STA.

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## DESCRIPTION CN105122754A

A method and apparatus for transmitting signal fields in a wireless LAN are disclosed. The method for transmitting a signal field in a wireless LAN includes the following steps: a first STA (station) generates a signal field; and a first STA (orthogonal frequency division multiplexing) symbol, a second OFDM symbol and in the third OFDM symbol, the signal field is sent to the second STA, where the first binary phase shift keying used in the first OFDM symbol can be referenced to rotate the second binary used in the second OFDM symbol. At least one of phase shift keying and third binary phase shift keying used in the third OFDM symbol.

Method and device for transmitting signal field

Technical field

The present invention relates to wireless communication, and more specifically, to a method and apparatus for transmitting signal fields in a wireless local area network (WLAN).

Background technique

The Institute of Electrical and Electronics Engineers (IEEE) 802.11 Wireless Next Generation Standing Committee (WNGSC) is a special committee that conducts mid-term and long-term inspections of the next-generation wireless local area network (WLAN).

At the IEEE meeting in March 2013, Broadcom proposed based on the WLAN standardization history that when the IEEE802.11ac standard is finalized, the next-generation WLAN following IEEE802.11ac should be discussed in the first half of 2013. On the basis of technical necessity and need for standardization, a proposal to create a research group for the next generation of WLAN was carried out at the IEEE meeting in March 2013.

The scope of HEW (so-called high-efficiency WLAN (HEW)) mainly discussed by the research group for the next-generation WLAN includes: 1) The 802.11 physical (PHY) layer and the medium access control (MAC) layer in the 2.4GHz and 5GHz frequency bands Improvement, 2) improvement of spectral efficiency and area throughput, and 3) performance improvement in actual indoor and outdoor environments (such as environments including interference sources, crowded heterogeneous networks, and environments with high user load) . The HEW mainly considers the situation of an environment crowded with access points (AP) and stations (STA), and the HEW conducts discussions on the improvement of spectrum efficiency and area throughput in this situation. Specifically, HEW focuses on the improvement of actual performance not only in an indoor environment but also in an outdoor environment, which is basically not considered in the existing WLAN.

HEW attaches great importance to wireless offices, smart homes, stadiums, hotspots, buildings/apartments, and discusses the improvement of system performance in an environment full of APs and STAs based on the corresponding situation.

Instead of a single basic service set (BSS) single link performance improvement, the discussion of the system performance improvement of the overlapping basic service set (OBSS) environment and outdoor environment and the discussion of cellular offloading are expected to be powerful. This HEW trend means that the next-generation WLAN gradually has a technical range similar to that of mobile communication. Considering that mobile communication technologies are discussed together with small

cells and WLAN technologies in direct-to-direct (D2D) communication areas, the technology and business convergence of next-generation WLANs based on HEW and mobile communication are expected to be further improved.

Summary of the invention

technical problem

An aspect of the present invention is to provide a method and apparatus for transmitting signal fields in a wireless communication system.

Another aspect of the present invention is to provide a method and apparatus for receiving signal fields.

Technical solutions

In order to realize an aspect of the present invention, a method for transmitting signal fields in a wireless local area network (WLAN) according to an embodiment of the present invention includes the following steps: the signal fields are generated by a first station (STA), and the first STA The signal field is sent to the second STA in the first orthogonal frequency division multiplexing (OFDM) symbol, the second OFDM symbol, and the third OFDM symbol, where it can be rotated based on the first constellation used in the first OFDM symbol At least one of the second constellation used in the second OFDM symbol and the third constellation used in the third OFDM symbol.

In order to implement another aspect of the present invention, an STA that transmits a signal field in a WLAN according to an embodiment of the present invention includes: a radio frequency (RF) unit configured to transmit and receive radio signals; and a processor, which is selectively Ground connected to the RF unit, where the processor may be configured to generate the signal field and transmit the signal field to the receiving STA in the first OFDM symbol, the second OFDM symbol, and the third OFDM symbol, and may be based on the first OFDM symbol To rotate at least one of the second constellation used in the second OFDM symbol and the third constellation used in the third OFDM symbol.

Beneficial effect

The newly defined physical layer convergence process (PLCP) protocol data unit (PPDU) can be detected while maintaining the automatic detection rules for the existing PPDU. The station (STA) can judge whether the received PPDU is the newly defined PPDU based on the modulation scheme of the fields included in the newly defined PPDU, with backward compatibility with the existing WLAN system.

Description of the drawings

FIG. 1 is a schematic diagram showing a wireless local area network (WLAN).

FIG. 2 is a diagram showing the layer structure of a WLAN system supported by IEEE802.11.

FIG. 3 is a schematic diagram showing a physical layer convergence process (PLCP) protocol data unit (PPDU) in a non-high throughput (HT) format.

Fig. 4 is a schematic diagram showing a PPDU in the HT format.

FIG. 5 is a schematic diagram showing a PPDU in a very high throughput (VHT) format.

FIG. 6 is a schematic diagram showing a method of transmitting fields included in each PPDU.

Fig. 7 is a schematic diagram showing a PPDU in a high efficiency WLAN (HEW) format according to the present invention.

Fig. 8 is a schematic diagram showing a PPDU of the HEW format according to the present invention.

FIG. 9 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

FIG. 10 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

Fig. 11 is a schematic diagram showing a group identifier field and a user channel location field according to an embodiment of the present invention.

FIG. 12 is a schematic diagram showing a wireless communication method according to an embodiment of the present invention.

FIG. 13 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

FIG. 14 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

FIG. 15 is a block diagram showing a wireless device according to an embodiment of the present invention.

detailed description

FIG. 1 is a conceptual diagram showing the structure of a wireless local area network (WLAN).

Figure 1(A) shows the structure of an IEEE (Institute of Electrical and Electronics Engineers) 802.11 infrastructure network. 1(A), the WLAN system may include one or more basic service sets (BSS, 100 and 105). BSS100 or BSS105 A group of APs (such as AP (Access Point) 125) and STAs (such as STA1 (Station) 100-1), which can successfully synchronize with each other to communicate with each other instead of being used to indicate the concept of a specific area . The BSS105 may include one AP130 and one or more STA105-1 and STA105-2 which can be connected to the AP130.

The infrastructure BSS may include at least one STA, AP125 and AP130 providing distribution services, and a distributed system (DS) 110 connecting multiple APs.

The distribution system 110 may implement an extended service set (ESS) 140 by connecting multiple BSS 100 and BSS 105. The ESS140 may be used as a term representing a network configured with one or more AP125 and AP230 connected via the distribution system 110. APs included in one ESS 140 may have the same SSID (Service Set Identifier).

The portal 120 can be used to implement a WLAN network (IEEE802.11) and other networks (for example, 802. X) The connecting bridge.

In the infrastructure network as shown in FIG. 1(A), the network between AP125 and AP130 and the network between AP125 and AP130 and STA100-1, STA105-1 and STA105-2 can be realized. However, in the absence of AP125 and AP130, a network can be established between STAs to perform communication. A network that performs communication without AP125 and AP130 established between STAs is defined as an ad hoc network or an independent BSS (Basic Service Set).

Fig. 1(B) is a conceptual diagram showing an independent BSS.

Referring to Figure 1(B), an independent BSS (IBSS) is a BSS operating in an ad hoc mode. IBSS does not include AP, making IBSS lack a centralized management entity. In other words, in IBSS, STA150-1, STA150-2, STA150-3, STA155-1, and STA155-2 are managed in a distributed manner. In IBSS, all STA150-1, STA150-2, STA150-3, STA155-1, and STA155-2 can be mobile STAs and are not allowed to access the distribution system, so that the IBSS forms a self-contained network.

STA is a media access control (MAC) that complies with IEEE (Institute of Electrical and Electronics Engineers) 802.11 standards and some functional media including a physical layer interface for radio media, and the term "STA" can include AP and non-APSTA in its definition (Station) Both.

The STA may be called various terms such as a mobile terminal, a wireless device, a wireless transmit/receive unit (WTRU), a user equipment (UE), a mobile station (MS), a mobile subscriber unit, or simply a user.

FIG. 2 is a diagram showing the layer structure of a WLAN system supported by IEEE802.11.

Fig. 2 conceptually shows the layer structure (PHY structure) of the WLAN system.

The WLAN system layer structure may include a MAC (Media Access Control) sublayer 220, a PLCP (Physical Layer Convergence Process) sublayer 210, and a PMD (Physical Media Related) sublayer 200. The PLCP sub-layer 210 is implemented such that the MAC sub-layer 220 is operated with the reliance on the PMD sub-layer 200 minimized. The PMD sublayer 200 may be used as a transmission interface to transmit data between multiple STAs.

The MAC sublayer 220, the PLCP sublayer 210, and the PMD sublayer 200 may conceptually include a management entity.

The management entity of the MAC sublayer 220 represents MLME (MAC layer management entity, 225), and the management entity of the physical layer represents PLME (PHY layer management entity, 215). Such management entities can provide interfaces where layer management operations are performed. The PLME215 is connected with the MLME225 to be able to perform management operations on the PLCP sublayer 210 and the PMD sublayer 200, and the MLME225 is also connected with the PLME215 to be able to perform management operations on the MAC sublayer 220.

There may be an SME (STA Management Entity, 250) to perform appropriate MAC layer operations. The SME250 can be operated as a layer independent component. MLME, PLME and SME can transmit information between mutual components based on primitives.

The operation of each sub-layer is briefly described as follows. The PLCP sublayer 110 transmits the MPDU (MAC Protocol Data Unit) received from the MAC sublayer 220 to the PMD sublayer 200 according to instructions from the MAC layer between the MAC sublayer 220 and the PMD sublayer 200, or transmits to the MAC sublayer 220 Frame from PMD sublayer 200. The PMD sublayer 200 is a PLCP sublayer and the PMD sublayer 200 can transmit data between multiple STAs in a radio medium manner. The MPDU (MAC Protocol Data Unit) delivered from the MAC sublayer 220 represents a PSDU (Physical Service Data Unit) on one side of the PLCP sublayer 210. The MPDU is similar to the PSDU, but in the case where A-MPDU (aggregated MPDU) obtained by aggregating multiple MPDUs has been transmitted, each MPDU may be different from the PSDU.

The PLCP sublayer 210 adds an additional field including information required by the physical layer transceiver while receiving the PSDU from the MAC sublayer 220 and transmitting the PSDU to the PMD sublayer 200. In this case, the added fields may include the PLCP preamble for the PSDU, the PLCP header, and the tail bits necessary to return the convolutional encoder to the zero state. The PLCP preamble can be used to allow the receiver to prepare for synchronization and antenna diversity before the PSDU is sent. The data field may include padding bits for the PSDU, a service field including a bit sequence for initializing the scrambler, and an encoding sequence in which a bit sequence added with tail bits has been encoded. In this case, as the coding scheme, one of BCC (Binary Convolutional Code) coding or LDPC (Low Density Parity Check) coding may be selected according to the coding scheme supported by the STA receiving the PPDU. The PLCP header may include the following fields, which contain information about the PPDU (PLCP Protocol Data Unit) to be transmitted.

The PLCP sublayer 210 adds the above-mentioned fields to the PSDU to generate a PPDU (PLCP Protocol Data Unit) and transmits it to the receiving station via the PMD sublayer 200, and the receiving station receives the PPDU and obtains data recovery from the PLCP preamble and PLCP header The necessary information to recover the data.

Figure 3 is a schematic diagram showing a physical layer convergence process (PLCP) protocol data unit (PPDU) in a non-high throughput format.

Figure 3 shows a non-HTPPDU format that supports IEEE802.11a/g. A PPDU in a non-HT format ("non-HTPPDU") can also be expressed as a PPDU in a traditional format ("legacy PPDU").

3, the non-HTP PDU may include a traditional short training field (L-STF) 300, a traditional long training field (L-LTF) 320, a traditional signal field (L-SIG) 340, and data 360.

L-STF 300 may include short training Orthogonal Frequency Division Multiplexing (OFDM) symbols. L-STF300 can be used for frame detection, automatic gain control (AGC), diversity detection, and coarse frequency/time synchronization.

L-LTF320 can include one long training OFDM symbol. L-LTF320 can be used for fine frequency/time synchronization and channel prediction.

L-SIG340 can be used to send control information. L-SIG340 may include information about data rate and data length.

The data 360 is a payload that may include a service field, a scrambled PLCP service data unit (PSDU), tail bits, and padding bits.

Fig. 4 is a schematic diagram showing a PPDU in the HT format.

FIG. 4 shows a PPDU supporting both IEEE802.11n and IEEE802.11a/g HT hybrid format ("HT hybrid PPDU") among PPDUs used in the HT format ("HTPPDU").

4, the HT hybrid PPDU may include HT-SIG400, HT-STF420, and HT-LTF440 in addition to the non-HTPPDU shown in FIG. 3.

HT-SIG400 may include information for interpreting HT hybrid PPDU. For example, HT-SIG400 may include modulation and coding scheme (MCS) information, PSDU length information, space-time block coding (STBC) information, and the like.

HT-STF420 can be used to improve AGC performance, timing synchronization and frequency synchronization. HT-STF420 has a total length of 4μs, which is the same as the total length of L-STF, but has a different cycle delay value from L-STF.

HT-LTF440 can be used for multiple input multiple output (MIMO) channel estimation and fine carrier frequency offset (CFO) estimation. A station (STA) supporting IEEE802.11n needs to estimate as many channels as the number of space-time streams (or space streams), and therefore the number of HT-LTF440 can be increased according to the number of space-time streams.

FIG. 5 is a schematic diagram showing a PPDU in a very high throughput (VHT) format.

5, the PPDU ("VHTPPDU") in the VHT format may include L-STF, L-LTF, L-SIG, VHT-SIG-A, VHT-STF, VHT-LTF, VHT-SIG-B, and data.

The L-STF field, the L-LTF field, and the L-SIG field are the fields included in the non-HTPPDU as described in FIG. 3 above. The remaining VHT-SIG-A500, VHT-STF520, VHT-LTF540, and VHT-SIG-B560 may only be included in the VHTPPDU.

VHT-SIG-A500 may include information for interpreting VHTPPDU. VHT-SIG-A500 may include VHT-SIG-A1 and VHT-SIG-A2. The VHT-SIG-A1 may include the bandwidth of the group identifier (ID) for the group used for transmission of the grouped STA in multi-user (MU) MIMO, regardless of whether space-time block coding is applied or not. Information and information about the number of streams used.

VHT-SIG-A2 may include information about whether to use a short guard interval (GI), forward error correction (FEC) information, information about MCS for a single user, information about channel coding types for multiple users, beam Shaping related information, redundant bits for cyclic redundancy check (CRC), and tail bits of the convolutional decoder.

VHT-STF520 can be used to improve automatic gain control estimation in a MIMO environment.

VHT-LTF540 is used to estimate the channel in a MIMO environment.

The VHT-SIG-B560 may include information about each STA (ie, information about PSDU length and MCS, tail bits, etc.).

FIG. 6 is a schematic diagram showing a method of transmitting fields included in each PPDU.

FIG. 6 shows a modulation scheme for the fields included in each PPDU (non-HTPPDU600, HTPPDU620, or VHTPPDU640). The STA can distinguish PPDUs based on the modulation scheme for the fields contained in the received PPDU. Differentiating PPDU (or distinguishing PPDU format) can be interpreted as different meanings. For example, distinguishing PPDUs may include determining whether the received PPDU can be decoded (or interpreted) by the STA. In addition, distinguishing PPDUs may mean determining whether the received PPDU is a PPDU that the STA can support. Alternatively, distinguishing PPDUs may mean distinguishing what information is sent through the received PPDU.

If the PPDU is in a different format, a different modulation scheme can be used for the field after the L-SIG. The STA may distinguish the PPDU based on the modulation scheme for the field after the L-SIG included in the received PPDU.

In the non-HTPPDU 600 shown at the top of FIG. 6, the modulation scheme for L-SIG may be binary phase shift keying (BPSK). Specifically, the data transmitted through the OFDM symbol 605 corresponding to L-SIG may be generated based on a constellation for BPSK ("BPSK constellation").

In the HTPPDU 620 shown in the middle part of FIG. 6, the modulation scheme for the HT-SIG after the L-SIG may be QBPSK. Specifically, the data transmitted through the first OFDM symbol 623 and the second OFDM symbol 626 corresponding to HT-SIG can be generated based on a constellation for QBPSK ("QBPSK constellation"). The QBPSK constellation may be a constellation that is rotated 90 degrees counterclockwise based on the BPSK constellation. The STA can distinguish the PPDU based on the modulation scheme for the reception of the field.

For example, the STA may detect the starting point of the HT-SIG based on the in-phase (I)/quadrature (Q) signal power ratio of the received data. Specifically, the STA may detect the HT-SIG based on the change of the modulation scheme (or the change of the constellation) used for the received data. In addition, the STA may determine whether the received PPDU is non-HTPPDU or HTPPDU based on information about the modulation scheme (or constellation) used for the received data.

In the HTPPDU 640 shown at the bottom of FIG. 6, the modulation scheme for VHT-SIG-A after L-SIG may be BPSK and QBPSK. Specifically, the data transmitted through the first OFDM symbol 643 corresponding to VHT-SIG-A may be generated based on the BPSK constellation, and the data transmitted through the second OFDM 646 corresponding to VHT-SIG-A may be generated based on the QBPSK constellation.

Likewise, the STA can detect VHT-SIG-A based on the change in the modulation scheme (or the change in constellation) used for the received data. In addition, the STA may determine whether the received PPDU is non-HTPPDU, HTPPDU, or VHTPPDU based on information about the modulation scheme (or constellation) used for the received data.

The modulation scheme for distinguishing the fields of the PPDU by each PPDU format may be represented by the term "automatic detection rule". The STA can distinguish PPDUs based on the modulation scheme for the received field according to the automatic detection rule.

In the following, the embodiments of the present invention show that both the existing PPDU (non-HTPPDU, HTPPDU or VHTPPDU) is distinguished based on the modulation scheme for the fields contained in the received PPDU and the one defined in the HEW as the next-generation WLAN High-efficiency WLAN (HEW) format PPDU method.

In the present invention, for the convenience of description, the next-generation WLAN may be expressed as a high-efficiency WLAN (HEW), HEW-supported frames may be expressed as HEW frames, and HEW-supported PPDUs may be expressed as HEW format PPDUs ( "HEWPPDU") and a STA that supports HEW may be expressed as HEWSTA.

In addition, PPDUs other than HEWPPDUs (such as non-HTPPDU, HTPPDU, or VHTPPDU) may be expressed as conventional PPDUs, frames transmitting and receiving conventional PPDUs may be expressed as conventional frames, and STAs that only support conventional PPDUs may It is represented as a traditional STA.

When the HEWPPDU is used, the HEWPPDU can be used to transmit and receive data in an environment where the HEWPPDU coexists with a conventional PPDU for a conventional STA supporting an existing WLAN system. In this environment, the traditional STA may not have backward compatibility with respect to the HEW. Therefore, HEWPPDU needs to be defined so as not to affect traditional STAs.

In the conventional automatic detection rules, different modulation schemes can be configured for the fields located after the L-SIG in the received PPDU to distinguish PPDU fields of different formats.

When using HEWPPDUs, a method for STAs to distinguish HEWPPDUs is required while maintaining traditional automatic detection rules. That is, it is necessary to define a HEWPPDU for supporting HEW in a nested mode (in which a new method is introduced while maintaining the traditional mode).

In the following, embodiments of the present invention show HEWPPDUs for supporting HEW in a nested mode (in which a new method is introduced while maintaining the traditional mode).

Fig. 7 is a schematic diagram showing a HEWPPDU according to the present invention.

Referring to FIG. 7, for convenience, the HEWPPDU can be divided into the traditional part of the L-SIG and the HEW part after the L-SIG. For example, the HEW part may include fields for supporting HEW (such as HEW-SIG, HEW-STF, HEW-LTF, and HEW-SIG2). These fields for supporting HEW are description fields for interpreting HEWPPDUs that do not include conventional parts. HEW-SIG can be located behind the traditional part of L-SIG. The information included in the HEW-SIG will be described below.

According to an embodiment of the present invention, L-SIG and HEW-SIG can be generated based on the following modulation schemes in order to distinguish HEWPPDUs from conventional PPDUs.

In HEWPPDU, the modulation scheme for L-SIG may be BPSK. Specifically, the data transmitted through the OFDM symbol (reference OFDM symbol) 710 corresponding to L-SIG may be generated based on the constellation of BPSK (reference constellation). That is, the BPSK constellation can be used in the OFDM symbol corresponding to L-SIG. In the embodiment of the present invention, L-SIG is described as corresponding to one OFDM symbol. However, if the L-SIG corresponds to multiple OFDM, the reference OFDM symbol may be the last OFDM symbol among the multiple OFDM symbols corresponding to the L-SIG.

In HEWPPDU, the modulation scheme for HEW-SIG may be QBPSK and BPSK. Specifically, the data transmitted through the first OFDM symbol 720 corresponding to HEW-SIG may be generated based on the constellation of QBPSK. That is, the QBPSK constellation can be used in the first OFDM symbol corresponding to HEW-SIG. The QBPSK constellation may be a constellation rotated 90 degrees based on the BPSK constellation.

The data transmitted through the second OFDM symbol 730 corresponding to HEW-SIG may be generated based on the constellation of BPSK. That is, the BPSK constellation can be used in the second OFDM symbol corresponding to HEW-SIG.

BPSK and QBPSK shown in the embodiment of the present invention are examples of different modulation schemes. In addition, BPSK may be referred to as a reference modulation scheme and QBPSK may be referred to as a rotated modulation scheme. The reference modulation scheme is a modulation scheme that serves as a reference for comparison with another modulation scheme, and the constellation for the reference modulation scheme may be referred to as a reference constellation. The rotated modulation scheme may be a modulation scheme that uses a constellation rotated by a specific angle based on a reference constellation. For ease of description, the embodiments of the present invention mainly show changes in modulation schemes based on BPSK and QBPSK.

Table 1 below shows the constellation used in transmitting the OFDM symbols of the fields included in the conventional PPDU

and the HEWPPDU.

[Table 1]

[image]

1, the STA may determine the modulation scheme (or the constellation used in the OFDM symbol) for the data transmitted in the OFDM symbol (for example, the reference OFDM symbol, the first OFDM symbol, or the second OFDM symbol) in which the received PPDU is transmitted. ), so as to distinguish the received PPDU. That is, the STA can determine the rotation of the constellation used in transmitting the OFDM symbols of the received PPDU, thereby distinguishing the received PPDU. Hereinafter, the embodiment of the present invention shows a method for the STA to determine the constellation used in the OFDM symbol in order to distinguish the received PPDU. Alternatively, the STA may determine the rotation of the constellation used in the OFDM symbol to distinguish the received PPDU.

In the following, a process for the STA to distinguish received PPDUs is shown.

Assuming that when the constellation used in the first OFDM symbol is not a QBPSK constellation, the HEWSTA receives the PPDU, and the HEWSTA can determine whether the received PPDU is a VHTPPDU or a non-HTPPDU. The HEWSTA may further determine whether the QBPSK constellation is used in the second OFDM symbol. When the QBPSK constellation is used in the second OFDM symbol, the STA can determine the received PPDU as a VHTPPDU.

When QBPSK is used in the first OFDM symbol, the HEWSTA may further determine the constellation used in the second OFDM symbol to distinguish PPDUs. For example, the HEWSTA may determine whether a BPSK constellation or a QBPSK constellation is used in the second OFDM symbol. When the QBPSK constellation is used in the second OFDM symbol, HEWSTA can distinguish the received PPDU as HTPPDU. When the BPSK constellation is used in the second OFDM symbol, the HEWSTA can distinguish the received PPDU as HEWPPDU.

Similarly, assuming that a traditional STA receives a PPDU, the traditional STA can determine the constellation used in the first OFDM symbol after the reference OFDM symbol or in both the first OFDM symbol and the second OFDM symbol to distinguish the received PPDU .

For example, when the QBPSK constellation is not used in at least one of the first OFDM symbol and/or the second OFDM symbol, the non-HTSTA can distinguish the received PPDU as a non-HTPPDU. When the QBPSK constellation is used in the first OFDM symbol and the second OFDM symbol, the HTSTA can determine that the received PPDU is an HTPPDU. When the BPSK constellation is used in the first OFDM symbol and the QBPSK constellation is used in the second OFDM symbol, the VHTSTA can determine that the received PPDU is a VHTPPDU.

A traditional STA can distinguish PPDUs based on an existing automatic detection method, and if the existing automatic detection method (for example, when the received PPDU is a HEWPPDU) does not distinguish the PPDU, channel access is delayed.

Based on the rotation of the constellation used in the OFDM symbols in Table 1, conventional STAs can distinguish PPDUs in the same way as existing methods, and HEWSTAs can distinguish HEWPPDUs.

Various methods can be used for the STA to determine the constellation used in the OFDM symbols contained in the conventional PPDU and HEWPPDU. For example, the STA may compare the norm values of the real part and the imaginary part of the modulation symbol transmitted through the OFDM symbol with a preset threshold, thereby determining whether the constellation used to generate the modulation symbol is a BPSK constellation or a QBPSK constellation.

In HEW, not only the constellation shown in FIG. 7 but also various combinations of constellations can be used to generate PPDUs.

Fig. 8 is a schematic diagram showing a HEWPPDU according to the present invention.

When the constellation shown in Table 1 is used in OFDM symbols, the reference OFDM symbol and the first OFDM symbol for transmitting HEWPPDU and HTPPDU use the same constellation. Therefore, if the HTSTA only performs automatic detection from the reference OFDM symbol to the first OFDM symbol, the HTSTA may not distinguish whether the received PPDU is an HTPPDU or a HEWPPDU.

FIG. 8 shows a method in which HTSTA only detects from the OFDM symbol (reference OFDM symbol) corresponding to L-SIG to the first OFDM symbol corresponding to HTSIG to distinguish whether the received PPDU is an HTPPDU. In FIG. 8, HEW-SIG is assumed to be a field corresponding to three OFDM symbols (a first OFDM symbol 820, a second OFDM symbol 830,

and a third OFDM symbol 840). In the HEW system, new technologies that are not used in the conventional WLAN system (such as Orthogonal Frequency Division Multiple Access (OFDMA) and Uplink (UL) Multi-User (MU)-MIMO) can be used. In addition, in the HEW system, there is a technology for improving communication performance in a dense environment of multiple APs and multiple STAs. Therefore, in the HEW system, additional information and/or fields for functions other than those in the traditional WLAN can be defined. Therefore, the HEW-SIG can be constructed by expanding three or more symbols instead of two symbols in the conventional system.

Table 2 below shows the constellation used in transmitting OFDM symbols of the fields included in the conventional PPDU and HEWPPDU.

[Table 2]

[image]

Referring to Table 2, the HT-SIG can be transmitted through two OFDM symbols (the first OFDM symbol and the second OFDM symbol). The constellation used by the first OFDM symbol and the second OFDM symbol for transmitting the HT-SIG may be rotated by 90 degrees based on the constellation used by the reference OFDM symbol.

The VHT-SIG can be transmitted through two OFDM symbols (the first OFDM symbol and the second OFDM symbol). The constellation used by the first OFDM symbol for transmitting the VHT-SIG may be the same as the constellation for the reference OFDM symbol. In addition, the constellation used by the second OFDM symbol transmitting the VHT-SIG may be rotated by 90 degrees based on the constellation used by the reference OFDM symbol.

According to the embodiment of the present invention, the HEW-SIG can be transmitted through three OFDM symbols (the first OFDM symbol 820, the second OFDM symbol 630, and the third OFDM symbol 840). The constellation used by the first OFDM symbol 820 and the second OFDM symbol 830 for transmitting HEW-SIG may be the same as the constellation used by the reference OFDM symbol 810. In addition, the constellation used by the third OFDM symbol 840 for transmitting HEW-SIG may be a constellation that is rotated 90 degrees counterclockwise based on the constellation used by the reference OFDM symbol 810. Although the HEW-SIG can be transmitted through three or more OFDM symbols, for ease of description, the HEW-SIG is assumed to be transmitted through three OFDM symbols.

When the constellation used in transmitting the OFDM symbols of the HEW-SIG is determined as shown in Table 2, what is shown is the determination process for the conventional STA and the HEWSTA to distinguish the received PPDU.

In the traditional STA, HTSTA and VHTSTA can distinguish the received PPDU based on the existing automatic detection rules. In detail, the HTSTA can detect the reference OFDM symbol and the first OFDM symbol, and when the QBPSK constellation is used in the first OFDM symbol, distinguish the received PPDU as the HTPPDU. When the BPSK constellation is used in the first OFDM symbol and the QBPSK constellation is used in the second OFDM symbol, the VHTSTA can distinguish the received PPDU as VHTPPDU. When it is recognized that the received PPDU is neither HTPPDU nor VHTPPDU, the HTSTA and VHTSTA of the traditional STA can delay channel access.

In a traditional STA, a non-HTSTA can detect from the reference OFDM symbol to the third OFDM symbol, and when the QBPSK constellation is used in the third OFDM symbol, it is distinguished that the received PPDU is not a non-HTPPDU. In this case, non-HTSTAs can also delay channel access.

The HEWSTA can determine the constellation used from the reference OFDM symbol to 3 OFDM symbols to distinguish PPDUs. The HEWSTA can distinguish HTPPDU and VHTPPDU based on the constellation used from the reference OFDM symbol to the second OFDM symbol. In addition, the HEWSTA can distinguish between non-HTPPDU and HEWPPDU based on the constellation used by the third OFDM symbol.

In addition to the constellation in the constellation table 2, the following various constellations (case 1 to case 6) can be used in the reference OFDM symbol to the third OFDM symbol to distinguish HEWPPDUs from PPDUs of other formats.

[table 3]

[image]

In HEWPPDU, unlike traditional PPDU, HEW-SIG can be sent through three OFDM symbols. Therefore, the HEWSTA can distinguish HEWPPD based on the constellation used in the reference OFDM symbol to the third OFDM symbol as shown in Table 3. According to an embodiment of the present invention, at least one of the first to third OFDM symbols corresponding to HEW-SIG may use a QBPSK constellation.

In order to support HEW, a signal field such as HEW-SIG may include various information. For example, when channel access is performed based on OFDMA, information on frequency resources (for example, channels) used for data transmission and reception of STAs, DL resource allocation, UL resource allocation information, etc. may be transmitted through a signal field. The signal field may also include information for supported UL MIMO. In addition, the signal field may include information used for interference management in an environment where STAs are dense with severe interference. Hereinafter, the embodiment of the present invention shows an example of the information included in the signal field in detail.

FIG. 9 is a schematic diagram showing a wireless communication method according to an embodiment of the present invention.

HEW can support OFDMA in multiple access mode.

Unlike the traditional WLAN, the HEW allows multiple STAs to communicate with the AP at the same time based on the frequency resources allocated to the corresponding STA.

9, a first frequency band 915, a second frequency band 925, and a third frequency band 935 may be allocated to a first STA910, a second STA920, and a third STA930, respectively, and communicate with the AP through the corresponding frequency bands.

The AP can allocate a frequency band to communicate with each of the STAs. The frequency band allocated to each STA may be frequency resources of various units. For example, the frequency band allocated to each STA may be one of a plurality of channels defined in a specific frequency band (for example, 2.4 GHz band, 5 GHz band, or 60 GHz band). Alternatively, the frequency band allocated to each STA may be a resource in a subunit of a divided channel.

The information about the frequency band allocated by each STA may be transmitted through HEWPPDU. For example, the HEW-SIG (or signal field) included in the HEWPPDU may include information about the frequency band allocated to each STA. Specifically, the HEW-SIG may include a channel allocation field, and the channel allocation field may include information about channels allocated to the STA.

For example, the AP may send information about the channel allocated to a single STA to the STA through the HEW-SIG of the HEWPPDU. Alternatively, the AP may transmit information about a frequency band allocated based on an identifier (ID) of the STA (for example, a group ID (GID) and an association ID (AID)) through the HEW-SIG. In detail, the AP may allocate channels to multiple STAs in such a way that the first channel is allocated to the STA corresponding to the first GID and the second channel is allocated to the STA corresponding to the second GID. In this way, the corresponding channel is allocated for multiple STAs, so that STAs performing access on the corresponding channel can be distributed.

The following Table 4 shows the channel allocation field of HEW-SIG that transmits channel allocation information.

[Table 4]

[image]

The channel allocation field in Table 4 is an example for transmitting channel allocation information about each of a plurality of STAs. The HEW-SIG may include other types of information for supporting simultaneous channel access by multiple STAs using different methods in different frequency resources.

The AP can change the information contained in the channel allocation field in the HEW-SIG according to the channel load, so that the STAs excessively converge on a specific channel.

FIG. 10 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

FIG. 10 shows another method for transmitting channel allocation information about each of a plurality of STAs. For example, the AP may transmit the group ID field for the STA and the user channel location field for the STA through the group ID management frame to configure the STA group and allocate a channel for each STA.

Referring to FIG. 10, the AP may send a group ID management frame to the STA (step S1000).

The group ID management frame may include a group ID field and a user channel location field.

FIG. 11 is a schematic diagram showing a group ID field and a user channel location field according to an embodiment of the present invention.

Referring to the top of FIG. 11, the group ID field 1100 may include a plurality of subfields (group ID 0 indicator to group ID 63 indicator) in an array indicating the corresponding group ID. In order to indicate the group ID of the STA, the group IDx indicator corresponding to the group ID of the STA may be configured as 1 in the group ID field 1100. The group ID y indicator that does

not correspond to the group ID of the STA may be configured as 0. For example, when the group ID of the STA is 1, the group ID1 indicator may be configured as 1 in the group ID field 1100 and the group ID field may be configured as "010000...0".

Referring to the bottom of FIG. 11, the user channel position field 1150 may include a plurality of subfields in an array indicating the user channel positions allocated to users included in a specific group (user channel position information in GID1 to user channel position in GID63 information). The STA may obtain the user channel position information included in the subfield indicated by the STA-based group ID in the user channel position field 1150. For example, when the STA has a group ID of 1, the STA can obtain the user channel location information on the STA from the user channel location information in GID1.

The STA may obtain information about the channel allocated to the STA based on the user channel position information obtained according to the group ID management frame and the channel allocation information on the HEW-SIG field to be received later, which will be described later.

The following Table 5 shows user channel position information (user channel position information in GIDx) corresponding to the bit value of the subfield.

<Table 5>

For example, when the STA has a group ID of 1, the AP may send the channel position information about the STA through the user channel position information in GID1 corresponding to the group ID field 1 in the user channel position field. When the user channel location information in GID1 has a value of "00", the STA may be assigned 0 user channel location information.

Referring back to FIG. 10, the AP transmits HEWPPDU to the STA (step S1010).

The AP may send HEWPPDU including HEW-SIG to the STA. The HEW-SIG may include channel allocation information allocated to the STA. Table 6 below shows the channel allocation information included in the HEW-SIG.

[Table 6]

[image]

The channel allocation information in Table 6 is shown at the bottom of FIG. 10. That is, the 12 bits corresponding to the channel allocation information can be divided into 3-bit units according to the user channel position information to transmit the channel information (0, 1, 2, 3). By using this method, it is possible to transmit information on channels to be used by multiple STAs included in the same group through HEW-SIG.

In a specific example, as described above, when the STA has user channel position information of 0, the STA may be allocated a channel based on bit information corresponding to the first to third bits of the channel allocation information. For example, when the first to third bits are "010", the second channel may be allocated to the STA. Similarly, when another STA has channel location information of 3, it can allocate channels to the STA through the same HEW-SIG based on bit information corresponding to the tenth to twelfth bits of the channel allocation information.

The STA transmits HEWPPDU through the allocated channel (step S1020).

The STA may send the HEWPPDU to the AP through a channel allocated based on the obtained user channel location information and the received channel allocation information in the HEW-SIG field.

The specific parameters listed in FIGS. 10 and 11 (such as the number of bits used for channel allocation information, bits allocated according to individual user channel position information and bit values of channel position information) are illustrative examples, and Various other parameters can be used.

FIG. 12 is a schematic diagram showing a wireless communication method according to an embodiment of the present invention.

Referring to FIG. 12, the STA 1250 may use UL MIMO to transmit UL data to the AP 1200. When the HEWSTA1250 supports UL MIMO, various control information can be included and transmitted in the HEWPPDU. For example, the AP 1200 may include and transmit information about whether UL MIMO is possible in the HEW-SIG of the HEWPPDU. In addition, the AP 1200 may include and transmit information about the number of space-time streams (or spatial streams) available for UL MIMO and information about channels to be used for UL MIMO in HEW-SIG.

The STA 1250 may determine whether to perform UL MIMO, the number of space-time streams to be used if UL MIMO is performed, and a channel for performing UL MIMO based on HEW-SIG.

For example, the STA1250 may perform UL MIMO through the first frequency band based on the received HEW-SIG based on

two spatial streams.

Table 7 below shows an example of the HEW-SIG field for transmitting UL MIMO related information.

[Table 7]

[image]

The information in Table 7 is an illustrative example, and at least one of the information can be included. In addition, HEW-SIG may include other information for supporting UL MIMO of STA.

FIG. 13 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

FIG. 13 shows a method for the AP to transmit to the STA information about the STA list for which the STA obtains a specific TXOP.

13, in the HEW, the AP can communicate with multiple STAs at the same time and transmit information about the STAs that simultaneously transmit and receive data.

The AP may include and transmit information about the number of STAs that obtain the same TXOP or information about a list of STAs that obtain the same TXOP in HEW-SIG. In addition, the AP can transmit information about the duration of TXOP through HEW-SIG.

For example, the AP 1300 may give TXOP specific ID information (for example, GID), and the STA may determine whether it is possible to transmit and receive data with the AP based on HEW-SIG. The AP 1300 may allocate TXOPs to STA1310 and STA1320 corresponding to the first GID and then allocate TXOPs to STA1310 and STA1320 corresponding to the second GID.

Table 8 below shows an example of the HEW-SIG field for transmitting TXOP related information.

[Table 8]

[image]

The information in Table 8 is an illustrative example, and at least one of the information can be included. In addition, the HEW-SIG may include other information for configuring TXOP for the STA.

FIG. 14 is a schematic diagram showing a wireless communication method in the HEW according to an embodiment of the present invention.

Referring to FIG. 14, in HEW, PPDU retransmission based on Hybrid Automatic Repeat Request (HARQ) may be supported.

In order to support HARQ-based retransmission, there may be needed identification information about whether the PPDU sent by the STA is a previously sent PPDU or a new PPDU, information about the number of retransmissions, and so on.

For example, when the AP1400 retransmits the PPDU to the STA1450, the AP may send, via the PPDU, retransmission indication information for indicating that the transmitted PPDU is the previously transmitted PPDU.

Table 9 below shows an example of the HEW-SIG field for transmitting retransmission related information.

[Table 9]

[image]

The information in Table 9 is an illustrative example, and HEW-SIG may include other information for supporting retransmission of STAs.

A plurality of information shown in FIGS. 9 to 14 may be included in other fields for supporting HEW instead of HEW-SIG. The multiple pieces of information shown in FIG. 9 to FIG. 14 may be variously combined and included in the HEW-SIG. In addition, the HEW-SIG may include not only a plurality of information shown in FIGS. 9 to 14 but also various information for supporting HEW.

FIG. 15 is a block diagram showing a wireless device to which the embodiment of the present invention can be applied.

15, the wireless device may be an STA that can implement the above-mentioned embodiments, and the wireless device may be an AP (1500) or a non-AP STA (station) (1550).

The AP1500 includes a processor 1510, a memory 1520, and an RF (Radio Frequency) unit 1530.

The RF unit 1530 may be connected with the processor 1520 to transmit/receive radio signals.

The processor 1510 implements the functions, processes, and/or methods as proposed herein. For example, according to the embodiments disclosed in FIG. 9 to FIG. 14 of the present invention, the processor 1510 may be implemented to perform the operation of the wireless device described above.

For example, the processor 1510 may use different constellations for modulating data transmitted in the multiple OFDM symbols when transmitting the signal field through the multiple OFDM symbols.

The STA 1550 includes a processor 1560, a memory 1570, and an RF (Radio Frequency) unit 1580.

The RF unit 1580 may be connected with the processor 1560 to transmit/receive radio signals.

The processor 1560 implements the functions, processes, and/or methods as proposed herein. For example, according to the embodiments disclosed in FIG. 9 to FIG. 14 of the present invention, the processor 1560 may be implemented to perform the operations of the wireless device described above.

For example, the processor 1560 may distinguish PPDUs based on a constellation used in a signal field transmitted through a plurality of OFDM symbols.

The processors 1510, 1560 may include ASICs (application specific integrated circuits), other chipsets, logic circuits, data processing equipment, and/or converters that perform conversion between baseband signals and radio signals. The memories 1520 and 1570 may include ROM (Read Only Memory), RAM (Random Access Memory), flash memory, memory card, storage medium, and/or other storage devices. The RF unit 1530, 1560 may include one or more antennas that transmit and/or receive radio signals.

When the implementation is implemented by software, the above solution may be embodied in a module (process or function, etc.) that performs the above function. The modules may be stored in the memories 1520, 1570 and executed by the processors 1510, 1560. The memories 1520 and 1570 may be placed inside or outside the processors 1510 and 1560, and may be connected to the processors 1510 and 1560 via various known methods.

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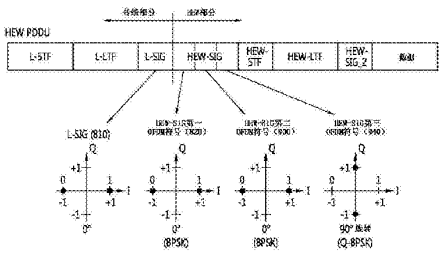
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(54)发明名称

用于发送信号字段的方法及其装置

(57)摘要

公开了一种用于在无线 LAN 中发送信号字段的方法及其装置。用于在无线 LAN 中发送信号字段的方法包括以下步骤：由第一 STA(站)产生信号字段；并且由第一 STA 在第一 OFDM(正交频分复用)符号、第二 OFDM 符号和第三 OFDM 符号中将该信号字段发送至第二 STA，其中，可以参考在第一 OFDM 符号中使用的第一二进制相移键控旋转在第二 OFDM 符号中使用的第二二进制相移键控和在第三 OFDM 符号中使用的第三二进制相移键控中的至少一个。




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1.一种用于在无线局域网 (WLAN) 中发送信号字段的方法,所述方法包括以下步骤 :

由第一站 (STA) 产生信号字段 ;并且

由第一 STA 在第一正交频分复用 (OFDM) 符号、第二 OFDM 符号和第三 OFDM 符号上将所述信号字段发送至第二 STA,

其中,基于在所述第一 OFDM 符号中使用的第一星座来旋转在所述第二 OFDM 符号中使用的第二星座和在所述第三 OFDM 符号中使用的第三星座中的至少一个。

2.根据权利要求 1 所述的方法,所述方法还包括由所述第一 STA 在基准 OFDM 符号中发送传统的信号 (L-SIG),

其中,所述基准 OFDM 符号在所述第一 OFDM 符号之前,并且

其中,所述第一星座与在所述基准 OFDM 符号中使用的基准星座是相同的。

3.根据权利要求 1 所述的方法,

其中,所述第一星座是二进制相移键控星座,

其中,所述第二星座和所述第三星座中的一个是正交二进制相移键控 (QBPSK) 星座,所述第二星座和所述第三星座中的另一个是 BPSK 星座,并且

其中,基于所述 BPSK 星座,所述 QBPSK 星座被逆时针旋转 90 度。

4.根据权利要求 1 所述的方法,

其中,所述信号字段包括针对具有与所述第二 STA 的组标识符 (ID) 相同的组标识符 (ID) 的多个 STA 的信道分配字段,并且

其中,所述信道分配字段包括与在特定的时间为所述多个 STA 中的每个的上行链路发送而分配的信道相关的信息。

5.根据权利要求 4 所述的方法,

其中,所述信号字段还包括与针对所述第二 STA 的多输入多输出 (MIMO) 的上行链路空间时间流的数量相关的信息。

6.一种用于在无线局域网 (WLAN) 中发送信号字段的站 (STA),所述 STA 包括 :

射频 (RF) 单元,所述射频单元被配置成发送和接收无线电信号 ;以及

处理器,所述处理器可操作地与所述 RF 单元连接,并且被配置成 :

产生信号字段 ;以及

在第一正交频分复用 (OFDM) 符号、第二 OFDM 符号和第三 OFDM 符号上向第二 STA 发送所述信号字段,

其中,基于在所述第一 OFDM 符号中使用的第一星座来旋转在所述第二 OFDM 符号中使用的第二星座和在所述第三 OFDM 符号中使用的第三星座中的至少一个。

7.根据权利要求 6 所述的 STA,

其中,所述处理器进一步被配置成在基准 OFDM 符号中发送传统的信号 (L-SIG),

其中,所述基准 OFDM 符号在所述第一 OFDM 符号之前,并且

其中,所述第一星座与在所述基准 OFDM 符号中使用的基准星座是相同的。

8.根据权利要求 6 所述的 STA,

其中,所述第一星座是二进制相移键控星座,

其中,所述第二星座和所述第三星座中的一个是正交二进制相移键控 (QBPSK) 星座,所述第二星座和所述第三星座中的另一个是 BPSK 星座,并且

其中，基于所述 BPSK 星座，所述 QBPSK 星座被逆时针旋转 90 度。

9. 根据权利要求 6 所述的 STA，

其中，所述信号字段包括针对具有与所述第二 STA 的组标识符 (ID) 相同的组标识符 (ID) 的多个 STA 的信道分配字段，并且

其中，所述信道分配字段包括与在特定的时间为所述多个 STA 中的每个的上行链路发送而分配的信道相关的信息。

10. 根据权利要求 9 所述的 STA，

其中，所述信号字段还包括与针对所述第二 STA 的多输入多输出 (MIMO) 的上行链路空间时间流的数量相关的信息。

# 用于发送信号字段的方法及其装置

## 技术领域

[0001] 本发明涉及无线通信，并且更具体地，涉及用于在无线局域网 (WLAN) 中发送信号字段的方法和装置。

## 背景技术

[0002] 电气和电子工程师协会 (IEEE)802.11 无线下一代常务委员会 (WNG SC) 是对下一代无线局域网 (WLAN) 进行中期和长期检查的特别委员会。

[0003] 在 2013 年 3 月的 IEEE 会议上，Broadcom 基于 WLAN 标准化历史建议当 IEEE 802.11ac 标准被最终确定时在 2013 年上半年需要对继 IEEE 802.11ac 之后的下一代 WLAN 进行讨论。在技术必要性和需要标准化的基础上，在 2013 年 3 月的 IEEE 会议上进行用于创建针对下一代 WLAN 的研究小组的议案。

[0004] 主要由针对下一代 WLAN 的研究小组讨论的 HEW( 所谓的高效 WLAN(HEW)) 的范围包括 :1) 在 2.4GHz 和 5GHz 频带中的 802.11 物理 (PHY) 层和介质访问控制 (MAC) 层的改善，2) 频谱效率和面积的吞吐量的提高，以及 3) 在实际的室内和室外环境 ( 诸如，包括干扰源的环境、拥挤异构网络和具有高的用户负荷的环境 ) 中的性能改善。HEW 主要考虑挤满接入点 (AP) 和站 (STA) 的环境的情形，并且 HEW 在该情形下进行关于频谱效率和面积吞吐量的提高的讨论。具体地，HEW 注重不仅在室内环境中而且在室外环境中的实际性能的改善，这在现有的 WLAN 中基本上不考虑。

[0005] HEW 对用于无线办公、智能家居、体育馆、热点、建筑 / 公寓给予大量的重视，并且基于相应的情形对充满 AP 和 STA 的环境的系统性能改善进行讨论。

[0006] 代替单个的基本服务集 (BSS) 单链路性能改善，对重叠基本服务集 (OBSS) 环境和室外环境的系统性能改善的讨论和对蜂窝卸载的讨论预期是有力的。该 HEW 趋势意味着下一代 WLAN 逐渐具有与移动通信类似的技术范围。考虑到移动通信技术连同小型小区和直接到直接 (D2D) 通信区域中的 WLAN 技术一起被讨论，基于 HEW 和移动通信的下一代 WLAN 的技术和商业会聚被期望进一步提升。

## 发明内容

[0007] 技术问题

[0008] 本发明的一方面是提供一种用于在无线通信系统中发送信号字段的方法和装置。

[0009] 本发明的另一方面是提供一种用于接收信号字段的方法和装置。

[0010] 技术方案

[0011] 为了实现本发明的一个方面，根据本发明一个实施方式的用于在无线局域网 (WLAN) 中发送信号字段的方法包括以下步骤 :由第一站 (STA) 生成信号字段，并且由第一 STA 在第一正交频分复用 (OFDM) 符号、第二 OFDM 符号和第三 OFDM 符号中将该信号字段发送到第二 STA，其中，可以基于在第一 OFDM 符号中使用的第一星座来旋转在第二 OFDM 符号中使用的第二星座和在第三 OFDM 符号中使用的第三星座中的至少一个。

[0012] 为了实现本发明的另一个方面，根据本发明的一个实施方式的在 WLAN 中发送信号字段的 STA 包括：射频 (RF) 单元，其被配置成发送和接收无线电信号；以及处理器，其选择性地连接到 RF 单元，其中，处理器可以被配置成产生信号字段并在第一 OFDM 符号、第二 OFDM 符号和第三 OFDM 符号中将信号字段发送到接收 STA，并且可以基于在第一 OFDM 符号中使用的第一星座来旋转在第二 OFDM 符号中使用的第二星座和在第三 OFDM 符号中使用的第三星座中的至少一个。

[0013] 有益效果

[0014] 新定义的物理层会聚过程 (PLCP) 协议数据单元 (PPDU) 可以在保持针对现有 PPDU 的自动检测规则的同时被检测。站 (STA) 可以基于包括在新定义的 PPDU 中的字段的调制方案判断接收到的 PPDU 是否是新定义的 PPDU，具有与现有的 WLAN 系统的向后兼容性。

## 附图说明

[0015] 图 1 是示出无线局域网 (WLAN) 的示意图。

[0016] 图 2 是示出由 IEEE 802.11 支持的 WLAN 系统的层结构的图。

[0017] 图 3 是示出非高吞吐量 (HT) 格式的物理层会聚过程 (PLCP) 协议数据单元 (PPDU) 的示意图。

[0018] 图 4 是示出 HT 格式的 PPDU 的示意图。

[0019] 图 5 是示出非常高吞吐量 (VHT) 格式的 PPDU 的示意图。

[0020] 图 6 是示出发送包括在每个 PPDU 中的字段的方法的示意图。

[0021] 图 7 是示出根据本发明的高效 WLAN(HEW) 格式的 PPDU 的示意图。

[0022] 图 8 是示出根据本发明的 HEW 格式的 PPDU 的示意图。

[0023] 图 9 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0024] 图 10 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0025] 图 11 是示出根据本发明的实施方式的组标识符字段和用户信道位置字段的示意图。

[0026] 图 12 是示出根据本发明的实施方式的无线通信方法的示意图。

[0027] 图 13 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0028] 图 14 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0029] 图 15 是示出根据本发明的实施方式的无线设备的框图。

## 具体实施方式

[0030] 图 1 是示出无线局域网 (WLAN) 的结构的概念图。

[0031] 图 1(A) 示出在 IEEE(电气和电子工程师协会)802.11 基础设施网络的结构。参照图 1(A)，WLAN 系统可以包括一个或更多个基本服务集 (BSS，100 和 105)。BSS 100 或 BSS105 一组 AP(诸如，AP(接入点)125) 和 STA(诸如，STA 1(站)100-1)，其可以成功地与彼此同步以彼此通信而不是用以指示特定区域的概念。BSS 105 可以包括一个 AP 130 和一个或更多个可连接到 AP 130 的 STA 105-1 和 STA 105-2。

[0032] 基础设施 BSS 可以包括至少一个 STA、提供分发服务的 AP 125 和 AP 130 以及连接多个 AP 的分布式系统 (DS)110。

[0033] 分发系统 110 可以通过连接多个 BSS 100 和 BSS 105 实现扩展的服务集(ESS)140。ESS 140 可以用作表示配置有经由分发系统 110 连接的一个或更多个 AP 125 和 AP 230 的网络的术语。包括在一个 ESS 140 中的 AP 可以具有相同的 SSID(服务集标识)。

[0034] 门户 120 可以用作执行 WLAN 网络 (IEEE 802.11) 与其它网络 (例如,802.X) 连接的桥梁。

[0035] 在如图 1(A) 中所示的基础设施网络中,可以实现 AP 125 与 AP 130 之间的网络以及 AP 125 和 AP 130 与 STA 100-1、STA 105-1 和 STA 105-2 之间的网络。然而,在没有 AP 125 和 AP 130 的情况下,可以在 STA 之间建立网络以执行通信。在 STA 之间建立没有 AP 125 和 AP 130 的执行通信的网络被定义为自组织网络或独立的 BSS(基本服务集)。

[0036] 图 1(B) 是示出独立的 BSS 的概念图。

[0037] 参照图 1(B),独立的 BSS(IBSS) 是在自组织模式下操作的 BSS。IBSS 不包括 AP,使得 IBSS 缺少集中的管理实体。换言之,在 IBSS 中,以分布式的方式管理 STA 150-1、STA 150-2、STA 150-3、STA 155-1 以及 STA 155-2。在 IBSS 中,所有的 STA 150-1、STA 150-2、STA 150-3、STA 155-1 和 STA 155-2 可以是移动的 STA,并且不允许接入到分发系统,使得 IBSS 形成自包含的网络。

[0038] STA 是包括符合 IEEE(电气和电子工程师学会)802.11 标准的媒体访问控制 (MAC) 和包括针对无线电媒体的物理层接口的一些功能媒介,并且术语“STA”在其定义中可以包括 AP 和非 AP STA(站) 两者。

[0039] STA 可以被称为诸如移动终端、无线设备、无线发送 / 接收单元 (WTRU)、用户设备 (UE)、移动站 (MS)、移动用户单元或简称为用户的各种术语。

[0040] 图 2 是示出由 IEEE 802.11 支持的 WLAN 系统的层结构的图。

[0041] 图 2 概念地示出 WLAN 系统的层结构 (PHY 结构)。

[0042] WLAN 系统层结构可以包括 MAC(媒体访问控制) 子层 220、PLCP(物理层会聚过程) 子层 210 以及 PMD(物理媒体相关) 子层 200。PLCP 子层 210 被实现使得以对 PMD 子层 200 的依赖最小化来操作 MAC 子层 220。PMD 子层 200 可以用作发送接口以在多个的 STA 之间传送数据。

[0043] MAC 子层 220、PLCP 子层 210 以及 PMD 子层 200 可以在概念上包括管理实体。

[0044] MAC 子层 220 的管理实体表示 MLME(MAC 层管理实体,225),并且物理层的管理实体表示 PLME(PHY 层管理实体,215)。这种管理实体可以在执行层管理操作的地方提供接口。PLME 215 与 MLME 225 连接以能够对 PLCP 子层 210 和 PMD 子层 200 执行管理操作,并且 MLME 225 还与 PLME 215 连接,以能够执行对 MAC 子层 220 的管理操作。

[0045] 可能存在 SME(STA 管理实体,250) 来执行适当的 MAC 层操作。SME 250 可以作为层独立部件而被操作。MLME、PLME 和 SME 可以基于基元在互部件之间传送信息。

[0046] 各子层的操作简述如下。PLCP 子层 110 根据来自 MAC 子层 220 和 PMD 子层 200 之间的 MAC 层的指令向 PMD 子层 200 传送从 MAC 子层 220 接收的 MPDU(MAC 协议数据单元),或向 MAC 子层 220 传送来自 PMD 子层 200 的帧。PMD 子层 200 是 PLCP 子层并且 PMD 子层 200 可以以无线电介质的方式在多个 STA 之间传送数据。从 MAC 子层 220 传递的 MPDU(MAC 协议数据单元) 表示在 PLCP 子层 210 的一侧上的 PSDU(物理服务数据单元)。MPDU 类似于 PSDU,但在通过聚合多个 MPDU 获得的 A-MPDU(聚集的 MPDU) 已经被传送的情况下,每个

MPDU 可能不同于 PSDU。

[0047] PLCP 子层 210 在从 MAC 子层 220 接收 PSDU 和向 PMD 子层 200 传送该 PSDU 的同时添加包括物理层收发器需要的信息的附加的字段。在这种情况下，所添加的字段可以包括针对 PSDU 的 PLCP 前导、PLCP 报头和将卷积编码器返回到零状态所必需的尾部比特。PLCP 前导可以用于允许接收器在 PSDU 被发送之前准备同步和天线分集。数据字段可以包括对 PSDU 的填充比特、包括用于初始化扰频器的比特序列的服务字段和其中已经对添加有尾部比特的比特序列进行编码的编码序列。在这种情况下，作为编码方案，可以根据由接收 PPDU 的 STA 所支持的编码方案选择 BCC（二进制卷积码）编码或 LDPC（低密度奇偶校验）编码中的一个。PLCP 报头可以包括以下字段，该字段包含关于将被发送的 PPDU(PLCP 协议数据单元）。

[0048] PLCP 子层 210 将上述字段添加到 PSDU 以生成 PPDU(PLCP 协议数据单元）并且经由 PMD 子层 200 将其发送给接收站，并且接收站接收 PPDU 并且获得对于从 PLCP 前导和 PLCP 报头进行的数据恢复所必需的信息以从而恢复该数据。

[0049] 图 3 是示出在非高吞吐量格式下的物理层会聚过程 (PLCP) 协议数据单元 (PPDU) 的示意图。

[0050] 图 3 示出了一种支持 IEEE 802.11a/g 的非 HT PPDU 格式。非 HT 格式的 PPDU(“非 HT PPDU”）也可以表示为传统格式的 PPDU（“传统 PPDU”）。

[0051] 参照图 3，非 HT PPDU 可以包括传统短训练字段 (L-STF)300、传统长训练字段 (L-LTF)320、传统信号字段 (L-SIG)340 和数据 360。

[0052] L-STF 300 可以包括短训练正交频分复用 (OFDM) 符号。L-STF 300 可以用于帧检测、自动增益控制 (AGC)、多样性检测以及粗略的频率 / 时间同步。

[0053] L-LTF 320 可以包括一个长训练 OFDM 符号。L-LTF 320 可以用于精细的频率 / 时间同步和信道预测。

[0054] L-SIG 340 可用于发送控制信息。L-SIG 340 可以包括关于数据速率和数据长度的信息。

[0055] 数据 360 是可以包括服务字段、加扰的 PLCP 服务数据单元 (PSDU)、尾部比特和填充比特的有效负载。

[0056] 图 4 是示出 HT 格式的 PPDU 的示意图。

[0057] 图 4 示出了用于 HT 格式（“HT PPDU”）的 PPDU 中的支持 IEEE 802.11n 和 IEEE 802.11a/g 两者的 HT 混合格式（“HT 混合 PPDU”）的 PPDU。

[0058] 参照图 4，HT 混合 PPDU 除了图 3 所示的非 HT PPDU 之外还可以包括 HT-SIG 400、HT-STF 420 和 HT-LTF 440。

[0059] HT-SIG 400 可以包括用于解释 HT 混合 PPDU 的信息。例如，HT-SIG 400 可以包括调制和编码方案 (MCS) 信息、PSDU 长度信息、空间时间块编码 (STBC) 信息等。

[0060] HT-STF 420 可以用于改进 AGC 性能、定时同步和频率同步。HT-STF 420 具有 4μs 的总长度，这是与 L-STF 的总长度相同的，但具有不同于 L-STF 的循环延迟值。

[0061] HT-LTF 440 可以用于多输入多输出 (MIMO) 信道估计和精细的载波频率偏移 (CFO) 估计。支持 IEEE 802.11n 的站 (STA) 需要估计与空间时间流（或空间流）的数目一样多的信道，并且因此 HT-LTF 440 的数量可以根据空间时间流的数量而增加。

[0062] 图 5 是示出非常高吞吐量 (VHT) 格式的 PPDU 的示意图。

[0063] 参照图 5，VHT 格式的 PPDU(“VHT PPDU”) 可以包括 L-STF、L-LTF、L-SIG、VHT-SIG-A、VHT-STF、VHT-LTF、VHT-SIG-B 和数据。

[0064] L-STF 字段、L-LTF 字段和 L-SIG 字段是包含在如上述图 3 所述的非 -HT PPDU 中的字段。剩余的 VHT-SIG-A 500、VHT-STF 520、VHT-LTF 540 和 VHT-SIG-B 560 可以仅被包括在 VHT PPDU 中。

[0065] VHT-SIG-A 500 可以包括用于解释 VHT PPDU 的信息。VHT-SIG-A 500 可以包括 VHT-SIG-A1 和 VHT-SIG-A2。VHT-SIG-A1 可以包括关于所使用的信道 ( 无论是否应用空间时间块编码 )、指示用于在多用户 (MU)MIMO 中的分组的 STA 的传输的组的组标识符 (ID) 的带宽信息以及关于使用的流的数量的信息。

[0066] VHT-SIG-A2 可以包括关于是否使用短的保护间隔 (GI) 的信息、前向纠错 (FEC) 信息、关于针对单个用户的 MCS 的信息、关于针对多用户的信道编码类型的信息、波束成形相关信息、用于循环冗余校验 (CRC) 的冗余比特以及卷积解码器的尾部比特。

[0067] VHT-STF 520 可以被用来在 MIMO 环境中改善自动增益控制估计。

[0068] VHT-LTF 540 被用于在 MIMO 环境中估计信道。

[0069] VHT-SIG-B 560 可以包括关于每个 STA 的信息 ( 即，关于 PSDU 长度和 MCS、尾部比特等的信息 )。

[0070] 图 6 是示出发送包括在每个 PPDU 中的字段的方法的示意图。

[0071] 图 6 示出了针对包括在每个 PPDU( 非 HT PPDU 600、HT PPDU 620 或 VHT PPDU 640) 中的字段的调制方案。STA 可以基于针对包含在接收的 PPDU 中的字段的调制方案区分 PPDU。区分 PPDU( 或区分 PPDU 格式 ) 可以被解释成不同的含义。例如，区分 PPDU 可以包括确定所接收的 PPDU 是否可以通过 STA 解码 ( 或解释 )。此外，区分 PPDU 可能意味着确定所接收的 PPDU 是否是 STA 能够支持的 PPDU。另选地，区分 PPDU 可能意味着区分通过接收的 PPDU 发送了什么信息。

[0072] 如果 PPDU 处于不同的格式，则不同的调制方案可以被用于 L-SIG 之后的字段。STA 可以基于针对包括在接收的 PPDU 中的 L-SIG 之后的字段的调制方案来区分 PPDU。

[0073] 在图 6 的顶部所示的非 HT PPDU 600 中，针对 L-SIG 的调制方案可以是二进制相移键控 (BPSK)。具体地，可以基于针对 BPSK 的星座 (“BPSK 星座”) 产生通过对应于 L-SIG 的 OFDM 符号 605 发送的数据。

[0074] 在图 6 的中部所示的 HT PPDU 620 中，针对 L-SIG 之后的 HT-SIG 的调制方案可以是 QBPSK。具体地，可以基于针对 QBPSK 的星座 (“QBPSK 星座”) 产生通过对应于 HT-SIG 的第一 OFDM 符号 623 和第二 OFDM 符号 626 发送的数据。QBPSK 星座可以是基于 BPSK 星座逆时针旋转 90 度的星座。STA 可以基于针对字段的接收的调制方案来区分 PPDU。

[0075] 例如，STA 可以基于所接收的数据的同相 (I)/ 正交 (Q) 信号功率比来检测 HT-SIG 的开始点。具体地，STA 可以基于用于所接收的数据的调制方案的变化 ( 或星座的变化 ) 来检测 HT-SIG。此外，STA 可以基于关于用于所接收的数据的调制方案 ( 或者星座 ) 的信息确定所接收的 PPDU 是非 -HT PPDU 还是 HT PPDU。

[0076] 在图 6 的底部所示的 HT PPDU 640 中，针对 L-SIG 之后的 VHT-SIG-A 的调制方案可以是 BPSK 和 QBPSK。具体地，可以基于 BPSK 星座生成通过对应于 VHT-SIG-A 的第一 OFDM 符

号643发送的数据，并且可以基于QBPSK星座生成通过对应于VHT-SIG-A的第二OFDM 646发送的数据。

[0077] 同样地，STA可以基于用于所接收的数据的调制方案的变化（或星座的变化）来检测VHT-SIG-A。另外，STA可以基于关于用于所接收的数据的调制方案（或星座）的信息确定所接收的PPDU是非-HT PPDU、HT PPDU还是VHT PPDU。

[0078] 针对于通过每个PPDU格式来区分PPDU的字段的调制方案可以由术语“自动检测规则”表示。STA可以根据自动检测规则基于针对所接收的字段的调制方案来区分PPDU。

[0079] 在下文中，本发明的实施方式示出了基于针对包含在所接收的PPDU中的字段的调制方案既区分现有的PPDU(非HT PPDU、HT PPDU或VHT PPDU)又在HEW中定义的作为下一代WLAN的高效率的WLAN(HEW)格式的PPDU的方法。

[0080] 在本发明中，为了便于描述，在下文中下一代WLAN可以被表示为高效率的WLAN(HEW)、支持HEW的帧可以被表示为HEW帧、支持HEW的PPDU可以被表示为HEW格式的PPDU(“HEW PPDU“)、并且支持HEW的STA可以被表示为HEW STA。

[0081] 此外，不同于HEW PPDU的PPDU(诸如，非HT PPDU、HT PPDU或VHT PPDU)可以被表示为传统的PPDU、发送和接收传统的PPDU的帧可以被表示为传统的帧、以及仅支持传统的PPDU的STA可以被表示为传统的STA。

[0082] 当使用HEW PPDU时，HEW PPDU可以用于在HEW PPDU与针对支持现有的WLAN系统的传统的STA的传统的PPDU共存的环境中发送和接收数据。在这种环境中，传统的STA可以没有相对于HEW的向后兼容性。因此，HEW PPDU需要被定义以便不影响传统的STA。

[0083] 在常规的自动检测规则中，不同的调制方案可以针对位于在接收的PPDU中的L-SIG之后的字段被配置以区分不同格式的PPDU字段。

[0084] 当使用HEW PPDU时，在保持传统的自动检测规则的情况下需要STA区分HEW PPDU的方法。也就是说，有必要定义用于在嵌套模式（其中，在保持传统模式的情况下引入新的方法）下支持HEW的HEW PPDU。

[0085] 在下文中，本发明的实施方式示出了用于在嵌套模式（其中，在保持传统模式的同时引入一种新的方法）下支持HEW的HEW PPDU。

[0086] 图7是示出根据本发明的HEW PPDU的示意图。

[0087] 参照图7，为方便起见，HEW PPDU可以被划分成L-SIG的传统部分和L-SIG后面的HEW部分。例如，HEW部分可以包括用于支持HEW的字段（诸如，HEW-SIG、HEW-STF、HEW-LTF和HEW-SIG2)。用于支持HEW的这些字段是用于解释不包括传统的部分的HEW PPDU的说明字段。HEW-SIG可以位于传统部分的L-SIG之后。下面将描述包括在HEW-SIG中的信息。

[0088] 根据本发明的实施方式，可以基于以下调制方案生成L-SIG和HEW-SIG，以便从传统的PPDU区分HEW PPDU。

[0089] 在HEW PPDU中，针对L-SIG的调制方案可以是BPSK。具体地，可以基于BPSK的星座（基准星座）产生通过与L-SIG对应的OFDM符号（基准OFDM符号）710发送的数据。也就是说，可以在与L-SIG对应的OFDM符号中使用BPSK星座。在本发明的实施方式中，L-SIG被描述为与一个OFDM符号相对应。然而，如果L-SIG与多个OFDM对应，则基准OFDM符号可以是与L-SIG对应的多个OFDM符号中的最后的OFDM符号。

[0090] 在HEW PPDU中，针对HEW-SIG的调制方案可以是QBPSK和BPSK。具体地，可以基

于 QBPSK 的星座产生通过与 HEW-SIG 对应的第一 OFDM 符号 720 发送的数据。也就是说，可以在与 HEW-SIG 对应的第一 OFDM 符号中使用 QBPSK 星座。QBPSK 星座可以是基于 BPSK 星座旋转 90 度的星座。

[0091] 可以基于 BPSK 的星座产生通过与 HEW-SIG 对应的第二 OFDM 符号 730 发送的数据。也就是说，可以在与 HEW-SIG 对应的第二 OFDM 符号中使用 BPSK 星座。

[0092] 在本发明的实施方式中所示的 BPSK 和 QBPSK 是不同的调制方案的示例。另外，BPSK 可以被称为基准调制方案并且 QBPSK 可以被称为旋转的调制方案。基准调制方案是作为与另一种调制方案进行比较的基准的调制方案，并且针对基准调制方案的星座可以被称为基准星座。旋转的调制方案可以是使用基于基准星座旋转特定角度的星座的调制方案。为了便于说明，本发明的实施方式主要示出了基于 BPSK 和 QBPSK 的调制方案的变化。

[0093] 下文中的表 1 示出了在发送包括在传统的 PPDU 和在 HEW PPDU 中的字段的 OFDM 符号中使用的星座。

[0094] [表 1]

[0095]

| | 基准 OFDM 符号（星座旋转角度） | 第一 OFDM 符号（星座旋转角度） | 第二 OFDM 符号（星座旋转角度） |
|---|---|---|---|
| 非 HT PPDU | L-SIG (BPSK) (0 度) | 数据字段 | 数据字段 |
| HT PPDU | L-SIG (BPSK) (0 度) | HT-SIG (QBPSK) (90 度) | HT-SIG (QBPSK) (90 度) |
| VHT PPDU | L-SIG (BPSK) (0 度) | VHT-SIG-A (BPSK) (0 度) | VHT-SIG-A (QBPSK) (90 度) |
| HEW PPDU | L-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (BPSK) (0 度) |

[0096] 参照图 1，STA 可以确定针对在发送所接收的 PPDU 的 OFDM 符号（例如，基准 OFDM 符号、第一 OFDM 符号或第二 OFDM 符号）中发送的数据的调制方案（或在 OFDM 符号中使用的星座），从而区分所接收到的 PPDU。也就是说，STA 可以确定在发送所接收的 PPDU 的 OFDM 符号中使用的星座的旋转，从而区分接收到的 PPDU。在下文中，本发明的实施方式示出了用于 STA 确定在 OFDM 符号中使用的星座以便区分接收到的 PPDU 的方法。另选地，STA 可以确定在 OFDM 符号中使用的星座的旋转以区分接收到的 PPDU。

[0097] 在下文中，示出了用于 STA 区分接收到的 PPDU 的过程。

[0098] 假定当在第一 OFDM 符号中使用的星座不是 QBPSK 星座时，HEW STA 接收了 PPDU，HEW STA 可以确定接收到的 PPDU 为 VHT PPDU 还是非 HT PPDU。HEW STA 可以进一步确定在第二 OFDM 符号中是否使用了 QBPSK 星座。当在第二 OFDM 符中使用 QBPSK 星座时，STA 可以将接收到的 PPDU 确定为 VHT PPDU。

[0099] 当在第一 OFDM 符号中使用 QBPSK 时，HEW STA 可以进一步确定在第二 OFDM 符号中使用的星座以区分 PPDU。例如，HEW STA 可以确定在第二 OFDM 符号中使用了 BPSK 星座还是 QBPSK 星座。当在第二 OFDM 符中使用 QBPSK 星座时，HEW STA 可以区分接收到的 PPDU 为 HT PPDU。当在第二 OFDM 符中使用 BPSK 星座时，HEW STA 可以区分接收到的 PPDU 为 HEW PPDU。

[0100] 同样地，假设传统的 STA 接收了 PPDU，传统的 STA 可以确定在基准 OFDM 符号之后

的第一 OFDM 符号中或在第一 OFDM 符号和第二 OFDM 符号两者中使用的星座来区分接收到的 PPDU。

[0101] 例如，当在第一 OFDM 符号和 / 或第二 OFDM 符号中的至少一个中不使用 QBPSK 星座时，非 HT STA 可以区分接收到的 PPDU 为非 HT PPDU。当在第一 OFDM 符号和第二 OFDM 符号中使用 QBPSK 星座时，HT STA 可以确定接收到的 PPDU 为 HT PPDU。当在第一 OFDM 符号中使用 BPSK 星座并且在第二 OFDM 符号中使用 QBPSK 星座时，VHT STA 可以确定接收到的 PPDU 为 VHT PPDU。

[0102] 传统的 STA 可以基于现有的自动检测方法来区分 PPDU，并且如果现有的自动检测方法（例如，当接收到的 PPDU 是 HEW PPDU 时）没有区分 PPDU 时，延迟信道访问。

[0103] 基于表 1 中的 OFDM 符号中使用的星座的旋转，传统的 STA 可以以与现有方法相同的方式区分 PPDU，并且 HEW STA 可以区分 HEW PPDU。

[0104] 各种方法可以被用于 STA，以确定在包含在传统的 PPDU 和 HEW PPDU 中的 OFDM 符号中使用的星座。例如，STA 可以将通过 OFDM 符号发送的调制符号的实部和虚部的范数值与预设阈值进行比较，从而确定用于产生调制符号的星座是 BPSK 星座还是 QBPSK 星座。

[0105] 在 HEW 中，不仅在图 7 中所示的星座而且星座的各种组合也可以被用来产生 PPDU。

[0106] 图 8 是示出根据本发明的 HEW PPDU 的示意图。

[0107] 当表 1 中所示的星座被用于 OFDM 符号中时，基准 OFDM 符号和发送 HEW PPDU 和 HT PPDU 的第一 OFDM 符号使用相同的星座。因此，如果 HT STA 仅从基准 OFDM 符号到第一 OFDM 符号进行自动检测，则 HT STA 可以不区分接收到的 PPDU 是 HT PPDU 还是 HEW PPDU。

[0108] 图 8 示出了 HT STA 仅从与 L-SIG 对应的 OFDM 符号（基准 OFDM 符号）到与 HT SIG 对应的第一 OFDM 符号进行检测以区分接收到的 PPDU 是否是 HT PPDU 的方法。在图 8 中，HEW-SIG 被假定为是与三个 OFDM 符号（第一 OFDM 符号 820、第二 OFDM 符号 830 和第三 OFDM 符号 840）对应的字段。在 HEW 系统中，可以使用在传统的 WLAN 系统中不使用的新技术（诸如，正交频分多址 (OFDMA) 和上行链路 (UL) 多用户 (MU)-MIMO）。此外，在 HEW 系统中，存在用于改善多个 AP 和多个 STA 的密集环境中的通信性能的技术。因此，在 HEW 系统中，可以定义针对除了传统的 WLAN 中的那些功能之外的其它功能的附加信息和 / 或字段。因此，可以通过扩展的三个或更多个符号而不是通过传统的系统中的两个符号来构成 HEW-SIG。

[0109] 下文的表 2 示出了在发送包括在传统的 PPDU 和 HEW PPDU 中的字段的 OFDM 符号中使用的星座。

[0110] [表 2]

[0111]

| | 基准 OFDM 符号（星座旋转角度） | 第一 OFDM 符号（星座旋转角度） | 第二 OFDM 符号（星座旋转角度） | 第三 OFDM 符号（星座旋转角度） |
|---|---|---|---|---|
| 非 HT PPDU | L-SIG (BPSK) (0 度) | 数据字段 | 数据字段 | 数据字段 |
| HT PPDU | L-SIG (BPSK) (0 度) | HT-SIG (QBPSK) (90 度) | HT-SIG (QBPSK) (90 度) | HT-STF |
| VHT PPDU | L-SIG (BPSK) (0 度) | VHT-SIG-A (BPSK) (0 度) | VHT-SIG-A (QBPSK) (90 度) | VHT-STF |
| HEW PPDU | L-SIG (BPSK) (0 度) | HEW-SIG (BPSK) (90 度) | HEW-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) |

[0112] 参照表 2，可以通过两个 OFDM 符号（第一 OFDM 符号和第二 OFDM 符号）发送 HT-SIG。可以基于由基准 OFDM 符号使用的星座将由发送 HT-SIG 的第一 OFDM 符号和第二 OFDM 符号使用的星座旋转 90 度。

[0113] 可以通过两个 OFDM 符号（第一 OFDM 符号和第二 OFDM 符号）发送 VHT-SIG。由发送 VHT-SIG 的第一 OFDM 符号使用的星座可以是与针对基准 OFDM 符号的星座是相同。另外，可以基于由基准 OFDM 符号使用的星座将由发送 VHT-SIG 的第二 OFDM 符号使用的星座旋转 90 度。

[0114] 根据本发明的实施方式，可以通过三个 OFDM 符号（第一 OFDM 符号 820、第二 OFDM 符号 830 和第三 OFDM 符号 840）发送 HEW-SIG。由发送 HEW-SIG 的第一 OFDM 符号 820 和第二 OFDM 符号 830 使用的星座可以与由基准 OFDM 符号 810 使用的星座是相同的。另外，由发送 HEW-SIG 的第三 OFDM 符号 840 使用的星座可以是基于由基准 OFDM 符号 810 使用的星座逆时针旋转 90 度的星座。虽然可以通过三个或更多个 OFDM 符号发送 HEW-SIG，但是为了便于描述，HEW-SIG 被假定为通过三个 OFDM 符号被发送。

[0115] 当在发送 HEW-SIG 的 OFDM 符号中使用的星座如表 2 所示被确定时，示出的是用于传统的 STA 和 HEW STA 的确定过程以区分接收到的 PPDU。

[0116] 在传统 STA 中，HT STA 和 VHT STA 能够基于现有的自动检测规则区分接收到 PPDU。详细地，HT STA 可以检测基准 OFDM 符号和第一 OFDM 符号，并且当在第一 OFDM 符号中使用 QBPSK 星座时，区分所接收到的 PPDU 作为 HT PPDU。当在第一 OFDM 符号中使用 BPSK 星座并且在第二 OFDM 符号中使用 QBPSK 星座时，VHT STA 可以区分接收到的 PPDU 为 VHT PPDU。当识别出接收到的 PPDU 既不是 HT PPDU 也不是 VHT PPDU 时，传统的 STA 的 HT STA 和 VHT STA 可以延迟信道访问。

[0117] 在传统的 STA 中，非 HT STA 可以从基准 OFDM 符号到第三 OFDM 符号进行检测，并且当在第三 OFDM 符号中使用 QBPSK 星座时，区分接收到的 PPDU 不为非 HT PPDU。在这种情况下，非 HT STA 也可以延迟信道访问。

[0118] HEW STA 可以确定在从基准 OFDM 符号到 3 个 OFDM 符号中使用的星座来区分 PPDU。HEW STA 可以基于由基准 OFDM 符号到第二 OFDM 符号使用的星座来区分 HT PPDU 和 VHT PPDU。另外，HEW STA 可以基于由第三 OFDM 符号使用的星座来区分非 HT PPDU 和 HEW PPDU。

[0119] 除了星座表 2 中的星座之外，可以在基准 OFDM 符号至第三 OFDM 符号中使用以下的各种星座（情况 1 至情况 6），以从其它格式的 PPDU 区分 HEW PPDU。

[0120] [表 3]

[0121]

| | 基准 OFDM 符号（星座旋转角度） | 第一 OFDM 符号（星座旋转角度） | 第二 OFDM 符号（星座旋转角度） | 第三 OFDM 符号（星座旋转角度） |
|---|---|---|---|---|
| 非 HT PPDU | L-SIG (BPSK) (0 度) | 数据字段 | 数据字段 | 数据字段 |
| HT PPDU | L-SIG (BPSK) (0 度) | HT-SIG (QBPSK) (90 度) | HT-SIG (QBPSK) (90 度) | HT-STF |
| VHT PPDU | L-SIG (BPSK) (0 度) | VHT-SIG-A (BPSK) (0 度) | VHT-SIG-A (QBPSK) (90 度) | VHT-STF |
| HEW PPDU（情况 1） | L-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (BPSK) (0 度) | HEW-SIG (BPSK) (0 度) |
| HEW PPDU（情况 2） | L-SIG (BPSK) (0 度) | HEW-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (BPSK) (0 度) |
| HEW PPDU（情况 3） | L-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (BPSK) (0 度) |
| HEW PPDU（情况 4） | L-SIG (BPSK) (0 度) | HEW-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (QBPSK) (90 度) |
| HEW PPDU（情况 5） | L-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) |
| HEW PPDU（情况 6） | L-SIG (BPSK) (0 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (QBPSK) (90 度) | HEW-SIG (QBPSK) (90 度) |

[0122] 在 HEW PPDU 中，不像传统的 PPDU，可以通过三个 OFDM 符号发送 HEW-SIG。因此，HEW STA 可以基于如表 3 所示的在基准 OFDM 符号至第三 OFDM 符号中使用的星座区分 HEW PPD。根据本发明的实施方式，与 HEW-SIG 对应的第一 OFDM 符号至第三 OFDM 符号中的至少一个可以使用 QBPSK 星座。

[0123] 为了支持 HEW，诸如 HEW-SIG 的信号字段可以包括各种信息。例如，当基于 OFDMA 执行信道访问时，可以通过信号字段发送关于用于 STA 的数据发送和接收的频率资源（例如，信道）的信息、DL 资源分配和 UL 资源分配信息等。信号字段还可以包括用于支持的 UL MIMO 的信息。此外，信号字段可以包括在干扰严重的 STA 密集的环境中用于干扰管理的信息。在下文中，本发明的实施方式详细地示出了包括在信号字段中的信息的示例。

[0124] 图 9 是示出根据本发明的实施方式的无线通信方法的示意图。

[0125] HEW 可以以多址模式支持 OFDMA。

[0126] 不像传统的 WLAN，HEW 基于分配给相应 STA 的频率资源允许多个 STA 同时与 AP 进

行通信。

[0127] 参照图9，可以将第一频带915、第二频带925和第三频带935分别分配给第一STA 910、第二STA 920和第三STA 930，并且通过相应频带与AP进行通信。

[0128] AP可以分配频带以与STA中的每个进行通信。分配给每个STA的频带可以是各种单位的频率资源。例如，分配给每个STA的频带可以是在特定频带（例如，2.4GHz频带、5GHz频带或60GHz频带）中定义的多个信道中的一个。另选地，分配给每个STA的频带可以是一个分割的信道的子单元中的资源。

[0129] 可以通过HEW PPDU发送关于由每个STA分配的频带的信息。例如，包括在HEW PPDU中的HEW-SIG（或信号字段）可以包括关于分配给每个STA的频带的信息。具体地，HEW-SIG可以包括信道分配字段，并且信道分配字段可以包括关于分配给STA的信道的信息。

[0130] 例如，AP可以通过HEW PPDU的HEW-SIG将关于分配给单个的STA的信道的信息发送给STA。另选地，AP可以通过HEW-SIG发送关于基于STA的标识符(ID)（例如，组ID(GID)和关联ID(AID)）分配的频带的信息。详细地，AP可以以第一信道被分配给与第一GID对应的STA以及第二信道被分配给与第二GID对应的STA的这样的方式为多个STA分配信道。以这种方式，相应的信道被针对多个STA而分配，使得在相应的信道上执行访问的STA可以是分布式的。

[0131] 以下的表4示出了发送信道分配信息的HEW-SIG的信道分配字段。

[0132] [表4]

[0133]

| | 分配的比特 | 字段 | 比特的数量 | 描述 |
|---|---|---|---|---|
| HEW-SIG | xx | 信道分配 | aa | 由STA的GID分配的信道<br>针对组ID a的信道1<br>针对组ID b的信道2<br>针对组ID c的信道3<br>...<br>针对组ID d的信道x |

[0134] 表4中的信道分配字段是用于发送关于多个STA中的每个的信道分配信息的示例。HEW-SIG可以包括用于由多个STA在不同的频率资源中使用不同的方法支持同时信道访问的其它类型的信息。

[0135] AP可以根据信道负载改变包含在HEW-SIG中的信道分配字段中的信息，使得STA在特定信道上过度会聚。

[0136] 图10是示出根据本发明的实施方式的HEW中的无线通信方法的示意图。

[0137] 图10示出了用于发送关于多个STA中的每个的信道分配信息的另一种方法。例如，AP可以通过组ID管理帧发送针对STA的组ID字段和针对STA的用户信道位置字段以配置STA组并且为每个STA分配信道。

[0138] 参照图10，AP可以向STA发送组ID管理帧（步骤S1000）。

[0139] 组ID管理帧可以包括组ID字段和用户信道位置字段。

[0140] 图11是示出根据本发明的实施方式的组ID字段和用户信道位置字段的示意图。

[0141] 参照图 11 的顶部，组 ID 字段 1100 可以包括指示相应组 ID 的阵列中的多个子字段（组 ID 0 指示符至组 ID 63 指示符）。为了指示 STA 的组 ID，与 STA 的组 ID 对应的组 ID x 指示符在组 ID 字段 1100 中可以被配置成 1。不与 STA 的组 ID 对应的组 ID y 指示符可以被配置成 0。例如，当 STA 的组 ID 为 1 时，组 ID 1 指示符在组 ID 字段 1100 中可以被配置成 1 并且组 ID 字段可以被配置成“010000…0”。

[0142] 参照图 11 的底部，用户信道位置字段 1150 在指示分配给包括在特定组中的用户的用户信道位置的阵列中可以包括多个子字段 (GID 1 中的用户信道位置信息至到 GID 63 中的用户信道位置信息）。STA 可以在用户信道位置字段 1150 中获取包括在基于 STA 的组 ID 指示的子字段中的用户信道位置信息。例如，当 STA 具有 1 的组 ID 时，STA 可以在 GID 1 中的用户信道位置信息中获取 STA 上的用户信道位置信息。

[0143] STA 可以基于根据组 ID 管理帧获得的用户信道位置信息来获得关于分配给 STA 的信道的信息以及随后将被接收的 HEW-SIG 字段上的信道分配信息，这将在后面描述。

[0144] 以下的表 5 示出了与子字段的比特值对应的用户信道位置信息 (GID x 中的用户信道位置信息）。

[0145] <表 5>

[0146]

| GID x 中的用户信道位置信息 | 用户信道位置信息 |
|---|---|
| 00 | 0 |
| 01 | 1 |
| 10 | 2 |
| 11 | 3 |

[0147] 例如，当 STA 具有 1 的组 ID 时，AP 可以通过与用户信道位置字段中的组 ID 字段 1 对应的 GID 1 中的用户信道位置信息发送关于 STA 的信道位置信息。当 GID 1 中的用户信道位置信息具有值“00”时，STA 可以被分配 0 的用户信道位置信息。

[0148] 返回参照图 10，AP 向 STA 发送 HEW PPDU（步骤 S1010）。

[0149] AP 可以向 STA 发送包括 HEW-SIG 的 HEW PPDU。HEW-SIG 可以包括分配给 STA 的信道分配信息。下面表 6 示出了包括在 HEW-SIG 中的信道分配信息。

[0150] [表 6]

[0151]

| | 分配的比特 | 字段 | 比特的数量 | 描述 |
|---|---|---|---|---|
| HEW-SIG | Bxx ～ Bxx+11 | 信道分配 | 12 | 与信道分配对应的12比特被分成三比特的单位以发送关于特定的用户信道位置信息的信道信息。<br>第一比特 ～第三比特：带有用户信道位置信息为0的关于STA的信道信息<br>第四比特 ～第六比特：带有用户信道位置信息为1的关于STA的信道信息<br>第七比特 ～第九比特：带有用户信道位置信息为2的关于STA的信道信息<br>第十比特 ～第十二比特：带有用户信道位置信息为3的关于STA的信道信息 |

[0152] 在图10的底部示出了表6中的信道分配信息。也就是，可以根据用户信道位置信息将与信道分配信息对应的12比特分成3比特的单元以发送信道信息(0,1,2,3)。通过使用这种方法，可以通过HEW-SIG发送关于将被包括在相同组中的多个STA使用的信道的信息。

[0153] 在具体的示例中，如上所述，当STA具有0的用户信道位置信息时，可以基于与信道分配信息的第一比特至第三比特对应的比特信息给STA分配信道。例如，当第一比特至第三比特是“010”时，可以给STA分配第二信道。同样地，当另一个STA具有3的信道位置信息时，可以基于与信道分配信息的第十比特至第十二比特对应的比特信息通过相同的HEW-SIG给该STA分配信道。

[0154] 该STA通过分配的信道发送HEW PPDU(步骤S1020)。

[0155] STA可以通过基于HEW-SIG字段中的获得的用户信道位置信息和接收的信道分配信息而分配的信道向AP发送HEW PPDU。

[0156] 在图10和图11中列出的具体参数(诸如，用于信道分配信息的比特的数量，根据单个的用户信道位置信息分配的比特和信道位置信息的比特值)是说明性的示例，并且可以使用各种其它参数。

[0157] 图12是示出根据本发明的实施方式的无线通信方法的示意图。

[0158] 参照图12，STA 1250可以使用UL MIMO向AP 1200发送UL数据。当在HEW STA 1250支持UL MIMO时，可以在HEW PPDU中包括和发送各种控制信息。例如，AP 1200可以包括并发送关于在HEW PPDU的HEW-SIG中UL MIMO是否是可能的信息。另外，AP 1200可以包括并发送关于可用于UL MIMO的空间时间流(或空间流)的数量的信息和关于将被用于HEW-SIG中的UL MIMO的信道的信息。

[0159] STA 1250可以基于HEW-SIG确定是否执行UL MIMO、如果UL MIMO被执行则将被使用的空间时间流的数量、以及用于执行UL MIMO的信道。

[0160] 例如，STA 1250可以基于两个空间流通过基于接收到的HEW-SIG的第一频带执行UL MIMO。

[0161] 下面表7示出了发送UL MIMO相关信息的HEW-SIG字段的示例。

[0162] [表 7]

[0163]

| | 分配的比特 | 字段 | 比特的数量 | 描述 |
|---|---|---|---|---|
| HEW-SIG | xx | 允许 UL MIMO | aa | 设置为 1 以允许 UL MIMO<br>设置为 0 以不允许 UL MIMO |
| | yy | UL MIMO 的 NSTS | bb | 为 0 空间时间流设置 0<br>为 1 空间时间流设置 1<br>为 2 空间时间流设置 2<br>为 3 空间时间流设置 3 |
| | zz | UL MIMO 的信道 | cc | 信道 xx |

[0164] 表 7 中的信息是说明性的示例，至少其中的一个信息可以被包括。此外，HEW-SIG 可以包括用于支持 STA 的 UL MIMO 的其它信息。

[0165] 图 13 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0166] 图 13 示出了用于 AP 向 STA 发送关于 STA 获得特定的 TXOP 的 STA 列表的信息的方法。

[0167] 参照图 13，在 HEW 中，AP 可以同时与多个 STA 进行通信并且发送关于同时发送和接收数据的 STA 的信息。

[0168] AP 可以包括并发送关于获得相同的 TXOP 的 STA 的数量的信息或关于在 HEW-SIG 中获得相同的 TXOP 的 STA 的列表的信息。另外，AP 可以通过 HEW-SIG 发送关于 TXOP 的持续时间的信息。

[0169] 例如，AP 1300 可以给予 TXOP 特定的 ID 信息（例如，GID），并且 STA 可确定是否有可能基于 HEW-SIG 用 AP 发送和接收数据。AP 1300 可以为与第一 GID 对应的 STA 1310 和 STA 1320 分配 TXOP 以及然后为与第二 GID 对应的 STA 1310 和 STA 1320 分配 TXOP。

[0170] 下面表 8 示出了发送 TXOP 相关信息的 HEW-SIG 字段的示例。

[0171] [表 8]

[0172]

| | 分配的比特 | 字段 | 比特的数量 | 描述 |
|---|---|---|---|---|
| HEW-SIG | xx | TXOP | aa | 关于分配 TXOP 的 STA 的信息<br>设置为 0 以为第一 STA 列表分配 TXOP<br>设置为 1 以为第二 STA 列表分配 TXOP<br>设置为 2 以为第三 STA 列表分配 TXOP |
| | yy | TXOP 持续时间 | bb | 为第一持续时间设置为 1<br>为第二持续时间设置为 0 |

[0173] 表 8 中的信息是说明性的示例，至少其中的一个信息可以被包括。此外，HEW-SIG 可以包括用于为 STA 配置 TXOP 的其它信息。

[0174] 图 14 是示出根据本发明的实施方式的 HEW 中的无线通信方法的示意图。

[0175] 参照图 14，在 HEW 中，可以支持基于混合自动重传请求 (HARQ) 的 PPDU 的重发。

[0176] 为了支持基于 HARQ 的重传，可能有需要的关于由 STA 发送的 PPDU 是否是先前发送的 PPDU 或新的 PPDU 的识别信息、关于重发的次数的信息等。

[0177] 例如，当 AP 1400 向 STA 1450 重发 PPDU 时，AP 可以经由 PPDU 发送用于指示所发送的 PPDU 是先前发送的 PPDU 的重发指示信息。

[0178] 下面表 9 示出了发送重发相关信息的 HEW-SIG 字段的示例。

[0179] [表 9]

[0180]

| | 分配的比特 | 字段 | 比特的数量 | 描述 |
|---|---|---|---|---|
| HEW-SIG | xx | 重发指示符 | aa | 为新的 PPDU 设置为 0<br>为重发的 PPDU 设置为 1 |

[0181] 表 9 中的信息是一个说明性的示例，并且 HEW-SIG 可以包括用于支持 STA 的重发的其它信息。

[0182] 图 9 至图 14 的中所示的多个信息可以被包括在代替 HEW-SIG 的用于支持 HEW 的其他字段中。图 9 至图 14 中所示的多个信息可以被不同地结合并包括在 HEW-SIG 中。此外，HEW-SIG 可以不仅包括图 9 至图 14 中所示的多个信息而且还包括用于支持 HEW 的各种信息。

[0183] 图 15 是示出本发明的实施方式可以应用的无线设备的框图。

[0184] 参照图 15，无线设备可以是可以实现上述实施方式的 STA，并且无线设备可以是 AP(1500) 或非 AP STA(站)(1550)。

[0185] AP 1500 包括处理器 1510、存储器 1520 和 RF(射频) 单元 1530。

[0186] RF 单元 1530 可以与处理器 1520 连接以发送 / 接收无线电信号。

[0187] 处理器 1510 实现如本文提出的功能、过程和 / 或方法。例如，根据本发明的图 9 至图 14 所公开的实施方式，处理器 1510 可以被实现以执行上述的无线设备的操作。

[0188] 例如，处理器 1510 可以在通过多个 OFDM 符号发送信号字段时使用用于调制多个 OFDM 符号中发送的数据的不同星座。

[0189] STA 1550 包括处理器 1560、存储器 1570 和 RF（射频）单元 1580。

[0190] RF 单元 1580 可以与处理器 1560 连接以发送 / 接收无线电信号。

[0191] 处理器 1560 实现如本文提出的功能、过程和 / 或方法。例如，根据本发明的图 9 至图 14 所公开的实施方式，处理器 1560 可以被实现以执行上述的无线设备的操作。

[0192] 例如，处理器 1560 可以基于在通过多个 OFDM 符号发送的信号字段中使用的星座区分 PPDU。

[0193] 处理器 1510、1560 可以包括 ASIC（专用集成电路），其它芯片组、逻辑电路、数据处理设备和 / 或执行基带信号和无线电信号之间的转换的转换器。存储器 1520、1570 可以包括 ROM（只读存储器）、RAM（随机存取存储器）、闪存存储器、存储器卡、存储介质和 / 或其它存储设备。RF 单元 1530、1580 可以包括发送和 / 或接收无线电信号的一个或更多个天线。

[0194] 当以软件实现实施方式时，可以在执行上述功能的模块（过程或功能等）中体现上述方案。模块可以被存储在存储器 1520、1570 中并且可以被处理器 1510、1560 执行。存储器 1520、1570 可以被放置在处理器 1510、1560 的内部或外部，并且可以经由各种已知的方法与处理器 1510、1560 连接。

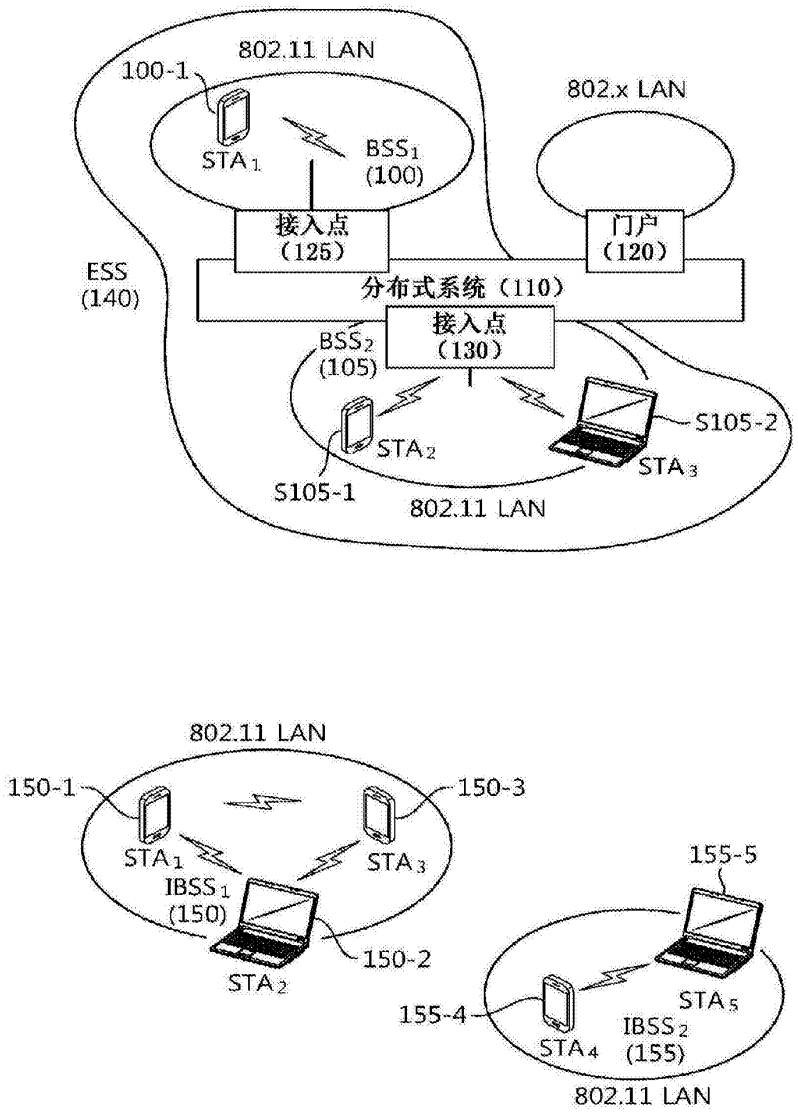

802.11 LAN
100-1
802.x LAN
STA1
BSS1
(100)
接入点
(125)
门户
(120)
ESS
(140)
分布式系统（110）
接入点
(130)
BSS2
(105)
S105-2
STA2
STA3
S105-1
802.11 LAN
802.11 LAN
150-1
150-3
STA1
STA3
IBSS1
(150)
150-2
STA2
155-5
STA5
155-4
STA4
IBSS2
(155)
802.11 LAN

图 1

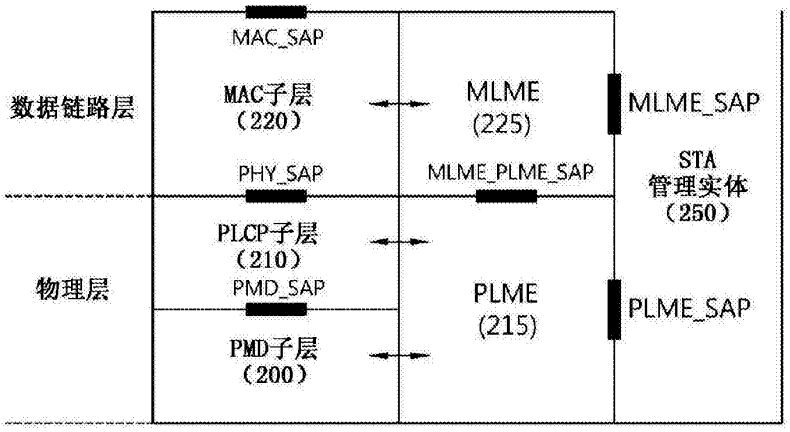

MAC_SAP
数据链路层
MAC子层
（220）
MLME
(225)
MLME_SAP
PHY_SAP
MLME_PLME_SAP
STA
管理实体
（250）
PLCP子层
（210）
物理层
PMD_SAP
PLME
(215)
PLME_SAP
PMD子层
（200）

图 2

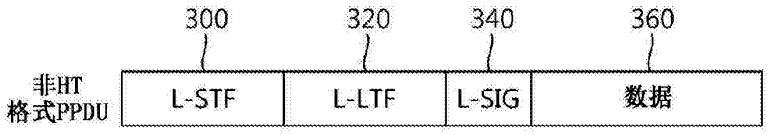

300
320
340
360
非HT
格式PPDU
L-STF
L-LTF
L-SIG
数据

图 3

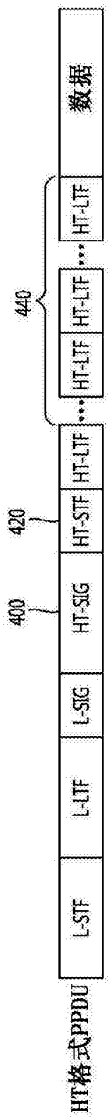

HT格式PPDU
L-STF
L-LTF
L-SIG
HT-SIG
HT-STF
HT-LTF
HT-LTF
HT-LTF
HT-LTF
数据
400
420
440

图 4

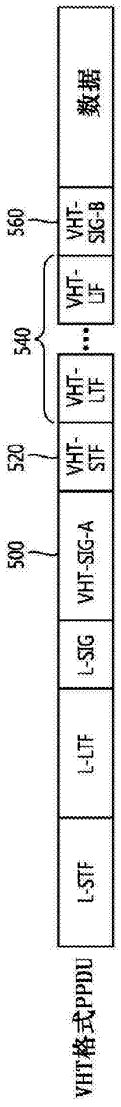

VHT格式PPDU
L-STF
L-LTF
L-SIG
VHT-SIG-A
VHT-STF
VHT-LTF
VHT-LTF
VHT-SIG-B
数据
500
520
540
560

图 5

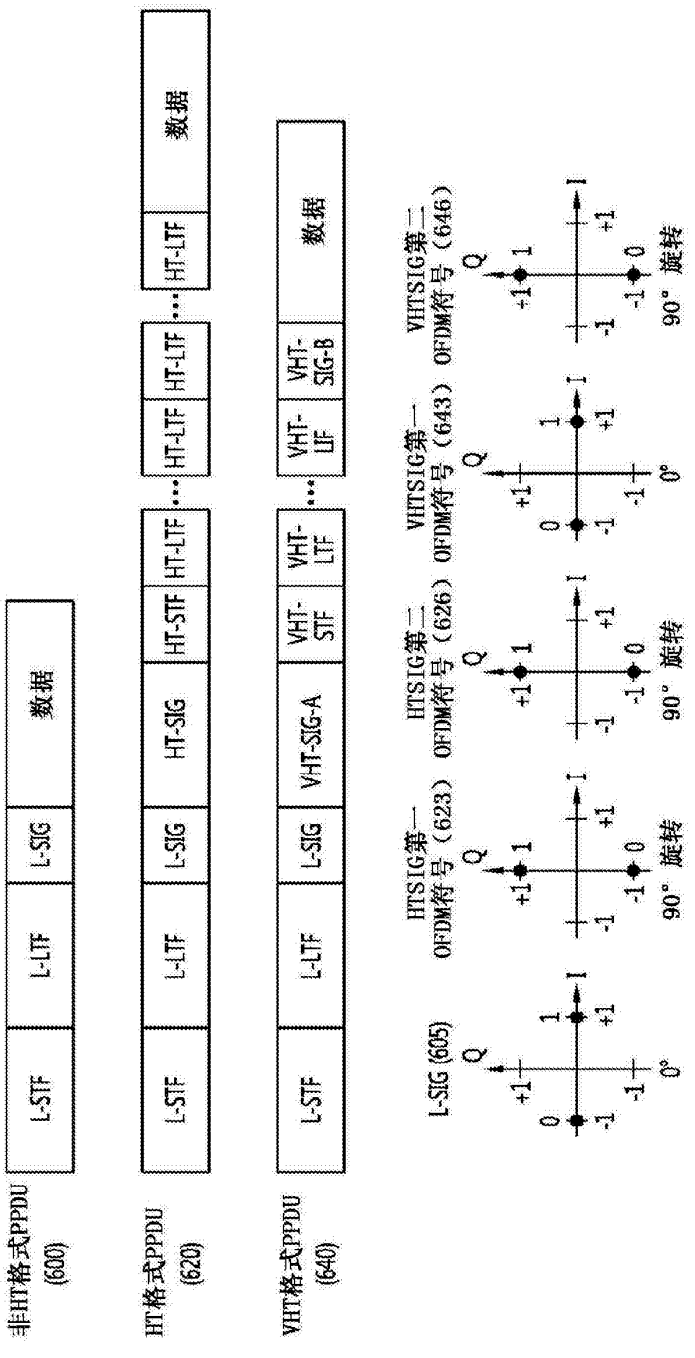

非HT格式PPDU (600)
L-STF
L-LTF
L-SIG
数据
HT格式PPDU (620)
L-STF
L-LTF
L-SIG
HT-SIG
HT-STF
HT-LTF
HT-LTF
HT-LTF
数据
VHT格式PPDU (640)
L-STF
L-LTF
L-SIG
VHT-SIG-A
VHT-STF
VHT-LTF
VHT-LIF
VHT-SIG-B
数据
L-SIG (605)
HTSIG第一 OFDM符号（623）
HTSIG第二 OFDM符号（626）
VHTSIG第一 OFDM符号（643）
VHTSIG第二 OFDM符号（646）
90° 旋转
0°

图 6

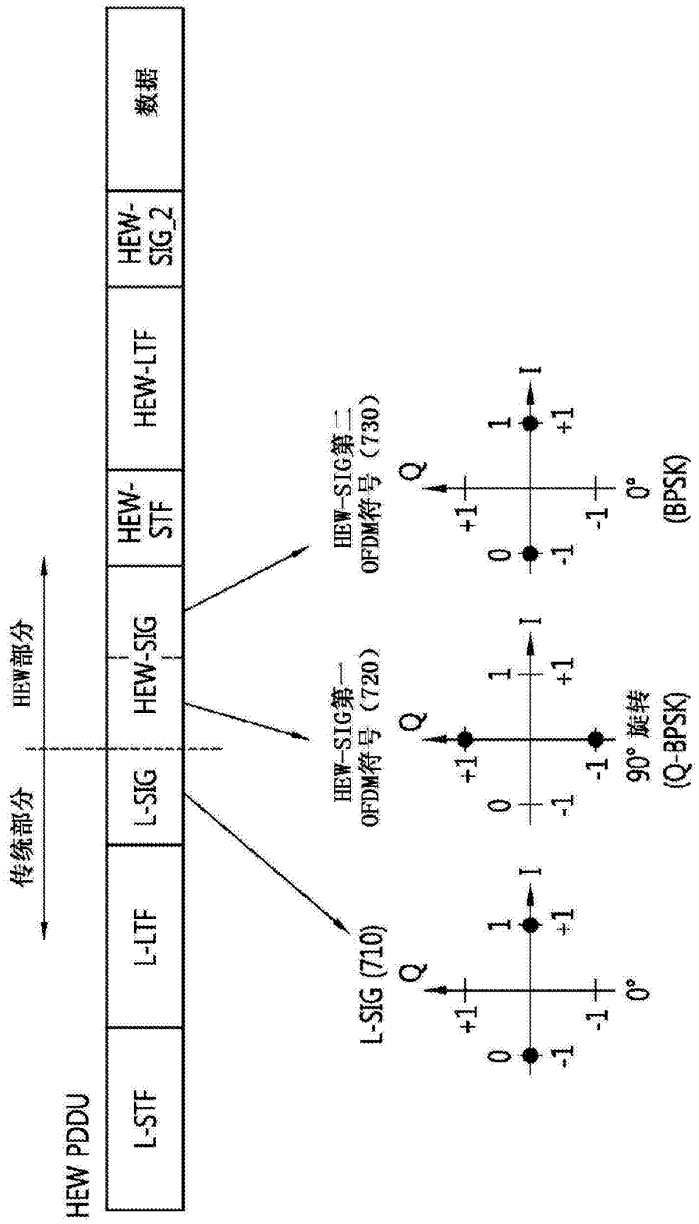

HEW PDDU
L-STF
L-LTF
L-SIG
HEW-SIG
HEW-STF
HEW-LTF
HEW-SIG_2
数据
传统部分
HEW部分
L-SIG (710)
HEW-SIG第一 OFDM符号（720）
HEW-SIG第二 OFDM符号（730）
90° 旋转 (Q-BPSK)
0° (BPSK)
Q
I
+1
0
-1

图 7

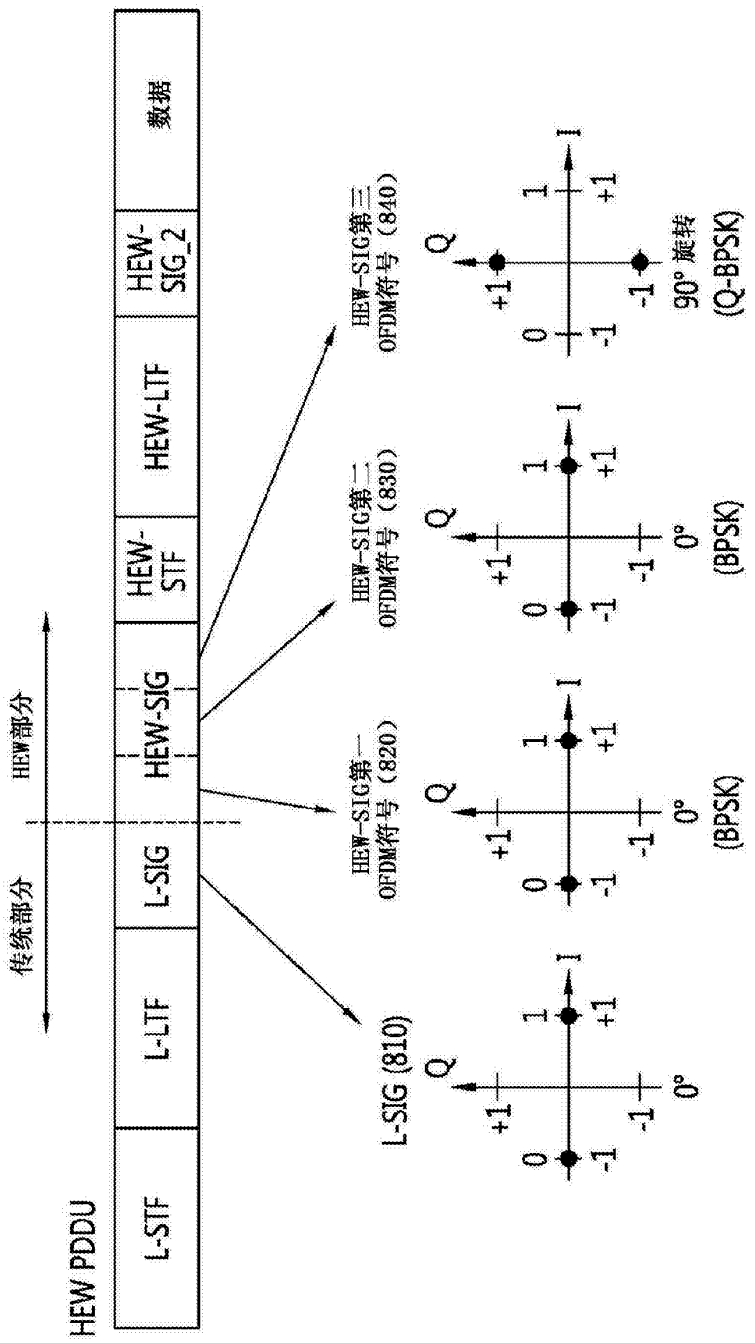

HEW PDDU
L-STF
L-LTF
L-SIG
HEW-SIG
HEW-STF
HEW-LTF
HEW-SIG_2
数据
传统部分
HEW部分
L-SIG (810)
HEW-SIG第一 OFDM符号（820）
HEW-SIG第二 OFDM符号（830）
HEW-SIG第三 OFDM符号（840）
0°
(BPSK)
90° 旋转
(Q-BPSK)
Q
I

图 8

25

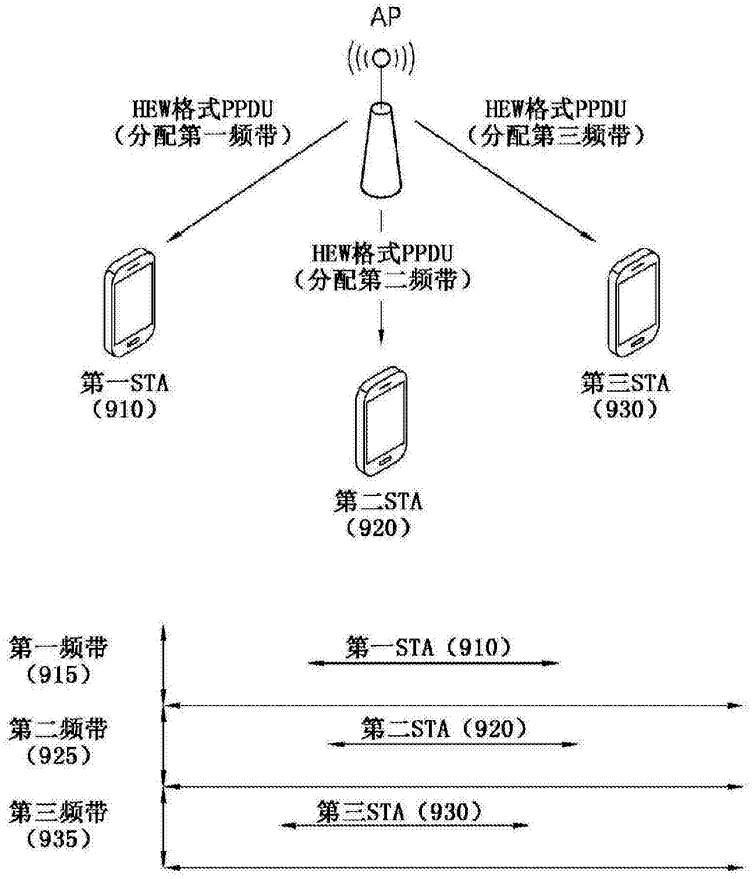

AP
HEW格式PPDU
（分配第一频带）
HEW格式PPDU
（分配第三频带）
HEW格式PPDU
（分配第二频带）
第一STA
（910）
第三STA
（930）
第二STA
（920）
第一频带
（915）
第一STA（910）
第二频带
（925）
第二STA（920）
第三频带
（935）
第三STA（930）

图 9

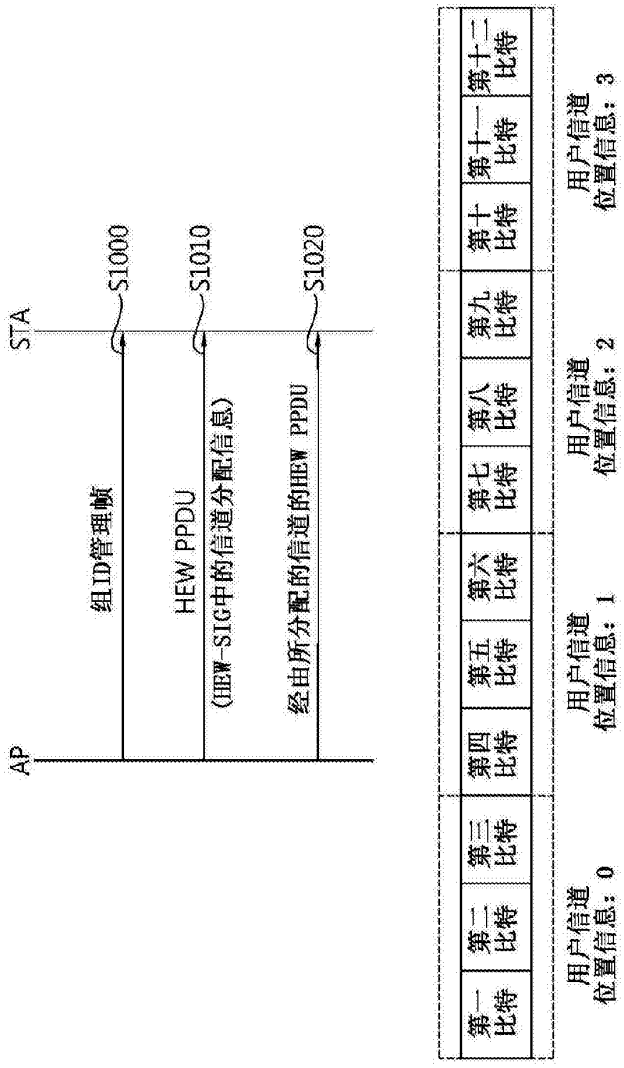

AP
STA
S1000
S1010
S1020
组ID管理帧
HEW PPDU
(HEW-SIG中的信道分配信息)
经由所分配的信道的HEW PPDU
第一比特
第二比特
第三比特
第四比特
第五比特
第六比特
第七比特
第八比特
第九比特
第十比特
第十一比特
第十二比特
用户信道位置信息：0
用户信道位置信息：1
用户信道位置信息：2
用户信道位置信息：3

图 10

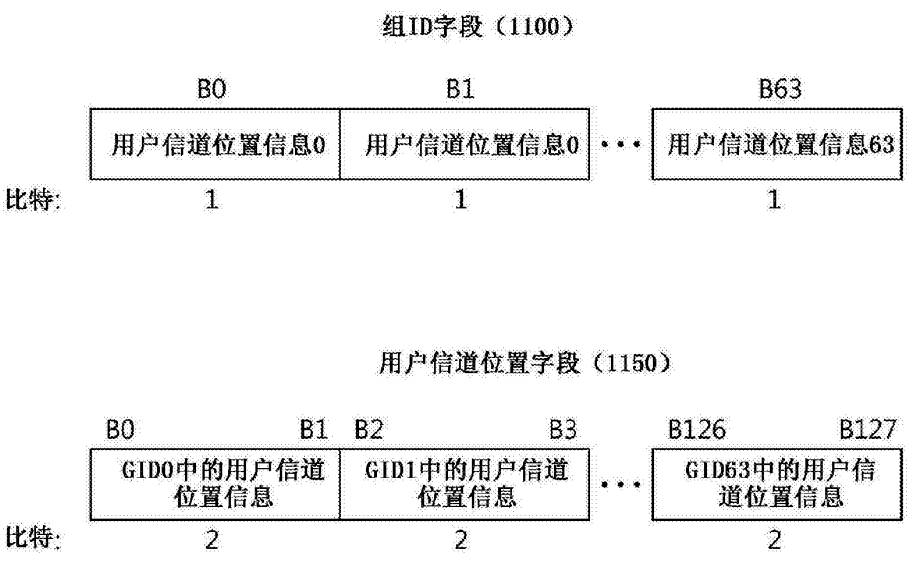

组ID字段（1100）
B0
B1
B63
用户信道位置信息0
用户信道位置信息0
用户信道位置信息63
比特:
1
1
1
用户信道位置字段（1150）
B0
B1
B2
B3
B126
B127
GID0中的用户信道位置信息
GID1中的用户信道位置信息
GID63中的用户信道位置信息
比特:
2
2
2

图 11


1200
1250
HEW格式PPDU（UL MIMO相关信息）
UL MIMO第一空间流
UL MIMO第二空间流
AP
STA

图 12

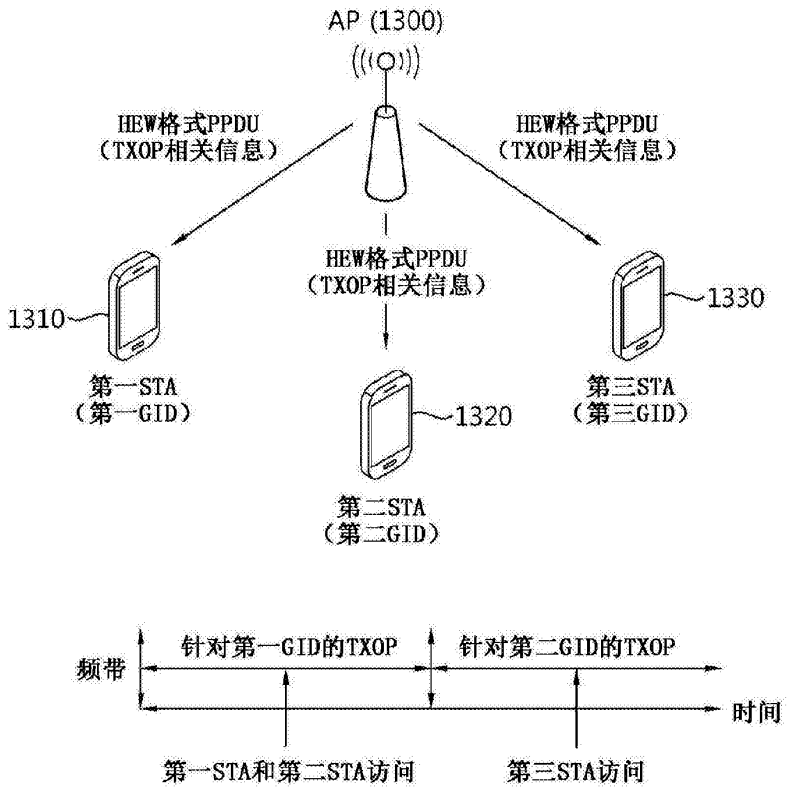

AP (1300)
HEW格式PPDU
（TXOP相关信息）
HEW格式PPDU
（TXOP相关信息）
HEW格式PPDU
（TXOP相关信息）
1310
1330
1320
第一STA
（第一GID）
第三STA
（第三GID）
第二STA
（第二GID）
频带
针对第一GID的TXOP
针对第二GID的TXOP
时间
第一STA和第二STA访问
第三STA访问

图 13

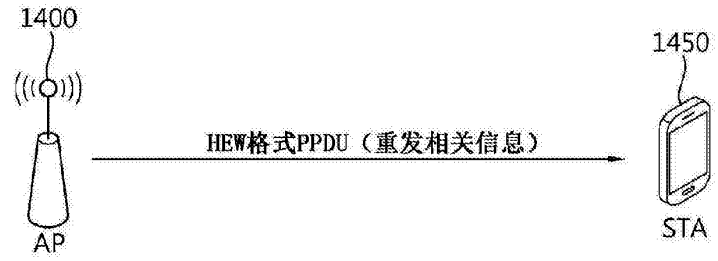

1400
1450
HEW格式PPDU（重发相关信息）
AP
STA

图 14

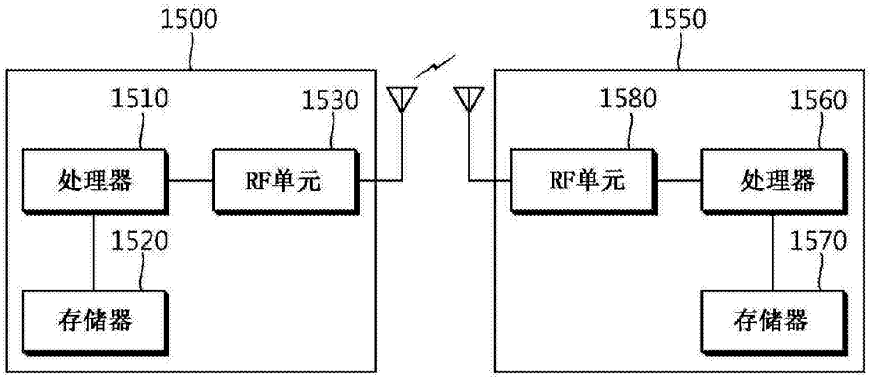

1500
1550
1510
1530
1580
1560
处理器
RF单元
RF单元
处理器
1520
1570
存储器
存储器

图 15

Espacenet

## Bibliographic data: CN102835061 (A) — 2012-12-19

Allocating and receiving tones for a frame

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**Applicant(s):** QUALCOMM INC ± (QUALCOMM INC)

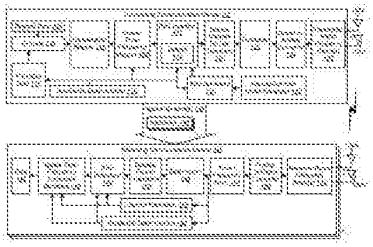
**Classification:** - international: *H04L5/00*
- cooperative: H04L27/20 (US); H04L27/22 (US); H04L27/2601 (US); H04L27/2608 (KR); H04L5/0046 (EP, KR, US); H04L5/0064 (KR); H04L69/22 (US)

**Application number:** CN20118018854 20110414 Global Dossier

**Priority number(s):** WO2011US32425 20110414 ; US20100323976P 20100414 ; US201113085964 20110413

**Also published as:** CN102835061 (B) EP2559189 (A1) EP2559189 (B1) ES2701747 (T3) HUE040640 (T2) more

Abstract of CN102835061 (A)



A communication device for allocating tones is described that includes a processor and instructions in memory in electronic communication with the processor. The communication device determines whether a bandwidth for signal transmission is 20, 40, 80 or 160 megahertz (MHz). The communication device respectively allocates tones for 20, 40, 80 or 160 MHz as follows: for a very high throughput (VHT) signal A1 (VHT-SIG-A1): 52, 104, 208, 416; a VHT signal A2 (VHT-SIG-A2): 52, 104, 208, 416; a VHT short training field (VHT-STF): 12, 24, 48, 48; one or more VHT long training field(s) (VHT-LTF(s)): 56, 114, 242, 484; a VHT signal B (VHT-SIG-B): 56, 114, 242, 484; and a data field (DATA): 56, 114, 242, 484. The communication device also transmits the signal.

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## CLAIMS CN102835061A

1.

A communication device for distributing Orthogonal Frequency Division Multiplexing (OFDM) tones, including:

processor;

Memory in electronic communication with the processor;

Instructions stored in the memory, the instructions are executable for:

Determine whether the bandwidth used for signal transmission is 20 megahertz (MHz), 40MHz, 80 MHz or 160MHz;

If the bandwidth is 20MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and 52 tones are allocated for the very high throughput signal field A2 (VHT-SIG-A2). The high throughput short training field (VHT-STF) is allocated 12 tones, one or more very high throughput long training fields (VHT-LTF) are allocated 56 tones, and the very high throughput signal field B (VHT-SIG) is allocated 56 tones. -B) 56 tones are allocated, and 56 tones are allocated for the data field (DATA);

If the bandwidth is 40MHz, 104 tones are allocated to the VHT-SIG-A1, 104 tones are allocated to the VHT-SIG-A2, and 24 tones are allocated to the VHT-STF, for the one or 114 tones are allocated to multiple VHT-LTFs, 114 tones are allocated to the VHT-SIG-B, and 114 tones are allocated to the DATA;

If the bandwidth is 80MHz, then 208 tones are allocated to the VHT-SIG-A1, 208 tones are allocated to the VHT-SIG-A2, 48 tones are allocated to the VHT-STF, for the one or 242 tones are allocated to multiple VHT-LTFs, 242 tones are allocated to the VHT-SIG-B, and 242 tones are allocated to the DATA;

If the bandwidth is 160MHz, 416 tones are allocated to the VHT-SIG-A1, 416 tones are allocated to the VHT-SIG-A2, and 48 tones are allocated to the VHT-STF, for the one or A plurality of VHT-LTFs are allocated 484 tones, the VHT-SIG-B is allocated 484 tones, and the DATA is allocated 484 tones; and

Transmit the signal.

2.

The communication device of claim 1, wherein the instructions are further executable to:

If the bandwidth is 20MHz, 12 tones are allocated for the non-high throughput (non-HT) short training field (L-STF), 52 tones are allocated for the non-HT long training field (L-LTF), and for non-HT The signal field (L-SIG) allocates 52 tones;

If the bandwidth is 40MHz, 24 tones are allocated to the L-STF, 104 tones are allocated to the L-LTF, and 104 tones are allocated to the L-SIG;

If the bandwidth is 80MHz, 48 tones are allocated to the L-STF, 208 tones are allocated to the L-LTF, and 208 tones are allocated to the L-SIG; and

If the bandwidth is 160 MHz, 48 tones are allocated to the L-STF, 416 tones are allocated to the L-LTF, and 416 tones are allocated to the L-SIG.

3.

The communication device according to claim 1, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries every 20 MHz bandwidth 27 bits, if the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

4.

The communication device of claim 1, wherein if the bandwidth is 80 MHz or 160 MHz, the VHT-SIG-B carries one or more padding bits.

5.

The communication device of claim 1, wherein the instructions are further executable to generate a bandwidth message based on the bandwidth.

6.

The communication device of claim 1, wherein the instructions are further executable to modulate the VHT-SIG-A2 using quadrature two-phase phase shift keying (QBPSK) to indicate that: the frame includes extremely high throughput Volume (VHT) signal.

7.

The communication device according to claim 1, wherein the instructions are further executable so that if the bandwidth is 80 MHz, subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103 insert pilot tones at the place.

8.

A communication device for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones, including:

processor;

Memory in electronic communication with the processor;

Instructions stored in the memory, the instructions are executable for:

Determine whether the bandwidth used for signal reception is 20 megahertz (MHz), 40MHz, 80 MHz or 160MHz;

If the bandwidth is 20MHz, 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), 52 tones for the very high throughput signal field A2 (VHT-SIG-A2), 12 tones for the very high throughput short training field (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), and for the very high throughput signal field B (VHT- SIG-B) 56 tones, and 56 tones for the data field (DATA);

If the bandwidth is 40MHz, 104 tones for the VHT-SIG-A1, 104 tones for the VHT-SIG-A2, 24 tones for the VHT-STF, and for the one Or 114 tones of a plurality of VHT-LTF, 114 tones for the VHT-SIG-B, and 114 tones for the DATA;

If the bandwidth is 80MHz, 208 tones for the VHT-SIG-A1, 208 tones for the VHT-SIG-A2, 48 tones for the VHT-STF, and for the one Or a plurality of 242 tones of VHT-LTF, 242 tones of the VHT-SIG-B, and 242 tones of the DATA; and

If the bandwidth is 160MHz, 416 tones for the VHT-SIG-A1, 416 tones for the VHT-SIG-A2, 48 tones for the VHT-STF, and for the one Or a plurality of 484 tones of VHT-LTF, 484 tones of the VHT-SIG-B, and 484 tones of the DATA.

9.

8. The communication device of claim 8, wherein the instructions are further executable to:

If the bandwidth is 20MHz, 12 tones for the non-high throughput (non-HT) short training field (L-STF), 52 tones for the non-HT long training field (L-LTF), and 52 tones of the HT signal field (L-SIG);

If the bandwidth is 40MHz, receive 24 tones for the L-STF, 104 tones for the L-LTF, and 104 tones for the L-SIG;

If the bandwidth is 80MHz, receiving 48 tones for the L-STF, 208 tones for the L-LTF, and 208 tones for the L-SIG; and

If the bandwidth is 160 MHz, 48 tones for the L-STF, 416 tones for the L-LTF, and 416 tones for the L-SIG are received.

10.

The communication device according to claim 8, wherein if the bandwidth is 20MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40MHz, the VHT-SIG-B carries every 20MHz bandwidth 27 bits, if the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

11.

The communication device according to claim 8, wherein if the bandwidth is 80 MHz or 160 MHz, the VHT-SIG-B carries one or more padding bits.

12.

The communication device according to claim 8, wherein the act of determining whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 80 MHz, or 160 MHz includes receiving a bandwidth indication.

13.

8. The communication device according to claim 8, wherein the instructions are further executable so that if the VHT-SIG-A2 uses quadrature two-phase phase shift keying (QBPSK), it can be used for very high throughput (VHT) signals Perform testing.

14.

The communication device according to claim 8, wherein the instructions are further executable so that if the bandwidth is 80 MHz, receive subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103 Pilot tone at the location.

15.

A method for allocating Orthogonal Frequency Division Multiplexing (OFDM) tones on a communication device includes:

Determine whether the bandwidth used for signal transmission is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

If the bandwidth is 20MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and 52 tones are allocated for the very high throughput signal field A2 (VHT-SIG-A2). The high throughput short training field (VHT-STF) is allocated 12 tones, one or more very high throughput long training fields (VHT-LTF) are allocated 56 tones, and the very high throughput signal field B (VHT-SIG) is allocated 56 tones. -B) Assign 56 tones, and assign 56 tones to the data field (DATA);

If the bandwidth is 40MHz, 104 tones are allocated to the VHT-SIG-A1, 104 tones are allocated to the VHT-SIG-A2, and 24 tones are allocated to the VHT-STF, for the one or 114 tones are allocated to multiple VHT-LTFs, 114 tones are allocated to the VHT-SIG-B, and 114 tones are allocated to the DATA;

If the bandwidth is 80MHz, then 208 tones are allocated for the VHT-SIG-A1, 208 tones are allocated for the VHT-SIG-A2, 48 tones are allocated for the VHT-STF, and for the one or 242 tones are allocated to multiple VHT-LTFs, 242 tones are allocated to the VHT-SIG-B, and 242 tones are allocated to the DATA;

If the bandwidth is 160MHz, then 416 tones are allocated to the VHT-SIG-A1, 416 tones are allocated to the VHT-SIG-A2, 48 tones are allocated to the VHT-STF, for the one or A plurality of VHT-LTFs are allocated 484 tones, the VHT-SIG-B is allocated

484 tones, and the DATA is allocated 484 tones; and

Transmit the signal.

16.

The method of claim 15, further comprising:

If the bandwidth is 20MHz, 12 tones are allocated for the non-high throughput (non-HT) short training field (L-STF), 52 tones are allocated for the non-HT long training field (L-LTF), and for non-HT The signal field (L-SIG) allocates 52 tones;

If the bandwidth is 40MHz, 24 tones are allocated to the L-STF, 104 tones are allocated to the L-LTF, and 104 tones are allocated to the L-SIG;

If the bandwidth is 80MHz, 48 tones are allocated to the L-STF, 208 tones are allocated to the L-LTF, and 208 tones are allocated to the L-SIG; and

If the bandwidth is 160 MHz, 48 tones are allocated to the L-STF, 416 tones are allocated to the L-LTF, and 416 tones are allocated to the L-SIG.

17.

The method of claim 15, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries 27 bits per 20 MHz. If the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

18.

The method of claim 15, wherein, if the bandwidth is 80 MHz or 160 MHz, the VHT-SIG-B carries one or more padding bits.

19.

The method of claim 15, further comprising generating a bandwidth message based on the bandwidth.

20.

The method of claim 15, further comprising: modulating the VHT-SIG-A2 using quadrature binary phase shift keying (QBPSK) to indicate that the frame includes a very high throughput (VHT) signal.

21.

The method of claim 15, further comprising: if the bandwidth is 80 MHz, inserting pilot tones at subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103.

22.

A method for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones on a communication device, including:

Determine whether the bandwidth used for signal reception is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

If the bandwidth is 20MHz, 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), 52 tones for the very high throughput signal field A2 (VHT-SIG-A2), 12 tones for the very high throughput short training field (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), for the very high throughput signal field B (VHT- SIG-B) 56 tones and 56 tones for the data field (DATA);

If the bandwidth is 40 MHz, 104 tones for the VHT-SIG-A1, 104 tones for the VHT-SIG-A2, 24 tones for the VHT-STF, and for the one Or 114 tones of multiple VHT-LTF, 114 tones for the VHT-SIG-B, and 114 tones for the DATA;

If the bandwidth is 80MHz, 208 tones for the VHT-SIG-A1, 208 tones for the VHT-SIG-A2, 48 tones for the VHT-STF, and for the

one Or more than 242 tones of VHT-LTF, 242 tones for said VHT-SIG-B, and 242 tones for said DATA; and

If the bandwidth is 160 MHz, then 416 tones for the VHT-SIG-A1, 416 tones for the VHT-SIG-A2, 48 tones for the VHT-STF, and for the one Or a plurality of 484 tones of VHT-LTF, 484 tones of the VHT-SIG-B, and 484 tones of the DATA.

23.

The method of claim 22, further comprising:

If the bandwidth is 20MHz, then receive 12 tones for the non-high throughput (non-HT) short training field (L-STF), 52 tones for the non-HT long training field (L-LTF), and for non-HT 52 tones of the HT signal field (L-SIG);

If the bandwidth is 40MHz, receive 24 tones for the L-STF, 104 tones for the L-LTF, and 104 tones for the L-SIG;

If the bandwidth is 80MHz, receiving 48 tones for the L-STF, 208 tones for the L-LTF, and 208 tones for the L-SIG; and

If the bandwidth is 160 MHz, 48 tones for the L-STF, 416 tones for the L-LTF, and 416 tones for the L-SIG are received.

24.

The method of claim 22, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries 27 bits per 20 MHz. If the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

25.

The method of claim 22, wherein if the bandwidth is 80 MHz or 160 MHz, the VHT-SIG-B carries one or more padding bits.

26.

The method of claim 22, wherein the step of determining whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 80 MHz, or 160 MHz includes receiving a bandwidth indication.

27.

The method of claim 22, further comprising, if the VHT-SIG-A2 uses quadrature two-phase phase shift keying (QBPSK), detecting a very high throughput (VHT) signal.

28.

The method of claim 22, further comprising: if the bandwidth is 80 MHz, receiving pilot tones at subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103.

29.

A computer program product for allocating Orthogonal Frequency Division Multiplexing (OFDM) tones includes a non-transitory tangible computer-readable medium having instructions thereon, the instructions including:

A code used to enable a communication device to determine whether the bandwidth used for signal transmission is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

A code for the communication device to perform the following operations: if the bandwidth is 20 MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 ( VHT-SIG-A2) 52 tones are allocated, 12 tones are allocated for the very high throughput short training field (VHT-STF), and 56 tones are allocated for one or more very high throughput long training fields (VHT-LTF) , Allocate 56 tones for the very high throughput signal field B (VHT-SIG-B), and allocate 56 tones for the data field (DATA);

The code used to make the communication device perform the following operations: if the bandwidth is 40MHz, 104 tones are allocated to the VHT-SIG-A1, 104 tones are allocated to the VHT-SIG-A2, and 104 tones are allocated to the VHT-SIG-A2. 24

tones are allocated to VHT-STF, 114 tones are allocated to the one or more VHT-LTFs, 114 tones are allocated to the VHT-SIG-B, and 114 tones are allocated to the DATA;

The code used to make the communication device perform the following operations: if the bandwidth is 80 MHz, 208 tones are allocated for VHT-SIG-A1, 208 tones are allocated for the VHT-SIG-A2, and for all The VHT-STF is allocated 48 tones, the one or more VHT-LTFs are allocated 242 tones, the VHT-SIG-B is allocated 242 tones, and the DATA is allocated 242 tones;

The code used to make the communication device perform the following operations: if the bandwidth is 160 MHz, 416 tones are allocated for the VHT-SIG-A1, 416 tones for the VHT-SIG-A2, and for the 48 tones are allocated to VHT-STF, 484 tones are allocated to the one or more VHT-LTF, 484 tones are allocated to the VHT-SIG-B, and 484 tones are allocated to the DATA; and

A code for causing the communication device to transmit the signal.

30.

The computer program product of claim 29, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries every The 20 MHz bandwidth is 27 bits. If the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

31.

The computer program product of claim 29, the instructions further comprising: code for causing the communication device to generate a bandwidth message based on the bandwidth.

32.

The computer program product according to claim 29, the instructions further comprising: code for causing the communication device to perform the following operations: use quadrature two-phase phase shift keying (QBPSK) to control the VHT-SIG-A2 Modulate to indicate that the frame includes a very high throughput (VHT) signal.

33.

A computer program product for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones includes a non-transitory tangible computer-readable medium having instructions thereon, the instructions including:

A code used for the communication device to determine whether the bandwidth used for signal reception is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

A code for the communication device to perform the following operations: if the bandwidth is 20MHz, receive 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 (VHT-SIG-A2) 52 tones, 12 tones for the very high throughput short training field (VHT-STF), 56 for one or more very high throughput long training fields (VHT-LTF) Tones, 56 tones for very high throughput signal field B (VHT-SIG-B), and 56 tones for data field (DATA);

The code used to make the communication device perform the following operations: if the bandwidth is 40MHz, receive 104 tones for the VHT-SIG-A1, 104 tones for the VHT-SIG-A2, and for all 24 tones of the VHT-STF, 114 tones for the one or more VHT-LTF, 114 tones for the VHT-SIG-B, and 114 tones for the DATA;

The code used to make the communication device perform the following operations: if the bandwidth is 80MHz, receive 208 tones for the VHT-SIG-A1, 208 tones for the VHT-SIG-A2, and for all 48 tones of the VHT-STF, 242 tones for the one or more VHT-LTF, 242 tones for the VHT-SIG-B, and 242 tones for the DATA; and

The code used to make the communication device perform the following operations: if the bandwidth is 160MHz, receive 416 tones for the VHT-SIG-A1, 416 tones for the VHT-SIG-A2, and for all The 48 tones of the VHT-STF, the 484 tones for the one or more VHT-LTF, the 484 tones for the VHT-SIG-B, and the 484 tones for the DATA.

34.

The computer program product of claim 33, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries every The 20 MHz bandwidth is 27 bits. If the bandwidth is 80 MHz, the VHT-SIG-

B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

35.

The computer program product of claim 33, wherein the step of determining whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 60 MHz, or 160 MHz includes receiving a bandwidth indication.

36.

The computer program product of claim 33, wherein the instructions further comprise: code for causing the communication device to perform the following operations: if the VHT-SIG-A2 uses quadrature two-phase phase shift keying ( QBPSK), it detects very high throughput (VHT) signals.

37.

A device for distributing Orthogonal Frequency Division Multiplexing (OFDM) tones includes:

A module used to determine whether the signal transmission bandwidth is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

A module for the following operations: if the bandwidth is 20MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 (VHT-SIG-A2) Allocate 52 tones, 12 tones for the very high throughput short training field (VHT-STF), and 56 tones for one or more very high throughput long training fields (VHT-LTF), for the very high throughput The signal field B (VHT-SIG-B) is allocated with 56 tones, and the data field (DATA) is allocated with 56 tones;

A module for the following operations: if the bandwidth is 40MHz, 104 tones are allocated to the VHT-SIG-A1, 104 tones are allocated to the VHT-SIG-A2, and 24 tones are allocated to the VHT-STF Tones, 114 tones are allocated to the one or more VHT-LTFs, 114 tones are allocated to the VHT-SIG-B, and 114 tones are allocated to the DATA;

Module for the following operations: if the bandwidth is 80MHz, 208 tones are allocated to the VHT-SIG-A1, 208 tones are allocated to the VHT-SIG-A2, and 48 tones are allocated to the VHT-STF Tones, 242 tones are allocated to the one or more VHT-LTFs, 242 tones are allocated to the VHT-SIG-B, and 242 tones are allocated to the DATA;

Module for the following operations: if the bandwidth is 160MHz, 416 tones are allocated to the VHT-SIG-A1, 416 tones are allocated to the VHT-SIG-A2, and 48 tones are allocated to the VHT-STF Tones, 484 tones are allocated to the one or more VHT-LTFs, 484 tones are allocated to the VHT-SIG-B, and 484 tones are allocated to the DATA; and

The module used to transmit the signal.

38.

The apparatus of claim 37, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries 27 bits per 20 MHz. If the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

39.

The apparatus of claim 37, further comprising: a module for generating a bandwidth message based on the bandwidth.

40.

The apparatus according to claim 37, further comprising a module for performing the following operations: modulating the VHT-SIG-A2 using quadrature two-phase phase shift keying (QBPSK) to indicate: the frame includes extremely high throughput ( VHT) signal.

41.

A device for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones includes:

A module used to determine whether the signal receiving bandwidth is 20 megahertz (MHz), 40MHz, 80MHz or 160MHz;

A module for the following operations: if the bandwidth is 20MHz, receive 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 (VHT-SIG-A2) ) 52 tones, 12 tones for very high throughput short training fields (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), for very high throughput 56 tones of the signal field B (VHT-SIG-B) and 56 tones for the data field (DATA);

A module for the following operations: if the bandwidth is 40MHz, receive 104 tones for the VHT-SIG-A1, 104 tones for the VHT-SIG-A2, and 24 tones for the VHT-STF Three tones, 114 tones for the one or more VHT-LTF, 114 tones for the VHT-SIG-B, and 114 tones for the DATA;

A module for the following operations: if the bandwidth is 80MHz, receive 208 tones for the VHT-SIG-A1, 208 tones for the VHT-SIG-A2, and 48 tones for the VHT-STF Three tones, 242 tones for the one or more VHT-LTF, 242 tones for the VHT-SIG-B, and 242 tones for the DATA; and

A module for the following operations: if the bandwidth is 160MHz, receive 416 tones for the VHT-SIG-A1, 416 tones for the VHT-SIG-A2, and 48 tones for the VHT-STF One tones, 484 tones for the one or more VHT-LTFs, 484 tones for the VHT-SIG-B, and 484 tones for the DATA.

42.

The apparatus of claim 41, wherein if the bandwidth is 20 MHz, the VHT-SIG-B carries 26 bits, and if the bandwidth is 40 MHz, the VHT-SIG-B carries 27 bits per 20 MHz. If the bandwidth is 80 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth, and if the bandwidth is 160 MHz, the VHT-SIG-B carries 29 bits per 20 MHz bandwidth.

43.

The apparatus of claim 41, wherein the step of determining whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 80 MHz or 160 MHz includes receiving a bandwidth indication.

44.

The apparatus of claim 41, further comprising a module for detecting a very high throughput (VHT) signal if the VHT-SIG-A2 uses quadrature two-phase phase shift keying (QBPSK).

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# DESCRIPTION CN102835061A

This application describes a communication device for distributing tones, the communication device including a processor and instructions in a memory for electronic communication with the processor. The communication device determines whether the bandwidth used for signal transmission is 20, 40, 80, or 160 megahertz (MHz). The communication device allocates tones for 20, 40, 80 or 160 MHz respectively as follows: for very high throughput (VHT) signal A1 (VHT-SIG-A1): 52, 104, 208, 416; VHT signal A2 (VHT-SIG -A2): 52, 104, 208, 416; VHT short training field (VHT-STF): 12, 24, 48, 48; one or more VHT long training fields (VHT-LTF): 56, 114, 242, 484; VHT signal B (VHT-SIG-B): 56, 114, 242, 484; and data field (DATA): 56, 114, 242, 484. The communication device also transmits the signal.

Assign and receive frame-specific tones

Related application

This application relates to and claims the priority of the U.S. Provisional Patent Application Serial No. 61/323,976 entitled "TONENUMEROLOGY FOR 802.11ac PREAMBLE" filed on April 14, 2010, and it is hereby incorporated by reference All are incorporated into this article.

Technical field

The present disclosure generally relates to communication systems. More specifically, the present disclosure relates to allocating and receiving tones for frames.

Background technique

Communication systems have been widely deployed to provide various types of communication content, such as data, voice, and video. These systems may be multiple-access systems that can support simultaneous communication between multiple communication devices (for example, wireless communication devices, access terminals, etc.) and one or more other communication devices (for example, base stations, access points, etc.).

In the past few years, the use of communication equipment has increased dramatically. Communication equipment often provides access to a network (for example, a local area network (LAN) or the Internet). Other communication devices (for example, access terminals, laptop computers, smart phones, multimedia players, gaming devices, etc.) can communicate wirelessly with communication devices that provide network access. Some communication devices comply with certain industry standards, such as the Institute of Electrical and Electronics Engineers (IEEE) 802.11 (for example, Wireless Fidelity or "Wi-Fi") standard. For example, users of communication devices often use such communication devices to connect to wireless networks.

As the use of communication equipment has increased, attempts are also being made to improve the capacity, reliability, and efficiency of communication equipment. Systems and methods that improve the capacity, reliability, and/or efficiency of communication devices may be beneficial.

Summary of the invention

A communication device for allocating Orthogonal Frequency Division Multiplexing (OFDM) tones is disclosed. The

communication device includes a processor and instructions stored in a memory in electronic communication with the processor. The communication device determines whether the bandwidth used for signal transmission is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. If the bandwidth is 20MHz, the communication device also allocates 52 tones for the very high throughput signal field A1 (VHT-SIG-A1) and 52 tones for the very high throughput signal field A2 (VHT-SIG-A2) Two tones, 12 tones are allocated for the very high throughput short training field (VHT-STF), and 56 tones are allocated for one or more very high throughput long training fields (VHT-LTF), for the very high throughput signal field B (VHT-SIG-B) 56 tones are allocated, and 56 tones are allocated for the data field (DATA). If the bandwidth is 40MHz, the communication device additionally allocates 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, 24 tones for VHT-STF, and for one or more VHTs -LTF allocates 114 tones, VHT-SIG-B is allocated 114 tones, and DATA is allocated 114 tones. If the bandwidth is 80MHz, the communication device further allocates 208 tones for VHT-SIG-A1, 208 tones for VHT-SIG-A2, 48 tones for VHT-STF, and for one or more VHTs -LTF allocates 242 tones, VHT-SIG-B is allocated 242 tones, and DATA is allocated 242 tones. If the bandwidth is 160MHz, the communication device also allocates 416 tones for VHT-SIG-A1, 416 tones for VHT-SIG-A2, 48 tones for VHT-STF, and for one or more VHTs -LTF allocates 484 tones, VHT-SIG-B allocates 484 tones, and DATA allocates 484 tones. The communication device additionally transmits the signal.

If the bandwidth is 20MHz, the communication device may allocate 12 tones for the non-high throughput (non-HT) short training field (L-STF) and 52 tones for the non-HT long training field (L-LTF) , And assign 52 tones to the non-HT signal field (L-SIG). If the bandwidth is 40 MHz, the communication device may also allocate 24 tones for the L-STF, 104 tones for the L-LTF, and 104 tones for the L-SIG. If the bandwidth is 80 MHz, the communication device may additionally allocate 48 tones for the L-STF, 208 tones for the L-LTF, and 208 tones for the L-SIG. If the bandwidth is 160 MHz, the communication device may further allocate 48 tones for the L-STF, 416 tones for the L-LTF, and 416 tones for the L-SIG.

If the bandwidth is 20 MHz, the VHT-SIG-B can carry 26 bits. If the bandwidth is 40 MHz, the VHT-SIG-B can carry 27 bits per 20 MHz bandwidth. If the bandwidth is 80 MHz, the VHT-SIG-B can carry 29 bits per 20 MHz bandwidth. If the bandwidth is 160 MHz, the VHT-SIG-B can carry 29 bits per 20 MHz bandwidth. If the bandwidth is 80MHz or 160MHz, the VHT-SIG-B may carry one or more padding bits.

The communication device may generate a bandwidth message based on the bandwidth. The communication device may use quadrature two-phase phase shift keying (QBPSK) to modulate the VHT-SIG-A2 to indicate that the frame includes a very high throughput (VHT) signal. If the bandwidth is 80MHz, the communication device can insert pilot tones at subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103.

Also disclosed is a communication device for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones. The communication device includes a processor and instructions stored in a memory in electronic communication with the processor. The communication device determines whether the bandwidth of the signal reception is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. If the bandwidth is 20MHz, the communication device also receives 52 tones for very high throughput signal field A1 (VHT-SIG-A1), and 52 tones for very high throughput signal field A2 (VHT-SIG-A2) 52 tones, 12 tones for very high throughput short training fields (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), for very high throughput signals 56 tones for field B (VHT-SIG-B), and 56 tones for the data field (DATA). If the bandwidth is 40 MHz, the communication device additionally receives 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, 24 tones for VHT-STF, and for one or more tones. 114 tones for VHT-LTF, 114 tones for VHT-SIG-B, and 114 tones for DATA. If the bandwidth is 80MHz, the communication device further receives 208 tones for VHT-SIG-A1, 208 tones for VHT-SIG-A2, 48 tones for VHT-STF, and for one or more tones 242 tones for VHT-LTF, 242 tones for VHT-SIG-B, and 242 tones for DATA. If the bandwidth is 160MHz, the communication device also receives 416 tones for VHT-SIG-A1, 416 tones for VHT-SIGA2, 48 tones for VHT-STF, and for one or more VHT- 484 tones for LTF, 484 tones for VHT-SIG-B, and 484 tones for DATA. The step of determining whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 80 MHz or 160 MHz may include receiving a bandwidth indication.

If the bandwidth is 20MHz, the communication device can receive 12 tones for non-high throughput (non-HT) short training fields (L-STF) and 52 tones for non-HT long training fields (L-LTF) Tones, and 52 tones for the non-HT signal field (L-SIG). If the bandwidth is 40 MHz, the communication device can receive 24 tones for the L-STF, 104 tones for the L-LTF, and 104 tones for the L-SIG. If the bandwidth is 80 MHz, the communication device can receive 48 tones for the L-STF, 208 tones for the L-LTF, and 208 tones for the L-SIG. If the bandwidth is 160 MHz, the communication device can receive 48 tones for the L-STF, 416 tones for the L-LTF, and 416 tones for the L-SIG.

If the bandwidth is 20 MHz, the VHT-SIG-B can carry 26 bits. If the bandwidth is 40MHz, the VHT-SIG-B can carry 27 bits per 20MHz bandwidth. If the bandwidth is 80 MHz, the VHT-SIG-B can carry 29 bits per 20 MHz bandwidth. If the bandwidth is 160 MHz, the VHT-SIG-B can carry 29 bits per 20 MHz bandwidth. If the bandwidth is 80MHz or 160MHz, the VHT-SIG-B carries one or more padding bits.

If the VHT-SIG-A2 uses quadrature two-phase phase shift keying (QBPSK), the communication device can detect very high throughput (VHT) signals. If the bandwidth is 80 MHz, the communication device can receive pilot tones at subcarrier indexes -103, -75, -39, -11, 11, 39, 75, and 103.

A method for distributing Orthogonal Frequency Division Multiplexing (OFDM) tones on a communication device is also disclosed. The method includes determining whether the bandwidth used for signal transmission is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. If the bandwidth is 20MHz, the method further includes: allocating 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), and allocating for the very high throughput signal field A2 (VHT-SIG-A2) 52 tones, 12 tones are allocated for the very high throughput short training field (VHT-STF), and 56 tones are allocated for one or more very high throughput long training fields (VHT-LTF), for the very high throughput signal Field B (VHT-SIG-B) is allocated 56 tones, and 56 tones are allocated to the data field (DATA). If the bandwidth is 40MHz, the method additionally includes: allocating 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, 24 tones for VHT-STF, and for one or more VHT-LTF is allocated 114 tones, VHT-SIG-B is allocated 114 tones, and DATA is allocated 114 tones. If the bandwidth is 80MHz, the method further includes: allocating 208 tones for VHT-SIG-A1, allocating 206 tones for VHT-SIG-A2, allocating 48 tones for VHT-STF, and for one or more VHT-LTF is allocated 242 tones, VHT-SIG-B is allocated 242 tones, and DATA is allocated 242 tones. If the bandwidth is 160MHz, the method further includes: allocating 416 tones for VHT-SIG-A1, allocating 416 tones for VHT-SIG-A2, allocating 48 tones for VHT-STF, and for one or more VHT-LTF is allocated 464 tones, VHT-SIG-B is allocated 484 tones, and DATA is allocated 484 tones. The method additionally includes transmitting the signal.

A method for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones on a communication device is also disclosed. The method includes determining whether the bandwidth used for signal reception is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. If the bandwidth is 20MHz, the method further includes: receiving 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 (VHT-SIG-A2) 52 tones, 12 tones for very high throughput short training field (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), for very high throughput 56 tones for signal field B (VHT-SIG-B) and 56 tones for data field (DATA). If the bandwidth is 40MHz, the method additionally includes: receiving 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, 24 tones for VHT-STF, and for one or more tones. 114 tones for VHT-LTF, 114 tones for VHT-SIG-B, and 114 tones for DATA. If the bandwidth is 80MHz, the method further includes: receiving 208 tones for VHT-SIG-A1, 208 tones for VHT-SIG-A2, 46 tones for VHT-STF, and for one or more tones. 242 tones for VHT-LTF, 242 tones for VHT-SIG-B, and 242 tones for DATA. If the bandwidth is 160MHz, the method further includes: receiving 416 tones for VHT-SIG-A1, 416 tones for VHT-SIG-A2, 48 tones for VHT-STF, and for one or more tones. 484 tones for VHT-LTF, 484 tones for VHT-SIG-B, and 484 tones for DATA.

A computer program product for allocating Orthogonal Frequency Division Multiplexing (OFDM) tones is also disclosed. The computer program product includes: a non-transitory tangible computer readable medium having instructions thereon. The instructions include codes for enabling the communication device to determine whether the bandwidth for signal transmission is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. The instruction also includes code for causing the communication device to perform the following operations: if the bandwidth is 20 MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput The signal field A2 (VHT-SIG-A2) is allocated 52 tones, 12 tones are allocated for the very high throughput short training field (VHT-STF), and for one or more very high throughput long training fields (VHT-LTF) ) 56 tones are allocated, 56 tones are allocated for the very high throughput signal field B (VHT-SIG-B), and 56 tones are allocated for the data field (DATA). The instruction additionally includes code for causing the communication device to perform the following operations: if the bandwidth is 40 MHz, 104 tones are allocated for VHT-SIG-A1, 104 tones are allocated for VHT-SIG-A2, and for VHT-STF is allocated 24 tones, one or more VHT-LTFs are allocated 114 tones, VHT-SIG-B is allocated 114 tones, and DATA is allocated 114 tones. The instruction further includes code for causing the communication device to perform the following operations: if the bandwidth is 80MHz, 208 tones are allocated for VHT-SIG-A1, 208 tones are allocated for VHT-SIG-A2, and for VHT -STF allocates 46 tones, allocates 242 tones for one or more VHT-LTFs, allocates 242 tones for VHT-SIG-B, and allocates 242 tones for DATA. The instruction also includes code for causing the communication device to perform the following operations: if the bandwidth is 160MHz, 416 tones are allocated for VHT-SIG-A1, 416 tones for VHT-SIG-A2, and for VHT -STF allocates 48 tones, allocates 484 tones for one or more VHT-LTFs, allocates 484 tones for VHT-SIG-B, and allocates 484 tones for DATA. The instructions additionally include code for causing the communication device to transmit the signal.

A computer program product for receiving orthogonal frequency division multiplexing (OFDM) tones is also disclosed. The computer program product includes: a non-transitory tangible computer readable medium with instructions. The instructions include codes for causing the communication device to determine whether the bandwidth for signal reception is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. The instruction also includes code for causing the communication device to perform the following operations: if the bandwidth is 20MHz, receive 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), 52 tones for the throughput signal field A2 (VHT-SIG-A2), 12 tones for the very high throughput short training field (VHT-STF), and

for one or more very high throughput long training fields (VHT- LTF) 56 tones, 56 tones for Very High Throughput Signal Field B (VHT-SIG-B), and 56 tones for Data Field (DATA). The instruction additionally includes code for causing the communication device to perform the following operations: if the bandwidth is 40MHz, receive 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, and for 24 tones for VHT-STF, 114 tones for one or more VHT-LTF, 114 tones for VHT-SIG-B, and 114 tones for DATA. The instruction further includes code for causing the communication device to perform the following operations: if the bandwidth is 80 MHz, receive 208 tones for VHT-SIG-A1, 208 tones for VHT-SIG-A2, 48 tones for VHT-STF, 242 tones for one or more VHT-LTF, 242 tones for VHT-SIG-B, and 242 tones for DATA. The instruction also includes code for causing the communication device to perform the following operations: if the bandwidth is 160MHz, receive 416 tones for VHT-SIG-A1, 416 tones for VHT-SIG-A2, and for 48 tones for VHT-STF, 484 tones for one or more VHT-LTF, 484 tones for VHT-SIG-B, and 484 tones for DATA.

Also disclosed is an apparatus for allocating Orthogonal Frequency Division Multiplexing (OFDM) tones. The device includes: a module for determining whether the bandwidth of signal transmission is 20 megahertz (MHz), 40 MHz, 80 MHz, or 160 MHz. The device also includes a module for the following operations: if the bandwidth is 20 MHz, 52 tones are allocated for the very high throughput signal field A1 (VHT-SIG-A1), and for the very high throughput signal field A2 (VHT -SIG-A2) Assign 52 tones, 12 tones for the very high throughput short training field (VHT-STF), and 56 tones for one or more very high throughput long training fields (VHT-LTF), 56 tones are allocated for the very high throughput signal field B (VHT-SIG-B) and 56 tones for the data field (DATA). The device additionally includes a module for the following operations: if the bandwidth is 40MHz, 104 tones are allocated to VHT-SIG-A1, 104 tones are allocated to VHT-SIG-A2, and 24 tones are allocated to VHT-STF , 114 tones are allocated for one or more VHT-LTF, 114 tones for VHT-SIG-B, and 114 tones for DATA. The device further includes a module for the following operations: if the bandwidth is 80MHz, 208 tones are allocated to VHT-SIG-A1, 208 tones are allocated to VHT-SIG-A2, and 48 tones are allocated to VHT-STF , 242 tones are allocated to one or more VHT-LTF, 242 tones are allocated to VHT-SIG-B, and 242 tones are allocated to DATA. The device also includes a module for the following operations: if the bandwidth is 160MHz, 416 tones are allocated to VHT-SIG-A1, 416 tones are allocated to VHT-SIG-A2, and 48 tones are allocated to VHT-STF , 484 tones are allocated to one or more VHT-LTF, 484 tones are allocated to VHT-SIG-B, and 484 tones are allocated to DATA. The device additionally includes: a module for transmitting the signal.

A device for receiving Orthogonal Frequency Division Multiplexing (OFDM) tones is also disclosed. The device includes: a module for determining whether the bandwidth of signal reception is 20 megahertz (MHz), 40 MHz, 80 MHz or 160 MHz. The apparatus further includes: if the bandwidth is 20MHz, receiving 52 tones for the very high throughput signal field A1 (VHT-SIG-A1), and for receiving 52 tones for the very high throughput signal field A2 (VHT-SIG- A2) 52 tones, 12 tones for very high throughput short training fields (VHT-STF), 56 tones for one or more very high throughput long training fields (VHT-LTF), for very high throughput Module of 56 tones of throughput signal field B (VHT-SIG-B) and 56 tones for data field (DATA). The apparatus additionally includes: if the bandwidth is 40MHz, receiving 104 tones for VHT-SIG-A1, 104 tones for VHT-SIG-A2, 24 tones for VHT-STF, and for one Or multiple modules of 114 tones for VHT-LTF, 114 tones for VHT-SIG-B, and 114 tones for DATA. The device further includes: if the bandwidth is 80MHz, receiving 208 tones for VHT-SIG-A1, 208 tones for VHT-SIG-A2, 48 tones for VHT-STF, for one Or multiple modules of 242 tones of VHT-LTF, 242 tones of VHT-SIG-B, and 242 tones of DATA. The device additionally includes: if the bandwidth is 160MHz, receiving 416 tones for VHT-SIG-A1, 416 tones for VHT-SIG-A2, 48 tones for VHT-STF, for one Or multiple modules of 484 tones for VHT-LTF, 484 tones for VHT-SIG-B, and 484 tones for DATA.

Description of the drawings

Figure 1 depicts a configuration of a transmitting communication device (in which a system and method for allocating tones for frames can be implemented) and a configuration of a receiving communication device (wherein, a system for receiving tones for frames can be implemented And method) block diagram;

Figure 2 is a diagram depicting an example of a communication frame that can be used according to the system and method disclosed herein;

Fig. 3 is a diagram depicting an example of a plurality of frames;

Figure 4 is a diagram depicting the constellation for the traditional signal field (L-SIG), the very high throughput signal A1 (VHT-SIG-A1), and the very high throughput signal A2 (VHT-SIG-A2);

Figure 5 is a diagram depicting an example of data and pilot tones for an 80MHz signal according to the system and method disclosed herein;

FIG. 6 is a flowchart depicting a configuration of a method for allocating tones for frames;

FIG. 7 is a flowchart depicting a configuration of a method for receiving tones for frames;

Figure 8 is a block diagram of a configuration of an access point in which a system and method for allocating tones for frames can be implemented;

Figure 9 is a block diagram of a communication device that can be used in multiple input and multiple output (MIMO) systems;

Figure 10 depicts certain components that may be included in a communication device, base station, and/or access point; and

Figure 11 depicts certain components that may be included in a wireless communication device and/or an access terminal.

detailed description

Examples of communication devices include cellular phone base stations or nodes, access points, wireless gateways, and wireless routers. Communication equipment can be based on certain industry standards, such as the Institute of Electrical and Electronics Engineers (IEEE) 802.11a, 802.11b, 802.11g, 802.11n, and/or 802.11ac (for example, wireless fidelity or "Wi-Fi") standards operating. Other examples of standards that communication equipment may comply with include: IEEE 802.16 (for example, Global Interoperability for Microwave Access or "WiMAX"), Third Generation Partnership Project (3GPP), 3GPP Long Term Evolution (LTE), and others (for example, where communication The equipment may be called Node B, Evolved Node B (eNB), etc.). Although some of the systems and methods disclosed herein can be described around one or more standards, this should not limit the scope of the present disclosure because the systems and methods can be applied to many systems and/or standards.

Some communication devices (for example, access terminals, client devices, client stations, etc.) can communicate wirelessly with other communication devices. Some communication devices can be called mobile devices, mobile stations, user stations, user equipment (UE), remote stations, access terminals, mobile terminals, terminals, user terminals, user units, and so on. Additional examples of communication devices include: laptop or desktop computers, cellular phones, smart phones, wireless modems, e-readers, tablet devices, gaming systems, and so on. Some of these communication devices can operate in accordance with one or more of the above-mentioned industry standards. Therefore, the general term "communication equipment" may include communication equipment described with different names according to industry standards (for example, access terminal, user equipment (UE), remote terminal, access point, base station, Node B, evolved Node B ( eNB) etc.).

Some communication devices may be able to provide access to the communication network. Examples of communication networks include, but are not limited to, telephone networks (for example, "landline" networks, such as the public switched telephone network (PSTN) or cellular telephone network), the Internet, local area networks (LAN), wide area networks (WAN), metropolitan area networks ( MAN) and so on.

The current work of the IEEE 802.11 group includes standardizing a new and faster version of 802.11 called VHT (Very High Throughput). This extension can be called 802.11ac. Technologies such as space division multiple access (SDMA) that allow multiple transmissions to occur in parallel without causing conflicts are being considered. Also considering the use of another signal bandwidth (BW), for example, using 80 megahertz (MHz) and 160MHz for transmission. A new physical layer (PHY) preamble can be defined based on systems and methods that allow both increased signal bandwidth and SDMA, and backward compatibility with 802.11n, 802.11a, and 802.11. In order to make the VHT preamble backward compatible, orthogonal frequency division multiplexing (OFDM) numerology can be used that can be demodulated by conventional equipment. However, OFDM computing that provides added functionality to 802.11ac devices can also be used. The calculations may include: (1) multiple data tones for each OFDM symbol in the preamble, (2) multiple data tones for OFDM data symbols, (3) multiple pilot tones, and (4) Multiple direct current (DC) zero carrier. The system and method disclosed herein describe OFDM subcarrier computing that can be applied to this type of VHT extension.

An 802.11ac frame with a preamble can be constructed to include multiple fields. In one configuration, the 802.11ac frame may include the traditional short training field or the non-high throughput short training field (L-STF), the traditional long training field or the non-high throughput long training field (L-LTF), the traditional Signal field or non-high throughput signal field (L-SIG), very high throughput signal field A1 (VHT-SIG-A1), very high throughput signal field A2 (VHT-SIG-A2), very high throughput Short training field (VHT-STF), one or more very high throughput long training fields (VHT-LTF), very high throughput signal field B (VHT-SIG-B), and data fields (for example, DATA or VHT-DATA).

802.11 The ac preamble is designed to support transmit beamforming and SDMA. The first part of the preamble can be transmitted in an omnidirectional manner (for example, using cyclic diversity or another scheme). This part of the preamble can include L-STF, L-LTF, L-SIG, VHT-SIG-A1, and VHT-SIG-A2. It should be noted that traditional devices (for example, devices that comply with traditional or earlier specifications) can decode L-STF, L-LTF, and L-SIG. However, 802.11ac devices can decode VHT-SIG-A1 and VHT-SIG-A2 (for example, appended to the preceding fields).

The second part of the 802.11ac preamble can be transmitted in an omnidirectional manner (maybe beamforming or maybe SDMA precoding). This second part of the preamble includes: VHT-STF, one or more VHT-LTF, and VHT-SIG-B. The data symbols (for example, in the data field) can be transmitted using the same antenna pattern as the second part of the preamble. Traditional or even all 802.11ac devices may not be able to decode the second part of the data symbol and preamble.

The aforementioned 802.11ac preamble has some control data that can be decoded by conventional 802.11a and 802.11n receivers. This data is included in L-SIG. The data in the L-SIG informs all receivers that the time that the transmission will occupy the wireless medium allows all devices to delay their transmission by a precise amount of time. In addition, the 802.11ac preamble allows the 802.11ac device to recognize the transmission as an 802.11ac transmission (and avoid determining that the transmission uses the 11a or 11n format). In addition, the 802.11ac preamble described in the system and method herein can enable the traditional 11a and 11n devices to detect the transmission as an 802.11a transmission, which is a valid transmission with valid data in the L-SIG.

According to the system and method disclosed herein, the number of data and pilot tones for 80MHz 802.11ac signals can be defined. This can be compared with the number of data and pilot tones for 20MHz 802.11n and 40MHz 802.11n signals. 20The MHz 802.11n signal uses 56 tones (52 data, 4 pilots) and one direct current (DC) tone. 40The MHz 802.11n signal uses 114 tones (108 data, 6 pilots) and 3 DC tones. The system and method disclosed herein depict 242 tones (234 data, 8 pilots) and 3 DC tones used for 80MHz 802.11ac signals. According to the exquisite frequency interleaver structure, reasonable cost filtering requirements, and efficiency considerations, 234 data tones according to the system and method of this paper can be used. It can also be noted that the 802.11a signal uses 52 tones (48 data tones and 4 pilot tones) and one DC tone.

The 802.11ac preamble described according to the system and method herein may include two parts or components. The first part can be transmitted omnidirectionally, and the second part can be transmitted by beamforming or SDMA precoding. The first three fields of the first or omnidirectional part may contain signals that can be decoded by 802.11a and 802.11n receivers (for example, L-STF, L-LTF, L-SIG). In addition, traditional 802.11a and 802.11n devices can determine that the 802.11ac transmission is an 802.11a transmission, so that these devices decode the L-SIG as if it were an 802.11a transmission.

The system and method disclosed herein can provide an appropriate number of tones to each field or signal that meets the constraints. This tone distribution is shown in Table (1). More specifically, Table (1) shows the number of OFDM tones that can be used for 802.11ac transmission of various signal bandwidths.

Table 1)

[image]

L-STF can use signals with 12 tones per 20MHz. In this case, the time domain signal has a repetition interval of 800 nanoseconds (ns). This repetition interval can be used for fast gain control, time offset estimation, and frequency offset estimation. The received signal strength can be measured quickly, because for an 800ns interval, only the time domain signal needs to be considered. Traditional 802.11a and 802.11n devices will expect 12 tones.

L-LTF and L-SIG can use 52 tones for 20MHz signals. This may be expected for 802.11a transmission through any traditional 802.11a or 802.11n device. When sending a 40MHz 802.11ac signal, the contents of these fields can be copied (and adjusted by complex numbers) to each 20MHz subband of the 40MHz signal. That is, L-SIG can be used in two 20MHz subbands with DC tones that are accurately separated by 20MHz. Therefore, the total number of tones just doubled. For 80MHz and 160MHz, the same design can be followed, and the fields can be adjusted and copied to each of 4 or 8 20MHz subbands.

According to the 802.11a specification, L-SIG can use 48 data tones and 4 pilots. For 40MHz, 80MHz, and 160MHz 802.11ac transmissions, the 24-bit data carried by L-SIG (for example, using two-phase phase shift keying (BPSK) and 1/2 coding rate) can be in each of the 20MHz subbands in the launch. This allows any legacy device that only receives on a single 20MHz channel to decode the data in the L-SIG and delay it appropriately.

The VHT-SIG-A1 and VHT-SIG-A2 fields or symbols can use 52 tones (48 data tones and 4 pilot tones) in 20 MHz. The number of data tones can be the same as L-SIG, because channel estimation can only be done for these data tones (the channel estimation is based on L-LTF). For 40MHz, 80MHz, and 160MHz bandwidths, for the same reason, the number of data tones and pilot tones follows L-LTF.

VHT-STF can be the same as L-STF, and can use signals with 12 tones per 20MHz. In this way, the receiving gain control algorithm can use only 800ns to quickly measure the received signal strength. If more tones are used, the receiver may need to wait a longer period of time for accurate signal strength measurements, so set constraints on the allotted time so that the analog receiving gain changes and stabilizes to their new values. Gain control may be required because the received signal strength

may be different for the second part of the preamble (and the data field) compared to the first part of the preamble. In addition, VHT-STF can be used to update the timing and frequency offset.

VHT-LTF, VHT-SIG-B, and data fields can use more OFDM tones than the first or omnidirectional part of the preamble. Therefore, each of these fields can use the same number of tones as DATA. For 20MHz and 40MHz 802.11ac transmission, the number of tones is selected to match the 802.11n standard. For 80MHz and 160MHz 802.11ac transmission, the number of tones can be selected as 242 and 484 respectively.

For 20MHz 802.11ac transmission, the VHT-SIG-B field carries 26 bits of data (52 tones, if BPSK and 1/2 rate coding are used). For 40MHz 802.11ac transmission, the VHT-SIG-B field can carry 54 bits of individual data or the same 27 bits of data in each 20MHz subband. The 80 MHz transmission of the VHT-SIG-B field can carry 29 bits of data in each 20 MHz subband, or 58 bits of data, or 117 bits of data in each 40 MHz subband. For 160MHz transmission, a similar choice can be made. It should be noted that although this article uses BPSK and 1/2 rate coding as examples, according to the system and method of this article, other modulation schemes and/or coding rates can be used, which allows a different number of bits to be included in each symbol . Table (2) depicts an example of the number of data tones and the number of bits per signal bandwidth that can be used according to the system and method disclosed herein.

Table 2)

[image]

For signal additional capabilities, additional bits for wider bandwidth signals can be used, which is possible when using signal bandwidths exceeding 20 MHz. For example, an 80MHz signal can include four independent 20MHz signals (streams), where each 20MHz signal can carry a different coded data stream. Each of these streams can have a different modulation and coding (for example, using a different modulation and coding scheme (MCS)). Each stream can additionally have a different number of bytes. In addition, each stream can have a different number of packet aggregations, for example, 802.11n type aggregated media access control (MAC) protocol data unit (A-MPDU) or polymer physical layer convergence process (PLCP) protocol data unit (PPDU), For example, each PPDU carries its own VHT-SIG-B field. All these features can be signaled and indicated by the VHT-SIG-B field bits carried in the corresponding 20MHz stream.

More details about a configuration in which the systems and methods disclosed herein can be applied are given below. In this configuration, multiple operands are specified. It should be noted that different operating numbers can be used in different configurations. In this example, the maximum number of detected transmit (Tx) antennas is 8. This can provide a reasonable compromise between complexity, cost, and preamble length. The maximum number of spatial streams (NSS) in a single user (SU) situation can be 8. Assuming that 8 transmit antennas can be detected, up to 8 spatial streams are originally supported.

In the case of multiple users, in this example, the maximum number of spatial streams (NSS) for each user (eg, access point, client, station, wireless communication device, etc.) is 4. Assuming that multiple users can share spatial streams, it is natural to make this number less than 8. This also complies with the very high throughput signal field (VHT-SIG) size limit and reduces the number of required representation bits. In the multi-user scenario, the maximum number of spatial streams (NSS) totaled on users in this example is 8. Assuming that 8 transmitting antennas can be detected, up to 8 spatial streams are originally supported.

The maximum number of multi-user users can be 4. Larger numbers may significantly increase the media access control (MAC) and/or physical (PHY) layer complexity. This complies with the (VHT-SIG) size limit and reduces the number of required representation bits.

The maximum number of detected transmitting antennas is 8, which meets project authorization request (PAR) requirements (for example, IEEE Standards Committee project authorization request (PAR) requirements). In the case of a single user, eight antennas with NSS=8 can allow a throughput greater than 500 megabits per second (Mbps). For the case of multiple users, eight antenna detection can allow throughput greater than 1 gigabit per second (Gbps). In addition, there may be physical restrictions on access points (AP) and stations (STA) that include more than 8 antennas. In addition, performing 16 antenna detection increases the length of the preamble. In addition, the number of bits required to indicate the number of antennas detected has also increased, although there may be a limited number of available bits in the frame preamble.

In the case of a single user, the maximum number of spatial streams (NSS) is 8, which meets the PAR requirement. In the case of a single user, eight spatial streams can allow a throughput greater than 500 Mbps. It should be noted that the maximum number of spatial streams (NSS) is less than or equal to the maximum number of antennas detected.

In the case of multiple users, the maximum number of spatial streams (NSS) per user is 4, which meets the PAR requirement.

For multi-user transmission, two transmissions with NSS=4 can allow a throughput greater than 1 Gbps. Assuming that multiple users can share the spatial stream, the number can naturally be made less than 8. This complies with the VHT-SIG field size limit and reduces the number of required representation bits. For example, three bits may be required to define the number of space-time streams (NSTS) for each user for multi-user transmission. For the resolvable long training field (LTF), these bits can be included in the very high throughput signal field A (VHT-SIG-A).

In the multi-user scenario, the maximum number of total spatial streams (NSS) on the user is 8, which meets the PAR requirement. For multi-user transmission, the sum of the number of spatial streams (NSS) equal to 8 can make the throughput greater than 1Gbps. Assuming that 8 transmit antennas can be detected, up to 8 spatial streams are originally supported.

The maximum number of multi-user users is 4 to meet PAR requirements. For example, a multi-user transmission with four users and two streams per user can allow a throughput greater than 1 Gbps. A larger number can significantly increase the MAC and/or PHY layer complexity. For example, it may be necessary to encrypt and modulate each user stream independently. However, having a maximum of four users in a multi-user situation meets the VHT-SIG size limit and reduces the number of required representation bits. It should be noted that NSS bits can be pre-allocated for each user in VHT-SIG-A. However, even if there are four multi-user users, most of the VHT-SIG-A bits are already allocated.

A configuration of the frame preamble may include the following features. The frame preamble can be used to rotate the second VHT-SIG field symbol (for example, VHT-SIG-A2) by 90 degrees to provide high-throughput automatic detection. This frame preamble can use the same modulation used in 802.11a/n for the VHT-SIG field: Binary Phase Shift Keying (BPSK) with 1/2 rate coding. Without the Greenfield format, a single frame preamble can be used.

In this configuration, the frame preamble can include multiple fields: L-STF, L-LTF, L-SIG field, VHT-SIG-A field (which can include, for example: VHT-SIG-A1 and VHT-SIG- A2 field or symbol), VHT-STF, one or more VHT-LTF, VHT-SIG-B field (which may include, for example, one symbol), and VHT-DATA field. The preamble can have a rate of 6 Mbps, and the length is determined by the variable T. The second symbol in VHT-SIG-A (for example, VHT-SIG-A2) may use a modulation or constellation that is rotated by 90 degrees relative to the first symbol in VHT-SIG-A (for example, VHT-SIG-A1) Mapping. In this way, VHT-SIG-A2 can be used for VHT automatic detection.

This method of automatic detection can provide reliable spoofing of existing 802.11n receivers (for example, as 802.11a packets), regardless of which 802.11n automatic detection algorithm is implemented in the existing 802.11n receiver. This method also (for example, for BPSK versus quadrature two-phase phase shift keying (QBPSK)) provides reliable 802.11ac automatic detection at the maximum Euclidean distance (Euclidean Distance). It should be noted that it may be dangerous to manipulate the modulation of the first VHT-SIG-A symbol (for example, VHT-SIG-A1). Considering the various existing implementations of 802.11n automatic detection, it may be unfair to assume any particular 802.11n automatic detection method as in other ways. For example, making such an assumption is more likely to cause: 802.11n devices erroneously detect the high throughput signal field (HT-SIG) and enter the energy detection-empty channel assessment (ED-CCA) stage.

As for the detection timing, the VHT-STF automatic gain control (AGC) can be delayed (before the VHT detection) by processing the time through a suitable fast Fourier transform (FFT). 802.11AC devices can run faster clocks to support higher throughput. Therefore, AGC calculations can be faster than high throughput (HT) devices. In one configuration, a portion of the guard interval (GI) for the first VHT-LTF can be used for AGC calculation. For 802.11ac, more complex functions are required than AGC calculations (for example, downlink multi-user (DL-MU) function, faster decoder, etc.). Therefore, VHTAGC enhancement may be insignificant. Accordingly, reliable traditional deception may be more important than the additional complexity enhanced by AGC.

Regarding the modulation of the VHT-SIG field, it may be preferable to continue to use the lowest possible MCS to modulate the VHT-SIG field. For example, MCS0 can be used to guarantee the longest range. This ensures that the header is not worse than the data field.

Regarding the Greenfield (GF) format, the second preamble format may preferably not be defined. In 802.11n, the GF format has so far only limited uses. However, one of the reasons for supporting the GF format in 802.11n is that there is a green space in the 5GHz range due to the limited use of 802.11a. Nevertheless, if there is no 5GHz deployment of 802.11n, it is meaningless for the 802.11ac Task Group (TGac). Therefore, it should be assumed that there will be a 5 GHz deployment of 802.11n. Similar to 802.11n, having multiple preamble types increases the difficulty of auto-detecting small physical layer (PHY) efficiency improvements. Therefore, the PHY improvement may be offset by the GF protection exchange.

According to the system and method disclosed in this article, some preamble design goals are given below. One goal is backward compatibility. For example, the preamble design can allow both robust legacy 802.11a delays and robust legacy

802.11n delays. Another preamble design goal is to perform reliable automatic detection between 802.11a, 802.11n (for example, for mixed mode (MM) and GF), and VHT preamble. Another goal is to have a single preamble structure in single-user (SU) and multi-user (MU) scenarios. Another design goal is to allow the VHT-SIG field to signal VHT PHY information. Training for wider channels and detection and delay in each sub-channel are further goals. Other preamble design goals include making the preamble have a low peak-to-average power ratio (PAPR) and minimizing or reducing the total preamble length.

In one configuration of the system and method disclosed herein, spoofing and automatic detection can be performed as follows. L-SIG spoofing can be used for both 802.11a and 802.11n receivers. For example, for 802.11a/g receivers, this can act as 802.11n spoofing. In one configuration, the bit rate can be 6 Mbps, where length/rate indicates duration. The 90-degree rotated BPSK (QBPSK) on the VHT-SIG symbol can be used for VHT automatic detection. 802.11n The receiver will treat the packet as an 802.11a packet (L-SIG spoofing).

Some additional details on the aggregation bits in the VHT-SIG for MU packets are given below. It may not be necessary to indicate the duration of the packet in the VHT-SIG again. For example, the length information can be obtained from the L-SIG field. The aggregated MAC protocol data unit (A-MPDU) structure can be used to provide length information to each MPDU. It may be required: A-MPDU is always used with VHT frames. The MAC layer can provide A-MPDUs to each user stream. The AMPDU pads the frame to the last byte, and the PHY layer provides 0-7 bits of padding. This same filling scheme can also be defined in the SU group. Therefore, the "aggregation" bit may not be needed in the VHT-SIG.

In the case of MU, the VHT-SIG-A field may include "common" bits for all clients. For example, the VHT-SIG-A field may indicate the number of space-time streams (NSTS) for each user. It should be noted that before using DL-MU grouping, it may be necessary to perform multi-user group and user identification (ID) allocation frame exchange in advance (for example, through detection and/or via management frames). Therefore, each user may be able to get his own NSTS information from the VHT-SIG-A field.

The VHT-SIG-B field contains user-specific information (for example, modulation and coding rate), and can be spatially multiplexed for different clients. The VHT-SIG-B field is set after all VHT-LTFs so as to achieve better receiver-side interference suppression in the DL-MU before decoding the VHT-SIG-B. This requires each client to get as many LTFs as needed to train the total number of spatial streams on all users-called "resolvable VHT-LTF". If all clients do not support receiver-side interference suppression or if interference suppression is not required, you can select "Unresolvable VHT-LTF".

Considerations for the VHT-SIG field include: bandwidth, short GI, group identification (ID) field, MCS, space-time block coding (STBC), detection, smoothing, coding type, cyclic redundancy check (CRC), and tail .

Various configurations will now be described around the drawings, where the same reference numbers may indicate functionally similar elements. The systems and methods generally described and illustrated in the drawings herein can be arranged and designed in a variety of different configurations. Therefore, the following more detailed description of various configurations, as shown in the drawings, is not intended to limit the scope of protection of the claims, but is merely representative of the system and method.

1 is a diagram depicting a configuration of a transmitting communication device 102 (in which a system and method for allocating tones for frames can be implemented) and a configuration of a receiving communication device 142 (wherein, a configuration for receiving tones for frames can be implemented) System and method) block diagram. The transmitting communication device 102 may include an encoder 106 having an input for receiving payload data 104 and/or preamble data 116 to be transmitted to one or more receiving communication devices 142. The payload data 104 may include voice, video, audio, and/or other data. The preamble data 116 may include control information, such as information that specifies a data rate, modulation and coding scheme (MCS), channel bandwidth, and the like. The encoder 106 may encode the data 104, 116 for forward error correction (FEC), encryption, packetization, and/or other known encodings used in the case of wireless transmission.

The constellation mapper 110 maps the data provided by the encoder 106 to the constellation. For example, the constellation mapper 110 may use a modulation scheme, such as: two-phase phase shift keying (BPSK), quadrature amplitude modulation (QAM), and so on. In the case of quadrature amplitude modulation (QAM), for example, the constellation mapper 110 may provide two bits per spatial stream 138, per data subcarrier 140, and per symbol period. In addition, for each spatial stream 138, each data subcarrier 140, and each symbol period, the constellation mapper 110 can output a 16-QAM constellation signal. Other modulations can be used, such as 64-QAM, which will result in a consumption of 6 bits per spatial stream 138, per data subcarrier 140, and per symbol period. Other variants are also possible.

The output of the constellation mapper 110 is provided to a space-time-frequency mapper 108, which maps the data to the

space-time-frequency (STF) dimension of the transmitter. Dimensions represent various structures or resources that allow data to be allocated. A given bit or set of bits (for example, a set of bits corresponding to a constellation point, a set of bits, etc.) can be mapped to a specific position in the dimension. Generally, the bits and/or signals mapped to different positions in the dimension are transmitted from the transmitting communication device 102, so that they are expected to be distinguishable at one or more receiving communication devices 142 with a certain probability. In one configuration, the space-time-frequency mapper 106 may perform space-time block coding (STBC).

One or more spatial streams 138 may be transmitted from the transmitting communication device 102 so that transmissions on different spatial streams 138 can be distinguished (with a certain probability) at the receiver. For example, bits mapped to a spatial dimension are transmitted as a spatial stream 138. This spatial stream 138 may be transmitted on its own antenna 132 spatially separated from other antennas 132, its own orthogonal superposition on a plurality of spatially separated antennas 132, its own polarization, and the like. Many techniques for separation of the spatial stream 138 (e.g., including spatial separation of the antenna 132, or other techniques that would allow its signal to be distinguished at the receiver) are known and available.

In the example shown in Figure 1, there are one or more spatial streams 138 transmitted using the same or different numbers (e.g., one or more) of antennas 132a-n. In some instances, because one or more other spatial streams 138 are inactive, only one spatial stream 138 may be available.

In the case where the transmitting communication device 102 uses multiple frequency subcarriers 140, there are multiple values for the frequency dimension, so that the space-time-frequency mapper 106 can map some bits to one frequency subcarrier 140 and map other bits Mapping to another frequency sub-carrier 140. Other frequency subcarriers 140 may be reserved as guard bands, pilot tone subcarriers, or the like that do not (or do not always) carry data 104, 106. For example, one or more data sub-carriers 140 and one or more pilot sub-carriers 140 may exist. It should be noted that in some examples or configurations, not all sub-carriers 140 can be excited immediately. For example, some tones may not be excited to enable filtering. In one configuration, the transmitting communication device 102 may use Orthogonal Frequency Division Multiplexing (OFDM) for transmission of multiple subcarriers 140. For example, depending on the multiplexing scheme used, the space-time-frequency mapper 108 can map (encode) the data 104, 116 to space, time, and/or frequency resources.

The time dimension refers to the symbol period. Different bits can be allocated to different symbol periods. When there are multiple spatial streams 138, multiple subcarriers 140, and multiple symbol periods, the transmission for one symbol period can be called "OFDM (Orthogonal Frequency Division Multiplexing) MIMO (Multiple Input, Multiple Output) symbol". The number of bits per symbol (for example, log2 of the number of constellations used) is multiplied by the number of spatial streams 138, multiplied by the number of data subcarriers 140, and divided by the length of the symbol period to determine the number of encoded data. Transmission rate.

Therefore, the space-time-frequency mapper 108 can map bits (or other units of input data) to one or more spatial streams 138, data subcarriers 140, and/or symbol periods. A separate path can be used to generate and/or launch a separate spatial stream 138. In some embodiments, these paths are implemented with unique hardware, but in other embodiments, the path hardware is reused for more than one spatial stream 138, or the path logic is executed for one or more spatial streams 138 Implemented in software. More specifically, each of the elements shown in the transmitting communication device 102 may be implemented as a single block/module or as multiple blocks/modules. For example, the transmitter radio frequency block 126 element may be implemented as a single block/module or as multiple parallel blocks/modules corresponding to each antenna 132a-n (e.g., each spatial stream 138). As used herein, the term "block/module" and its variants may refer to specific elements or components that can be implemented by hardware, software, or a combination of both.

The transmitting communication device 102 may include a pilot generator block/module 130. The pilot generator block/module 130 can generate pilot sequences. The pilot sequence can be a set of pilot symbols. In one configuration, for example, the value in the pilot sequence can be represented by a signal having a specific phase, amplitude, and/or frequency. For example, "1" may indicate a pilot symbol with a specific phase and/or amplitude, and "-1" may indicate a pilot symbol with a different (eg, opposite or reverse) phase and/or amplitude.

In some configurations, the transmitting communication device 102 may include a pseudo-random noise generator 128. The pseudo-random noise generator 128 may generate a pseudo-random noise sequence or signal (for example, a numerical value) for scrambling the pilot sequence. For example, the pilot sequence for consecutive OFDM symbols can be multiplied with consecutive numbers from the pseudo-random noise sequence, thereby scrambling the pilot sequence of each OFDM symbol. When sending the pilot sequence to the receiving communication device 142, the received pilot sequence may be unscrambled by the pilot processor 148.

The output of the space-time-frequency mapper 106 may be distributed in frequency and/or spatial dimensions. The pilot

insertion block/module 112 inserts pilot tones into the pilot tone subcarrier 140. For example, the pilot sequence may be mapped to the subcarrier 140 at a specific index 114. For example, pilot symbols from the pilot sequence may be mapped to sub-carriers 140, which are interspersed with data sub-carriers 140 and/or other sub-carriers 140. In other words, the pilot sequence or signal can be combined with the data sequence or signal. In some configurations, one or more direct current (DC) tones can be concentrated at index 0.

In some configurations, the combined data and pilot signal can be provided to the rotating block/module (not shown in Figure 1). The rotation block/module can use rotation or multiplication factors to rotate the pilot symbols and/or data symbols. For example, the rotating block/module can rotate the VHT-SIG-A2 symbol to provide automatic VHT detection.

The transmitting communication device 102 may include a bandwidth determination block/module 116. The bandwidth determination block/module 116 may determine the channel bandwidth to be used for transmission to one or more receiving communication devices 142. This determination may be based on one or more factors, such as: receiving communication device 142 compatibility, the number of receiving communication devices 142 (using communication channels), channel quality (e.g., channel noise), and/or received indicators. In one configuration, the bandwidth determination block/module 116 may determine whether the bandwidth used for channel transmission is 20 MHz, 40 MHz, 80 MHz, or 160 MHz.

The bandwidth determination block/module 116 may provide an indication of the bandwidth determination to one or more blocks/modules. For example, the bandwidth indication may be provided to the space-time-frequency mapper 108, the pilot insertion block/module 112, and/or the pilot generator 130. Additionally or alternatively, a bandwidth indication may be provided as part of the preamble data 116. For example, one or more bits in the preamble data 116 may be allocated to indicate the bandwidth indication. Additionally or alternatively, the bandwidth indication may be implicitly indicated in the preamble data 116. Thus, the bandwidth indication can be signaled to one or more receiving communication devices 142. This may enable one or more receiving communication devices 142 to receive the preamble data 116 using the selected channel bandwidth.

The space-time-frequency mapper 108 may use the bandwidth indication to map the preamble data 116 to multiple tones (e.g., sub-carrier 140). For example, the system and method disclosed herein may define multiple OFDM tones or subcarriers 140, and the transmitting communication device 102 may use the multiple OFDM tones or subcarriers 140 based on the channel bandwidth (e.g., as specified by the bandwidth indicator), Used for the transmission of preamble data 116. It is also possible to specify multiple OFDM tones based on a specific preamble field. For example, based on the bandwidth determination and preamble field indicated in Table (1) above, the space-time-frequency mapper 108 can map the preamble data 116 to multiple OFDM tones. For example, if the current field is VHT-SIG-B and the bandwidth indication specifies a bandwidth of 80 MHz, the space-time-frequency mapper 108 can map the preamble data 116 to 234 OFDM tones or sub-carriers 140, leaving the rest for pilot 8 OFDM tones, and three subcarriers 140 as DC tones. In some configurations, the space-time-frequency mapper 108 may use a look-up table to determine the multiple tones or subcarriers to use for the specified bandwidth.

More specifically, if the determined bandwidth is 20 MHz, the transmitting communication device 102 may allocate 12 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, and The VHT-SIG-A1 field or symbol is allocated 52 OFDM tones, the VHT-SIG-A2 field or symbol is allocated 52 OFDM tones, the VHT-STF is allocated 12 OFDM tones, and the VHT-LTF is allocated to one or more VHT-LTF (for example, Each of the VHT-LTF) is allocated 56 OFDM tones, 56 OFDM tones are allocated for the VHT-SIG-B field, and/or 56 OFDM tones are allocated for the DATA field. If the determined bandwidth is 40MHz, the transmitting communication device 102 can allocate 24 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for L-SIG field, and for VHT-SIG- A1 field or symbol is allocated 104 OFDM tones, VHT-SIG-A2 field or symbol is allocated 104 OFDM tones, VHT-STF is allocated 24 OFDM tones, one or more VHT-LTF is allocated 114 OFDM tones, The VHT-SIG-B field is allocated 114 OFDM tones, and/or 114 OFDM tones are allocated to the DATA field. If the bandwidth is 80MHz, the transmitting communication device 102 can allocate 48 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for L-SIG field, VHT-SIG-A1 field, or Symbol allocation 208 OFDM tones, VHT-SIG-A2 field or symbol allocation 208 OFDM tones, VHT-STF allocation 48 OFDM tones, one or more VHT-LTF allocation 242 OFDM tones, for VHT-SIG -The B field allocates 242 OFDM tones, and/or allocates 242 OFDM tones for the DATA field. If the bandwidth is 160MHz, the transmitting communication device 102 can allocate 48 OFDM tones for L-STF, 416 OFDM tones for L-LTF, 416 OFDM tones for L-SIG field, or VHT-SIG-A1 field or 416 OFDM tones for symbol allocation, 416 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 484 OFDM tones for one or more VHT-LTF, and VHT-SIG -B field or symbol allocates 484 OFDM tones, and/or allocates 484 OFDM tones for the DATA field.

In some configurations, the bandwidth indication may also be provided to the pilot generator 130. The pilot generator 130 can use the bandwidth indicator to generate an appropriate number of pilot symbols. For example, the pilot generator 130 can generate 8 pilot symbols (with 242 OFDM tones: 234 data tones and 8 pilot tones, and 3 DC subcarriers 140) for an 80 MHz signal.

In some configurations, the bandwidth indication may additionally be provided to the pilot insertion block/module 112. The pilot insertion block/module 112 can use this indication to determine the subcarrier index 114 for pilot symbol insertion. For example, 80MHz bandwidth may indicate that pilot symbols should be inserted at indexes -103, -75, -39, -11, 11, 39, 75, and 103.

The inverse discrete Fourier transform (IDFT) block/module 120 is provided with data and/or pilot signals. The inverse discrete Fourier transform (IDFT) block/module 120 converts the frequency signals of the data 104, 116, and inserts pilot tones into the time domain signal, which represents the signal on the spatial stream 138 and/or the target Time domain sampling of the symbol period. In one configuration, for example, the IDFT block/module 120 may perform a 256-point inverse fast Fourier transform (IFFT).

The formatter 122 is provided with a time domain signal. The formatter (for example, one or more formatting blocks/modules) 122 can obtain the output of the inverse discrete Fourier transform (IDFT) block/module 120, convert it from a parallel signal to a serial (P/S), and add Cyclic prefix and/or perform guard interval windowing (guard interval windowing), etc.

The formatter 122 output may be provided to a digital-to-analog converter (DAC) 124. A digital-to-analog converter (DAC) 124 can convert the formatter 122 output from one or more digital signals to one or more analog signals. A digital-to-analog converter (DAC) 124 may provide an analog signal to one or more transmitter radio frequency (TX RF) blocks 126.

One or more transmitter radio frequency blocks 126 may be coupled to or include power amplifiers. The power amplifier can amplify analog signals for transmission. One or more transmitter radio frequency blocks 126 can output radio frequency (RF) signals to one or more antennas 132a-n, thereby transmitting the data 104, 116 input to the encoder 106 through a wireless medium, which is suitably configured to be Or multiple receiving communication devices 142 receive.

One or more receiving communication devices 142 may receive and use signals from the transmitting communication device 102. For example, the receiving communication device 142 may use the received bandwidth indicator to receive a given number of OFDM tones or subcarriers 140. Additionally or alternatively, the receiving communication device 142 may use the pilot sequence generated by the transmitting communication device 102 to describe the characteristics of the channel, the transmitter failure and/or the receiver failure, and use this feature to improve the coding performance during transmission. Reception of data 104 and 116.

For example, the receiving communication device 142 may include one or more antennas 136a-n provided to one or more receiver radio frequency (RXRF) blocks 158 (which may be greater than, less than or equal to the number of antennas 132a-n of the transmitting communication device 102 and / Or the number of spatial streams 138). One or more receiver radio frequency (RX RF) blocks 158 may output analog signals to one or more analog-to-digital converters (ADC) 156. For example, the receiver radio frequency block 158 may receive and down-convert the signal, which may be provided to the analog-to-digital converter 156. As with the transmitting communication device 102, the number of spatial streams 138 processed may or may not be equal to the number of antennas 136a-n. In addition, each spatial stream 138 does not need to be limited to one antenna 136, because various techniques such as beamsteering and orthogonalization can be used to reach multiple receiver streams.

One or more analog-to-digital converters (ADC) 156 can convert the received analog signal into one or more digital signals. These outputs of the one or more analog-to-digital converters (ADC) 156 may be provided to one or more time and/or frequency synchronization blocks/modules 154. The time and/or frequency synchronization block/module 154 may (try to) synchronize or align the digital signals in time and/or frequency (e.g., receiving communication device 142 clock).

The (synchronized) output of the time and/or frequency synchronization block/module 154 may be provided to one or more formatters 152. For example, the formatter 152 may receive the output of the time and/or frequency synchronization block/module 154, remove prefixes, etc., and/or parallelize the data for discrete Fourier transform (DFT) processing.

The output of one or more formatters 152 may be provided to one or more discrete Fourier transform (DFT) blocks/modules 150. The Discrete Fourier Transform (DFT) block/module 150 can convert one or more signals from the time domain to the frequency domain. The pilot processor 148 may use the frequency domain signal (for example, of each spatial stream 138) to determine the signal transmitted by the transmitting communication device 102 (for example, the spatial stream 138, the frequency subcarrier 140, and/or a set of symbol periods). ) One or more pilot tones. The pilot processor 148 may additionally or alternatively de-scramble the pilot sequence. The pilot processor 148 may use one or more pilot sequences described herein to perform phase and/or frequency and/or amplitude tracking. The pilot tones can be provided to the space-time-frequency detection and/or decoding block/module 146, and the space-time-frequency detection and/or decoding block/module 146 can detect and/or detect data in various dimensions. decoding. The space-time-frequency detection and/or decoding block/module 146 may output the received data 144 (for example, an estimate of the payload data 104 and/or preamble data 116 transmitted by the transmitting communication device 102 by the receiving communication device 142).

In some configurations, the receiving communication device 142 knows that the transmission sequence is sent as part of the overall information sequence. The receiving communication device 142 can implement channel estimation with the help of these known transmission sequences. To assist pilot tone tracking, processing, and/or data detection and decoding, the channel estimation block/module 160 may be based on the output from the time and/or frequency synchronization block/module 154, the pilot processor 148 and/or space-time- The frequency detection and/or decoding block/module 146 provides the estimated signal. Optionally, for a known transmission sequence, if the de-formatting and discrete Fourier transform are the same as the payload data part of the total information sequence, it can be based on the discrete Fourier transform (DFT) block/ The output of the module 150 provides the estimated signal to the pilot processor 148 and/or the space-time-frequency detection and/or decoding block/module 146.

The bandwidth determination block/module 134 may use the output of the time/frequency synchronization block/module 154 to determine the channel bandwidth (used for receiving communications). For example, the bandwidth determination block/module 134 may receive a bandwidth indication from the transmitting communication device 102 for indicating the channel bandwidth. For example, the bandwidth determination block/module 134 can obtain an explicit or implicit bandwidth indication. In one configuration, the bandwidth indication may indicate a channel bandwidth of 20MHz, 40MHz, 80MHz, or 160MHz. The bandwidth determination block/module 134 may determine a bandwidth for receiving communications based on the indication, and the pilot frequency processor 148 and/or the space-time-frequency detection/decoding block/module 146 may provide an indication of the determined bandwidth.

More specifically, if the determined bandwidth is 20MHz, the receiving communication device 142 can receive 12 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, 52 OFDM tones for VHT-SIG-A1 fields or symbols, 52 OFDM tones for VHT-SIG-A2 fields or symbols, 12 OFDM tones for VHT-STF, 56 for one or more VHT-LTF OFDM tones, 56 OFDM tones for the VHT-SIG-B field, and/or 56 OFDM tones for the DATA field. If the bandwidth is determined to be 40MHz, the receiving communication device 142 can receive 24 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for L-SIG field, and for VHT-SIG-A1 104 OFDM tones for fields or symbols, 104 OFDM tones for VHT-SIG-A2 fields or symbols, 24 OFDM tones for VHT-STF, 114 OFDM tones for one or more VHT-LTF, for VHT -114 OFDM tones for the SIG-B field, and/or 114 OFDM tones for the DATA field. If the bandwidth is 80MHz, the receiving communication device 142 can receive 48 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for L-SIG field, and VHT-SIG-A1 field. Or symbol 208 OFDM tones, 208 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 242 OFDM tones for one or more VHT-LTF, for VHT- 242 OFDM tones for the SIG-B field, and/or 242 OFDM tones for the DATA field. If the bandwidth is 160MHz, the receiving communication device 142 can receive 48 OFDM tones for L-STF, 416 OFDM tones for L-LTF, 416 OFDM tones for L-SIG field, and for VHT-SIG-A1 field. 416 OFDM tones for or symbols, 416 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 484 OFDM tones for one or more VHT-LTF, for VHT- 484 OFDM tones for the SIG-B field, and/or 484 OFDM tones for the DATA field.

The pilot processor 148 may use the determined bandwidth indication to extract pilot symbols from the discrete Fourier transform block/module 150 output. For example, if the determined bandwidth indication specifies that the bandwidth is 80 MHz, the pilot processor 148 may extract pilot symbols from indexes -103, -75, -39, -11, 11, 39, 75, and 103.

The space-time frequency detection/decoding block/module 146 may use the determined bandwidth indication to detect and/or decode the preamble data and/or payload data from the received signal. For example, if the current field is the VHT-SIG-B field and the determined bandwidth indication specifies that the bandwidth is 80 MHz, the space-time frequency detection/decoding block/module 146 can perform the preamble from 234 OFDM tones or subcarriers 140 The data is detected and/or decoded (eg, 8 OFDM tones are pilot tones and three subcarriers 140 are used for DC tones). In some configurations, the space-time-frequency detection/decoding block/module 146 may use a look-up table to determine the number of tones or subcarriers to receive for a specified bandwidth.

Figure 2 is a diagram depicting an example of a communication frame 200 that can be used according to the system and method disclosed herein. The frame 200 may include one or more portions or fields of preamble symbols, pilot symbols, and/or data symbols. For example, the frame 200 may include an 802.11ac preamble 260 and a data field 282 (e.g., DATA or VHT-DATA field). In one configuration, the 802.11ac preamble 260 may have a duration of 40 to 68 s. (For example, the receiving communication device 142) may use the preamble 260 and/or pilot symbols to synchronize, detect, demodulate, and/or decode the preamble 116 and/or payload data 104 included in the frame 200.

The frame 200 with the 802.11ac preamble 260 may be constructed to include multiple fields. In one configuration, the 802.11ac frame 200 may include a traditional short training field or a non-high throughput short training field (L-STF) 266, a traditional long training field or a non-high throughput long training field (L-LTF) 268. Traditional signal field or non-high throughput signal field (L-SIG) 270, very high throughput signal symbol or field A1 (VHT-SIG-A1) 272, very high throughput signal symbol or field A2

(VHT- SIG-A2) 274, Very High Throughput Short Training Field (VHT-STF) 276, One or more Very High Throughput Long Training Fields (VHT-LTF) 278, Very High Throughput Signal Field B (VHT-SIG- B) 280, and the data field (DATA) 282.

802.11 The ac preamble 260 may support transmit beamforming and SDMA. The first part or part 262 of the preamble 260 may be transmitted in an omnidirectional manner (for example, using cyclic diversity or another scheme). This first part 262 of the preamble 260 may include L-STF 266, L-LTF 268, L-SIG 270, VHT-SIG-A1272, and VHT-SIG-A2274. The first part 262 of the preamble 260 can be decoded by a conventional device (for example, a device that conforms to a conventional or earlier specification).

The second part or part 264 of the 802.11ac preamble 260 may be transmitted in an omnidirectional manner (which may be beamforming or may be SDMA precoding). This second part 264 of the preamble 260 includes: VHT-STF 276, one or more VHT-LTFs 278, and VHT-SIG-B 280. The data symbols (e.g., in the data field 282) can be transmitted using the same antenna pattern as the second part 264 of the preamble 260. The data field 282 may also be transmitted omnidirectionally (which may be beamformed or may be SDMA precoded). The data symbol and the second part 264 of the preamble 260 may not be decoded by traditional devices (even all 802.11ac devices).

802.11 The ac preamble 260 may include some control data that can be decoded by traditional 802.11a and 802.11n receivers. The control data is contained in L-SIG 270. The data in L-SIG 270 informs all receivers that the transmission will occupy the time of the wireless medium, so that all devices can delay their transmission for a precise amount of time. In addition, the 802.11ac preamble 260 allows the 802.11ac device to recognize the transmission as an 802.11ac transmission (and avoid determining that the transmission is in 802.11a or 802.11n format). In addition, the 802.11ac preamble described in the system and method of this article can enable traditional 802.11a and 802.11n devices to detect the transmission as an 802.11a transmission. The 802.11a transmission is valid with valid data in L-SIG 270 transmission.

According to the system and method disclosed herein, the number of data and pilot tones for 80MHz 802.11ac signals can be defined. This can be compared with the number of data and pilot tones for 20MHz 802.11n and 40MHz 802.11n signals. 20The MHz 802.11n signal uses 56 tones (52 data, 4 pilots), one of which is a direct current (DC) tone. 40The MHz 802.11n signal uses 114 tones (108 data, 6 pilots), of which 3 are DC tones. The system and method disclosed in this document depict 242 tones (for example, 234 data tones and 8 pilot tones) used for 80MHz 802.11ac signals, of which 3 are DC tones. Exquisite frequency interleaver structure and reasonable cost filtering requirements can prompt the use of 234 data tones according to the system and method of this paper. It can also be noted that the 802.11a signal uses 52 tones (48 data tones and 4 pilot tones), one of which is a DC tone.

The 802.11ac preamble 260 described according to the system and method herein may include two parts or parts. The first part 262 may be transmitted omnidirectionally (for example, using cyclic delay diversity), and the second part 264 may be transmitted omnidirectionally (using beamforming or using SDMA precoding). The first three fields of the first or omnidirectional part 262 (for example, L-STF 266, L-LTF 268, and L-SIG 270) may contain signals that can be decoded by 802.11a and 802.11n receivers. In addition, traditional 802.11a and 802.11n devices can determine that the 802.11ac transmission is an 802.11a transmission, so that these traditional devices decode the L-SIG 270 as if it were an 802.11a transmission.

The system and method disclosed herein can provide an appropriate number of tones to each preamble 260 field and/or data field 282 that meets the constraints. This tone distribution is shown in Table (3). More specifically, Table (3) shows the number of OFDM tones that can be used for 802.11ac transmission for various signal bandwidths.

table 3)

[image]

L-STF 266 can use a signal with 12 tones per 20MHz. In this case, the time domain signal may have a repetition interval of 800 nanoseconds (ns). This repetition interval can be used for fast gain control, time offset estimation, and frequency offset estimation. The received signal strength can be measured quickly, because for an 800ns interval, only the time domain signal needs to be considered. Traditional 802.11a and 802.11n devices will expect 12 tones.

L-LTF 268 and L-SIG 270 can use 52 tones for 20MHz signals. This may be expected for 802.11a transmission through any traditional 802.11a or 802.11n device. When sending a 40MHz 802.11ac signal, the contents of these fields 268 and 270 can be copied (and adjusted with complex numbers) to each 20MHz subband of the 40MHz signal. That is, the L-SIG field 270 can be used for two 20 MHz subbands with DC tones that are accurately separated by 20 MHz. Therefore, the total number of tones just doubled. For 80MHz and 160MHz, the same design can be followed, and the fields can be adjusted and copied to each of 4 or 8 20MHz subbands.

According to the 802.11a specification, L-SIG 270 can use 48 data tones and 4 pilots. For 40MHz, 80MHz, and 160MHz 802.11ac transmission, 24-bit data carried by L-SIG (for example, using two-phase phase shift keying (BPSK) and 1/2 coding rate) can be in each of the 20MHz subbands emission. This allows any conventional device that only receives on a single 20MHz channel to decode the data in the L-SIG 270 and delay it appropriately.

The VHT-SIG-A1 symbol or field 272 and the VHT-SIG-A2 symbol or field 274 can use 52 tones (48 data tones and 4 pilot tones) in 20 MHz. The number of data tones can be the same as L-SIG 270, because channel estimation can be completed for these data tones (the channel estimation is based on L-LTF 268). For 40MHz, 80MHz, and 160MHz bandwidths, for the same reason, the number of data tones and pilot tones can follow L-LTF 268.

Like L-STF 266, VHT-STF 276 can use signals with 12 tones per 20 MHz. In this way, the receive gain control algorithm can quickly measure the received signal strength using a period of only 800ns. If more tones are used, the receiver may need to wait a longer period of time for accurate signal strength measurements, thereby setting constraints on the allotted time so that the analog reception gain changes and stabilizes to their new value. Gain control may be required because the strength of the received signal may be different for the second part 264 of the preamble 260 (and the data field 282) compared to the first part 262 of the preamble 260. In addition, VHT-STF 276 can be used to update the timing and frequency offset.

Compared with the first or omnidirectional part 262 of the preamble 260, one or more of the VHT-LTF 278, VHT-SIG-B field 280, and DATA field 282 can use more OFDM tones. Therefore, each of these fields 278, 280 can use the same number of tones as the DATA field 282. For 20MHz and 40MHz 802.11ac transmission, the number of tones can be selected to match the 802.11n standard. For 80MHz and 160MHz 802.11ac transmission, the number of tones can be selected as 242 and 484 respectively.

For 20MHz 802.11ac transmission, for example, if BPSK and 1/2 rate coding are used, the VHT-SIG-B field 280 carries 26 bits of data. For 40MHz 802.11ac transmission, the VHT-SIG-B field 280 can carry 54 bits of unique data or the same 27 bits of data in each 20MHz subband. The 80 MHz transmission of the VHT-SIG-B field 280 can carry 29 bits of data in each 20 MHz subband, or 58 bits of data, or 117 bits of data in each 40 MHz subband. For 160MHz transmission, a similar choice can be made. Therefore, when the bandwidth increases from 20MHz to 40MHz to 80MHz, VHT-SIG-B 280 can carry more information bits.

For signal additional capabilities, additional bits for wider bandwidth signals can be used, which is possible when using signal bandwidths exceeding 20 MHz. For example, an 80MHz signal can include four independent 20MHz signals (streams), where each 20MHz signal can carry a different coded data stream. Each of these streams can have a different modulation and coding (for example, using a different modulation and coding scheme (MCS)). Each stream can additionally have a different number of bytes. In addition, each stream can have a different number of packet aggregations, for example, 802.11n type aggregated media access control (MAC) protocol data unit (A-MPDU) or polymer physical layer convergence process (PLCP) protocol data unit (PPDU). For example, each PPDU carries its own VHT-SIG-B field 280. All these features can be signaled and indicated by the 280 bits of the VHT-SIG-B field carried in the corresponding 20MHz stream.

FIG. 3 is a diagram depicting an example of a plurality of frames 300. Specifically, FIG. 3 depicts an 802.11a preamble 384, an 802.11n Greenfield (GF) preamble 394, an 802.11n mixed mode (MM) preamble 325, and an 802.11ac preamble 360 according to the system and method disclosed herein. More specifically, the traditional 802.11a preamble 384, the traditional 802.11n Greenfield preamble 394, and the traditional 802.11n mixed mode preamble 325 are depicted. The illustrated 802.11a preamble 384 may have a duration of 20 s. The 802.11n Greenfield preamble 394 shown may have a duration of 28 to 36 μs. The illustrated 802.11n mixed mode (MM) preamble 325 may have a duration of 36 to 48 μs. According to the system and method disclosed herein, the shown 802.11ac preamble 360 may have a duration of 40 to 68 s.

802.11 The ac preamble 360 can support transmit beamforming and SDMA. The first part or part 362 of the preamble 360 may be transmitted in an omnidirectional manner (for example, using cyclic diversity or another scheme). The first part 362 of the preamble 360 may include L-STF 366, L-LTF 368, L-SIG 370, VHT-SIG-A1372, and VHT-SIG-A2374. The first part 362 of the preamble 360 can be decoded by conventional equipment (for example, equipment that conforms to conventional or earlier specifications).

The second part or part 364 of the 802.11ac preamble 360 may be transmitted in an omnidirectional manner (which may be beamforming or may be SDMA precoding). The second part 364 of the preamble 360 includes: VHT-STF 376, one or more VHT-LTFs 378, and VHT-SIG-B 380. The data symbols (e.g., in the data field 382) can be transmitted using the same antenna pattern as the second part 364 of the preamble 360. The data field 382 may also be transmitted omnidirectionally (which may be beamformed or may be SDMA precoded). The data symbol and the second part 364 of the preamble 360 may not be decoded by traditional devices (even all 802.11ac devices).

802.11 The ac preamble 360 may include some control data that can be decoded by traditional 802.11a and 802.11n receivers. The control data is included in L-SIG 370. The data in L-SIG 370 informs all receivers that the transmission will occupy the time of the wireless medium, so that all devices can delay their transmission for a precise amount of time. In addition, the 802.11ac preamble 360 allows 802.11ac devices to recognize the transmission as an 802.11ac transmission (and avoid determining that the transmission is in 802.11a or 802.11n format). In addition, the 802.11ac preamble 360 described in the system and method of this article can make the traditional 802.11a and 802.11n devices believe that the transmission is an 802.11a transmission, and the 802.11a transmission is valid with valid data in L-SIG 370. transmission.

The traditional 802.11a preamble 384 includes L-STF 386, L-LTF 388, and L-SIG 390, which can be transmitted together with the data field 392. 802.11n Greenfield (GF) preamble 394 includes high throughput short training field (HT-STF) 396, high throughput long training field 1 (HT-LTF1) 398, high throughput signal 1 (HT-SIG-1) 301. The high throughput signal 2 (HT-SIG-2) 303 and one or more high throughput long training fields (HT-LTF) 305 may be transmitted together with the data field 307. 802.11n Mixed mode (MM) preamble 325 includes L-STF 309, L-LTF 311, L-SIG 313, HT-SIG-1315, HT-SIG-2317, high throughput short training field (HT-STF) 319, And one or more HT-LTF 321, which can be transmitted together with the data field 323. As can be seen from FIG. 3, some of the fields included in the 802.11ac preamble 360 correspond to similar fields in the traditional preambles 384, 325. In this way, when the 802.11ac preamble 360 is used, backward compatibility with legacy devices can be allowed.

Figure 4 depicts the traditional signal field (L-SIG) 470, the very high throughput signal A1 (VHT-SIG-A1) 472 (for example, the first symbol), and the very high throughput signal A2 (VHT-SIG-A2). ) A constellation diagram of 474 (for example, the second symbol). Each constellation is depicted on the in-phase (I) axis and the quadrature (Q) axis. More specifically, FIG. 4 depicts an example of a modulation scheme that can be used for the first and second symbols in the VHT-SIG-A field and the L-SIG field according to the system and method disclosed herein.

The transmitting communication device 102 may use BPSK modulation with 1/2 rate coding for the L-SIG field 470 in the 802.11ac frame 200. In this scheme, the modulation symbol at +1 on the in-phase axis can be used to represent the bit with the value "1". In addition, the modulation symbol at -1 on the in-phase axis can be used to represent the bit with the value "0".

According to the system and method disclosed herein, the transmitting communication device 102 can use BPSK modulation with 1/2 rate coding for the VHT-SIG-A1472 in the 802.11ac frame 200. In this scheme, the modulation symbol at +1 on the in-phase axis can be used to represent the bit with the value "1". In addition, the modulation symbol at -1 on the in-phase axis can be used to represent the bit with the value "0".

According to the system and method disclosed herein, the transmitting communication device 102 can use QBPSK modulation with 1/2 rate coding for the VHT-SIG-A2474 in the 802.11ac frame 200 (for example, BPSK modulation with 90 degree rotation). In this scheme, the modulation symbol at +1 on the orthogonal axis can be used to represent the bit with the value "1". In addition, the modulation symbol at -1 on the orthogonal axis can be used to represent the bit with the value "0".

Figure 5 is a diagram depicting an example of data and pilot tones for an 80 MHz signal 543 according to the system and method disclosed herein. The data and pilot tones for the 20 MHz 802.11n signal 527 and the data and pilot tones for the 40 MHz 802.11n signal 535 are also depicted. According to the system and method disclosed herein, the number of data tones and pilot tones 545a-h for 80MHz 802.11ac signal 543 can be defined. This can be compared with the number of data tones and pilot tones 529a-d of the 20MHz 802.11n signal 527, and the number of data tones and pilot tones 537a-f of the 40MHz 802.11n signal 535.

20 The MHz 802.11n signal 527 uses 56 tones, including 52 data tones and 4 pilot tones 529a-d, and a direct current (DC) tone 531. The data tones and pilot tones 529a-d can be located based on the subcarrier number or index 533. For example, pilot A 529a is located at -21, pilot B 529b is located at -7, pilot C 529c is located at 7, and pilot D 529d is located at 21. In this case, the single DC tone 531 is at zero.

40 The MHz 802.11n signal 535 uses 114 tones, including 108 data tones, 6 pilot tones 537a-f, and 3 direct current (DC) tones 539. The data tones and pilot tones 537a-f can be located based on the subcarrier number or index 541. For example, pilot A 537a is located at -53, pilot B 537b is located at -25, pilot C 537c is located at -11, pilot D 537d is located at 11, pilot E 537e is located at 25, and pilot F 537f is located at 53. In this case, the 3 DC tones 539 are located at -1, 0, and 1.

The system and method disclosed herein depict 242 tones used for the 80MHz 802.11ac signal 543, including 234 data tones and 8 pilot tones 545a-h, and 3 DC tones 547. The data tones and pilot tones 545a-h can be located according to the subcarrier number or index 549. For example, pilot A 545a is at -103, pilot B 545b is at -75, pilot C 545c is at -39, pilot D 545d is at -11, pilot E 545e is at 11, pilot F 537f is at 39, pilot G 545g is located at 75, and pilot H 545h is located at 103. In this case, the 3 DC

tones 547 are located at -1, 0, and 1. The use of 234 data tones according to the system and method of this paper can be promoted through the delicate frequency interleaver structure and reasonable cost filtering requirements. For example, when the transmitting communication device 102 determines a channel bandwidth of 80 MHz, 102 may allocate subcarriers 140 for data tones and pilot tones 545a-h according to the 802.11ac signal 543 shown in FIG. In addition, for example, when the receiving communication device 142 determines a channel bandwidth of 80 MHz, 142 may receive subcarriers 140 for data and pilot tones 545a-h according to the 802.11ac signal 543 shown in FIG. 5. It can be noted that the 802.11a signal (not shown in Figure 5) uses 52 tones (for example, 48 data tones and 4 pilot tones) and one DC tone.

Figure 6 is a flowchart depicting one configuration of a method 600 for assigning tones to frames. The transmitting communication device 102 may determine 602 whether the bandwidth used for signal transmission is 20 MHz, 40 MHz, 80 MHz, or 160 MHz. The determination 602 may be based on one or more factors, such as: receiving communication device 142 compatibility, the number of receiving communication devices 142 (using a communication channel), channel quality (for example, channel noise), and/or received indicator Wait.

If it has been determined that the bandwidth of 602 is 20MHz, the transmitting communication device 102 can allocate 60412 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, and for VHT-SIG -A1 field or symbol is assigned 52 OFDM tones, VHT-SIG-A2 field or symbol is assigned 52 OFDM tones, VHT-STF is assigned 12 OFDM tones, one or more VHT-LTF is assigned 56 OFDM tones, 56 OFDM tones are allocated for the VHT-SIG-B field, and/or 56 OFDM tones are allocated for the DATA field. If it is determined that the bandwidth of 602 is 40MHz, the transmitting communication device 102 can allocate 60624 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for L-SIG field, and for VHT-SIG -A1 field or symbol is allocated 104 OFDM tones, VHT-SIG-A2 field or symbol is allocated 104 OFDM tones, VHT-STF is allocated 24 OFDM tones, and one or more VHT-LTF is allocated 114 OFDM tones, 114 OFDM tones are allocated for the VHT-SIG-B field, and/or 114 OFDM tones are allocated for the DATA field.

If it has been determined that the bandwidth of 602 is 80MHz, the transmitting communication device 102 can allocate 60848 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for L-SIG field, and for VHT-SIG -A1 field or symbol is allocated 208 OFDM tones, VHT-SIG-A2 field or symbol is allocated 208 OFDM tones, VHT-STF is allocated 48 OFDM tones, and one or more VHT-LTF is allocated 242 OFDM tones, 242 OFDM tones are allocated for the VHT-SIG-B field, and/or 242 OFDM tones are allocated for the DATA field. If the bandwidth of 602 is determined to be 160 MHz, the transmitting communication device 102 can allocate 61048 OFDM tones for L-STF, 416 OFDM tones for L-LTF, 416 OFDM tones for L-SIG field, and VHT- SIG-A1 field or symbol is allocated 416 OFDM tones, VHT-SIG-A2 field or symbol is allocated 416 OFDM tones, VHT-STF is allocated 48 OFDM tones, and one or more VHT-LTF is allocated 484 OFDM tones , Allocate 484 OFDM tones for the VHT-SIG-B field and/or symbol, and/or allocate 484 OFDM tones for the DATA field.

The transmitting communication device 102 can transmit 612 the signal. For example, the transmitting communication device 102 may perform IDFT on the signal, format the signal, convert the signal into an analog signal, and use one or more antennas 132a-n to radiate the signal.

FIG. 7 is a flowchart depicting a configuration of a method 700 for receiving tones for a frame. The receiving communication device 142 may determine 702 whether the bandwidth used for signal reception is 20 MHz, 40 MHz, 80 MHz, or 160 MHz. For example, the receiving communication device 142 may receive an indicator or message that specifies the bandwidth for signal reception. It should be noted that the indicator or message can be explicit or implicit. For example, the indicator or message may explicitly include bits for specifying bandwidth. In another configuration, the indicator or message can be embedded with another type of data or transmission characteristics, such as the selection of adjustment types, ordering of information, and so on.

If it has been determined that the bandwidth of 702 is 20MHz, the receiving communication device 142 can receive 704 12 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, and VHT -52 OFDM tones for SIG-A1 field or symbol, 52 OFDM tones for VHT-SIG-A2 field or symbol, 12 OFDM tones for VHT-STF, 56 OFDM for one or more VHT-LTF Tones, 56 OFDM tones for the VHT-SIG-B field, and/or 56 OFDM tones for the DATA field. If it has been determined that the bandwidth of 702 is 40MHz, the receiving communication device 142 can receive 706 24 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for L-SIG field, and VHT -104 OFDM tones for SIG-A1 field or symbol, 104 OFDM tones for VHT-SIG-A2 field or symbol, 24 OFDM tones for VHT-STF, 114 OFDM for one or more VHT-LTF Tones, 114 OFDM tones for the VHT-SIG-B field, and/or 114 OFDM tones for the DATA field.

If it is determined that the bandwidth of 702 is 80MHz, the receiving communication device 142 can receive 708 48 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for L-SIG field, and VHT -208 OFDM tones for SIG-A1 fields or symbols, 208 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 242 OFDM tones for one or more VHT-LTF Tones, 242 OFDM tones for the VHT-SIG-B field, and/or 242 OFDM tones for the DATA field. If it is determined that the bandwidth of 702 is 160MHz, the receiving communication device 142 can receive 710 48 OFDM tones for L-STF, 416 OFDM

tones for L-LTF, 416 OFDM tones for L-SIG field, and VHT -416 OFDM tones for SIG-A1 field or symbol, 416 OFDM tones for VHT-SIG-A2 field or symbol, 48 OFDM tones for VHT-STF, 484 OFM for one or more VHT-LTF Tones, 484 OFDM tones for the VHT-SIG-B field and/or symbol, and/or 484 OFDM tones for the DATA field.

Fig. 8 is a block diagram of a configuration of the access point 802 in which a system and method for assigning tones to frames can be implemented. The access point 802 may include an encoder 806 having an input for receiving payload data 804 and/or preamble data 816 to be transmitted to one or more access terminals 842. The payload data 804 may include voice, video, audio, and/or other data. The preamble data 816 may include control information, such as information for specifying data rate, modulation and coding scheme (MCS), channel bandwidth, and so on. The encoder 806 can encode the data 804, 816 for forward error correction (FEC), encryption, packetization, and/or other known encodings used in the case of wireless transmission. For example, the encoder 806 may encode the data 804, 816 using convolutional codes or low-density parity check (LDPC) encoding.

The constellation mapper 810 maps the data provided by the encoder 806 to the constellation. For example, the constellation mapper 810 may use a modulation scheme, such as: two-phase phase shift keying (BPSK), quadrature amplitude modulation (QAM), and so on. In the case of using quadrature amplitude modulation (QAM), for example, the constellation mapper 810 can provide two bits per spatial stream 838, per data subcarrier 840, and per symbol period. In addition, for each spatial stream 838, each data subcarrier 840, and each symbol period, the constellation mapper 810 can output a 16-QAM constellation signal. Other modulations can be used, such as 64-QAM, which will result in a consumption of 6 bits per spatial stream 838, per data subcarrier 840, and per symbol period. Other variants are also possible.

The output of the constellation mapper 810 is provided to a space-time-frequency mapper 808, which maps the data to the space-time-frequency (STF) dimension of the transmitter. Dimensions represent various structures or resources that allow data to be allocated. A given bit or set of bits (for example, a bit group corresponding to a constellation point, a set of bits, etc.) can be mapped to a specific position in the dimension. Generally, the bits and/or signals mapped to different positions in the dimension are transmitted from the access point 802, so that they are expected to be distinguishable at one or more access terminals 842 with some probability. In one configuration, the space-time-frequency mapper 808 may perform space-time block coding (STBC).

One or more spatial streams 838 may be transmitted from the access point 802 so that transmissions on different spatial streams 838 can be distinguished (with a certain probability) at the receiver. For example, the bits mapped to a spatial dimension are transmitted as a spatial stream 838. This spatial stream 838 may be transmitted on its own antenna 832 spatially separated from other antennas 832, its own orthogonal superposition on a plurality of spatially separated antennas 832, its own polarization, and the like. Many techniques for separation of the spatial stream 838 (e.g., including spatial separation of the antenna 832, or other techniques that would allow its signals to be distinguished at the receiver) are known and available.

In the example shown in Figure 8, there are one or more spatial streams 838 that use the same or different numbers (e.g., one or more) of antennas 832a-n for transmission. In some instances, because one or more other spatial streams 838 are inactive, only one spatial stream 838 may be available.

In the case where the access point 802 uses multiple frequency subcarriers 840, there are multiple values for the frequency dimension, so that the space-time-frequency mapper 808 can map some bits to one frequency subcarrier 840, and map other bits Map to another frequency sub-carrier 840. Other frequency sub-carriers 840 may be reserved as guard bands, pilot tone sub-carriers, or the like that do not (or do not always) carry data 804, 816. For example, there may be one or more data subcarriers 840 and one or more pilot subcarriers 840. It should be noted that in some examples or configurations, not all sub-carriers 840 can be excited immediately. For example, some tones (for example, DC tones) may not be excited in order to enable filtering. In one configuration, the access point 802 may use Orthogonal Frequency Division Multiplexing (OFDM) for the transmission of multiple subcarriers 840. For example, depending on the multiplexing scheme used, the space-time-frequency mapper 808 can map (encode) the data 804, 816 to space, time, and/or frequency resources.

The time dimension refers to the symbol period. Different bits can be allocated to different symbol periods. When there are multiple spatial streams 838, multiple subcarriers 840, and multiple symbol periods, the transmission for one symbol period can be called "OFDM (Orthogonal Frequency Division Multiplexing) MIMO (Multiple Input, Multiple Output) symbol". The number of bits per symbol (for example, log2 of the number of constellations used) is multiplied by the number of spatial streams 838, multiplied by the number of data subcarriers 840, and divided by the length of the symbol period to determine the number of encoded data. Transmission rate.

Therefore, the space-time-frequency mapper 808 can map bits (or other units of input data) to one or more spatial streams 838, data subcarriers 840, and/or symbol periods. Separate paths can be used to generate and/or launch separate spatial streams

838. In some embodiments, these paths are implemented with unique hardware, while in other embodiments, the path hardware is reused for more than one spatial stream 838, or the path logic is implemented in software for one or more spatial streams 838. Achieved in. More specifically, each of the elements shown in the access point 802 may be implemented as a single block/module or as multiple blocks/modules. For example, the transmitter radio frequency block 826 element may be implemented as a single block/module or as multiple parallel blocks/modules corresponding to each antenna 832a-n (e.g., each spatial stream 838). As used herein, the term "block/module" and its variants may refer to specific elements or components that can be implemented by hardware, software, or a combination of both.

The access point 802 may include a pilot generator block/module 830. The pilot generator block/module 830 can generate pilot sequences. The pilot sequence can be a set of pilot symbols. In one configuration, for example, the value in the pilot sequence may be represented by a signal having a specific phase, amplitude, and/or frequency. For example, "1" may indicate a pilot symbol with a specific phase and/or amplitude, and "-1" may indicate a pilot symbol with a different (eg, opposite or reverse) phase and/or amplitude.

In some configurations, the access point 802 may include a pseudo-random noise generator 828. The pseudo-random noise generator 828 can generate a pseudo-random noise sequence or signal (e.g., a numerical value) for scrambling the pilot sequence. For example, the pilot sequence for consecutive OFDM symbols can be multiplied with consecutive numbers from the pseudo-random noise sequence, thereby scrambling the pilot sequence of each OFDM symbol. When sending the pilot sequence to the access terminal 842, the received pilot sequence can be descrambled by the pilot processor 848.

The output of the space-time-frequency mapper 808 may be distributed in frequency and/or spatial dimensions. The pilot insertion block/module 812 inserts the pilot tone into the pilot tone subcarrier 840. For example, the pilot sequence can be mapped to the subcarrier 840 at a specific index. For example, pilot symbols from the pilot sequence may be mapped to sub-carriers 840 that are interspersed with data sub-carriers 840 and/or other sub-carriers 140. In other words, the pilot sequence or signal can be combined with the data sequence or signal. In an example, if the 80MHz frequency band 863 is used for transmission, the pilot tone or subcarrier 840 can be set at index k={-103, -75, -39, -11,11,39,75,103} . In some configurations, one or more direct current (DC) tones may be concentrated at index 0.

In some configurations, the combined data and pilot signal can be provided to the rotating block/module (not shown in Figure 8). The rotation block/module can use a rotation or multiplication factor to rotate the pilot symbols and/or data symbols. For example, the rotation block/module can make the VHT-SIG-A2 symbol rotate 90 degrees relative to the VHT-SIG-A1 to provide automatic VHT detection.

The access point 802 may include a bandwidth determination block/module 816. The bandwidth determination block/module 818 may determine the channel bandwidth to be used for transmission to one or more access terminals 842. The determination may be based on one or more factors, such as: access terminal 842 compatibility, number of access terminals 842 (to use the communication channel), channel quality (eg, channel noise), and/or received indicator Wait. In one configuration, the bandwidth determination block/module 818 may determine whether the bandwidth used for channel transmission is 20 MHz, 40 MHz, 80 MHz, or 160 MHz. In one example, the bandwidth determination block/module 818 may determine that the 80 MHz band 863 will be used for transmission.

The bandwidth determination block/module 818 may provide an indication of bandwidth determination to one or more blocks/modules. For example, the bandwidth indication may be provided to the space-time-frequency mapper 808, the pilot insertion block/module 812, and/or the pilot generator 830. Additionally or alternatively, a bandwidth indication may be provided as part of the preamble data 816. For example, one or more bits in the preamble data 816 can be allocated to indicate the bandwidth indication. Additionally or alternatively, the bandwidth indication may be implicitly indicated in the preamble data 816. Thus, the bandwidth indication can be signaled to one or more access terminals 842. This may enable one or more access terminals 842 to receive preamble data 816 using the selected channel bandwidth.

The space-time-frequency mapper 808 can use the bandwidth indication to map the preamble data 816 to multiple tones (e.g., subcarrier 840). For example, the systems and methods disclosed herein can define the number of OFDM tones or subcarriers 840 that the access point 802 can use (e.g., as specified by the bandwidth indication) to transmit the preamble data 816 based on the channel bandwidth. The number of OFDM tones can also be specified according to a specific preamble field. For example, based on the bandwidth determination and preamble field indicated in Table (1) above, the space-time-frequency mapper 808 can map the preamble data 816 to multiple OFDM tones. For example, if the current field is VHT-SIG-B and the bandwidth indication specifies a bandwidth 863 of 80 MHz, the space-time-frequency mapper 808 can map the preamble data 816 to 234 OFDM tones or subcarriers 840, and the remaining The 8 OFDM tones of the pilot and the three subcarriers 840 are used as DC tones. In some configurations, the space-time-frequency mapper 808 may use a look-up table to determine the number of tones or subcarriers to use for the specified bandwidth.

More specifically, if the determined bandwidth is 20MHz, the access point 802 can allocate 12 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, and VHT-SIG-A1 field or symbol is allocated 52 OFDM tones, VHT-SIG-A2 field or symbol is allocated 52 OFDM tones, VHT-STF is allocated 12 OFDM tones, and one or more VHT-LTF is allocated 56 OFDM tones, 56 OFDM tones are allocated for the VHT-SIG-B field, and/or 56 OFDM tones are allocated for the DATA field. If the bandwidth is determined to be 40MHz, the access point 802 can allocate 24 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for L-SIG field, and VHT-SIG-A1 field. Or symbol allocation 104 OFDM tones, for VHT-SIG-A2 field or symbol allocation 104 OFDM tones, for VHT-STF allocation for 24 OFDM tones, for one or more VHT-LTF allocation for 114 OFDM tones, for VHT- The SIG-B field allocates 114 OFDM tones, and/or allocates 114 OFDM tones for the DATA field. If the bandwidth is 80MHz, the access point 802 can allocate 48 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for L-SIG field, VHT-SIG-A1 field, or Symbol allocation 208 OFDM tones, VHT-SIG-A2 field or symbol allocation 208 OFDM tones, VHT-STF allocation 48 OFDM tones, one or more VHT-LTF allocation 242 OFDM tones, for VHT-SIG -The B field allocates 242 OFDM tones, and/or allocates 242 OFDM tones for the DATA field. If the bandwidth is 160MHz, the access point 802 can allocate 48 OFDM tones for L-STF, 416 OFDM tones for L-LTF, 416 OFDM tones for L-SIG field, VHT-SIG-A1 field, or Symbol allocation 416 OFDM tones, VHT-SIG-A2 field or symbol allocation 416 OFDM tones, VHT-STF allocation 48 OFDM tones, one or more VHT-LTF allocation 484 OFDM tones, for VHT-SIG -The B field or field is allocated 484 OFDM tones, and/or the DATA field is allocated 484 OFDM tones.

In some configurations, the bandwidth indication may also be provided to the pilot generator 830. The pilot generator 830 can use the bandwidth indication to generate an appropriate number of pilot symbols. For example, the pilot generator 830 can generate 8 pilot symbols (with 242 OFDM tones: 234 data tones and 8 pilot tones, and 3 DC subcarriers 840) for an 80MHz signal.

In some configurations, the bandwidth indication may additionally be provided to the pilot insertion block/module 812. The pilot insertion block/module 812 can use this indication to determine the subcarrier index for pilot symbol insertion. For example, 80MHz bandwidth may indicate that pilot symbols should be inserted at indexes -103, -75, -39, -11, 11, 39, 75, and 103.

Data and/or pilot signals are provided to the Inverse Fast Fourier Transform (IFFT) block/module 820. The inverse fast Fourier transform (IFFT) block/module 820 converts the frequency signals of the data 804 and 816, and inserts pilot tones into the time domain signal, which represents the signal on the spatial stream 838 and/or the target Time domain sampling of the symbol period. In one configuration, for example, the IFFT block/module 820 may perform a 256-point inverse fast Fourier transform (IFFT).

The time domain signal is provided to the formatter 822. The formatter (for example, one or more formatting blocks/modules) 822 can get the output of the Inverse Fast Fourier Transform (IFFT) block/module 820, convert it from parallel signals to serial (P/S), and add Cyclic prefix and/or perform guard interval windowing, etc.

The formatter 822 output may be provided to a digital-to-analog converter (DAC) 824. A digital-to-analog converter (DAC) 824 can convert the formatter 822 output from one or more digital signals to one or more analog signals. A digital-to-analog converter (DAC) 824 may provide an analog signal to one or more transmitter radio frequency (TX RF) blocks 826.

One or more transmitter radio frequency blocks 826 may be coupled to or include power amplifiers. The power amplifier can amplify the analog signal for transmission. The one or more transmitter radio frequency blocks 826 can output radio frequency (RF) signals to one or more antennas 832a-n, thereby transmitting the data 804, 816 input to the encoder 806 through a wireless medium, which is suitably configured to be Or multiple access terminals 842 receive.

One or more access terminals 842 can receive and use signals from the access point 802. For example, the access terminal 842 may use the received bandwidth indicator to receive a given number of OFDM tones or subcarriers 840. Additionally or alternatively, the access terminal 842 can use the pilot sequence generated by the access point 802 to describe the characteristics of the channel, transmitter failure, and/or receiver failure, and use this feature to improve the performance of the transmission code. Reception of data 804, 816.

For example, the access terminal 842 may include one or more antennas 836a-n provided to one or more receiver radio frequency (RX RF) blocks 858 (which may be greater than, less than, or equal to the number of antennas 832a-n of the access point 802 And/or the number of spatial streams 838). One or more receiver radio frequency (RX RF) blocks 858 may output analog signals to one or more analog-to-digital converters (ADC) 856. For example, the receiver radio frequency block 858 may receive and down-convert the signal, which may be provided to the analog-to-digital converter 856. Like the access point 802, the number of spatial streams 838 processed may or may not be equal to the number of antennas 836a-n. In addition, each spatial stream 838 does not need to be limited to one antenna 836, because various techniques such as beamsteering and orthogonalization can be used to reach multiple receiver streams.

One or more analog-to-digital converters (ADC) 856 can convert the received analog signal into one or more digital signals. These outputs of the one or more analog-to-digital converters (ADC) 856 may be provided to one or more time and/or frequency synchronization blocks/modules 854. Time and/or frequency synchronization block/module 854 can (try to) synchronize or align digital signals in time and/or frequency (for example, access terminal 842 clock).

The (synchronized) output of the time and/or frequency synchronization block/module 854 may be provided to one or more formatters 852. For example, the formatter 852 may receive the output of the time and/or frequency synchronization block/module 854, remove prefixes, etc., and/or parallelize the data for fast Fourier transform (FFT) processing.

The output of one or more formatters 852 may be provided to one or more fast Fourier transform (FFT) blocks/modules 850. The Fast Fourier Transform (FFT) block/module 850 can convert one or more signals from the time domain to the frequency domain. The pilot processor 848 may use the frequency domain signal (for example, of each spatial stream 838) to determine the signal transmitted by the access point 802 (for example, the spatial stream 838, frequency subcarriers 840, and/or a set of symbol periods). ) One or more pilot tones. The pilot processor 848 may additionally or alternatively de-scramble the pilot sequence. The pilot processor 848 may use one or more pilot sequences described herein for phase and/or frequency and/or amplitude tracking. The pilot tones can be provided to the space-time-frequency detection and/or decoding block/module 846, and the space-time-frequency detection and/or decoding block/module 846 can detect and/or detect data in various dimensions. decoding. The space-time-frequency detection and/or decoding block/module 846 may output the received data 844 (for example, the access terminal 842 estimates the payload data 804 and/or preamble data 816 transmitted by the access point 802) .

In some configurations, the access terminal 842 knows that the transmission sequence is sent as part of the total information sequence. The access terminal 842 can perform channel estimation with the help of these known transmission sequences. In order to assist pilot tone tracking, processing, and/or data detection and decoding, the channel estimation block/module 860 can be based on the output from the time and/or frequency synchronization block/module 854, the pilot processor 848 and/or space-time- The frequency detection and/or decoding block/module 846 provides the estimated signal. Optionally, if for a known transmission sequence, the formatting and fast Fourier transform are the same as the payload data part of the total information sequence, it can be based on the data from the fast Fourier transform (FFT) block/module The output of 850 provides the estimated signal to the pilot processor 848 and/or the space-time-frequency detection and/or decoding block/module 846.

The bandwidth determination block/module 834 can use the time/frequency synchronization block/module output to determine the channel bandwidth (for received communications). For example, the bandwidth determination block/module 834 may receive a bandwidth indication from the access point 802 for indicating the channel bandwidth. For example, the bandwidth determination block/module 834 can obtain an explicit or implicit bandwidth indication. In one configuration, the bandwidth indication may indicate a channel bandwidth of 20 MHz, 40 MHz, 80 MHz, or 160 MHz. The bandwidth determination block/module 834 may determine the bandwidth for receiving the communication based on the indication, and the pilot frequency processor 848 and/or the space-time-frequency detection/decoding block/module 846 may provide an indication of the determined bandwidth.

More specifically, if the determined bandwidth is 20MHz, the access terminal 842 can receive 12 OFDM tones for L-STF, 52 OFDM tones for L-LTF, 52 OFDM tones for L-SIG field, 52 OFDM tones for VHT-SIG-A1 fields or symbols, 52 OFDM tones for VHT-SIG-A2 fields or symbols, 12 OFDM tones for VHT-STF, 56 for one or more VHT-LTF OFDM tones, 56 OFDM tones for the VHT-SIG-B field, and/or 56 OFDM tones for the DATA field. If the determined bandwidth is 40MHz, the access terminal 842 can receive 24 OFDM tones for L-STF, 104 OFDM tones for L-LTF, 104 OFDM tones for the L-SIG field, and for VHT-SIG -104 OFDM tones for A1 field or symbol, 104 OFDM tones for VHT-SIG-A2 field or symbol, 24 OFDM tones for VHT-STF, 114 OFDM tones for one or more VHT-LTF, 114 OFDM tones for the VHT-SIG-B field, and/or 114 OFDM tones for the DATA field. If the bandwidth is 80MHz, the access terminal 842 can receive 48 OFDM tones for L-STF, 208 OFDM tones for L-LTF, 208 OFDM tones for the L-SIG field, and for the VHT-SIG-A1 field Or symbol 208 OFDM tones, 208 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 242 OFDM tones for one or more VHT-LTF, for VHT- 242 OFDM tones for the SIG-B field, and/or 242 OFDM tones for the DATA field. If the bandwidth is 160MHz, the access terminal 842 can receive 48 OFDM tones for L-STF, 416 OFDM tones for L-LTF, 416 OFDM tones for the L-SIG field, and for the VHT-SIG-A1 field 416 OFDM tones for or symbols, 416 OFDM tones for VHT-SIG-A2 fields or symbols, 48 OFDM tones for VHT-STF, 484 OFDM tones for one or more VHT-LTF, for VHT- 484 OFDM tones for the SIG-B field or symbol, and/or 484 OFDM tones for the DATA field.

The pilot processor 848 may use the determined bandwidth indication to extract pilot symbols from the output of the fast Fourier transform block/module 850. For example, if the determined bandwidth indication specifies an 80 MHz bandwidth 863, the pilot processor 848 may extract pilot symbols from indexes -103, -75, -39, -11, 11, 39, 75, and 103.

The space-time frequency detection/decoding block/module 846 can use the determined bandwidth indication to detect and/or

decode the preamble data from the received signal. For example, if the current field is the VHT-SIG-B field and the determined bandwidth indication specifies that the bandwidth is 80MHz, the space-time frequency detection/decoding block/module 846 can compare the preamble from 234 OFDM tones or subcarriers 840 The data is detected and/or decoded (for example, where 8 OFDM tones are pilot tones, and three subcarriers 840 are used for DC tones). In some configurations, the space-time-frequency detection/decoding block/module 846 may use a look-up table to determine the number of tones or subcarriers to receive for a specified bandwidth.

In one configuration, the access terminal 842 may also transmit data 857 (e.g., preamble data and/or payload data) to the access point 802. For example, the access terminal 842 may include a transmitter 859. The transmitter 859 may include a transmission bandwidth determination block/module 861 (for convenience, it is depicted as "transmission bandwidth" in FIG. 8). The transmission bandwidth determination block/module 861 can determine the communication bandwidth used for transmission to the access point 802. For example, the transmitter 859 may perform the same or similar operation as that performed by the access point 802 for assigning tones to frames. In this way, for example, the transmitter 859 can obtain data 857, determine the bandwidth, assign tones to the frame based on the bandwidth (and frame fields or signals), map data and pilots to tones, and/or be similar to the access point 802, Transmit the generated signal.

In some configurations, the access point 802 may include a receiver 853 for receiving data and/or pilot symbols. For example, the access point 802 may receive bandwidth indications, data, and/or pilot symbols from the access terminal 842. The receiver 853 may include a reception bandwidth determination block/module 855 (for convenience, it is depicted as "reception bandwidth" in FIG. 8). The reception bandwidth determination block/module 855 can determine the reception bandwidth in a similar manner to the bandwidth determination block/module 834 included in the access terminal 842. For example, the access point 802 may receive a bandwidth indication or message from the access terminal 842, and 802 may use the bandwidth indication or message to determine the received bandwidth. The access point 802 can use the reception bandwidth determination to detect, decode, demodulate, etc., one or more signals received from the access terminal 842. For example, the receiver 853 may similarly perform one or more operations performed by the access terminal 842. In other words, the receiver 853 may similarly perform one or more operations that the access terminal 842 performs to obtain the data 844 it receives in order to receive the tone of the frame (e.g., receive data 851).

FIG. 9 is a block diagram of a communication device 965 that can be used in a multiple input and multiple output (MIMO) system. Examples of the communication device 965 may include: a transmitting communication device 102, a receiving communication device 142, an access point 802, an access terminal 842, a base station, a user equipment (UE), and the like. In the communication device 965, the baseband processor 973 is provided with service data for multiple data streams from one or more data sources 967 and/or application processors 969. Specifically, the transmission processing block/module 977 included in the baseband processor 973 may be provided with service data. Then, the corresponding data stream can be transmitted through each transmitting antenna 995a-n. The transmission processing block/module 977 can format, encode, and interleave the service data of each data stream based on a specific coding scheme selected for each data stream to provide encoded data.

The transmission processing block/module 977 can execute the method 600 shown in FIG. 6. For example, the transmit processing block/module 977 may include a tone assignment block/module 979. The pitch assignment block/module 979 can execute instructions to assign tones to frames.

Orthogonal frequency division multiplexing (OFDM) technology can be used to multiplex the coded data of each data stream with the pilot data from the pilot generator 975. The pilot data may be a known data pattern processed in a known manner, and the pilot data may be used at the receiver to estimate the channel response. Then, it can be based on the specific modulation scheme selected for each data stream (for example, binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), M phase shift keying (M-PSK), Quadrature amplitude modulation (QAM) or M-order quadrature amplitude modulation (M-QAM)) modulates the multiplexed pilot and coded data of the data stream (ie, symbol mapping) to provide modulation symbols. The instructions executed by the processor determine the data rate, coding, and modulation of each data stream.

The transmit (TX) multiple input multiple output (MIMO) processing block/module 989 can provide modulation symbols for all data streams, and the transmit (TX) multiple input multiple output (MIMO) processing block/module 989 can further process these modulation symbols (For example, for OFDM). The transmit (TX) multiple input multiple output (MIMO) processing block/module 989 then provides multiple modulation symbol streams to the transmitters 993a-n. The transmit (TX) multiple input multiple output (MIMO) processing block/module 989 can apply beamforming weights to the symbols of the data stream and the antenna 995 used to transmit the symbols.

Each transmitter 993 can receive and process its own symbol stream to provide one or more analog signals, and further adjust these analog signals (for example, amplify, filter, and up-convert) to provide a channel suitable for passing MIMO The

transmitted modulated signal. The modulated signals from the transmitters 993a-n are respectively transmitted from the antennas 995a-n. For example, the modulated signal can be sent to another communication device (not shown in Figure 9).

The communication device 965 can receive a modulated signal (from another communication device). These modulated signals are received by the antenna 995 and adjusted by the receiver 993 (for example, filtering, amplifying, down-converting, digitizing). In other words, each receiver 993 can adjust the received signal (for example, filter, amplify, and down-convert), digitize the adjusted signal to provide samples, and further process these samples to provide corresponding " Received" symbol stream.

Then, the receiving processing block/module 983 included in the baseband processor 973 receives the symbol stream from the receiver, and processes the received symbol stream based on a specific receiver processing technology, so as to provide multiple "detected "flow. The receiving processing block/module 983 demodulates, deinterleaves, and decodes each stream in order to recover the service data of the data stream.

The receiving processing block/module 983 can execute the method 700 shown in FIG. 7. For example, the receiving processing block/module 983 may include the tone receiving block/module 985. The tone receiving block/module 985 can execute instructions to receive the tone of the frame.

The precoding processing block/module 981 included in the baseband processor 973 may receive channel state information (CSI) from the receiving processing block/module 983. Then, the precoding processing block/module 981 determines which precoding matrix is to be used to determine the beamforming weights, and then processes the extracted message. It should be noted that the baseband processor 973 can store information on the baseband memory 987 and obtain information from the baseband memory 987.

The service data restored by the baseband processor 973 can be provided to the application processor 969. The application processor 969 can store information in the application memory 971 and obtain information from the application memory 971.

Figure 10 depicts certain components that may be included in a communication device, base station, and/or access point 1097. The aforementioned transmitting communication device 102, receiving communication device 142, access point 802, and/or communication device 965 may be configured similar to the communication device/base station/access point 1097 shown in FIG.

The communication device/base station/access point 1097 includes a processor 1015. The processor 1015 may be a general-purpose single-chip microprocessor or a multi-chip microprocessor (for example, ARM), a dedicated microprocessor (for example, a digital signal processor (DSP)), a microcontroller, a programmable gate array, or the like. The processor 1015 may be called a central processing unit (CPU). Although only a single processor 1015 is shown in the communication device/base station/access point 1097 of FIG. 10, in other optional configurations, a combination of processors (for example, ARM and DSP) may be used.

The communication device/base station/access point 1097 also includes a memory 1099 for electronic communication with the processor 1015 (that is, the processor 1015 can read information from the memory 1099 and/or write information to the memory 1099). The memory 1099 may be any electronic component capable of storing electronic information. The memory 1099 may be random access memory (RAM), read only memory (ROM), disk storage media, optical storage media, flash memory devices in RAM, on-board memory included in the processor, programmable memory Read memory (PROM), erasable programmable read-only memory (EPROM), electrically erasable PROM (EEPROM), registers, etc., including their combinations.

The data 1001 and the instruction 1003 can be stored in the memory 1099. Instructions 1003 may include one or more programs, routines, subroutines, functions, procedures, codes, and so on. Instructions 1003 may include a single computer readable sentence or many computer readable sentences. The instruction 1003 can be executed by the processor 1015 to implement the methods 600 and 700 described above. The execution of the instruction 1003 may include the use of the data 1001 stored in the memory 1099. FIG. 10 shows some instructions 1003a and data 1001a loaded into the processor 1015.

The communication device/base station/access point 1097 may also include a transmitter 1011 and a receiver 1013 to allow the communication device/base station/access point 1097 and remote locations (for example, another communication device, access terminal, access Point, etc.) to transmit and receive signals. The transmitter 1011 and the receiver 1013 may be collectively referred to as a transceiver 1009. The antenna 1007 may be electrically coupled to the transceiver 1009. The communication device/base station/access point 1097 may also include (not shown in the figure) multiple transmitters, multiple receivers, multiple transceivers, and/or multiple antennas.

The various components of the communication device/base station/access point 1097 may be coupled together through one or

more buses, and the one or more buses may include a power bus, a control signal bus, a status signal bus, a data bus, and the like. For simplicity, each bus is shown as a bus system 1005 in FIG. 10.

Figure 11 depicts certain components that may be included in a wireless communication device and/or access terminal 1117. One or more of the aforementioned transmitting communication device 102, receiving communication device 142, access terminal 842, and communication device 965 can be configured similar to the wireless communication device/access terminal 1117 shown in FIG. 11.

The wireless communication device/access terminal 1117 includes a processor 1137. The processor 1137 may be a general-purpose single-chip microprocessor or a multi-chip microprocessor (for example, ARM), a dedicated microprocessor (for example, a digital signal processor (DSP)), a microcontroller, a programmable gate array, or the like. The processor 1137 may be called a central processing unit (CPU). Although only a single processor 1137 is shown in the wireless communication device/access terminal 1117 of FIG. 11, in an alternative configuration, a combination of processors 1137 (for example, ARM and DSP) may be used.

The wireless communication device/access terminal 1117 also includes a memory 1119 for electronic communication with the processor 1137 (that is, the processor 1137 can read information from the memory 1119 and/or write information to the memory 1119). The memory 1119 may be any electronic component capable of storing electronic information. The memory 1119 may be random access memory (RAM), read only memory (ROM), magnetic disk storage media, optical storage media, flash memory devices in RAM, on-board memory included in the processor 1137, and Programmable read-only memory (PROM), erasable programmable read-only memory (EPROM), electrically erasable PROM (EEPROM), registers, etc., including their combinations.

The data 1121a and the instructions 1123a can be stored in the memory 1119. The instruction 1123a may include one or more programs, routines, subroutines, functions, procedures, codes, and so on. The instruction 1123a may include a single computer-readable sentence or many computer-readable sentences. The instruction 1123a may be executed by the processor 1137 to implement one or more of the above-mentioned methods 600 and 700. The execution of the instruction 1123a may include the use of the data 1121a stored in the memory 1119. Figure 11 shows some instructions 1123b and data 1121b loaded into the processor 1137 (which may come from the instructions 1123a and data 1121a in the memory 1119).

The wireless communication device/access terminal 1117 may also include a transmitter 1133 and a receiver 1135 to allow communication between the wireless communication device/access terminal 1117 and a remote location (for example, another electronic device, wireless communication device, etc.) Signal transmission and reception. The transmitter 1133 and the receiver 1135 may be collectively referred to as a transceiver 1131. The antenna 1129 may be electrically coupled to the transceiver 1131. The wireless communication device/access terminal 1117 may also include (not shown in the figure) multiple transmitters 1133, multiple receivers 1135, multiple transceivers 1131, and/or multiple antennas 1129.

In some configurations, the wireless communication device/access terminal 1117 may include one or more microphones 1125 for capturing sound signals. In one configuration, the microphone 1125 may be a converter that converts sound signals (e.g., speech, speech) into electrical or electronic signals. Additionally or alternatively, the wireless communication device/access terminal 1117 may include one or more speakers. In one configuration, the speaker 1127 may be a converter that converts electrical or electronic signals into sound signals.

Various components of the wireless communication device/access terminal 1117 may be coupled together through one or more buses, and the one or more buses may include a power bus, a control signal bus, a status signal bus, a data bus, and the like. For simplicity, each bus is shown as a bus system 1139 in FIG. 11.

In the above description, reference numerals are sometimes used in combination with various terms. Where a term is used in conjunction with an icon, this may refer to a specific element shown in one or more of the drawings. The term is used without a reference number, which may be a term generally referring to not limited to any particular drawing.

The term "determining" covers a wide range of actions, so "determining" can include calculation, calculation, processing, derivation, investigation, search (for example, search in a table, database or other data structure), ascertain, etc. In addition, "determining" may include: receiving (for example, receiving information), accessing (for example, accessing data in a memory), and the like. In addition, "determining" may include analysis, selection, selection, establishment, and so on.

Unless expressly stated otherwise, the phrase "based on" does not mean "based only on." In other words, the phrase "based on" includes both "based only on" and "based on at least".

The functions described herein may be stored as one or more instructions on a processor-readable or computer-readable

medium. The term "computer-readable medium" refers to any available medium that can be accessed by a computer or processor. Such media can include, for example, but not limited to: RAM, ROM, EEPROM, flash memory, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage, or can be used to store instructions or data that can be accessed by a computer or processor Any other medium of desired program code in structural form. The magnetic disks and optical discs used in this article include: compact discs (CD), laser discs, optical discs, digital versatile discs (DVD), floppy disks, and Blu-ray [image] discs. Disks are usually used to reproduce data with magnetic, while optical disks are used by lasers. Light reproduction data. It should be noted that the computer-readable medium may be tangible and non-transitory. The term "computer program product" refers to a computing device or processor combined with code or instructions (for example, a "program"), and the code or instructions can be executed, processed, or calculated by the computing device or processor. As used herein, the term "code" may refer to software, instructions, code, or data executable by a computing device or processor.

Software or instructions can also be transmitted through transmission media. For example, if you use coaxial cable, optical cable, twisted pair, digital subscriber line (DSL), or wireless technology (such as infrared, radio, and microwave) to transmit software from a website, server, or other remote source, the coaxial cable, Fiber optic cable, twisted pair, DSL or wireless technologies (such as infrared, radio, and microwave) are included in the definition of transmission media.

The method disclosed herein includes one or more steps or actions for achieving the method. The method steps and/or actions can be interchanged without departing from the scope of the claims. In other words, unless the normal operation of the method requires steps or actions in a specific order, the specific steps and/or operation order and/or use can be modified without departing from the scope of the claims.

It should be understood that the claims are not limited to the precise configurations and components shown above. Without departing from the scope of the claims, various modifications, changes and changes can be made to the arrangement, operation and details of the systems, methods and devices described herein.

See the claims for what is claimed.

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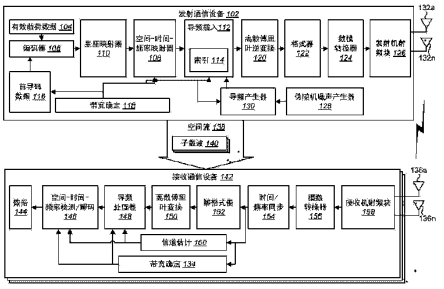
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分配和接收针对帧的音调

(57)摘要

本申请描述了用于分配音调的通信设备，该通信设备包括处理器以及与所述处理器进行电子通信的存储器中的指令。该通信设备确定用于信号发射的带宽是否为20、40、80或160兆赫兹(MHz)。所述通信设备分别针对20、40、80或160MHz如下分配音调：针对极高吞吐量(VHT)信号A1(VHT-SIG-A1)：52、104、208、416；VHT信号A2(VHT-SIG-A2)：52、104、208、416；VHT短训练字段(VHT-STF)：12、24、48、48；一个或多个VHT长训练字段(VHT-LTF)：56、114、242、484；VHT信号B(VHT-SIG-B)：56、114、242、484；以及数据字段(DATA)：56、114、242、484。该通信设备还发射该信号。



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1. 一种用于分配正交频分复用(OFDM)音调的通信设备,包括:

处理器;

与所述处理器进行电子通信的存储器;

存储在所述存储器中的指令,所述指令可执行用于:

确定用于信号发射的带宽是否为 20 兆赫兹(MHz)、40MHz、80MHz 或 160MHz;

如果所述带宽是 20MHz,则针对极高吞吐量信号字段 A1(VHT-SIG-A1)分配 52 个音调,针对极高吞吐量信号字段 A2(VHT-SIG-A2)分配 52 个音调,针对极高吞吐量短训练字段(VHT-STF)分配 12 个音调,针对一个或多个极高吞吐量长训练字段(VHT-LTF)分配 56 个音调,针对极高吞吐量信号字段 B(VHT-SIG-B)分配 56 个音调,以及针对数据字段(DATA)分配 56 个音调;

如果所述带宽是 40MHz,则针对所述 VHT-SIG-A1 分配 104 个音调,针对所述 VHT-SIG-A2 分配 104 个音调,针对所述 VHT-STF 分配 24 个音调,针对所述一个或多个 VHT-LTF 分配 114 个音调,针对所述 VHT-SIG-B 分配 114 个音调,针对所述 DATA 分配 114 个音调;

如果所述带宽是 80MHz,则针对所述 VHT-SIG-A1 分配 208 个音调,针对所述 VHT-SIG-A2 分配 208 个音调,针对所述 VHT-STF 分配 48 个音调,针对所述一个或多个 VHT-LTF 分配 242 个音调,针对所述 VHT-SIG-B 分配 242 个音调,针对所述 DATA 分配 242 个音调;

如果所述带宽是 160MHz,则针对所述 VHT-SIG-A1 分配 416 个音调,针对所述 VHT-SIG-A2 分配 416 个音调,针对所述 VHT-STF 分配 48 个音调,针对所述一个或多个 VHT-LTF 分配 484 个音调,针对所述 VHT-SIG-B 分配 484 个音调,针对所述 DATA 分配 484 个音调;以及

发射所述信号。

2. 如权利要求 1 所述的通信设备,其中所述指令进一步可执行用于:

如果所述带宽是 20MHz,则针对非高吞吐量(非 HT)短训练字段(L-STF)分配 12 个音调,针对非 HT 长训练字段(L-LTF)分配 52 个音调,以及针对非 HT 信号字段(L-SIG)分配 52 个音调;

如果所述带宽是 40MHz,则针对所述 L-STF 分配 24 个音调,针对所述 L-LTF 分配 104 个音调,以及针对所述 L-SIG 分配 104 个音调;

如果所述带宽是 80MHz,则针对所述 L-STF 分配 48 个音调,针对所述 L-LTF 分配 208 个音调,以及针对所述 L-SIG 分配 208 个音调;以及

如果所述带宽是 160MHz,则针对所述 L-STF 分配 48 个音调,针对所述 L-LTF 分配 416 个音调,以及针对所述 L-SIG 分配 416 个音调。

3. 如权利要求 1 所述的通信设备,其中,如果所述带宽是 20MHz,则所述 VHT-SIG-B 携带 26 比特,如果所述带宽是 40MHz,则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特,如果所述带宽是 80MHz,则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特,以及如果所述带宽是 160MHz,则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

4. 如权利要求 1 所述的通信设备,其中,如果所述带宽是 80MHz 或 160MHz,则所述 VHT-SIG-B 携带一个或多个填充比特。

5. 如权利要求 1 所述的通信设备，其中，所述指令进一步可执行以便基于所述带宽产生带宽消息。

6. 如权利要求 1 所述的通信设备，其中，所述指令进一步可执行以便使用正交二相相移键控（QBPSK）对所述 VHT-SIG-A2 进行调制，以指示：帧包括极高吞吐量（VHT）信号。

7. 如权利要求 1 所述的通信设备，其中，所述指令进一步可执行以便如果所述带宽是 80MHz，则在子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处插入导频音调。

8. 一种用于接收正交频分复用（OFDM）音调的通信设备，包括：

处理器；

与所述处理器进行电子通信的存储器；

存储在所述存储器中的指令，所述指令可执行用于：

确定用于信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz；

如果所述带宽是 20MHz，则接收针对极高吞吐量信号字段 A1（VHT-SIG-A1）的 52 个音调、针对极高吞吐量信号字段 A2（VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B（VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调；

如果所述带宽是 40MHz，则接收针对所述 VHT-SIG-A1 的 104 个音调、针对所述 VHT-SIG-A2 的 104 个音调、针对所述 VHT-STF 的 24 个音调、针对所述一个或多个 VHT-LTF 的 114 个音调、针对所述 VHT-SIG-B 的 114 个音调、以及针对所述 DATA 的 114 个音调；

如果所述带宽是 80MHz，则接收针对所述 VHT-SIG-A1 的 208 个音调、针对所述 VHT-SIG-A2 的 208 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 242 个音调、针对所述 VHT-SIG-B 的 242 个音调、以及针对所述 DATA 的 242 个音调；以及

如果所述带宽是 160MHz，则接收针对所述 VHT-SIG-A1 的 416 个音调、针对所述 VHT-SIG-A2 的 416 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 484 个音调、针对所述 VHT-SIG-B 的 484 个音调、以及针对所述 DATA 的 484 个音调。

9. 如权利要求 8 所述的通信设备，其中所述指令进一步可执行用于：

如果所述带宽是 20MHz，则接收针对非高吞吐量（非 HT）短训练字段（L-STF）的 12 个音调、针对非 HT 长训练字段（L-LTF）的 52 个音调、以及针对非 HT 信号字段（L-SIG）的 52 个音调；

如果所述带宽是 40MHz，则接收针对所述 L-STF 的 24 个音调、针对所述 L-LTF 的 104 个音调、以及针对所述 L-SIG 的 104 个音调；

如果所述带宽是 80MHz，则接收针对所述 L-STF 的 48 个音调、针对所述 L-LTF 的 208 个音调、以及针对所述 L-SIG 的 208 个音调；以及

如果所述带宽是 160MHz，则接收针对所述 L-STF 的 48 个音调、针对所述 L-LTF 的 416 个音调、以及针对所述 L-SIG 的 416 个音调。

10. 如权利要求 8 所述的通信设备，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带 26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

11. 如权利要求 8 所述的通信设备，其中，如果所述带宽是 80MHz 或 160MHz，则所述 VHT-SIG-B 携带一个或多个填充比特。

12. 如权利要求 8 所述的通信设备，其中，确定所述用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz 的动作包括对带宽指示进行接收。

13. 如权利要求 8 所述的通信设备，其中，所述指令进一步可执行以便如果所述 VHT-SIG-A2 使用正交二相相移键控（QBPSK），则对极高吞吐量（VHT）信号进行检测。

14. 如权利要求 8 所述的通信设备，其中，所述指令进一步可执行以便如果所述带宽是 80MHz，则接收子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处的导频音调。

15. 一种用于在通信设备上分配正交频分复用（OFDM）音调的方法，包括：

确定用于信号发射的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz；

如果所述带宽是 20MHz，则针对极高吞吐量信号字段 A1（VHT-SIG-A1）分配 52 个音调，针对极高吞吐量信号字段 A2（VHT-SIG-A2）分配 52 个音调，针对极高吞吐量短训练字段（VHT-STF）分配 12 个音调，针对一个或多个极高吞吐量长训练字段（VHT-LTF）分配 56 个音调，针对极高吞吐量信号字段 B（VHT-SIG-B）分配 56 个音调，针对数据字段（DATA）分配 56 个音调；

如果所述带宽是 40MHz，则针对所述 VHT-SIG-A1 分配 104 个音调，针对所述 VHT-SIG-A2 分配 104 个音调，针对所述 VHT-STF 分配 24 个音调，针对所述一个或多个 VHT-LTF 分配 114 个音调，针对所述 VHT-SIG-B 分配 114 个音调，针对所述 DATA 分配 114 个音调；

如果所述带宽是 80MHz，则针对所述 VHT-SIG-A1 分配 208 个音调，针对所述 VHT-SIG-A2 分配 208 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 242 个音调，针对所述 VHT-SIG-B 分配 242 个音调，针对所述 DATA 分配 242 个音调；

如果所述带宽是 160MHz，则针对所述 VHT-SIG-A1 分配 416 个音调，针对所述 VHT-SIG-A2 分配 416 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 484 个音调，针对所述 VHT-SIG-B 分配 484 个音调，针对所述 DATA 分配 484 个音调；以及

发射所述信号。

16. 如权利要求 15 所述的方法，进一步包括：

如果所述带宽是 20MHz，则针对非高吞吐量（非 HT）短训练字段（L-STF）分配 12 个音调，针对非 HT 长训练字段（L-LTF）分配 52 个音调，以及针对非 HT 信号字段（L-SIG）分配 52 个音调；

如果所述带宽是 40MHz，则针对所述 L-STF 分配 24 个音调，针对所述 L-LTF 分配 104 个音调，以及针对所述 L-SIG 分配 104 个音调；

如果所述带宽是 80MHz，则针对所述 L-STF 分配 48 个音调，针对所述 L-LTF 分配 208 个音调，以及针对所述 L-SIG 分配 208 个音调；以及

如果所述带宽是 160MHz，则针对所述 L-STF 分配 48 个音调，针对所述 L-LTF 分配 416 个音调，以及针对所述 L-SIG 分配 416 个音调。

17. 如权利要求 15 所述的方法，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带

26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

18. 如权利要求 15 所述的方法，其中，如果所述带宽是 80MHz 或 160MHz，则所述 VHT-SIG-B 携带一个或多个填充比特。

19. 如权利要求 15 所述的方法，进一步包括基于所述带宽产生带宽消息。

20. 如权利要求 15 所述的方法，进一步包括：使用正交二相相移键控（QBPSK）对所述 VHT-SIG-A2 进行调制，以指示：帧包括极高吞吐量（VHT）信号。

21. 如权利要求 15 所述的方法，进一步包括：如果所述带宽是 80MHz，则在子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处插入导频音调。

22. 一种用于在通信设备上对正交频分复用（OFDM）音调进行接收的方法，包括：

确定用于信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz；

如果所述带宽是 20MHz，则接收针对极高吞吐量信号字段 A1（VHT-SIG-A1）的 52 个音调、针对极高吞吐量信号字段 A2（VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B（VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调；

如果所述带宽是 40MHz，则接收针对所述 VHT-SIG-A1 的 104 个音调、针对所述 VHT-SIG-A2 的 104 个音调、针对所述 VHT-STF 的 24 个音调、针对所述一个或多个 VHT-LTF 的 114 个音调、针对所述 VHT-SIG-B 的 114 个音调、以及针对所述 DATA 的 114 个音调；

如果所述带宽是 80MHz，则接收针对所述 VHT-SIG-A1 的 208 个音调、针对所述 VHT-SIG-A2 的 208 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 242 个音调、针对所述 VHT-SIG-B 的 242 个音调、以及针对所述 DATA 的 242 个音调；以及

如果所述带宽是 160MHz，则接收针对所述 VHT-SIG-A1 的 416 个音调、针对所述 VHT-SIG-A2 的 416 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 484 个音调、针对所述 VHT-SIG-B 的 484 个音调、以及针对所述 DATA 的 484 个音调。

23. 如权利要求 22 所述的方法，进一步包括：

如果所述带宽是 20MHz，则接收针对非高吞吐量（非 HT）短训练字段（L-STF）的 12 个音调，针对非 HT 长训练字段（L-LTF）的 52 个音调，以及针对非 HT 信号字段（L-SIG）的 52 个音调；

如果所述带宽是 40MHz，则接收针对所述 L-STF 的 24 个音调，针对所述 L-LTF 的 104 个音调，以及针对所述 L-SIG 的 104 个音调；

如果所述带宽是 80MHz，则接收针对所述 L-STF 的 48 个音调，针对所述 L-LTF 的 208 个音调，以及针对所述 L-SIG 的 208 个音调；以及

如果所述带宽是 160MHz，则接收针对所述 L-STF 的 48 个音调，针对所述 L-LTF 的 416 个音调，以及针对所述 L-SIG 的 416 个音调。

24. 如权利要求 22 所述的方法，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带 26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则

所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

25. 如权利要求 22 所述的方法，其中，如果所述带宽是 80MHz 或 160MHz，则所述 VHT-SIG-B 携带一个或多个填充比特。

26. 如权利要求 22 所述的方法，其中，确定所述用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz 的步骤包括对带宽指示进行接收。

27. 如权利要求 22 所述的方法，进一步包括，如果所述 VHT-SIG-A2 使用正交二相相移键控（QBPSK），则对极高吞吐量（VHT）信号进行检测。

28. 如权利要求 22 所述的方法，进一步包括：如果所述带宽是 80MHz，则接收子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处的导频音调。

29. 一种用于分配正交频分复用（OFDM）音调的计算机程序产品，包括其上具有指令的非临时性有形的计算机可读介质，所述指令包括：

用于使通信设备确定用于信号发射的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的代码；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 20MHz，则针对极高吞吐量信号字段 A1（VHT-SIG-A1）分配 52 个音调，针对极高吞吐量信号字段 A2（VHT-SIG-A2）分配 52 个音调，针对极高吞吐量短训练字段（VHT-STF）分配 12 个音调，针对一个或多个极高吞吐量长训练字段（VHT-LTF）分配 56 个音调，针对极高吞吐量信号字段 B（VHT-SIG-B）分配 56 个音调，以及针对数据字段（DATA）分配 56 个音调；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 40MHz，则针对所述 VHT-SIG-A1 分配 104 个音调，针对所述 VHT-SIG-A2 分配 104 个音调，针对所述 VHT-STF 分配 24 个音调，针对所述一个或多个 VHT-LTF 分配 114 个音调，针对所述 VHT-SIG-B 分配 114 个音调，以及针对所述 DATA 分配 114 个音调；

用于使所述所述通信设备进行如下操作的代码：如果所述带宽是 80MHz，则针对 VHT-SIG-A1 分配 208 个音调，针对所述 VHT-SIG-A2 分配 208 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 242 个音调，针对所述 VHT-SIG-B 分配 242 个音调，以及针对所述 DATA 分配 242 个音调；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 160MHz，则针对所述 VHT-SIG-A1 分配 416 个音调，针对所述 VHT-SIG-A2 分配 416 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 484 个音调，针对所述 VHT-SIG-B 分配 484 个音调，以及针对所述 DATA 分配 484 个音调；以及

用于使所述通信设备发射所述信号的代码。

30. 如权利要求 29 所述的计算机程序产品，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带 26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

31. 如权利要求 29 所述的计算机程序产品，所述指令进一步包括：用于使所述通信设备基于所述带宽产生带宽消息的代码。

32. 如权利要求 29 所述的计算机程序产品，所述指令进一步包括：用于使所述通信设备进行如下操作的代码：使用正交二相相移键控（QBPSK）对所述 VHT-SIG-A2 进行调制，以

便指示：帧包括极高吞吐量（VHT）信号。

33. 一种用于接收正交频分复用（OFDM）音调的计算机程序产品，包括其上具有指令的非临时性有形的计算机可读介质，所述指令包括：

用于使通信设备确定用于信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的代码；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 20MHz，则接收针对极高吞吐量信号字段 A1（VHT-SIG-A1）的 52 个音调、针对极高吞吐量信号字段 A2（VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B（VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 40MHz，则接收针对所述 VHT-SIG-A1 的 104 个音调、针对所述 VHT-SIG-A2 的 104 个音调，针对所述 VHT-STF 的 24 个音调、针对所述一个或多个 VHT-LTF 的 114 个音调、针对所述 VHT-SIG-B 的 114 个音调、以及针对所述 DATA 的 114 个音调；

用于使所述通信设备进行如下操作的代码：如果所述带宽是 80MHz，则接收针对所述 VHT-SIG-A1 的 208 个音调、针对所述 VHT-SIG-A2 的 208 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 242 个音调、针对所述 VHT-SIG-B 的 242 个音调、以及针对所述 DATA 的 242 个音调；以及

用于使所述通信设备进行如下操作的代码：如果所述带宽是 160MHz，则接收针对所述 VHT-SIG-A1 的 416 个音调、针对所述 VHT-SIG-A2 的 416 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 484 个音调、针对所述 VHT-SIG-B 的 484 个音调、以及针对所述 DATA 的 484 个音调。

34. 如权利要求 33 所述的计算机程序产品，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带 26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

35. 如权利要求 33 所述的计算机程序产品，其中，确定所述用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz 的步骤包括对带宽指示进行接收。

36. 如权利要求 33 所述的计算机程序产品，其中，所述指令进一步包括：用于使所述通信设备进行如下操作的代码：如果所述 VHT-SIG-A2 使用正交二相相移键控（QBPSK），则对极高吞吐量（VHT）信号进行检测。

37. 一种用于分配正交频分复用（OFDM）音调的装置，包括：

用于确定信号发射的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的模块；

用于如下操作的模块：如果所述带宽是 20MHz，则针对极高吞吐量信号字段 A1（VHT-SIG-A1）分配 52 个音调，针对极高吞吐量信号字段 A2（VHT-SIG-A2）分配 52 个音调，针对极高吞吐量短训练字段（VHT-STF）分配 12 个音调，针对一个或多个极高吞吐量长训练字段（VHT-LTF）分配 56 个音调，针对极高吞吐量信号字段 B（VHT-SIG-B）分配 56 个音调，针对数据字段（DATA）分配 56 个音调；

用于如下操作的模块：如果所述带宽是 40MHz，则针对所述 VHT-SIG-A1 分配 104 个音

调，针对所述 VHT-SIG-A2 分配 104 个音调，针对所述 VHT-STF 分配 24 个音调，针对所述一个或多个 VHT-LTF 分配 114 个音调，针对所述 VHT-SIG-B 分配 114 个音调，针对所述 DATA 分配 114 个音调；

用于如下操作的模块：如果所述带宽是 80MHz，则针对所述 VHT-SIG-A1 分配 208 个音调，针对所述 VHT-SIG-A2 分配 208 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 242 个音调，针对所述 VHT-SIG-B 分配 242 个音调，针对所述 DATA 分配 242 个音调；

用于如下操作的模块：如果所述带宽是 160MHz，则针对所述 VHT-SIG-A1 分配 416 个音调，针对所述 VHT-SIG-A2 分配 416 个音调，针对所述 VHT-STF 分配 48 个音调，针对所述一个或多个 VHT-LTF 分配 484 个音调，针对所述 VHT-SIG-B 分配 484 个音调，针对所述 DATA 分配 484 个音调；以及

用于发射所述信号的模块。

38. 如权利要求 37 所述的装置，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带 26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

39. 如权利要求 37 所述的装置，进一步包括：用于基于所述带宽产生带宽消息的模块。

40. 如权利要求 37 所述的装置，进一步包括进行如下操作的模块：使用正交二相相移键控（QBPSK）对所述 VHT-SIG-A2 进行调制，以指示：帧包括极高吞吐量（VHT）信号。

41. 一种用于接收正交频分复用（OFDM）音调的装置，包括：

用于确定信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的模块；

用于如下操作的模块：如果所述带宽是 20MHz，则接收针对极高吞吐量信号字段 A1（VHT-SIG-A1）的 52 个音调、针对极高吞吐量信号字段 A2（VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B（VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调；

用于如下操作的模块：如果所述带宽是 40MHz，则接收针对所述 VHT-SIG-A1 的 104 个音调、针对所述 VHT-SIG-A2 的 104 个音调、针对所述 VHT-STF 的 24 个音调、针对所述一个或多个 VHT-LTF 的 114 个音调、针对所述 VHT-SIG-B 的 114 个音调、以及针对所述 DATA 的 114 个音调；

用于如下操作的模块：如果所述带宽是 80MHz，则接收针对所述 VHT-SIG-A1 的 208 个音调、针对所述 VHT-SIG-A2 的 208 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 242 个音调、针对所述 VHT-SIG-B 的 242 个音调、以及针对所述 DATA 的 242 个音调；以及

用于如下操作的模块：如果所述带宽是 160MHz，则接收针对所述 VHT-SIG-A1 的 416 个音调、针对所述 VHT-SIG-A2 的 416 个音调、针对所述 VHT-STF 的 48 个音调、针对所述一个或多个 VHT-LTF 的 484 个音调、针对所述 VHT-SIG-B 的 484 个音调、以及针对所述 DATA 的 484 个音调。

42. 如权利要求 41 所述的装置，其中，如果所述带宽是 20MHz，则所述 VHT-SIG-B 携带

26 比特，如果所述带宽是 40MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 27 比特，如果所述带宽是 80MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特，以及如果所述带宽是 160MHz，则所述 VHT-SIG-B 携带每 20MHz 带宽 29 比特。

43. 如权利要求 41 所述的装置，其中，确定所述用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz 的步骤包括对带宽指示进行接收。

44. 如权利要求 41 所述的装置，进一步包括，用于如果所述 VHT-SIG-A2 使用正交二相相移键控（QBPSK），则对极高吞吐量（VHT）信号进行检测的模块。

# 分配和接收针对帧的音调

[0001] 相关申请

[0002] 本申请涉及并且要求享有于 2010 年 4 月 14 日提交的、题目为“TONE NUMEROLOGY FOR 802.11ac PREAMBLE”的美国临时专利申请序列号 No.61/323,976 的优先权，并且在此通过引用的方式将其全部合并入本文。

## 技术领域

[0003] 本公开内容总体涉及通信系统。更具体地，本公开内容涉及分配和接收针对帧的音调。

## 背景技术

[0004] 已广泛部署通信系统，以提供各种类型的通信内容，比如数据、语音、视频等。这些系统可以是能够支持多个通信设备（例如，无线通信设备、接入终端等）与一个或多个其它通信设备（例如，基站、接入点等）进行同时通信的多址系统。

[0005] 在过去的几年中，通信设备的使用已经急剧增加。通信设备常常提供到网络（例如，局域网（LAN）或者互联网）的接入。其它通信设备（例如，接入终端、膝上型计算机、智能电话、多媒体播放器、游戏设备等）可以与提供网络接入的通信设备进行无线地通信。一些通信设备符合某些工业标准，比如，电气及电子工程师学会（IEEE）802.11（例如，无线保真或“Wi-Fi”）标准。例如，通信设备用户常常使用这样的通信设备连接到无线网络。

[0006] 随着通信设备的使用已经增加，也在试图提高通信设备容量、可靠性、以及效率。改善通信设备容量、可靠性和 / 或效率的系统和方法可能是有益的。

## 发明内容

[0007] 公开了一种用于分配正交频分复用（OFDM）音调的通信设备。所述通信设备包括处理器以及与所述处理器进行电子通信的存储器中存储的指令。所述通信设备确定用于信号发射的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz。如果所述带宽是 20MHz，则所述通信设备还针对极高吞吐量信号字段 A1（VHT-SIG-A1）分配 52 个音调，针对极高吞吐量信号字段 A2（VHT-SIG-A2）分配 52 个音调，针对极高吞吐量短训练字段（VHT-STF）分配 12 个音调，针对一个或多个极高吞吐量长训练字段（VHT-LTF）分配 56 个音调，针对极高吞吐量信号字段 B（VHT-SIG-B）分配 56 个音调，针对数据字段（DATA）分配 56 个音调。如果所述带宽是 40MHz，则所述通信设备另外针对 VHT-SIG-A1 分配 104 个音调，针对 VHT-SIG-A2 分配 104 个音调，针对 VHT-STF 分配 24 个音调，针对一个或多个 VHT-LTF 分配 114 个音调，针对 VHT-SIG-B 分配 114 个音调，针对 DATA 分配 114 个音调。如果所述带宽是 80MHz，则所述通信设备进一步针对 VHT-SIG-A1 分配 208 个音调，针对 VHT-SIG-A2 分配 208 个音调，针对 VHT-STF 分配 48 个音调，针对一个或多个 VHT-LTF 分配 242 个音调，针对 VHT-SIG-B 分配 242 个音调，针对 DATA 分配 242 个音调。如果所述带宽是 160MHz，则所述通信设备还针对 VHT-SIG-A1 分配 416 个音调，针对 VHT-SIG-A2 分配 416 个音调，针对 VHT-STF 分配 48

个音调，针对一个或多个 VHT-LTF 分配 484 个音调，针对 VHT-SIG-B 分配 484 个音调，针对 DATA 分配 484 个音调。所述通信设备另外发射所述信号。

[0008] 如果所述带宽是 20MHz，则所述通信设备可以针对非高吞吐量（非 HT）短训练字段（L-STF）分配 12 个音调，针对非 HT 长训练字段（L-LTF）分配 52 个音调，以及针对非 HT 信号字段（L-SIG）分配 52 个音调。如果所述带宽是 40MHz，则所述通信设备还可以针对所述 L-STF 分配 24 个音调，针对所述 L-LTF 分配 104 个音调，以及针对所述 L-SIG 分配 104 个音调。如果所述带宽是 80MHz，则所述通信设备另外可以针对所述 L-STF 分配 48 个音调，针对所述 L-LTF 分配 208 个音调，以及针对所述 L-SIG 分配 208 个音调。如果所述带宽是 160MHz，则所述通信设备可以进一步针对所述 L-STF 分配 48 个音调，针对所述 L-LTF 分配 416 个音调，以及针对所述 L-SIG 分配 416 个音调。

[0009] 如果所述带宽是 20MHz，所述 VHT-SIG-B 可以携带 26 比特。如果所述带宽是 40MHz，则所述 VHT-SIG-B 可以携带每 20MHz 的带宽 27 比特。如果所述带宽是 80MHz，则所述 VHT-SIG-B 可以携带每 20MHz 的带宽 29 比特。如果所述带宽是 160MHz，所述 VHT-SIG-B 可以携带每 20MHz 的带宽 29 比特。如果所述带宽是 80MHz 或 160MHz，则所述 VHT-SIG-B 可以携带一个或多个填充比特。

[0010] 所述通信设备可以基于所述带宽产生带宽消息。所述通信设备可以使用正交二相相移键控（QBPSK）来对所述 VHT-SIG-A2 进行调制，以指示 :帧包括极高吞吐量（VHT）信号。如果所述带宽是 80MHz，则所述通信设备可以在子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处插入导频音调。

[0011] 还公开了一种用于接收正交频分复用（OFDM）音调的通信设备。所述通信设备包括处理器以及与所述处理器进行电子通信的存储器中所存储的指令。所述通信设备确定信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz。如果所述带宽是 20MHz，则所述通信设备还接收针对极高吞吐量信号字段 A1 （VHT-SIG-A1）的 52 个音调，针对极高吞吐量信号字段 A2 （VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B （VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调。如果所述带宽是 40MHz，则所述通信设备另外接收针对 VHT-SIG-A1 的 104 个音调、针对 VHT-SIG-A2 的 104 个音调、针对 VHT-STF 的 24 个音调、针对一个或多个 VHT-LTF 的 114 个音调、针对 VHT-SIG-B 的 114 个音调、以及针对 DATA 的 114 个音调。如果所述带宽是 80MHz，则所述通信设备进一步接收针对 VHT-SIG-A1 的 208 个音调、针对 VHT-SIG-A2 的 208 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 242 个音调、针对 VHT-SIG-B 的 242 个音调、以及针对 DATA 的 242 个音调。如果所述带宽是 160MHz，则所述通信设备还接收针对 VHT-SIG-A1 的 416 个音调、针对 VHT-SIGA2 的 416 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 484 个音调、针对 VHT-SIG-B 的 484 个音调、以及针对 DATA 的 484 个音调。确定所述用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz 的步骤可以包括对带宽指示进行接收。

[0012] 如果所述带宽是 20MHz，则所述通信设备可以接收针对非高吞吐量（非 HT）短训练字段（L-STF）的 12 个音调、针对非 HT 长训练字段（L-LTF）的 52 个音调、以及针对非 HT 信号字段（L-SIG）的 52 个音调。如果所述带宽是 40MHz，则所述通信设备可以接收针对所述

L-STF 的 24 个音调、针对所述 L-LTF 的 104 个音调、以及针对所述 L-SIG 的 104 个音调。如果所述带宽是 80MHz，则所述通信设备可以接收针对所述 L-STF 的 48 个音调、针对所述 L-LTF 的 208 个音调、以及针对所述 L-SIG 的 208 个音调。如果所述带宽是 160MHz，则所述通信设备可以接收针对所述 L-STF 的 48 个音调、针对所述 L-LTF 的 416 个音调、以及针对所述 L-SIG 的 416 个音调。

[0013] 如果所述带宽是 20MHz，所述 VHT-SIG-B 可以携带 26 比特。如果所述带宽是 40MHz，所述 VHT-SIG-B 可以携带每 20MHz 的带宽 27 比特。如果所述带宽是 80MHz，所述 VHT-SIG-B 可以携带每 20MHz 的带宽 29 比特。如果所述带宽是 160MHz，所述 VHT-SIG-B 可以携带每 20MHz 的带宽 29 比特。如果所述带宽是 80MHz 或 160MHz，则所述 VHT-SIG-B 携带一个或多个填充比特。

[0014] 如果所述 VHT-SIG-A2 使用正交二相相移键控(QBPSK)，则所述通信设备可以对极高吞吐量(VHT)信号进行检测。如果所述带宽是 80MHz，则所述通信设备可以接收子载波索引 -103、-75、-39、-11、11、39、75 以及 103 处的导频音调。

[0015] 还公开了一种用于在通信设备上分配正交频分复用(OFDM)音调的方法。所述方法包括：确定用于信号发射的带宽是否为 20 兆赫兹(MHz)、40MHz、80MHz 或 160MHz。如果所述带宽是 20MHz，则所述方法还包括：针对极高吞吐量信号字段 A1(VHT-SIG-A1)分配 52 个音调，针对极高吞吐量信号字段 A2(VHT-SIG-A2)分配 52 个音调，针对极高吞吐量短训练字段(VHT-STF)分配 12 个音调，针对一个或多个极高吞吐量长训练字段(VHT-LTF)分配 56 个音调，针对极高吞吐量信号字段 B (VHT-SIG-B)分配 56 个音调，针对数据字段(DATA)分配 56 个音调。如果所述带宽是 40MHz，则所述方法另外包括：针对 VHT-SIG-A1 分配 104 个音调，针对 VHT-SIG-A2 分配 104 个音调，针对 VHT-STF 分配 24 个音调，针对一个或多个 VHT-LTF 分配 114 个音调，针对 VHT-SIG-B 分配 114 个音调，针对 DATA 分配 114 个音调。如果所述带宽是 80MHz，则所述方法进一步包括：针对 VHT-SIG-A1 分配 208 个音调，针对 VHT-SIG-A2 分配 208 个音调，针对 VHT-STF 分配 48 个音调，针对一个或多个 VHT-LTF 分配 242 个音调，针对 VHT-SIG-B 分配 242 个音调，针对 DATA 分配 242 个音调。如果所述带宽是 160MHz，则所述方法还包括：针对 VHT-SIG-A1 分配 416 个音调，针对 VHT-SIG-A2 分配 416 个音调，针对 VHT-STF 分配 48 个音调，针对一个或多个 VHT-LTF 分配 484 个音调，针对 VHT-SIG-B 分配 484 个音调，以及针对 DATA 分配 484 个音调。所述方法另外包括：发射所述信号。

[0016] 还公开了一种用于在通信设备上对正交频分复用(OFDM)音调进行接收的方法。所述方法包括：确定用于信号接收的带宽是否为 20 兆赫兹(MHz)、40MHz、80MHz 或 160MHz。如果所述带宽是 20MHz，则所述方法还包括：接收针对极高吞吐量信号字段 A1 (VHT-SIG-A1)的 52 个音调、针对极高吞吐量信号字段 A2 (VHT-SIG-A2)的 52 个音调、针对极高吞吐量短训练字段(VHT-STF)的 12 个音调、针对一个或多个极高吞吐量长训练字段(VHT-LTF)的 56 个音调、针对极高吞吐量信号字段 B (VHT-SIG-B)的 56 个音调、以及针对数据字段(DATA)的 56 个音调。如果所述带宽是 40MHz，则所述方法另外包括：接收针对 VHT-SIG-A1 的 104 个音调、针对 VHT-SIG-A2 的 104 个音调、针对 VHT-STF 的 24 个音调、针对一个或多个 VHT-LTF 的 114 个音调、针对 VHT-SIG-B 的 114 个音调、针对 DATA 的 114 个音调。如果所述带宽是 80MHz，则所述方法进一步包括：接收针对 VHT-SIG-A1 的 208 个音调、针对 VHT-SIG-A2 的 208 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 242 个音调、针对

VHT-SIG-B 的 242 个音调、以及针对 DATA 的 242 个音调。如果所述带宽是 160MHz，则所述方法还包括：接收针对 VHT-SIG-A1 的 416 个音调、针对 VHT-SIG-A2 的 416 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 484 个音调、针对 VHT-SIG-B 的 484 个音调、以及针对 DATA 的 484 个音调。

[0017] 还公开了一种用于分配正交频分复用（OFDM）音调的计算机程序产品。所述计算机程序产品包括：其上具有指令的非临时性有形计算机可读介质。所述指令包括：用于使通信设备确定用于信号发射的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的代码。所述指令还包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 20MHz，则针对极高吞吐量信号字段 A1（VHT-SIG-A1）分配 52 个音调，针对极高吞吐量信号字段 A2（VHT-SIG-A2）分配 52 个音调，针对极高吞吐量短训练字段（VHT-STF）分配 12 个音调，针对一个或多个极高吞吐量长训练字段（VHT-LTF）分配 56 个音调，针对极高吞吐量信号字段 B（VHT-SIG-B）分配 56 个音调，以及针对数据字段（DATA）分配 56 个音调。所述指令另外包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 40MHz，则针对 VHT-SIG-A1 分配 104 个音调，针对 VHT-SIG-A2 分配 104 个音调，针对 VHT-STF 分配 24 个音调，针对一个或多个 VHT-LTF 分配 114 个音调，针对 VHT-SIG-B 分配 114 个音调，针对 DATA 分配 114 个音调。所述指令进一步包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 80MHz，则针对 VHT-SIG-A1 分配 208 个音调，针对 VHT-SIG-A2 分配 208 个音调，针对 VHT-STF 分配 48 个音调，针对一个或多个 VHT-LTF 分配 242 个音调，针对 VHT-SIG-B 分配 242 个音调，以及针对 DATA 分配 242 个音调。所述指令还包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 160MHz，则针对 VHT-SIG-A1 分配 416 个音调，针对 VHT-SIG-A2 分配 416 个音调，针对 VHT-STF 分配 48 个音调，针对一个或多个 VHT-LTF 分配 484 个音调，针对 VHT-SIG-B 分配 484 个音调，以及针对 DATA 分配 484 个音调。所述指令另外包括用于使所述通信设备发射所述信号的代码。

[0018] 还公开了一种用于接收正交频分复用（OFDM）音调的计算机程序产品。所述计算机程序产品包括：具有指令的非临时性有形计算机可读介质。所述指令包括：用于使通信设备确定用于信号接收的带宽是否为 20 兆赫兹（MHz）、40MHz、80MHz 或 160MHz 的代码。所述指令还包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 20MHz，则接收针对极高吞吐量信号字段 A1（VHT-SIG-A1）的 52 个音调、针对极高吞吐量信号字段 A2（VHT-SIG-A2）的 52 个音调、针对极高吞吐量短训练字段（VHT-STF）的 12 个音调、针对一个或多个极高吞吐量长训练字段（VHT-LTF）的 56 个音调、针对极高吞吐量信号字段 B（VHT-SIG-B）的 56 个音调、以及针对数据字段（DATA）的 56 个音调。所述指令另外包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 40MHz，则接收针对 VHT-SIG-A1 的 104 个音调、针对 VHT-SIG-A2 的 104 个音调、针对 VHT-STF 的 24 个音调、针对一个或多个 VHT-LTF 的 114 个音调、针对 VHT-SIG-B 的 114 个音调、以及针对 DATA 的 114 个音调。所述指令进一步包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 80MHz，则接收针对 VHT-SIG-A1 的 208 个音调、针对 VHT-SIG-A2 的 208 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 242 个音调、针对 VHT-SIG-B 的 242 个音调、以及针对 DATA 的 242 个音调。所述指令还包括用于使所述通信设备进行如下操作的代码：如果所述带宽是 160MHz，则接收针对 VHT-SIG-A1 的 416 个音调、针对 VHT-SIG-A2 的 416 个音调、针

对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 484 个音调、针对 VHT-SIG-B 的 484 个音调、以及针对 DATA 的 484 个音调。

[0019] 还公开了一种用于分配正交频分复用(OFDM)音调的装置。所述装置包括:用于确定信号发射的带宽是否为 20 兆赫兹(MHz)、40MHz、80MHz 或 160MHz 的模块。所述装置还包括用于如下操作的模块:如果所述带宽是 20MHz,则针对极高吞吐量信号字段 A1(VHT-SIG-A1)分配 52 个音调,针对极高吞吐量信号字段 A2(VHT-SIG-A2)分配 52 个音调,针对极高吞吐量短训练字段(VHT-STF)分配 12 个音调,针对一个或多个极高吞吐量长训练字段(VHT-LTF)分配 56 个音调,针对极高吞吐量信号字段 B(VHT-SIG-B)分配 56 个音调,以及针对数据字段(DATA)分配 56 个音调。所述装置另外包括用于如下操作的模块:如果所述带宽是 40MHz,则针对 VHT-SIG-A1 分配 104 个音调,针对 VHT-SIG-A2 分配 104 个音调,针对 VHT-STF 分配 24 个音调,针对一个或多个 VHT-LTF 分配 114 个音调,针对 VHT-SIG-B 分配 114 个音调,以及针对 DATA 分配 114 个音调。所述装置进一步包括用于如下操作的模块:如果所述带宽是 80MHz,则针对 VHT-SIG-A1 分配 208 个音调,针对 VHT-SIG-A2 分配 208 个音调,针对 VHT-STF 分配 48 个音调,针对一个或多个 VHT-LTF 分配 242 个音调,针对 VHT-SIG-B 分配 242 个音调,针对 DATA 分配 242 个音调。所述装置还包括用于如下操作的模块:如果所述带宽是 160MHz,则针对 VHT-SIG-A1 分配 416 个音调,针对 VHT-SIG-A2 分配 416 个音调,针对 VHT-STF 分配 48 个音调,针对一个或多个 VHT-LTF 分配 484 个音调,针对 VHT-SIG-B 分配 484 个音调,针对 DATA 分配 484 个音调。所述装置另外包括:用于发射所述信号的模块。

[0020] 还公开了一种用于接收正交频分复用(OFDM)音调的装置。所述装置包括:用于确定信号接收的带宽是否为 20 兆赫兹(MHz)、40MHz、80MHz 或 160MHz 的模块。所述装置还包括:用于如果所述带宽是 20MHz,则接收针对极高吞吐量信号字段 A1(VHT-SIG-A1)的 52 个音调、针对极高吞吐量信号字段 A2(VHT-SIG-A2)的 52 个音调、针对极高吞吐量短训练字段(VHT-STF)的 12 个音调、针对一个或多个极高吞吐量长训练字段(VHT-LTF)的 56 个音调、针对极高吞吐量信号字段 B(VHT-SIG-B)的 56 个音调、以及针对数据字段(DATA)的 56 个音调的模块。所述装置另外包括:用于如果所述带宽是 40MHz,则接收针对 VHT-SIG-A1 的 104 个音调、针对 VHT-SIG-A2 的 104 个音调、针对 VHT-STF 的 24 个音调、针对一个或多个 VHT-LTF 的 114 个音调、针对 VHT-SIG-B 的 114 个音调、以及针对 DATA 的 114 个音调的模块。所述装置进一步包括:用于如果所述带宽是 80MHz,则接收针对 VHT-SIG-A1 的 208 个音调、针对 VHT-SIG-A2 的 208 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 242 个音调、针对 VHT-SIG-B 的 242 个音调、针对 DATA 的 242 个音调的模块。所述装置另外包括:用于如果所述带宽是 160MHz,则接收针对 VHT-SIG-A1 的 416 个音调、针对 VHT-SIG-A2 的 416 个音调、针对 VHT-STF 的 48 个音调、针对一个或多个 VHT-LTF 的 484 个音调、针对 VHT-SIG-B 的 484 个音调、以及针对 DATA 的 484 个音调的模块。

## 附图说明

[0021] 图 1 是描绘发射通信设备的一种配置(其中,可以实现用于分配针对帧的音调的系统和方法)以及接收通信设备的一种配置(其中,可以实现用于接收针对帧的音调的系统和方法)的框图;

[0022] 图 2 是描绘根据本文公开的系统和方法，可以使用的通信帧的一个示例的图；

[0023] 图 3 是描绘多个帧的示例的图；

[0024] 图 4 是描绘针对传统信号字段(L-SIG)、极高吞吐量信号 A1 (VHT-SIG-A1)、以及极高吞吐量信号 A2 (VHT-SIG-A2)的星座的图；

[0025] 图 5 是描绘根据本文公开的系统和方法，针对 80MHz 信号的数据和导频音调的一个示例的图；

[0026] 图 6 是描绘用于分配针对帧的音调的方法的一种配置的流程图；

[0027] 图 7 是描绘用于接收针对帧的音调的方法的一种配置的流程图；

[0028] 图 8 是接入点的一种配置的框图，其中可以实现用于分配针对帧的音调的系统和方法；

[0029] 图 9 是可以在多输入和多输出(MIMO)系统中使用的通信设备的框图；

[0030] 图 10 描绘可以包括在通信设备、基站和 / 或接入点内的某些部件；以及

[0031] 图 11 描绘可以包括在无线通信设备和 / 或接入终端内的某些部件。

## 具体实施方式

[0032] 通信设备的示例包括蜂窝电话基站或节点、接入点、无线网关、以及无线路由器。通信设备可以根据某些工业标准，比如，电气与电子工程师学会(IEEE)802.11a、802.11b、802.11g、802.11n 和 / 或 802.11ac (例如，无线保真或者“Wi-Fi”)标准进行操作。通信设备可能符合的标准的其它示例包括：IEEE 802.16(例如，微波接入全球互通或者“WiMAX”)、第三代合作伙伴计划(3GPP)、3GPP 长期演进(LTE)以及其它(例如，其中通信设备可以叫做节点 B、演进节点 B (eNB)等)。尽管可以围绕一个或多个标准来描述本文公开的系统和方法中的一些，但是这应该不会限制本公开内容的范围，因为系统和方法可以应用于很多系统和 / 或标准。

[0033] 一些通信设备(例如，接入终端、客户设备、客户站等)可以与其它通信设备进行无线通信。一些通信设备可以叫做移动设备、移动站、用户站、用户设备(UE)、远程站、接入终端、移动终端、终端、用户终端、用户单元等。通信设备的另外的示例包括：膝上型或台式计算机、蜂窝电话、智能电话、无线调制解调器、电子阅读器、平板设备、游戏系统等。这些通信设备中的一些可以根据上述一个或多个工业标准进行操作。因此，概括性术语“通信设备”可以包括根据工业标准用不同命名描述的通信设备(例如，接入终端、用户装置(UE)、远程终端、接入点、基站、节点 B、演进节点 B (eNB)等)。

[0034] 一些通信设备可以能够提供到通信网络的接入。通信网络的示例包括但不限于，电话网络(例如，“陆线”网络，比如公共交换电话网(PSTN)或蜂窝电话网络)、互联网、局域网(LAN)、广域网(WAN)、城域网(MAN)等。

[0035] IEEE 802.11 小组的当前工作包括对名称为 VHT (极高吞吐量)的、802.11 的新且更快版本进行标准化。该扩展可以叫做 802.11ac。正在考虑在不导致冲突的情况下，允许多个传输并行出现的技术，比如空分多址(SDMA)。还在考虑使用另外的信号带宽(BW)，比如，使用 80 兆赫兹(MHz)和 160MHz 进行传输。可以根据既允许增加的信号带宽和 SDMA、又允许对 802.11n、802.11a、以及 802.11 向后兼容的系统和方法，来定义新的物理层(PHY)前导码。为了使 VHT 前导码向后兼容，可以利用能够被传统设备解调的正交频分复用(OFDM)

计算学(numerology)。然而,也可以使用向 802.11ac 设备提供增加功能的 OFDM 计算学。该计算学可以包括 :(1)针对前导码中的每个 OFDM 符号的多个数据音调,(2)针对 OFDM 数据符号的多个数据音调,(3)多个导频音调,以及(4)多个直流(DC)零载波。本文公开的系统和方法描述了能够应用于这类 VHT 扩展的 OFDM 子载波计算学。

[0036] 具有前导码的 802.11ac 帧可以构建为包括多个字段。在一种配置中,802.11ac 帧可以包括传统的短训练字段或非高吞吐量短训练字段(L-STF)、传统的长训练字段或非高吞吐量长训练字段(L-LTF)、传统的信号字段或非高吞吐量信号字段(L-SIG)、极高吞吐量的信号字段 A1 (VHT-SIG-A1)、极高吞吐量信号字段 A2 (VHT-SIG-A2)、极高吞吐量短训练字段(VHT-STF)、一个或多个极高吞吐量长训练字段(VHT-LTF)、极高吞吐量信号字段 B (VHT-SIG-B)、以及数据字段(例如,DATA 或 VHT-DATA)。

[0037] 802.11ac 前导码设计为支持发射波束成形和 SDMA。可以通过全向方式(例如,使用循环分集或另一个方案)来发射前导码的第一部分。前导码的这个部分可以包括 L-STF、L-LTF、L-SIG、VHT-SIG-A1、以及 VHT-SIG-A2。应该注意的是,传统设备(例如,符合传统或较早规范的设备)可以对 L-STF、L-LTF、以及 L-SIG 进行解码。然而,802.11ac 设备可以对(例如,附加到前述字段的)VHT-SIG-A1 和 VHT-SIG-A2 进行解码。

[0038] 可以通过全向方式(可能是波束成形或者可能是 SDMA 预编码)发射 802.11ac 前导码的第二部分。前导码的这个第二部分包括 :VHT-STF、一个或多个 VHT-LTF、以及 VHT-SIG-B。可以利用与前导码的第二部分相同的天线模式发射(例如,数据字段中的)数据符号。传统的甚至所有的 802.11ac 设备可能不可以对数据符号和前导码的第二部分进行解码。

[0039] 上述 802.11ac 前导码具有可以被传统的 802.11a 和 802.11n 接收机解码的一些控制数据。该数据是包含在 L-SIG 中的。L-SIG 中的数据通知所有接收机 :发射将占据无线介质的时间,使得所有的设备能够把它们的发射推迟一段精确的时间量。此外,802.11ac 前导码允许 802.11ac 设备把该发射辨别为 802.11ac 发射(并且避免确定该发射使用了 11a 或 11n 格式)。此外,根据本文的系统和方法所述的 802.11ac 前导码可以使得传统的 11a 和 11n 设备把该发射检测为 802.11a 发射,该 802.11a 发射是具有 L-SIG 中的有效数据的有效发射。

[0040] 根据本文公开的系统和方法,可以定义针对 80MHz 802.11ac 信号的数据和导频音调的数量。这可以与针对 20MHz 802.11n 和 40MHz 802.11n 信号的数据和导频音调的数量进行比较。20MHz 802.11n 信号使用 56 个音调(52 个数据,4 个导频)以及一个直流(DC)音调。40MHz 802.11n 信号使用 114 个音调(108 个数据,6 个导频)以及 3 个 DC 音调。本文公开的系统和方法描绘了针对 80MHz 802.11ac 信号使用的 242 个音调(234 个数据,8 个导频)以及 3 个 DC 音调。根据精致的频率交织器构造、合理的成本滤波需求以及效率方面的考虑,可以促使采用根据本文的系统和方法的 234 个数据音调。还可以注意的是,802.11a 信号使用 52 个音调(48 个数据音调和 4 个导频音调)以及一个 DC 音调。

[0041] 根据本文的系统和方法所述的 802.11ac 前导码可以包括两个部分或部件。可以全向地发射第一部分,并且可以通过波束成形或 SDMA 预编码来发射第二部分。所述第一或全向部分的开头三个字段可以包含 802.11a 和 802.11n 接收机可解码的信号(例如,L-STF、L-LTF、L-SIG)。此外,传统的 802.11a 和 802.11n 设备可以确定 802.11ac 传输是 802.11a

传输，使得这些设备对 L-SIG 进行解码，就好像其是 802.11a 传输一样。

[0042] 本文公开的系统和方法可以向满足所述约束的每个字段或信号提供合适数量的音调。表(1)中示出了这种音调分配。更具体地，表(1)示出了可以针对各种信号带宽的 802.11ac 传输而使用的 OFDM 音调的数量。

[0043] 表(1)

[0044]

| 字段 | 信号带宽 | | | |
|---|---|---|---|---|
| | 20 MHz | 40 MHz | 80 MHz | 160 MHz |
| L-STF | 12 | 24 | 48 | 48 |
| L-LTF | 52 | 104 | 208 | 416 |
| L-SIG | 52 | 104 | 208 | 416 |
| VHT-SIG-A1 | 52 | 104 | 208 | 416 |
| VHT-SIG-A2 | 52 | 104 | 208 | 416 |
| VHT-STF | 12 | 24 | 48 | 48 |
| VHT-LTF | 56 | 114 | 242 | 484 |
| VHT-SIG-B | 56 | 114 | 242 | 484 |
| 数据 | 56 | 114 | 242 | 484 |

[0045] L-STF 可以使用每 20MHz 12 个音调的信号。在这种情形中，时域信号具有 800 纳秒(ns)的重复间隔。该重复间隔可以用于快速增益控制、时间偏移估计、以及频率偏移估计。可以快速测量已接收的信号强度，因为对于一个 800ns 间隔，只需要考虑时域信号。传统的 802.11a 和 802.11n 设备将期望 12 个音调。

[0046] L-LTF 和 L-SIG 针对 20MHz 信号可以使用 52 个音调。这可能期望用于通过任何传统的 802.11a 或 802.11n 设备的 802.11a 传输。当发送 40MHz802.11ac 信号时，可以把这些字段的内容复制(并且通过复数调整)到 40MHz 信号的每个 20MHz 子带。也就是说，L-SIG 可以用于被 20MHz 精确分隔的具有 DC 音调的两个 20MHz 子带中。因此，音调的总数刚好翻倍。对于 80MHz 和 160MHz，可以遵循相同的设计，并且把字段调整且复制到 4 个或 8 个 20MHz 子带中的每一个。

[0047] 根据 802.11a 规范，L-SIG 可以使用 48 个数据音调和 4 个导频。对于 40MHz、80MHz、以及 160MHz 802.11ac 发射，由 L-SIG (例如，使用二相相移键控(BPSK)和 1/2 编码速率)携带的 24 比特的数据可以在 20MHz 子带中的每一个中发射。这样允许仅在单个 20MHz 信道上接收的任何传统设备对 L-SIG 中的数据进行解码并且适当地延迟。

[0048] VHT-SIG-A1 和 VHT-SIG-A2 字段或者符号可以在 20MHz 中使用 52 个音调(48 个数据音调和 4 个导频音调)。数据音调的数量可以和 L-SIG 相同，因为只能针对这些数据音调完成信道估计(该信道估计是基于 L-LTF)。对于 40MHz、80MHz 以及 160MHz 带宽，出于同样的原因，数据音调和导频音调的数量遵循 L-LTF。

[0049] VHT-STF 可以和 L-STF 一样，可以使用每 20MHz 12 个音调的信号。通过这种方式，

接收增益控制算法可以使用仅仅 800ns 的时间，快速地测量接收信号强度。如果使用更多音调，则接收机可能需要等待更长的时间段进行精确的信号强度测量，因此对所分配的时间设置约束，使得模拟接收增益变化并且稳定到它们的新数值上。可能需要增益控制，因为与前导码的第一部分相比较，对于前导码的第二部分（以及数据字段）而言，已接收的信号强度可能是不同的。此外，可以使用 VHT-STF 来完成对定时和频率偏移的更新。

[0050] VHT-LTF、VHT-SIG-B、以及数据字段可以使用比前导码的第一或全向部分更多的 OFDM 音调。因此，这些字段中的每一个可以使用和 DATA 相同数量的音调。对于 20MHz 和 40MHz 802.11ac 传输而言，音调的数量选择为与 802.11n 标准相匹配。对于 80MHz 和 160MHz 802.11ac 传输而言，可以分别将音调的数量选定为 242 和 484。

[0051] 对于 20MHz 802.11ac 传输，VHT-SIG-B 字段携带 26 比特的数据（52 个音调，如果使用了 BPSK 和 1/2 速率编码的话）。对于 40MHz 802.11ac 传输，VHT-SIG-B 字段可以在每个 20MHz 子带中携带 54 比特的单独的数据或者相同的 27 比特的数据。VHT-SIG-B 字段的 80MHz 传输可以在每个 20MHz 子带中携带 29 比特的数据，或者在每个 40MHz 子带中携带 58 比特的数据，或者 117 比特的数据。对于 160MHz 传输，可以作出相似的选择。应该注意的是，虽然本文使用 BPSK 和 1/2 速率编码作为示例，但是根据本文的系统和方法，可以使用其它调制方案和 / 或编码速率，这样可以允许不同数量的比特包括在每个符号中。表（2）描绘了根据本文公开的系统和方法，可以使用的每个信号带宽的数据音调数量和比特数量的一个示例。

[0052] 表（2）

[0053]

| VHT-SIG-B | 信号带宽 | | | |
|---|---|---|---|---|
| | 20 MHz | 40 MHz | 80 MHz | 160 MHz |
| 音调的数量 | 56 | 114 | 242 | 484 |
| 数据音调的数量 | 52 | 108 | 234 | 468 |
| 每20MHz带宽的比特数量 | 26 | 27 | 29+1 填充 | 29+2 填充 |

[0054] 对于信号附加能力，可以使用针对更宽带宽信号的额外比特，这在使用超过 20MHz 的信号带宽时是有可能的。例如，80MHz 信号可以包括四个独立的 20MHz 信号（流），其中，每个 20MHz 信号可以携带不同的编码的数据流。这些流中的每一个可以具有不同的调制和编码（例如，使用不同的调制和编码方案（MCS））。每个流可以另外具有不同数量的字节。此外，每个流可以具有不同数量的分组聚合，比如，802.11n 类型的聚合媒体访问控制（MAC）协议数据单元（A-MPDU）或者聚合物理层汇聚过程（PLCP）协议数据单元（PPDU），例如，其中每个 PPDU 携带其自己的 VHT-SIG-B 字段。所有的这些特征可以由相应的 20MHz 流中携带的 VHT-SIG-B 字段比特用信号表示并且指示。

[0055] 下面给出关于其中可以应用本文所公开的系统和方法的一种配置的更多细节。在这种配置中，规定了多个操作数字。应该注意的是，不同的操作数字可以用于不同的配置中。在这个示例中，所探测到的发射（Tx）天线的最大数量是 8。这样可以提供合理的复杂度、成本、和前导码长度折衷。单用户（SU）情形中的空间流的最大数量（$N_{SS}$）可以是 8。假

定可以探测到 8 个发射天线，则本来就支持多达 8 个空间流。

[0056] 在多用户的情形中，本例中，每个用户（例如，接入点、客户端、站、无线通信设备等）的空间流的最大数量（$N_{SS}$）是 4。假定多个用户可以共享空间流，自然可以使该数量小于 8。这也符合极高吞吐量信号字段（VHT-SIG）尺寸限制，并且减小了所需要的表示比特的数量。在多用户情形中，本例中的用户上总计的空间流的最大数量（$N_{SS}$）是 8。假定可以探测到 8 个发射天线，则本来就支持多达 8 个空间流。

[0057] 多用户的用户最大数量可以是 4。更大的数量可能明显增大媒体访问控制（MAC）和 / 或物理（PHY）层复杂度。这符合（VHT-SIG）尺寸限制，并且减小了所需要的表示比特的数量。

[0058] 所探测到的发射天线的最大数量为 8，符合项目授权请求（PAR）需求（例如，IEEE 标准委员会项目授权请求（PAR）需求）。对于单个用户的情形，具有 $N_{SS}$ ＝ 8 的八个天线可以允许大于 500 兆比特每秒（Mbps）的吞吐量。对于多个用户的情形，八个天线探测可以允许大于 1 吉比特每秒（Gbps）的吞吐量。此外，可能存在对包括超过 8 个天线的接入点（AP）和站（STA）的物理限制。此外，进行 16 个天线探测增大了前导码长度。此外，用于指示所探测的天线数量所需要的比特数量也增大了，尽管在帧前导码中可以存在有限数量的可用比特。

[0059] 在单个用户的情形中，使得最大数量的空间流（$N_{SS}$）为 8，符合 PAR 需求。对于单个用户的情形，八个空间流可以允许大于 500Mbps 的吞吐量。应当注意的是，空间流的最大数量（$N_{SS}$）小于或者等于所探测的天线的最大数量。

[0060] 在多个用户的情形中，每个用户的空间流的最大数量（$N_{SS}$）为 4，符合 PAR 需求。对于多用户传输，$N_{SS}$ ＝ 4 的两个传输可以允许大于 1Gbps 的吞吐量。假定多个用户可以共享空间流，自然可以使该数量小于 8。这符合 VHT-SIG 字段尺寸限制，并且减小了所需要的表示比特的数量。例如，可能需要三个比特来定义用于多用户传输的每一用户的空间 - 时间流的数量（$N_{STS}$）。对于可解析的长训练字段（LTF），这些比特可以包括在极高吞吐量信号字段 A （VHT-SIG-A）中。

[0061] 在多用户情形中，用户上总计的空间流的最大数量（$N_{SS}$）为 8，符合 PAR 要求。对于多用户传输，空间流的数量的总和（$N_{SS}$）等于 8 可以使得吞吐量大于 1Gbps。假定可以探测到 8 个发射天线，则本来就支持多达 8 个空间流。

[0062] 多用户的用户最大数量为 4 满足 PAR 需求。例如，具有四个用户的多用户传输并且每个用户两个流可以允许吞吐量大于 1Gbps。更大的数量可以明显增大 MAC 和 / 或 PHY 层复杂度。例如，可能需要对每个用户流进行独立地加密和调制。然而，在多用户情形中具有最多四个用户符合 VHT-SIG 尺寸限制，并且减小所需要的表示比特的数量。应当注意的是，可以在 VHT-SIG-A 中针对每个用户预先分配 $N_{SS}$ 比特。然而，即使有四个多用户的用户，VHT-SIG-A 比特中的大多数是已经分配的。

[0063] 帧前导码的一种配置可以包括下列特征。帧前导码可以使用对第二 VHT-SIG 字段符号（例如，VHT-SIG-A2）进行 90 度旋转，来提供极高吞吐量自动检测。这个帧前导码可以针对 VHT-SIG 字段使用与 802.11a/n 中所使用的相同调制；具有 1/2 速率编码的二相相移键控（BPSK）。在不具有 Greenfield 格式的情况下，可以使用单个帧前导码。

[0064] 在这种配置中，帧前导码可以包括多个字段：L-STF、L-LTF、L-SIG 字段、

VHT-SIG-A 字段(其可以包括例如 :VHT-SIG-A1 和 VHT-SIG-A2 字段或符号)、VHT-STF、一个或多个 VHT-LTF、VHT-SIG-B 字段(其可以包括例如一个符号)、以及 VHT-DATA 字段。前导码可以具有 6Mbps 的速率,并且长度是由变量 T 决定的。VHT-SIG-A 中的第二符号(例如,VHT-SIG-A2)可以使用相对于 VHT-SIG-A 中的第一符号(例如,VHT-SIG-A1)进行 90 度旋转的调制或星座映射。这样,VHT-SIG-A2 可以用于 VHT 自动检测。

[0065] 进行自动检测的这种方法可以提供现有 802.11n 接收机的可靠欺骗(例如,作为 802.11a 分组),不管在现有 802.11n 接收机中实施的是哪种 802.11n 自动检测算法。该方法还(例如,针对 BPSK 相对于正交二相相移键控(QBPSK))在最大欧几里德距离(Euclidean Distance)的情况下提供可靠的 802.11ac 自动检测。应该注意的是,对第一 VHT-SIG-A 符号(例如,VHT-SIG-A1)的调制进行操作可能是危险的。考虑到 802.11n 自动检测的各种现有实施方案,将任何特定的 802.11n 自动检测方法假想成其它方式中的那样可能是不公平的。例如,作出这样的假想更有可能造成 :802.11n 设备错误地检测高吞吐量信号字段(HT-SIG)并且进入能量检测 - 空信道评估(ED-CCA)阶段。

[0066] 至于检测时序,可以(在 VHT 检测之前)通过合适的快速傅里叶变换(FFT)对时间进行处理,来对 VHT-STF 自动增益控制(AGC)进行延迟。802.11ac 设备可以运行更快的时钟来支持更高的吞吐量。因此,AGC 计算可以比高吞吐量(HT)设备更快。在一种配置中,针对第一 VHT-LTF 的保护间隔(GI)的一部分可以用于 AGC 计算。对于 802.11ac 而言,需要比 AGC 计算更加复杂的功能(例如,下行链路多用户(DL-MU)功能、更快的解码器等)。因此,VHTAGC 增强可能是微不足道的。相应地,与 AGC 增强的额外复杂度相比,可靠的传统欺骗可能更重要。

[0067] 关于 VHT-SIG 字段的调制,可以优选继续使用最低可能的 MCS 对 VHT-SIG 字段进行调制。例如,MCS0 可以用于保证最长的范围。这样可以确保 :头部不比数据字段更差。

[0068] 关于 Greenfield (GF)格式,可以优选不定义第二前导码格式。在 802.11n 中,GF 格式至今只有有限的用途。然而,支持 802.11n 中的 GF 格式的理由之一是 :由于 802.11a 的有限使用而在 5GHz 范围内存在绿色空间(green space)。尽管如此,如果不存在 802.11n 的 5GHz 部署,则对于 802.11ac 任务小组(TGac)是没有意义的。因此,应该假设的是,将存在 802.11n 的 5GHz 部署。类似于 802.11n,具有多个前导码类型增加了对小物理层(PHY)效率提高进行自动检测的难度。因此,PHY 提高可能被 GF 保护交换所抵消。

[0069] 根据本文公开的系统和方法,下面给出一些前导码设计目标。一个目标是向后兼容。例如,前导码设计可以允许稳健的传统 802.11a 延迟和稳健的传统 802.11n 延迟。另一个前导码设计目标是在 802.11a、802.11n (例如,针对混合模式(MM)和 GF)以及 VHT 前导码之间进行可靠的自动检测。另一个目标是要在单用户(SU)和多用户(MU)情形中具有单个前导码结构。另一个设计目标是要允许由 VHT-SIG 字段用信号表示 VHT PHY 信息。针对更宽信道进行训练以及在每个子信道内进行检测和迟延是进一步的目标。还有其它的前导码设计目标包括使得前导码具有低的峰均功率比(PAPR),并且最小化或者降低总的前导码长度。

[0070] 在本文公开的系统和方法的一种配置中,欺骗和自动检测可以如下执行。L-SIG 欺骗可以用于 802.11a 和 802.11n 接收机两者。例如,对于 802.11a/g 接收机,这可以作为 802.11n 欺骗。在一种配置中,比特率可以是 6Mbps,其中长度 / 速率指示了持续时间。

VHT-SIG 符号上的 90 度旋转的 BPSK（QBPSK）可以用于 VHT 自动检测。802.11n 接收机将把该分组作为 802.11a 分组来对待（L-SIG 欺骗）。

[0071] 下面给出关于针对 MU 分组的 VHT-SIG 中的聚合比特的一些额外细节。可能不需要再次在 VHT-SIG 中指示分组的持续时间。例如，可以从 L-SIG 字段获得长度信息。聚合的 MAC 协议数据单元（A-MPDU）结构可以用于向各个 MPDU 提供长度信息。可能要求 :A-MPDU 总是与 VHT 帧一起使用。MAC 层可以向各个每用户流提供 A-MPDU，该 AMPDU 把帧填充到最后一个字节，并且 PHY 层提供 0-7 比特的填充。这种相同的填充方案还可以定义在 SU 分组中。因此，VHT-SIG 中可以不需要“聚合”比特。

[0072] 在 MU 的情形中，VHT-SIG-A 字段可以包括针对所有客户端的“共同”比特。例如，VHT-SIG-A 字段可以指示针对每个用户的空间 - 时间流的数量（$N_{STS}$）。应该注意的是，在使用 DL-MU 分组之前可能需要事先进行多用户组和用户标识（ID）分配帧交换（例如，通过探测和 / 或经由管理帧）。因此，每个用户可能能够从 VHT-SIG-A 字段得到其自己的 $N_{STS}$ 信息。

[0073] VHT-SIG-B 字段包含用户特定信息（例如，调制和编码速率），并且可以针对不同客户端进行空间复用。VHT-SIG-B 字段是设置在所有 VHT-LTF 后面的，以便在对 VHT-SIG-B 进行解码之前能够在 DL-MU 中实现更佳的接收机侧干扰抑制。这需要每个客户端得到根据需要尽可能多的 LTF，以便对全部用户上的空间流的总数量进行训练——叫做“可解析的 VHT-LTF”。如果所有的客户端不支持接收机侧干扰抑制或者如果不需要干扰抑制，则可以选择“不可解析的 VHT-LTF”。

[0074] 针对 VHT-SIG 字段的考虑包括 :带宽、短 GI，组标识（ID）字段、MCS、空间 - 时间块编码（STBC）、探测、平滑、编码类型、循环冗余校验（CRC）、以及尾部。

[0075] 现在围绕附图来描述各种配置，其中同样的附图标记可以指示功能相似的元件。可以通过各种不同的配置来布置和设计这里的附图中总体地描述和示出的系统和方法。因此，下面对多种配置的更详细描述，如附图中所示，不是想要限制权利要求保护的范围，而仅仅是所述系统和方法的代表。

[0076] 图 1 是描绘发射通信设备 102 的一种配置（其中可以实现用于分配针对帧的音调的系统和方法）以及接收通信设备 142 的一种配置（其中，可以实现用于接收针对帧的音调的系统和方法）的框图。发射通信设备 102 可以包括具有输入端的编码器 106，所述输入端用于接收要向一个或多个接收通信设备 142 发射的有效载荷数据 104 和 / 或前导码数据 116。有效载荷数据 104 可以包括语音、视频、音频和 / 或其它数据。前导码数据 116 可以包括控制信息，比如规定了数据速率、调制和编码方案（MCS）、信道带宽等的信息。编码器 106 可以对数据 104、116 进行编码，用于前向纠错（FEC）、加密、分组化、和 / 或在无线发射的情况下所使用的已知的其它编码。

[0077] 星座映射器 110 把编码器 106 提供的数据映射到星座中。例如，星座映射器 110 可以使用调制方案，比如 :二相相移键控（BPSK）、正交幅度调制（QAM），等。在使用正交幅度调制（QAM）的情况下，例如，星座映射器 110 可以提供每一空间流 138、每一数据子载波 140、每一符号周期两比特。此外，针对每一空间流 138、每一数据子载波 140、每一符号周期，星座映射器 110 可以输出 16-QAM 星座信号。可以使用其它调制，比如 64-QAM，其将导致每一空间流 138、每一数据子载波 140、每一符号周期 6 比特的消耗。其它变型也是有可能的。

[0078] 星座映射器 110 的输出提供给空间 - 时间 - 频率映射器 108，该空间 - 时间 - 频率

映射器 108 把数据映射到发射机的空间 - 时间 - 频率(STF)维度上。维度表示允许对数据进行分配的各种构造或资源。给定比特或比特的集合(例如,对应于星座点的一组比特、比特的集合等)可以映射到维度中的特定位置。一般地,映射到维度中的不同位置的比特和 / 或信号是从发射通信设备 102 发射的,从而期望它们在一个或多个接收通信设备 142 处是可以以某种概率区分的。在一种配置中,空间 - 时间 - 频率映射器 108 可以执行空间 - 时间块编码(STBC)。

[0079] 一个或多个空间流 138 可以从发射通信设备 102 发射,使得不同空间流 138 上的传输在接收机处是可以(以某种概率)区分的。例如,映射到一个空间维度的比特是作为一个空间流 138 发射的。该空间流 138 可以在与其它天线 132 在空间上分开的其自己的天线 132 上、其自己在多个空间上分开的天线 132 上的正交叠加、其自己的极化等上发射。用于空间流 138 分开(例如,包括在空间上把天线 132 分开,或者将允许在接收机处区分其信号的其它技术)的很多技术是已知并且可以使用的。

[0080] 在图 1 中所示的例子中,存在使用相同或不同数量(例如,一个或多个)的天线 132a-n 发射的一个或多个空间流 138。在一些实例中,由于一个或多个其它空间流 138 不活动,只有一个空间流 138 可能是可用的。

[0081] 在发射通信设备 102 使用多个频率子载波 140 的情况下,存在针对频率维度的多个值,使得空间 - 时间 - 频率映射器 108 可以把一些比特映射到一个频率子载波 140,并且把其它比特映射到另一个频率子载波 140。其它频率子载波 140 可以保留作为保护频带、导频音调子载波、或者不(或不总是)携带数据 104、106 的类似事物。例如,可以存在一个或多个数据子载波 140 和一个或多个导频子载波 140。应该注意的是,在一些实例或配置中,并非所有的子载波 140 都是可以立即激发的。例如,可能不激发一些音调以便能够进行滤波。在一种配置中,发射通信设备 102 可以使用正交频分复用(OFDM)以用于多个子载波 140 的传输。例如,根据所使用的复用方案,空间 - 时间 - 频率映射器 108 可以把数据 104、116 映射(编码)到空间、时间和 / 或频率资源。

[0082] 时间维度指的是符号周期。可以把不同比特分配给不同符号周期。在存在多个空间流 138、多个子载波 140 以及多个符号周期的情况下,针对一个符号周期的传输可以叫做“OFDM (正交频分复用)MIMO (多输入,多输出)符号”。可以通过把每个符号的比特数量(例如,所使用的星座的数量的 $\log_2$)乘以空间流 138 的数量,乘以数据子载波 140 的数量,除以符号周期的长度,来确定编码数据的传输速率。

[0083] 因此,空间 - 时间 - 频率映射器 108 可以把比特(或者其它单位的输入数据)映射到一个或多个空间流 138、数据子载波 140、和 / 或符号周期。可以使用单独的路径来产生和 / 或发射单独的空间流 138。在一些实施方案中,这些路径是用独特的硬件实现的,然而在其它实施方案中,路径硬件重复用于不止一个空间流 138,或者路径逻辑是在针对一个或多个空间流 138 而执行的软件中实现的。更具体地,发射通信设备 102 中示出的元件中的每一个可以实现为单个块 / 模块或者实现为多个块 / 模块。例如,发射机射频块 126 元件可以实现为单个块 / 模块或者实现为对应于每个天线 132a-n 的多个并行块 / 模块(例如,每个空间流 138)。如本文所使用的,术语“块 / 模块”及其变型可以表示可通过硬件、软件或二者的结合实现的特定元件或部件。

[0084] 发射通信设备 102 可以包括导频产生器块 / 模块 130。导频产生器块 / 模块 130

可以产生导频序列。导频序列可以是一组导频符号。在一种配置中，例如，可以通过具有特定的相位、幅度和 / 或频率的信号表示导频序列中的数值。例如，“1”可以表示具有特定相位和 / 或幅度的导频符号，而“-1”可以表示具有不同(例如，相反或者反向的)相位和 / 或幅度的导频符号。

[0085] 在一些配置中，发射通信设备 102 可以包括伪随机噪声产生器 128。伪随机噪声产生器 128 可以产生用于对导频序列进行加扰的伪随机噪声序列或信号(例如，数值)。例如，针对连续 OFDM 符号的导频序列可以与来自伪随机噪声序列的连续数字相乘，从而对每一 OFDM 符号的导频序列进行加扰。当向接收通信设备 142 发送导频序列时，可以通过导频处理器 148 对已接收的导频序列进行解扰(unscramble)。

[0086] 空间 - 时间 - 频率映射器 108 的输出可以分布在频率和 / 或空间维度上。导频插入块 / 模块 112 把导频音调插入导频音调子载波 140。例如，导频序列可以映射到特定索引 114 处的子载波 140。例如，来自导频序列的导频符号可以映射到子载波 140，所述子载波 140 是与数据子载波 140 和 / 或其它子载波 140 散布(intersperse)的。换句话说，导频序列或信号可以与数据序列或信号相结合。在一些配置中，一个或多个直流(DC)音调可以集中在索引 0 处。

[0087] 在一些配置中，可以把组合的数据和导频信号提供给旋转块 / 模块(图 1 中未示出)。旋转块 / 模块可以使用旋转或乘法因子以便对导频符号和 / 或数据符号进行旋转。例如，旋转块 / 模块可以对 VHT-SIG-A2 符号进行旋转，以便提供 VHT 自动检测。

[0088] 发射通信设备 102 可以包括带宽确定块 / 模块 118。带宽确定块 / 模块 118 可以确定要用于向一个或多个接收通信设备 142 进行发射的信道带宽。该确定可以基于一个或多个因素，比如 :接收通信设备 142 兼容性、(使用通信信道的)接收通信设备 142 的数量、信道质量(例如，信道噪声)和 / 或已接收的指示符等。在一个配置中，带宽确定块 / 模块 118 可以确定用于信道发射的带宽是否为 20MHz、40MHz、80MHz 或 160MHz。

[0089] 带宽确定块 / 模块 118 可以向一个或多个块 / 模块提供带宽确定的指示。例如，可以把该带宽指示提供给空间 - 时间 - 频率映射器 108、导频插入块 / 模块 112 和 / 或导频产生器 130。附加地或可选地，可以提供带宽指示，作为前导码数据 116 的一部分。例如，可以分配前导码数据 116 中的一个或多个比特，以表示该带宽指示。附加地或可选地，可以在前导码数据 116 中隐含指示带宽指示。从而，可以向一个或多个接收通信设备 142 用信号发送该带宽指示。这可以能够使一个或多个接收通信设备 142 使用已选择的信道带宽来接收前导码数据 116。

[0090] 空间 - 时间 - 频率映射器 108 可以使用带宽指示，把前导码数据 116 映射到多个音调(例如，子载波 140)。例如，本文公开的系统和方法可以定义多个 OFDM 音调或子载波 140，发射通信设备 102 可以基于(例如，如带宽指示所规定的)信道带宽，使用所述多个 OFDM 音调或子载波 140，用于前导码数据 116 的发射。还可以根据特定的前导码字段来规定多个 OFDM 音调。例如，基于上面的表(1)中所指示的带宽确定和前导码字段，空间 - 时间 - 频率映射器 108 可以把前导码数据 116 映射到多个 OFDM 音调。例如，如果当前字段是 VHT-SIG-B 并且带宽指示规定 80MHz 的带宽，则空间 - 时间 - 频率映射器 108 可以把前导码数据 116 映射到 234 个 OFDM 音调或子载波 140，剩下针对导频的 8 个 OFDM 音调，以及三个子载波 140 作为 DC 音调。在一些配置中，空间 - 时间 - 频率映射器 108 可以使用查找表以

确定要用于规定带宽的多个音调或子载波。

[0091] 更具体地，如果已确定的带宽是 20MHz，则发射通信设备 102 可以针对 L-STF 分配 12 个 OFDM 音调，针对 L-LTF 分配 52 个 OFDM 音调、针对 L-SIG 字段分配 52 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 52 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 52 个 OFDM 音调、针对 VHT-STF 分配 12 个 OFDM 音调、针对一个或多个 VHT-LTF（例如，VHT-LTF 中的每一个）分配 56 个 OFDM 音调、针对 VHT-SIG-B 字段分配 56 个 OFDM 音调、和 / 或针对 DATA 字段分配 56 个 OFDM 音调。如果所确定的带宽为 40MHz，则发射通信设备 102 可以针对 L-STF 分配 24 个 OFDM 音调，针对 L-LTF 分配 104 个 OFDM 音调、针对 L-SIG 字段分配 104 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 104 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 104 个 OFDM 音调、针对 VHT-STF 分配 24 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 114 个 OFDM 音调、针对 VHT-SIG-B 字段分配 114 个 OFDM 音调、和 / 或针对 DATA 字段分配 114 个 OFDM 音调。如果带宽为 80MHz，则发射通信设备 102 可以针对 L-STF 分配 48 个 OFDM 音调，针对 L-LTF 分配 208 个 OFDM 音调、针对 L-SIG 字段分配 208 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 208 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 208 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 242 个 OFDM 音调、针对 VHT-SIG-B 字段分配 242 个 OFDM 音调、和 / 或针对 DATA 字段分配 242 个 OFDM 音调。如果带宽为 160MHz，则发射通信设备 102 可以针对 L-STF 分配 48 个 OFDM 音调，针对 L-LTF 分配 416 个 OFDM 音调、针对 L-SIG 字段分配 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 416 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 484 个 OFDM 音调、针对 VHT-SIG-B 字段或符号分配 484 个 OFDM 音调、和 / 或针对 DATA 字段分配 484 个 OFDM 音调。

[0092] 在一些配置中，还可以把带宽指示提供给导频产生器 130。导频产生器 130 可以使用该带宽指示以产生合适数量的导频符号。例如，导频产生器 130 可以针对 80MHz 信号产生 8 个导频符号（具有 242 个 OFDM 音调：234 个数据音调和 8 个导频音调，以及 3 个 DC 子载波 140）。

[0093] 在一些配置中，另外可以把带宽指示提供给导频插入块 / 模块 112。导频插入块 / 模块 112 可以使用该指示以确定子载波索引 114，以便进行导频符号插入。例如，80MHz 带宽可以指示：应该在索引 -103、-75、-39、-11、11、39、75 和 103 处插入导频符号。

[0094] 向离散傅里叶逆变换（IDFT）块 / 模块 120 提供数据和 / 或导频信号。离散傅里叶逆变换（IDFT）块 / 模块 120 对数据 104、116 的频率信号进行转换，并且把导频音调插入时域信号，所述时域信号表示空间流 138 上的信号和 / 或针对符号周期的时域采样。在一种配置中，例如，IDFT 块 / 模块 120 可以执行 256 点快速傅里叶逆变换（IFFT）。

[0095] 向格式器 122 提供时域信号。格式器（例如，一个或多个格式化块 / 模块）122 可以得到离散傅里叶逆变换（IDFT）块 / 模块 120 的输出，把其从并行信号转换为串行（P/S），添加循环前缀和 / 或执行保护间隔加窗（guard interval windowing）等。

[0096] 格式器 122 输出可以提供给数模转换器（DAC）124。数模转换器（DAC）124 可以把格式器 122 输出从一个或多个数字信号转换为一个或多个模拟信号。数模转换器（DAC）124 可以向一个或多个发射机射频（TX RF）块 126 提供模拟信号。

[0097] 一个或多个发射机射频块 126 可以耦合到功率放大器，或者包括功率放大器。所

述功率放大器可以对模拟信号进行放大以用于传输。一个或多个发射机射频块 126 可以向一个或多个天线 132a-n 输出射频(RF)信号，从而把输入到编码器 106 的数据 104、116 通过无线介质发送，其合适地配置为由一个或多个接收通信设备 142 接收。

[0098] 一个或多个接收通信设备 142 可以接收并且使用来自发射通信设备 102 的信号。例如，接收通信设备 142 可以使用已接收的带宽指示符来接收给定数量的 OFDM 音调或子载波 140。附加地或可选地，接收通信设备 142 可以使用发射通信设备 102 所产生的导频序列来描述信道、发射机故障和 / 或接收机故障的特征，并且使用该特征来改善对传输中编码的数据 104、116 的接收。

[0099] 例如，接收通信设备 142 可以包括提供给一个或多个接收机射频(RX RF)块 158 的一个或多个天线 136a-n(其可以大于、小于或等于发射通信设备 102 天线 132a-n 的数量和 / 或空间流 138 的数量)。一个或多个接收机射频(RX RF)块 158 可以向一个或多个模数转换器(ADC) 156 输出模拟信号。例如，接收机射频块 158 可以对信号进行接收并且下变频，可以将该信号提供给模数转换器 156。和发射通信设备 102 一样，所处理的空间流 138 的数量可能或可能不等于天线 136a-n 的数量。此外，每个空间流 138 不需要限于一个天线 136，因为可以使用各种波束控制(beamsteering)、正交化等技术到达多个接收机流。

[0100] 一个或多个模数转换器(ADC) 156 可以把已接收的模拟信号转换成一个或多个数字信号。所述一个或多个模数转换器(ADC) 156 的这些输出可以提供给一个或多个时间和 / 或频率同步块 / 模块 154。时间和 / 或频率同步块 / 模块 154 可以(尝试)在时间和 / 或频率上对数字信号进行同步或对齐(例如，接收通信设备 142 时钟)。

[0101] 时间和 / 或频率同步块 / 模块 154 的(同步)输出可以提供给一个或多个解格式器 152。例如，解格式器 152 可以接收时间和 / 或频率同步块 / 模块 154 的输出，移除前缀等，和 / 或对数据进行并行化以用于离散傅里叶变换(DFT)处理。

[0102] 一个或多个解格式器 152 输出可以提供给一个或多个离散傅里叶变换(DFT)块 / 模块 150。离散傅里叶变换(DFT)块 / 模块 150 可以把一个或多个信号从时域转换到频域。导频处理器 148 可以使用(例如，每一空间流 138 的)频域信号，以确定发射通信设备 102 所发送的(例如，空间流 138、频率子载波 140、和 / 或一组符号周期上的)一个或多个导频音调。导频处理器 148 可以附加地或者可选地对导频序列进行解扰(de-scramble)。导频处理器 148 可以使用本文所述的一个或多个导频序列，进行相位和 / 或频率和 / 或幅度跟踪。可以把导频音调提供给空间 - 时间 - 频率检测和 / 或解码块 / 模块 146，所述空间 - 时间 - 频率检测和 / 或解码块 / 模块 146 可以对各个维度上的数据进行检测和 / 或解码。空间 - 时间 - 频率检测和 / 或解码块 / 模块 146 可以输出已接收的数据 144(例如，接收通信设备 142 对发射通信设备 102 发射的有效载荷数据 104 和 / 或前导码数据 116 的估计)。

[0103] 在一些配置中，接收通信设备 142 知道发射序列作为总信息序列的一部分发送。接收通信设备 142 可以在这些已知发射序列的帮助下实施信道估计。为了协助导频音调跟踪、处理和 / 或数据检测和解码，信道估计块 / 模块 160 可以基于来自时间和 / 或频率同步块 / 模块 154 的输出，向导频处理器 148 和 / 或空间 - 时间 - 频率检测和 / 或解码块 / 模块 146 提供估计信号。可选地，对于已知的发射序列而言，如果解格式化和离散傅里叶变换是与总信息序列的有效载荷数据部分相同的，则可以基于来自离散傅里叶变换(DFT)块 / 模块 150 的输出，把估计信号提供给导频处理器 148 和 / 或空间 - 时间 - 频率检测和 / 或

解码块 / 模块 146。

[0104] 带宽确定块 / 模块 134 可以使用时间 / 频率同步块 / 模块 154 输出来确定(用于接收通信的)信道带宽。例如,带宽确定块 / 模块 134 可以接收来自发射通信设备 102 的用于指示信道带宽的带宽指示。例如,带宽确定块 / 模块 134 可以获得明确的或隐含的带宽指示。在一种配置中,带宽指示可以指示 20MHz、40MHz、80MHz 或 160MHz 的信道带宽。带宽确定块 / 模块 134 可以基于该指示来确定用于接收通信的带宽,并且向导频处理器 148 和 / 或空间 - 时间 - 频率检测 / 解码块 / 模块 146 提供已确定带宽的指示。

[0105] 更具体地,如果已确定的带宽是 20MHz,则接收通信设备 142 可以接收针对 L-STF 的 12 个 OFDM 音调、针对 L-LTF 的 52 个 OFDM 音调、针对 L-SIG 字段的 52 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 52 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 52 个 OFDM 音调、针对 VHT-STF 的 12 个 OFDM 音调、针对一个或多个 VHT-LTF 的 56 个 OFDM 音调、针对 VHT-SIG-B 字段的 56 个 OFDM 音调、和 / 或针对 DATA 字段的 56 个 OFDM 音调。如果带宽确定为 40MHz,则接收通信设备 142 可以接收针对 L-STF 的 24 个 OFDM 音调、针对 L-LTF 的 104 个 OFDM 音调、针对 L-SIG 字段的 104 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 104 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 104 个 OFDM 音调、针对 VHT-STF 的 24 个 OFDM 音调、针对一个或多个 VHT-LTF 的 114 个 OFDM 音调、针对 VHT-SIG-B 字段的 114 个 OFDM 音调、和 / 或针对 DATA 字段的 114 个 OFDM 音调。如果带宽是 80MHz,则接收通信设备 142 可以接收针对 L-STF 的 48 个 OFDM 音调、针对 L-LTF 的 208 个 OFDM 音调、针对 L-SIG 字段的 208 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 208 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 208 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 242 个 OFDM 音调、针对 VHT-SIG-B 字段的 242 个 OFDM 音调、和 / 或针对 DATA 字段的 242 个 OFDM 音调。如果带宽是 160MHz,则接收通信设备 142 可以接收针对 L-STF 的 48 个 OFDM 音调、针对 L-LTF 的 416 个 OFDM 音调、针对 L-SIG 字段的 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 416 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 484 个 OFDM 音调、针对 VHT-SIG-B 字段的 484 个 OFDM 音调、和 / 或针对 DATA 字段的 484 个 OFDM 音调。

[0106] 导频处理器 148 可以使用已确定的带宽指示来从离散傅里叶变换块 / 模块 150 输出中提取导频符号。例如,如果已确定的带宽指示规定了带宽是 80MHz,则导频处理器 148 可以从索引 -103、-75、-39、-11、11、39、75 以及 103 中提取导频符号。

[0107] 空间 - 时间频率检测 / 解码块 / 模块 146 可以使用已确定的带宽指示来从已接收的信号中对前导码数据和 / 或有效载荷数据进行检测和 / 或解码。例如,如果当前字段是 VHT-SIG-B 字段并且已确定的带宽指示规定了带宽是 80MHz,则空间 - 时间频率检测 / 解码块 / 模块 146 可以从 234 个 OFDM 音调或子载波 140 中对前导码数据进行检测和 / 或解码(例如,8 个 OFDM 音调是导频音调,并且三个子载波 140 用于 DC 音调)。在一些配置中,空间 - 时间 - 频率检测 / 解码块 / 模块 146 可以使用查找表来确定针对规定带宽的要接收的音调或子载波的数量。

[0108] 图 2 是描绘根据本文公开的系统和方法,可以使用的通信帧 200 的一个示例的图。帧 200 可以包括前导码符号、导频符号和 / 或数据符号的一个或多个部分或字段。例如,帧 200 可以包括 802.11ac 前导码 260 和数据字段 282 (例如,DATA 或 VHT-DATA 字段)。在一

种配置中，802.11ac 前导码 260 可以具有 40 到 68μs 的持续时间。(例如，接收通信设备 142)可以使用前导码 260 和 / 或导频符号来对帧 200 中所包括的前导码 116 和 / 或有效载荷数据 104 进行同步、检测、解调和 / 或解码。

[0109] 具有 802.11ac 前导码 260 的帧 200 可以构建为包括多个字段。在一种配置中，802.11ac 帧 200 可以包括传统的短训练字段或非高吞吐量短训练字段(L-STF)266、传统的长训练字段或非高吞吐量长训练字段(L-LTF)268、传统的信号字段或非高吞吐量信号字段(L-SIG)270、极高吞吐量信号符号或字段 A1 (VHT-SIG-A1)272、极高吞吐量信号符号或字段 A2 (VHT-SIG-A2)274、极高吞吐量短训练字段(VHT-STF)276、一个或多个极高吞吐量长训练字段(VHT-LTF)278、极高吞吐量信号字段 B (VHT-SIG-B)280、以及数据字段(DATA)282。

[0110] 802.11ac 前导码 260 可以支持发射波束成形和 SDMA。可以通过全向方式(例如，使用循环分集或另一个方案)来发射前导码 260 的第一部分或部位 262。前导码 260 的这个第一部分 262 可以包括 L-STF 266、L-LTF268、L-SIG 270、VHT-SIG-A1272、以及 VHT-SIG-A2274。可以通过传统设备(例如，符合传统或较早规范的设备)对前导码 260 的第一部分 262 进行解码。

[0111] 可以通过全向方式(可能是波束成形的或者可能是 SDMA 预编码的)发射 802.11ac 前导码 260 的第二部分或部位 264。前导码 260 的这个第二部分 264 包括 :VHT-STF 276、一个或多个 VHT-LTF 278、以及 VHT-SIG-B 280。可以使用与前导码 260 的第二部分 264 相同的天线模式发射(例如，数据字段 282 中的)数据符号。还可以全向地(可能是波束成形的或者可能是 SDMA 预编码的)发射数据字段 282。数据符号和前导码 260 的第二部分 264 可能是不能被传统设备(甚至所有的 802.11ac 设备)解码的。

[0112] 802.11ac 前导码 260 可以包括 :可被传统的 802.11a 和 802.11n 接收机解码的一些控制数据。该控制数据是包含在 L-SIG 270 中的。L-SIG 270 中的数据通知所有的接收机 :传输将占据无线介质的时间，使得所有的设备可以把它们的发射推迟一段精确的时间量。此外，802.11ac 前导码 260 允许 802.11ac 设备把该传输辨别成 802.11ac 传输(并且避免确定该传输是 802.11a 或 802.11n 格式的)。此外，根据本文的系统和方法所述的 802.11ac 前导码可以使得传统的 802.11a 和 802.11n 设备把该传输检测为 802.11a 传输，该 802.11a 传输是具有 L-SIG 270 中的有效数据的有效传输。

[0113] 根据本文公开的系统和方法，可以定义针对 80MHz 802.11ac 信号的数据和导频音调的数量。这可以与针对 20MHz 802.11n 和 40MHz 802.11n 信号的数据和导频音调的数量进行比较。20MHz 802.11n 信号使用 56 个音调(52 个数据，4 个导频)，其中一个直流(DC)音调。40MHz 802.11n 信号使用 114 个音调(108 个数据，6 个导频)，其中 3 个 DC 音调。本文公开的系统和方法描绘了针对 80MHz 802.11ac 信号使用的 242 个音调(例如，234 个数据音调和 8 个导频音调)，其中 3 个 DC 音调。精致的频率交织器构造和合理成本滤波需求，可以促使使用根据本文的系统和方法的 234 个数据音调。还可以注意的是，802.11a 信号使用 52 个音调(48 个数据音调和 4 个导频音调)，其中一个 DC 音调。

[0114] 根据本文的系统和方法所述的 802.11ac 前导码 260 可以包括两个部分或部位。可以全向地(例如，采用循环延迟分集)发射第一部分 262，并且可以全向地(采用波束成形或采用 SDMA 预编码)发射第二部分 264。第一或全向部分 262 的开头三个字段(例如，L-STF

266、L-LTF 268、L-SIG270）可以包含 802.11a 和 802.11n 接收机可解码的信号。此外，传统的 802.11a 和 802.11n 设备可以确定 802.11ac 传输是 802.11a 传输，使得这些传统设备对 L-SIG 270 进行解码就好像其是 802.11a 传输一样。

[0115] 本文公开的系统和方法可以向满足所述约束的每个前导码 260 字段和 / 或数据字段 282 提供合适数量的音调。在表(3)中示出了这种音调分配。更具体地，表(3)示出了可以针对各种信号带宽进行 802.11ac 传输所使用的 OFDM 音调的数量。

[0116] 表(3)

[0117]

| 字段 | 信号带宽 | | | |
|---|---|---|---|---|
| | 20 MHz | 40 MHz | 80 MHz | 160 MHz |
| L-STF | 12 | 24 | 48 | 48 |
| L-LTF | 52 | 104 | 208 | 416 |
| L-SIG | 52 | 104 | 208 | 416 |
| VHT-SIG-A1 | 52 | 104 | 208 | 416 |
| VHT-SIG-A2 | 52 | 104 | 208 | 416 |
| VHT-STF | 12 | 24 | 48 | 48 |
| VHT-LTF | 56 | 114 | 242 | 484 |
| VHT-SIG-B | 56 | 114 | 242 | 484 |
| DATA | 56 | 114 | 242 | 484 |

[0118] L-STF 266 可以使用每 20MHz 12 个音调的信号。在这种情形中，时域信号可以具有 800 纳秒(ns)的重复间隔。该重复间隔可以用于快速增益控制、时间偏移估计和频率偏移估计。可以快速地测量已接收的信号强度，因为对于一个 800ns 间隔，只需要考虑时域信号。传统的 802.11a 和 802.11n 设备将期望 12 个音调。

[0119] L-LTF 268 和 L-SIG 270 可以针对 20MHz 信号使用 52 个音调。这可能期望用于通过任何传统的 802.11a 或 802.11n 设备的 802.11a 传输。当发送 40MHz 802.11ac 信号时，可以把这些字段 268、270 的内容复制(并且用复数调整)到 40MHz 信号的每个 20MHz 子带。也就是说，L-SIG 字段 270 可以用于被 20MHz 精确分隔的、具有 DC 音调的两个 20MHz 子带。因此，音调的总数刚好翻倍。对于 80MHz 和 160MHz，可以遵循相同的设计，并且把字段调整且复制到 4 个或 8 个 20MHz 子带中的每一个中。

[0120] 根据 802.11a 规范，L-SIG 270 可以使用 48 个数据音调和 4 个导频。对于 40MHz、80MHz 以及 160MHz 802.11ac 传输，由 L-SIG (例如，使用二相相移键控(BPSK)和 1/2 编码

速率)携带的 24 比特的数据可以在 20MHz 子带中的每一个中发射。这允许仅在单个 20MHz 信道上进行接收的任何传统的设备对 L-SIG 270 中的数据进行解码并且适当地延迟。

[0121] VHT-SIG-A1 符号或字段 272 以及 VHT-SIG-A2 符号或字段 274 可以使用 20MHz 中的 52 个音调(48 个数据音调和 4 个导频音调)。数据音调的数量可以和 L-SIG 270 相同,因为可以针对这些数据音调完成信道估计(该信道估计是基于 L-LTF 268)。对于 40MHz、80MHz 以及 160MHz 带宽,出于同样的原因,数据音调和导频音调的数量可以遵循 L-LTF 268。

[0122] 和 L-STF 266 一样,VHT-STF 276 可以使用每 20MHz 12 个音调的信号。通过这种方式,接收增益控制算法可以使用仅仅 800ns 的时段来快速地测量接收信号强度。如果使用更多音调,则接收机可能需要等待更长的时间段进行精确的信号强度测量,从而对所分配的时间设置约束,使得模拟接收增益变化并且稳定到它们的新数值。可能需要增益控制,因为与前导码 260 的第一部分 262 相比较,对于前导码 260 的第二部分 264(以及数据字段 282)而言,已接收信号的强度可能是不同的。此外,可以使用 VHT-STF 276 来完成对定时和频率偏移的更新。

[0123] 与前导码 260 的第一或全向部分 262 相比,一个或多个 VHT-LTF 278、VHT-SIG-B 字段 280 以及 DATA 字段 282 可以使用更多 OFDM 音调。因此,这些字段 278、280 的每一个可以使用和 DATA 字段 282 相同数量的音调。对于 20MHz 和 40MHz 802.11ac 传输而言,音调的数量可以选定为与 802.11n 标准相匹配。对于 80MHz 和 160MHz 802.11ac 传输,可以分别将音调的数量选定为 242 和 484。

[0124] 对于 20MHz 802.11ac 传输,例如,如果使用 BPSK 和 1/2 速率编码,则 VHT-SIG-B 字段 280 携带 26 比特的数据。对于 40MHz 802.11ac 传输,VHT-SIG-B 字段 280 可以在每个 20MHz 子带中携带 54 比特的独特数据或者相同的 27 比特的数据。VHT-SIG-B 字段 280 的 80MHz 传输可以在每个 20MHz 子带中携带 29 比特的数据,或者在每个 40MHz 子带中携带 58 比特的数据,或者 117 比特的数据。对于 160MHz 传输,可以作出相似的选择。因此,当带宽从 20MHz 到 40MHz 到 80MHz 增大时,VHT-SIG-B 280 可以携带更多信息比特。

[0125] 对于信号附加能力,可以使用针对更宽带宽信号的额外比特,这在使用超过 20MHz 的信号带宽时是有可能的。例如,80MHz 信号可以包括四个独立的 20MHz 信号(流),其中,每个 20MHz 信号可以携带不同编码的数据流。这些流中的每一个可以具有不同的调制和编码(例如,使用不同的调制和编码方案(MCS))。每个流可以另外具有不同数量的字节。此外,每个流可以具有不同数量的分组聚合,比如,802.11n 类型的聚合媒体访问控制(MAC)协议数据单元(A-MPDU)或者聚合物理层汇聚过程(PLCP)协议数据单元(PPDU),例如,其中每个 PPDU 携带其自己的 VHT-SIG-B 字段 280。所有的这些特征可以通过相应的 20MHz 流中携带的 VHT-SIG-B 字段 280 比特用信号表示并且指示。

[0126] 图 3 是描绘多个帧 300 的示例的图。具体地,图 3 描绘了根据本文公开的系统和方法的 802.11a 前导码 384、802.11n Greenfield (GF)前导码 394、802.11n 混合模式(MM)前导码 325 以及 802.11ac 前导码 360。更具体地,描绘了传统 802.11a 前导码 384、传统 802.11n Greenfield 前导码 394 以及传统 802.11n 混合模式前导码 325。所示的 802.11a 前导码 384 可以具有 20μs 的持续时间。所示的 802.11n Greenfield 前导码 394 可以具有 28 到 36μs 的持续时间。所示的 802.11n 混合模式(MM)前导码 325 可以具有 36 到 48μs 的持续时间。根据本文公开的系统和方法,所示 802.11ac 前导码 360 可以具有 40 到 68μs

的持续时间。

[0127] 802.11ac 前导码 360 可以支持发射波束成形和 SDMA。可以通过全向方式(例如,使用循环分集或另一个方案)来发射前导码 360 的第一部分或部位 362。前导码 360 的第一部分 362 可以包括 L-STF 366、L-LTF 368、L-SIG 370、VHT-SIG-A1372、以及 VHT-SIG-A2374。可以通过传统设备(例如,符合传统或较早规范的设备)对前导码 360 的第一部分 362 进行解码。

[0128] 可以通过全向方式(可能是波束成形的或者可能是 SDMA 预编码的)来发射 802.11ac 前导码 360 的第二部分或部位 364。前导码 360 的该第二部分 364 包括 :VHT-STF 376、一个或多个 VHT-LTF 378、以及 VHT-SIG-B 380。可以使用与前导码 360 的第二部分 364 相同的天线模式发射(例如,数据字段 382 中的)数据符号。还可以全向地(可能是波束成形的或者可能是 SDMA 预编码的)发射数据字段 382。数据符号和前导码 360 的第二部分 364 可能是不能被传统设备(甚至所有的 802.11ac 设备)解码的。

[0129] 802.11ac 前导码 360 可以包括 :可被传统的 802.11a 和 802.11n 接收机解码的一些控制数据。该控制数据是包含在 L-SIG 370 中的。L-SIG 370 中的数据通知所有的接收机 :发射将占据无线介质的时间,使得所有的设备可以把它们的传输推迟一段精确的时间量。此外,802.11ac 前导码 360 允许 802.11ac 设备把该传输辨别成 802.11ac 传输(并且避免确定该传输是 802.11a 或 802.11n 格式的)。此外,根据本文的系统和方法所述的 802.11ac 前导码 360 可以使得传统的 802.11a 和 802.11n 设备相信该传输是 802.11a 传输,该 802.11a 传输是具有 L-SIG 370 中的有效数据的有效传输。

[0130] 传统的 802.11a 前导码 384 包括 L-STF 386、L-LTF 388、以及 L-SIG390,它们可以连同数据字段 392 一起发射。802.11n Greenfield (GF) 前导码 394 包括高吞吐量短训练字段(HT-STF)396、高吞吐量长训练字段 1 (HT-LTF1)398、高吞吐量信号 1 (HT-SIG-1)301、高吞吐量信号 2 (HT-SIG-2)303、以及一个或多个高吞吐量长训练字段(HT-LTF)305,它们可以与数据字段 307 一起发射。802.11n 混合模式(MM)前导码 325 包括 L-STF 309、L-LTF 311、L-SIG 313、HT-SIG-1315、HT-SIG-2317、高吞吐量短训练字段(HT-STF)319、以及一个或多个 HT-LTF 321,它们可以连同数据字段 323 一起发射。如能够从图 3 中看到,802.11ac 前导码 360 中所包括的字段中的一些对应于传统前导码 384、325 中的相似字段。这样当使用 802.11ac 前导码 360 时,可以允许与传统设备向后兼容。

[0131] 图 4 是描绘针对传统信号字段(L-SIG)470、极高吞吐量信号 A1 (VHT-SIG-A1)472(例如,第一符号)、以及极高吞吐量信号 A2 (VHT-SIG-A2)474 (例如,第二符号)的星座图。每个星座是在同相(I)轴和正交(Q)轴上描绘的。更具体地,图 4 描绘了根据本文公开的系统和方法,可以用于 VHT-SIG-A 字段中的第一和第二符号以及用于 L-SIG 字段的调制方案的示例。

[0132] 发射通信设备 102 可以针对 802.11ac 帧 200 中的 L-SIG 字段 470,使用具有 1/2 速率编码的 BPSK 调制。在该方案中,可以用同相轴上的 +1 处的调制符号表示具有数值“1”的比特。此外,可以用同相轴上的 -1 处的调制符号表示具有数值“0”的比特。

[0133] 根据本文公开的系统和方法,发射通信设备 102 可以针对 802.11ac 帧 200 中的 VHT-SIG-A1472,使用具有 1/2 速率编码的 BPSK 调制。在该方案中,可以用同相轴上的 +1 处的调制符号表示具有数值“1”的比特。此外,可以用同相轴上的 -1 处的调制符号表示具

有数值“0”的比特。

[0134] 根据本文公开的系统和方法，发射通信设备 102 可以针对 802.11ac 帧 200 中的 VHT-SIG-A2474，使用具有 1/2 速率编码的 QBPSK 调制（例如，具有 90 度旋转的 BPSK 调制）。在该方案中，可以用正交轴上的 +1 处的调制符号表示具有数值“1”的比特。此外，可以用正交轴上的 -1 处的调制符号表示具有数值“0”的比特。

[0135] 图 5 是描绘根据本文公开的系统和方法，针对 80MHz 信号 543 的数据和导频音调的一个示例的图。还描绘了针对 20MHz 802.11n 信号 527 的数据和导频音调、以及针对 40MHz 802.11n 信号 535 的数据和导频音调。根据本文公开的系统和方法，可以定义针对 80MHz 802.11ac 信号 543 的数据音调和导频音调 545a-h 的数量。这可以与 20MHz 802.11n 信号 527 的数据音调和导频音调 529a-d 的数量、40MHz 802.11n 信号 535 的数据音调和导频音调 537a-f 的数量相比较。

[0136] 20MHz 802.11n 信号 527 使用 56 个音调，包括 52 个数据音调和 4 个导频音调 529a-d、以及一个直流（DC）音调 531。可以根据子载波编号或索引 533 来定位数据音调和导频音调 529a-d。例如，导频 A 529a 位于 -21，导频 B 529b 位于 -7，导频 C 529c 位于 7，以及导频 D 529d 位于 21。在这种情况下，单个 DC 音调 531 位于 0。

[0137] 40MHz 802.11n 信号 535 使用 114 个音调，包括 108 个数据音调和 6 个导频音调 537a-f、以及 3 个直流（DC）音调 539。可以根据子载波编号或索引 541 来定位数据音调和导频音调 537a-f。例如，导频 A 537a 位于 -53，导频 B 537b 位于 -25，导频 C 537c 位于 -11，导频 D 537d 位于 11，导频 E 537e 位于 25，以及导频 F 537f 位于 53。在这种情况下，3 个 DC 音调 539 位于 -1、0、以及 1。

[0138] 本文公开的系统和方法描绘了针对 80MHz 802.11ac 信号 543 使用的 242 个音调，包括 234 个数据音调和 8 个导频音调 545a-h、以及 3 个 DC 音调 547。可以根据子载波编号或索引 549 来定位数据音调和导频音调 545a-h。例如，导频 A 545a 位于 -103，导频 B 545b 位于 -75，导频 C 545c 位于 -39，导频 D 545d 位于 -11，导频 E 545e 位于 11，导频 F 537f 位于 39，导频 G 545g 位于 75，以及导频 H 545h 位于 103。在这种情况下，3 个 DC 音调 547 位于 -1、0、以及 1。可以通过精致的频率交织器构造和合理成本滤波需求，来促使根据本文的系统和方法使用 234 个数据音调。例如，当发射通信设备 102 确定 80MHz 的信道带宽时，102 可以根据图 5 中所示的 802.11ac 信号 543，针对数据音调和导频音调 545a-h 分配子载波 140。此外，例如，当接收通信设备 142 确定 80MHz 的信道带宽时，142 可以根据图 5 中所示的 802.11ac 信号 543，接收针对数据和导频音调 545a-h 的子载波 140。可以注意的是，802.11a 信号（图 5 中未示出）使用 52 个音调（例如，48 个数据音调和 4 个导频音调）以及一个 DC 音调。

[0139] 图 6 是描绘用于针对帧分配音调的方法 600 的一个配置的流程图。发射通信设备 102 可以确定 602 用于信号传输的带宽是否为 20MHz、40MHz、80MHz 或 160MHz。该确定 602 可以基于一个或多个因素，比如：接收通信设备 142 兼容性、（使用通信信道的）接收通信设备 142 的数量、信道质量（例如，信道噪声）、和 / 或已接收的指示符等。

[0140] 如果已确定 602 的带宽为 20MHz，则发射通信设备 102 可以针对 L-STF 分配 60412 个 OFDM 音调，针对 L-LTF 分配 52 个 OFDM 音调、针对 L-SIG 字段分配 52 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 52 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 52 个 OFDM

音调、针对 VHT-STF 分配 12 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 56 个 OFDM 音调、针对 VHT-SIG-B 字段分配 56 个 OFDM 音调、和 / 或针对 DATA 字段分配 56 个 OFDM 音调。如果已确定 602 的带宽为 40MHz，则发射通信设备 102 可以针对 L-STF 分配 60624 个 OFDM 音调，针对 L-LTF 分配 104 个 OFDM 音调、针对 L-SIG 字段分配 104 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 104 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 104 个 OFDM 音调、针对 VHT-STF 分配 24 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 114 个 OFDM 音调、针对 VHT-SIG-B 字段分配 114 个 OFDM 音调、和 / 或针对 DATA 字段分配 114 个 OFDM 音调。

[0141] 如果已确定 602 的带宽为 80MHz，则发射通信设备 102 可以针对 L-STF 分配 60848 个 OFDM 音调，针对 L-LTF 分配 208 个 OFDM 音调、针对 L-SIG 字段分配 208 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 208 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 208 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 242 个 OFDM 音调、针对 VHT-SIG-B 字段分配 242 个 OFDM 音调、和 / 或针对 DATA 字段分配 242 个 OFDM 音调。如果已确定 602 的带宽为 160MHz，则发射通信设备 102 可以针对 L-STF 分配 61048 个 OFDM 音调，针对 L-LTF 分配 416 个 OFDM 音调、针对 L-SIG 字段分配 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 416 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 484 个 OFDM 音调、针对 VHT-SIG-B 字段和 / 或符号分配 484 个 OFDM 音调、和 / 或针对 DATA 字段分配 484 个 OFDM 音调。

[0142] 发射通信设备 102 可以发射 612 该信号。例如，发射通信设备 102 可以对信号执行 IDFT，对该信号进行格式化，把该信号转换为模拟信号，并且使用一个或多个天线 132a-n 对该信号进行辐射。

[0143] 图 7 是描绘用于接收针对帧的音调的方法 700 的一种配置的流程图。接收通信设备 142 可以确定 702 用于信号接收的带宽是否为 20MHz、40MHz、80MHz 或 160MHz。例如，接收通信设备 142 可以接收指示符或消息，该指示符或消息规定了用于信号接收的带宽。应该注意的是，该指示符或消息可以是明确的或者隐含的。例如，所述指示符或消息可以明确包括用于规定带宽的比特。在另一种配置中，指示符或消息可以嵌入有另一类型的数据或传输的特征，比如对调整类型的选择、信息排序等。

[0144] 如果已确定 702 的带宽为 20MHz，则接收通信设备 142 可以接收 704 针对 L-STF 的 12 个 OFDM 音调，针对 L-LTF 的 52 个 OFDM 音调、针对 L-SIG 字段的 52 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 52 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 52 个 OFDM 音调、针对 VHT-STF 的 12 个 OFDM 音调、针对一个或多个 VHT-LTF 的 56 个 OFDM 音调、针对 VHT-SIG-B 字段的 56 个 OFDM 音调、和 / 或针对 DATA 字段的 56 个 OFDM 音调。如果已确定 702 的带宽为 40MHz，则接收通信设备 142 可以接收 706 针对 L-STF 的 24 个 OFDM 音调，针对 L-LTF 的 104 个 OFDM 音调、针对 L-SIG 字段的 104 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 104 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 104 个 OFDM 音调、针对 VHT-STF 的 24 个 OFDM 音调、针对一个或多个 VHT-LTF 的 114 个 OFDM 音调、针对 VHT-SIG-B 字段的 114 个 OFDM 音调、和 / 或针对 DATA 字段的 114 个 OFDM 音调。

[0145] 如果已确定 702 的带宽为 80MHz，则接收通信设备 142 可以接收 708 针对 L-STF 的 48 个 OFDM 音调，针对 L-LTF 的 208 个 OFDM 音调、针对 L-SIG 字段的 208 个 OFDM 音调、针

对 VHT-SIG-A1 字段或符号的 208 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 208 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 242 个 OFDM 音调、针对 VHT-SIG-B 字段的 242 个 OFDM 音调、和 / 或针对 DATA 字段的 242 个 OFDM 音调。如果已确定 702 的带宽为 160MHz，则接收通信设备 142 可以接收 710 针对 L-STF 的 48 个 OFDM 音调、针对 L-LTF 的 416 个 OFDM 音调、针对 L-SIG 字段的 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 416 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 484 个 OFM 音调、针对 VHT-SIG-B 字段和 / 或符号的 484 个 OFDM 音调、和 / 或针对 DATA 字段的 484 个 OFDM 音调。

[0146] 图 8 是接入点 802 的一种配置的框图，其中可以实现用于针对帧分配音调的系统和方法。接入点 802 可以包括具有输入端的编码器 806，所述输入端用于接收要向一个或多个接入终端 842 发射的有效载荷数据 804 和 / 或前导码数据 816。有效载荷数据 804 可以包括语音、视频、音频和 / 或其它数据。前导码数据 816 可以包括控制信息，比如用于规定数据速率、调制和编码方案（MCS）、信道带宽等的信息。编码器 806 可以对数据 804、816 进行编码，用于前向纠错（FEC）、加密、分组化、和 / 或在无线传输情况下所使用的已知的其它编码。例如，编码器 806 可以使用卷积码或者低密度奇偶校验（LDPC）编码对数据 804、816 进行编码。

[0147] 星座映射器 810 把编码器 806 所提供的数据映射到星座中。例如，星座映射器 810 可以使用调制方案，比如：二相相移键控（BPSK）、正交幅度调制（QAM）等。在使用正交幅度调制（QAM）的情况下，例如，星座映射器 810 可以提供每一空间流 838、每一数据子载波 840、每一符号周期两比特。此外，针对每一空间流 838、每一数据子载波 840、每一符号周期，星座映射器 810 可以输出 16-QAM 星座信号。可以使用其它调制，比如 64-QAM，其将导致每一空间流 838、每一数据子载波 840、每一符号周期 6 比特的消耗。其它变型也是有可能的。

[0148] 星座映射器 810 的输出提供给空间 - 时间 - 频率映射器 808，该空间 - 时间 - 频率映射器 108 把数据映射到发射机的空间 - 时间 - 频率（STF）维度上。维度表示允许对数据进行分配的各种构造或资源。给定的比特或比特的集合（例如，对应于星座点的比特组、比特的集合等）可以映射到维度中的特定位置。一般地，映射到维度中的不同位置的比特和 / 或信号是从接入点 802 发射的，从而期望它们在一个或多个接入终端 842 处是可以以某种概率区分的。在一种配置中，空间 - 时间 - 频率映射器 808 可以执行空间 - 时间块编码（STBC）。

[0149] 一个或多个空间流 838 可以从接入点 802 发射，使得不同空间流 838 上的传输在接收机处是可以（以某种概率）区分的。例如，映射到一个空间维度的比特是作为一个空间流 838 发射的。该空间流 838 可以在与其它天线 832 空间分开的其自己的天线 832 上、其自己在多个空间上分开的天线 832 上的正交叠加、其自己的极化等上发射。用于空间流 838 分开（例如，包括在空间上把天线 832 分开，或者将允许在接收机处区分其信号的其它技术）的很多技术是已知并且可以使用的。

[0150] 在图 8 中所示的例子中，存在使用相同或不同数量（例如，一个或多个）的天线 832a-n 进行发射的一个或多个空间流 838。在一些实例中，由于一个或多个其它空间流 838 不活动，只有一个空间流 838 可能是可用的。

[0151] 在接入点 802 使用多个频率子载波 840 的情况下，存在针对频率维度的多个值，使

得空间－时间－频率映射器808可以把一些比特映射到一个频率子载波840，并且把其它比特映射到另一个频率子载波840。其它频率子载波840可以保留作为保护频带、导频音调子载波、或者不(或不总是)携带数据804、816的类似事物。例如，可能存在一个或多个数据子载波840和一个或多个导频子载波840。应该注意的是，在一些实例或配置中，并非所有的子载波840都是可以立即激发的。例如，可能不激发一些音调(例如，DC音调)，以便能够进行滤波。在一种配置中，接入点802可以使用正交频分复用(OFDM)以用于多个子载波840的传输。例如，根据所使用的复用方案，空间－时间－频率映射器808可以把数据804、816映射(编码)到空间、时间和／或频率资源。

[0152] 时间维度指的是符号周期。可以把不同比特分配给不同符号周期。在存在多个空间流838、多个子载波840以及多个符号周期的情况下，针对一个符号周期的传输可以叫做“OFDM（正交频分复用）MIMO（多输入，多输出）符号”。可以通过将每一个符号的比特数量(例如，所使用的星座的数量的$\log_2$)乘以空间流838的数量，乘以数据子载波840的数量，除以符号周期的长度，来确定编码数据的传输速率。

[0153] 因此，空间－时间－频率映射器808可以把比特(或者输入数据的其它单元)映射到一个或多个空间流838、数据子载波840和／或符号周期。可以使用单独路径来产生和／或发射单独的空间流838。在一些实施方案中，这些路径是用独特的硬件实现的，然而在其它实施方案中，路径硬件重复用于不止一个空间流838，或者路径逻辑是在针对一个或多个空间流838执行的软件中实现的。更具体地，接入点802中示出的元件中的每一个可以实现为单个块／模块或者实现为多个块／模块。例如，发射机射频块826元件可以实现为单个块／模块或者实现为对应于每个天线832a-n的多个并行块／模块(例如，每个空间流838)。如本文所使用的，术语“块／模块”及其变型可以表示可通过硬件、软件或二者的结合实现的特定元件或部件。

[0154] 接入点802可以包括导频产生器块／模块830。导频产生器块／模块830可以产生导频序列。导频序列可以是一组导频符号。在一种配置中，例如，可以通过具有特定的相位、幅度和／或频率的信号表示导频序列中的数值。例如，“1”可以表示具有特定相位和／或幅度的导频符号，而“-1”可以表示具有不同(例如，相反的或者反向的)相位和／或幅度的导频符号。

[0155] 在一些配置中，接入点802可以包括伪随机噪声产生器828。伪随机噪声产生器828可以产生用于对导频序列进行加扰的伪随机噪声序列或信号(例如，数值)。例如，针对连续OFDM符号的导频序列可以与来自伪随机噪声序列的连续数字相乘，从而对每一OFDM符号的导频序列进行加扰。当向接入终端842发送该导频序列时，可以通过导频处理器848对已接收的导频序列进行解扰。

[0156] 空间－时间－频率映射器808的输出可以分布在频率和／或空间维度上。导频插入块／模块812把导频音调插入导频音调子载波840。例如，导频序列可以映射到特定索引处的子载波840。例如，来自导频序列的导频符号可以映射到子载波840，所述子载波840是与数据子载波840和／或其它子载波140散布的。换句话说，导频序列或信号可以与数据序列或信号相结合。在一个示例中，如果使用80MHz频带863进行传输，则可以把导频音调或子载波840设置在索引k={-103,-75,-39,-11,11,39,75,103}处。在一些配置中，一个或多个直流(DC)音调可以集中在索引0处。

[0157] 在一些配置中，可以把组合的数据和导频信号提供给旋转块 / 模块(图 8 中未示出)。旋转块 / 模块可以使用旋转或乘法因子，以便对导频符号和 / 或数据符号进行旋转。例如，旋转块 / 模块可以使 VHT-SIG-A2 符号相对于 VHT-SIG-A1 进行 90 度旋转，以便提供 VHT 自动检测。

[0158] 接入点 802 可以包括带宽确定块 / 模块 818。带宽确定块 / 模块 818 可以确定要用于向一个或多个接入终端 842 进行传输的信道带宽。该确定可以基于一个或多个因素，比如 :接入终端 842 兼容性、(要使用通信信道的)接入终端 842 的数量、信道质量(例如，信道噪声)、和 / 或已接收的指示符等。在一种配置中，带宽确定块 / 模块 818 可以确定用于信道发射的带宽是否为 20MHz、40MHz、80MHz 或 160MHz。在一个示例中，带宽确定块 / 模块 818 可以确定 80MHz 频带 863 将用于发射。

[0159] 带宽确定块 / 模块 818 可以向一个或多个块 / 模块提供带宽确定的指示。例如，该带宽指示可以提供给空间 - 时间 - 频率映射器 808、导频插入块 / 模块 812 和 / 或导频产生器 830。附加地或可选地，可以提供带宽指示，作为前导码数据 816 的一部分。例如，可以分配前导码数据 816 中的一个或多个比特，以表示该带宽指示。附加地或可选地，可以在前导码数据 816 中隐含指示该带宽指示。从而，可以向一个或多个接入终端 842 用信号发送该带宽指示。这样可能够使一个或多个接入终端 842 使用已选择的信道带宽来接收前导码数据 816。

[0160] 空间 - 时间 - 频率映射器 808 可以使用带宽指示，把前导码数据 816 映射到多个音调(例如，子载波 840)。例如，本文公开的系统和方法可以定义接入点 802 可以(例如，如带宽指示所规定的)基于信道带宽对前导码数据 816 进行发射所使用的 OFDM 音调或子载波 840 的数量。还可以根据特定的前导码字段来规定 OFDM 音调的数量。例如，基于上面的表(1)所指示的带宽确定和前导码字段，空间 - 时间 - 频率映射器 808 可以把前导码数据 816 映射到多个 OFDM 音调。例如，如果当前字段是 VHT-SIG-B 并且带宽指示规定了 80MHz 的带宽 863，则空间 - 时间 - 频率映射器 808 可以把前导码数据 816 映射到 234 个 OFDM 音调或子载波 840，剩下针对导频的 8 个 OFDM 音调，以及三个子载波 840 作为 DC 音调。在一些配置中，空间 - 时间 - 频率映射器 808 可以使用查找表以确定要用于规定带宽的音调或子载波的数量。

[0161] 更具体地，如果已确定的带宽是 20MHz，则接入点 802 可以针对 L-STF 分配 12 个 OFDM 音调，针对 L-LTF 分配 52 个 OFDM 音调、针对 L-SIG 字段分配 52 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 52 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 52 个 OFDM 音调、针对 VHT-STF 分配 12 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 56 个 OFDM 音调、针对 VHT-SIG-B 字段分配 56 个 OFDM 音调、和 / 或针对 DATA 字段分配 56 个 OFDM 音调。如果带宽确定为 40MHz，则接入点 802 可以针对 L-STF 分配 24 个 OFDM 音调，针对 L-LTF 分配 104 个 OFDM 音调、针对 L-SIG 字段分配 104 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 104 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 104 个 OFDM 音调、针对 VHT-STF 分配 24 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 114 个 OFDM 音调、针对 VHT-SIG-B 字段分配 114 个 OFDM 音调、和 / 或针对 DATA 字段分配 114 个 OFDM 音调。如果带宽为 80MHz，则接入点 802 可以针对 L-STF 分配 48 个 OFDM 音调，针对 L-LTF 分配 208 个 OFDM 音调、针对 L-SIG 字段分配 208 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 208 个 OFDM 音调、

针对 VHT-SIG-A2 字段或符号分配 208 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 242 个 OFDM 音调、针对 VHT-SIG-B 字段分配 242 个 OFDM 音调、和 / 或针对 DATA 字段分配 242 个 OFDM 音调。如果带宽为 160MHz，则接入点 802 可以针对 L-STF 分配 48 个 OFDM 音调，针对 L-LTF 分配 416 个 OFDM 音调、针对 L-SIG 字段分配 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号分配 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号分配 416 个 OFDM 音调、针对 VHT-STF 分配 48 个 OFDM 音调、针对一个或多个 VHT-LTF 分配 484 个 OFDM 音调、针对 VHT-SIG-B 字段或字段分配 484 个 OFDM 音调、和 / 或针对 DATA 字段分配 484 个 OFDM 音调。

[0162] 在一些配置中，带宽指示还可以提供给导频产生器 830。导频产生器 830 可以使用该带宽指示，以产生合适数量的导频符号。例如，导频产生器 830 可以针对 80MHz 信号产生 8 个导频符号（具有 242 个 OFDM 音调 :234 个数据音调和 8 个导频音调，以及 3 个 DC 子载波 840）。

[0163] 在一些配置中，带宽指示另外可以提供给导频插入块 / 模块 812。导频插入块 / 模块 812 可以使用该指示以确定子载波索引用于导频符号插入。例如，80MHz 带宽可以指示 : 应该在索引 -103、-75、-39、-11、11、39、75 和 103 处插入导频符号。

[0164] 向快速傅里叶逆变换（IFFT）块 / 模块 820 提供数据和 / 或导频信号。快速傅里叶逆变换（IFFT）块 / 模块 820 对数据 804、816 的频率信号进行转换，并且将导频音调插入时域信号，所述时域信号表示空间流 838 上的信号和 / 或针对符号周期的时域采样。在一种配置中，例如，IFFT 块 / 模块 820 可以执行 256 点快速傅里叶逆变换（IFFT）。

[0165] 向格式器 822 提供时域信号。格式器（例如，一个或多个格式化块 / 模块）822 可以得到快速傅里叶逆变换（IFFT）块 / 模块 820 的输出，把其从并行信号转换为串行（P/S），添加循环前缀和 / 或执行保护间隔加窗等。

[0166] 格式器 822 输出可以提供给数模转换器（DAC）824。数模转换器（DAC）824 可以把格式器 822 输出从一个或多个数字信号转换为一个或多个模拟信号。数模转换器（DAC）824 可以向一个或多个发射机射频（TX RF）块 826 提供模拟信号。

[0167] 一个或多个发射机射频块 826 可以耦合到功率放大器，或者包括功率放大器。功率放大器可以对模拟信号进行放大以用于传输。一个或多个发射机射频块 826 可以向一个或多个天线 832a-n 输出射频（RF）信号，从而把输入到编码器 806 的数据 804、816 通过无线介质发送，其合适地配置为被一个或多个接入终端 842 接收。

[0168] 一个或多个接入终端 842 可以接收并且使用来自接入点 802 的信号。例如，接入终端 842 可以使用已接收的带宽指示符来接收给定数量的 OFDM 音调或子载波 840。附加地或可选地，接入终端 842 可以使用接入点 802 所产生的导频序列来描述信道、发射机故障和 / 或接收机故障的特征，并且使用该特征来改善对传输中编码的数据 804、816 的接收。

[0169] 例如，接入终端 842 可以包括提供给一个或多个接收机射频（RX RF）块 858 的一个或多个天线 836a-n（其可以大于、小于或等于接入点 802 天线 832a-n 的数量和 / 或空间流 838 的数量）。一个或多个接收机射频（RX RF）块 858 可以向一个或多个模数转换器（ADC）856 输出模拟信号。例如，接收机射频块 858 可以对信号进行接收并且下变频，该信号可以提供给模数转换器 856。和接入点 802 一样，所处理的空间流 838 的数量可以或可以不等于天线 836a-n 的数量。此外，每个空间流 838 不需要限于一个天线 836，因为可以使用各种波

束控制(beamsteering)、正交化等技术到达多个接收机流。

[0170] 一个或多个模数转换器(ADC)856可以把已接收的模拟信号转换成一个或多个数字信号。所述一个或多个模数转换器(ADC)856的这些输出可以提供给一个或多个时间和/或频率同步块/模块854。时间和/或频率同步块/模块854可以(尝试)在时间和/或频率上把数字信号同步或对齐(例如,接入终端842时钟)。

[0171] 时间和/或频率同步块/模块854的(同步)输出可以提供给一个或多个解格式器852。例如,解格式器852可以接收时间和/或频率同步块/模块854的输出,移除前缀等,和/或对数据进行并行化,以用于快速傅里叶变换(FFT)处理。

[0172] 一个或多个解格式器852输出可以提供给一个或多个快速傅里叶变换(FFT)块/模块850。快速傅里叶变换(FFT)块/模块850可以把一个或多个信号从时域转换到频域。导频处理器848可以使用(例如,每一空间流838的)频域信号,以确定接入点802所发送的(例如,空间流838、频率子载波840和/或一组符号周期上的)一个或多个导频音调。导频处理器848可以附加地或者可选地对导频序列进行解扰(de-scramble)。导频处理器848可以使用本文所述的一个或多个导频序列进行相位和/或频率和/或幅度跟踪。可以把导频音调提供给空间-时间-频率检测和/或解码块/模块846,所述空间-时间-频率检测和/或解码块/模块846可以对各个维度上的数据进行检测和/或解码。空间-时间-频率检测和/或解码块/模块846可以输出已接收的数据844(例如,接入终端842对接入点802所发射的有效载荷数据804和/或前导码数据816的估计)。

[0173] 在一些配置中,接入终端842知道发射序列作为总信息序列的一部分发送。接入终端842可以在这些已知的发射序列的帮助下实施信道估计。为了协助导频音调跟踪、处理和/或数据检测和解码,信道估计块/模块860可以基于来自时间和/或频率同步块/模块854的输出,向导频处理器848和/或空间-时间-频率检测和/或解码块/模块846提供估计信号。可选地,如果对于已知的发射序列而言,解格式化和快速傅里叶变换是与总信息序列的有效载荷数据部分相同,则可以基于来自快速傅里叶变换(FFT)块/模块850的输出,把估计信号提供给导频处理器848和/或空间-时间-频率检测和/或解码块/模块846。

[0174] 带宽确定块/模块834可以使用时间/频率同步块/模块输出来确定(用于已接收通信的)信道带宽。例如,带宽确定块/模块834可以接收来自接入点802的用于指示信道带宽的带宽指示。例如,带宽确定块/模块834可以获得明确的或隐含的带宽指示。在一种配置中,带宽指示可以指示20MHz、40MHz、80MHz或160MHz的信道带宽。带宽确定块/模块834可以基于该指示来确定用于接收通信的带宽,并且向导频处理器848和/或空间-时间-频率检测/解码块/模块846提供已确定带宽的指示。

[0175] 更具体地,如果已确定的带宽是20MHz,则接入终端842可以接收针对L-STF的12个OFDM音调,针对L-LTF的52个OFDM音调、针对L-SIG字段的52个OFDM音调、针对VHT-SIG-A1字段或符号的52个OFDM音调、针对VHT-SIG-A2字段或符号的52个OFDM音调、针对VHT-STF的12个OFDM音调、针对一个或多个VHT-LTF的56个OFDM音调、针对VHT-SIG-B字段的56个OFDM音调、和/或针对DATA字段的56个OFDM音调。如果已确定的带宽是40MHz,则接入终端842可以接收针对L-STF的24个OFDM音调、针对L-LTF的104个OFDM音调、针对L-SIG字段的104个OFDM音调、针对VHT-SIG-A1字段或符号的104个

OFDM 音调、针对 VHT-SIG-A2 字段或符号的 104 个 OFDM 音调、针对 VHT-STF 的 24 个 OFDM 音调、针对一个或多个 VHT-LTF 的 114 个 OFDM 音调、针对 VHT-SIG-B 字段的 114 个 OFDM 音调、和 / 或针对 DATA 字段的 114 个 OFDM 音调。如果带宽是 80MHz，则接入终端 842 可以接收针对 L-STF 的 48 个 OFDM 音调、针对 L-LTF 的 208 个 OFDM 音调、针对 L-SIG 字段的 208 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 208 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 208 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 242 个 OFDM 音调、针对 VHT-SIG-B 字段的 242 个 OFDM 音调、和 / 或针对 DATA 字段的 242 个 OFDM 音调。如果带宽是 160MHz，则接入终端 842 可以接收针对 L-STF 的 48 个 OFDM 音调、针对 L-LTF 的 416 个 OFDM 音调、针对 L-SIG 字段的 416 个 OFDM 音调、针对 VHT-SIG-A1 字段或符号的 416 个 OFDM 音调、针对 VHT-SIG-A2 字段或符号的 416 个 OFDM 音调、针对 VHT-STF 的 48 个 OFDM 音调、针对一个或多个 VHT-LTF 的 484 个 OFDM 音调、针对 VHT-SIG-B 字段或符号的 484 个 OFDM 音调、和 / 或针对 DATA 字段的 484 个 OFDM 音调。

[0176] 导频处理器 848 可以使用已确定的带宽指示，从快速傅里叶变换块 / 模块 850 输出中提取导频符号。例如，如果已确定的带宽指示规定了 80MHz 带宽 863，则导频处理器 848 可以从索引 -103、-75、-39、-11、11、39、75 以及 103 中提取导频符号。

[0177] 空间 - 时间频率检测 / 解码块 / 模块 846 可以使用已确定的带宽指示，从已接收的信号中对前导码数据进行检测和 / 或解码。例如，如果当前字段是 VHT-SIG-B 字段并且已确定的带宽指示规定了带宽为 80MHz，则空间 - 时间频率检测 / 解码块 / 模块 846 可以从 234 个 OFDM 音调或子载波 840 中对前导码数据进行检测和 / 或解码（例如，其中 8 个 OFDM 音调是导频音调，并且三个子载波 840 用于 DC 音调）。在一些配置中，空间 - 时间 - 频率检测 / 解码块 / 模块 846 可以使用查找表来确定对于规定带宽而言要接收的音调或子载波的数量。

[0178] 在一种配置中，接入终端 842 还可以向接入点 802 发射数据 857（例如，前导码数据和 / 或有效载荷数据）。例如，接入终端 842 可以包括发射机 859。发射机 859 可以包括传输带宽确定块 / 模块 861（为了方便起见，图 8 中描绘成“传输带宽”）。传输带宽确定块 / 模块 861 可以确定用于向接入点 802 传输的通信带宽。例如，发射机 859 可以执行与接入点 802 所执行的相同或相似的用于针对帧分配音调的操作。这样，例如，发射机 859 可以获得数据 857，确定带宽，基于该带宽（以及帧字段或信号）来针对帧分配音调，把数据和导频映射到音调，和 / 或类似于接入点 802，发射所产生的信号。

[0179] 在一些配置中，接入点 802 可以包括用于接收数据和 / 或导频符号的接收机 853。例如，接入点 802 可以从接入终端 842 接收带宽指示、数据和 / 或导频符号。接收机 853 可以包括接收带宽确定块 / 模块 855（为了方便起见，图 8 中描绘成“接收带宽”）。接收带宽确定块 / 模块 855 可以通过与接入终端 842 中所包括的带宽确定块 / 模块 834 相似的方式来确定接收带宽。例如，接入点 802 可以从接入终端 842 接收带宽指示或消息，802 可以用该带宽指示或消息来确定接收带宽。接入点 802 可以使用该接收带宽确定来对从接入终端 842 接收到的一个或多个信号进行检测、解码、解调等。例如，接收机 853 可以类似地执行接入终端 842 所执行的一个或多个操作。换句话说，接收机 853 可以类似地执行接入终端 842 为了获得其接收到的数据 844 而执行的一个或多个操作，以便接收帧的音调（例如，接收数据 851）。

[0180] 图 9 是可以在多输入和多输出(MIMO)系统中使用的通信设备 965 的框图。通信设备 965 的示例可以包括 :发射通信设备 102、接收通信设备 142、接入点 802、接入终端 842、基站、用户设备(UE)等。在通信设备 965 中,从一个或多个数据源 967 和 / 或应用处理器 969 向基带处理器 973 提供针对多个数据流的业务数据。具体地,可以向基带处理器 973 中包括的发射处理块 / 模块 977 提供业务数据。然后,可以通过每个发射天线 995a-n 发射相应的数据流。发射处理块 / 模块 977 可以基于针对每个数据流而选择的特定编码方案,对该数据流的业务数据进行格式化、编码以及交织,以便提供编码数据。

[0181] 发射处理块 / 模块 977 可以执行图 6 中所示的方法 600。例如,发射处理块 / 模块 977 可以包括音调分配块 / 模块 979。音调分配块 / 模块 979 可以执行指令,以便向帧分配音调。

[0182] 可以使用正交频分复用(OFDM)技术,把每个数据流的编码数据与来自导频产生器 975 的导频数据进行复用。导频数据可以是通过已知方式处理的已知数据模式,并且在接收机处可以使用该导频数据对信道响应进行估计。然后,可以基于针对每个数据流所选择的特定调制方案(例如,二相相移键控(BPSK)、正交相移键控(QPSK)、M 相相移键控(M-PSK)、正交幅度调制(QAM)或 M 阶正交幅度调制(M-QAM)),对该数据流的已复用导频和编码数据进行调制(即,符号映射),以便提供调制符号。通过处理器执行的指令来确定每个数据流的数据速率、编码和调制。

[0183] 可以向发射(TX)多输入多输出(MIMO)处理块 / 模块 989 提供所有数据流的调制符号,发射(TX)多输入多输出(MIMO)处理块 / 模块 989 可以对这些调制符号作进一步处理(例如,用于 OFDM)。发射(TX)多输入多输出(MIMO)处理块 / 模块 989 随后向发射机 993a-n 提供多个调制符号流。发射(TX)多输入多输出(MIMO)处理块 / 模块 989 可以向数据流的符号和用于发射所述符号的天线 995 应用波束成形权重。

[0184] 每个发射机 993 可以接收并且处理各自的符号流,以便提供一个或多个模拟信号,并且对这些模拟信号进行进一步调节(例如,放大、滤波、以及上变频),以便提供适合于通过 MIMO 信道传输的调制信号。来自发射机 993a-n 的调制信号分别从天线 995a-n 发射。例如,可以向另一个通信设备(图 9 中未示出)发送所述调制信号。

[0185] 通信设备 965 可以接收(来自另一个通信设备的)调制信号。这些调制信号是由天线 995 接收的,并且由接收机 993 进行调节(例如,滤波、放大、下变频、数字化)。换句话说,每个接收机 993 可以对各自接收的信号进行调节(例如,滤波、放大、以及下变频),对已调节信号进行数字化以便提供采样,并对这些采样进一步处理以便提供相应的“已接收的”符号流。

[0186] 然后,基带处理器 973 中所包括的接收处理块 / 模块 983 从接收机接收符号流,并且基于特定的接收机处理技术,对已接收的符号流进行处理,以便提供多个“已检测到的”流。接收处理块 / 模块 983 对每个流进行解调、解交织、以及解码,以便恢复该数据流的业务数据。

[0187] 接收处理块 / 模块 983 可以执行图 7 中所示的方法 700。例如,接收处理块 / 模块 983 可以包括音调接收块 / 模块 985。音调接收块 / 模块 985 可以执行指令,以便接收帧的音调。

[0188] 基带处理器 973 中所包括的预编码处理块 / 模块 981 可以从接收处理块 / 模块

983 接收信道状态信息(CSI)。然后,预编码处理块 / 模块 981 确定要使用哪个预编码矩阵来确定波束成形权重,并且随后对已提取的消息进行处理。应当注意的是,基带处理器 973 可以把信息存储在基带存储器 987 上,并且从该基带存储器 987 获取信息。

[0189] 可以向应用处理器 969 提供基带处理器 973 所恢复的业务数据。应用处理器 969 可以把信息存储在应用存储器 971 中,并且从该应用存储器 971 获取信息。

[0190] 图 10 描绘了可以包括在通信设备、基站和 / 或者接入点 1097 内的某些部件。上述发射通信设备 102、接收通信设备 142、接入点 802、和 / 或通信设备 965 可以配置为类似于图 10 中所示的通信设备 / 基站 / 接入点 1097。

[0191] 通信设备 / 基站 / 接入点 1097 包括处理器 1015。处理器 1015 可以是通用的单芯片微处理器或者多芯片微处理器(例如,ARM)、专用微处理器(例如,数字信号处理器(DSP))、微控制器、可编程门阵列等。处理器 1015 可以叫做中央处理单元(CPU)。虽然图 10 的通信设备 / 基站 / 接入点 1097 中仅示出了单个处理器 1015,但是在其它可选的配置中,可以使用处理器的组合(例如,ARM 和 DSP)。

[0192] 通信设备 / 基站 / 接入点 1097 还包括与处理器 1015 进行电子通信的存储器 1099(即,处理器 1015 可以从存储器 1099 读信息,和 / 或向存储器 1099 写信息)。存储器 1099 可以是能够存储电子信息的任何电子部件。存储器 1099 可以是随机存取存储器(RAM)、只读存储器(ROM)、磁盘存储介质、光存储介质、RAM 中的闪存器件、处理器中包括的板上存储器(on-board memory)、可编程只读存储器(PROM)、可擦除可编程只读存储器(EPROM)、电可擦除 PROM (EEPROM)、寄存器等,包括它们的组合。

[0193] 数据 1001 和指令 1003 可以保存在存储器 1099 中。指令 1003 可以包括一个或多个程序、例程、子例程、函数、过程、代码等。指令 1003 可以包括单个计算机可读语句或很多计算机可读语句。指令 1003 可以通过处理器 1015 来执行,以实施上述方法 600、700。对指令 1003 的执行可以包括对保存在存储器 1099 中的数据 1001 的使用。图 10 示出了加载到处理器 1015 中的一些指令 1003a 和数据 1001a。

[0194] 通信设备 / 基站 / 接入点 1097 还可以包括发射机 1011 和接收机 1013,以便允许在通信设备 / 基站 / 接入点 1097 和远端位置(例如,另一个通信设备、接入终端、接入点等)之间进行信号的发射和接收。发射机 1011 和接收机 1013 可以统称为收发机 1009。天线 1007 可以电耦合到收发机 1009。通信设备 / 基站 / 接入点 1097 还可以包括(图中未示出)多个发射机、多个接收机、多个收发机和 / 或多个天线。

[0195] 通信设备 / 基站 / 接入点 1097 的各个部件可以通过一条或者多条总线耦合在一起,所述一条或者多条总线可以包括电源总线、控制信号总线、状态信号总线、数据总线等。为了简化,各个总线在图 10 中示出为总线系统 1005。

[0196] 图 11 描绘了可以包括在无线通信设备和 / 或接入终端 1117 内的某些部件。上述发射通信设备 102、接收通信设备 142、接入终端 842、以及通信设备 965 中的一个或多个可以配置为类似于图 11 中所示的无线通信设备 / 接入终端 1117。

[0197] 无线通信设备 / 接入终端 1117 包括处理器 1137。处理器 1137 可以是通用的单芯片微处理器或者多芯片微处理器(例如,ARM)、专用微处理器(例如,数字信号处理器(DSP))、微控制器、可编程门阵列等。处理器 1137 可以叫做中央处理单元(CPU)。虽然图 11 的无线通信设备 / 接入终端 1117 中仅示出了单个处理器 1137,但是在可选配置中,可以使

用处理器 1137 的组合(例如,ARM 和 DSP)。

[0198] 无线通信设备 / 接入终端 1117 还包括与处理器 1137 进行电子通信的存储器 1119(即,处理器 1137 可以从存储器 1119 读信息,和 / 或向存储器 1119 写信息)。存储器 1119 可以是能够存储电子信息的任何电子部件。存储器 1119 可以是随机存取存储器(RAM)、只读存储器(ROM)、磁盘存储介质、光存储介质、RAM 中的闪存器件、处理器 1137 中包括的板上存储器(on-board memory)、可编程只读存储器(PROM)、可擦除可编程只读存储器(EPROM)、电可擦除 PROM (EEPROM)、寄存器等,包括它们的组合。

[0199] 数据 1121a 和指令 1123a 可以保存在存储器 1119 中。指令 1123a 可以包括一个或多个程序、例程、子例程、函数、过程、代码等。指令 1123a 可以包括单个计算机可读语句或很多计算机可读语句。指令 1123a 可以通过处理器 1137 执行,以便实施上述方法 600、700 中的一个或多个。对指令 1123a 的执行可以包括对存储器 1119 中存储的数据 1121a 的使用。图 11 示出了加载到处理器 1137 中的一些指令 1123b 和数据 1121b (其可能来自存储器 1119 中的指令 1123a 和数据 1121a)。

[0200] 无线通信设备 / 接入终端 1117 还可以包括发射机 1133 和接收机 1135,以便允许在无线通信设备 / 接入终端 1117 和远端位置(例如,另一个电子设备、无线通信设备等)之间进行信号的发射和接收。发射机 1133 和接收机 1135 可以统称为收发机 1131。天线 1129 可以电耦合到收发机 1131。无线通信设备 / 接入终端 1117 还可以包括(图中未示出)多个发射机 1133、多个接收机 1135、多个收发机 1131 和 / 或多个天线 1129。

[0201] 在一些配置中,无线通信设备 / 接入终端 1117 可以包括一个或多个麦克风 1125,用于捕获声音信号。在一种配置中,麦克风 1125 可以是把声音信号(例如,语音、演讲)转换成电的或电子的信号的转换器。附加地或者可选地,无线通信设备 / 接入终端 1117 可以包括一个或多个扬声器。在一种配置中,扬声器 1127 可以是把电的或电子的信号转换成声音信号的转换器。

[0202] 无线通信设备 / 接入终端 1117 的各种部件可以通过一条或者多条总线耦合在一起,所述一条或者多条总线可以包括电源总线、控制信号总线、状态信号总线、数据总线等。为了简化,各个总线在图 11 中示出为总线系统 1139。

[0203] 在上面的描述中,附图标记有时与各种术语结合使用。在与附图标记相结合使用术语的位置,这可能是指代附图中的一个或多个中示出的特定元件。在没有附图标记的情况下使用术语,这可能是概括性地指代不限于任何特定附图的术语。

[0204] 术语“确定”涵盖了多种广泛的动作,因此“确定”可以包括计算、运算、处理、推导、调查、查找(例如,在表格、数据库或者其它数据结构中查找)、查明等。此外,“确定”可以包括 :接收(例如,接收信息)、访问(例如,访问存储器中的数据)等。此外,“确定”可以包括解析、选择、选取、建立等。

[0205] 除非另外明确说明,否则短语“基于”并不意味着“仅基于”。换句话说,短语“基于”同时包含“仅基于”和“至少基于”两层含义。

[0206] 本文所述的功能可以作为一条或多条指令存储在处理器可读的或者计算机可读的介质上。术语“计算机可读介质”是指能够通过计算机或处理器访问的任何可用介质。这类介质可以包括,例如但不限于 :RAM、ROM、EEPROM、闪存、CD-ROM 或其它光盘存储器、磁盘存储器或其它磁性存储器、或者可用于存储能够通过计算机或处理器访问的具有指令或数

据结构形式的所期望的程序代码的任何其它介质。本文所使用的磁盘和光碟包括：压缩光碟（CD）、激光光碟、光碟、数字多功能光碟（DVD）、软盘以及蓝光®光碟，其中磁盘通常用磁再现数据，而光碟是由激光器用光再现数据。应该注意的是，计算机可读介质可以是有形并且非临时性的。术语“计算机程序产品”指的是与代码或指令（例如，“程序”）相结合的计算设备或处理器，所述代码或指令可以由所述计算设备或处理器执行、处理、或计算。如本文所使用的，术语“代码”可以指计算设备或处理器可执行的软件、指令、代码或数据。

[0207] 软件或指令还可以通过传输介质进行传输。例如，如果从网站、服务器或其它远程源使用同轴电缆、光缆、双绞线、数字用户线（DSL）、或者无线技术（例如红外线、无线电、以及微波）来传输软件，则同轴电缆、光缆、双绞线、DSL 或无线技术（例如红外线、无线电、以及微波）包括在传输介质的定义中。

[0208] 本文公开的方法包括用于实现所述方法的一个或多个步骤或动作。在不脱离权利要求范围的前提下，方法步骤和 / 或动作可以互换。换句话说，除非该方法的正常操作需要特定顺序的步骤或者动作，否则可以在不脱离权利要求范围的前提下修改具体的步骤和 / 或操作的顺序和 / 或使用。

[0209] 应当理解的是，权利要求不限于上面所示的精确配置和部件。在不脱离权利要求范围的前提下，可以对本文所述的系统、方法和设备的布置、操作和细节进行各种修改、改变和变化。

[0210] 所主张的内容参见权利要求书。

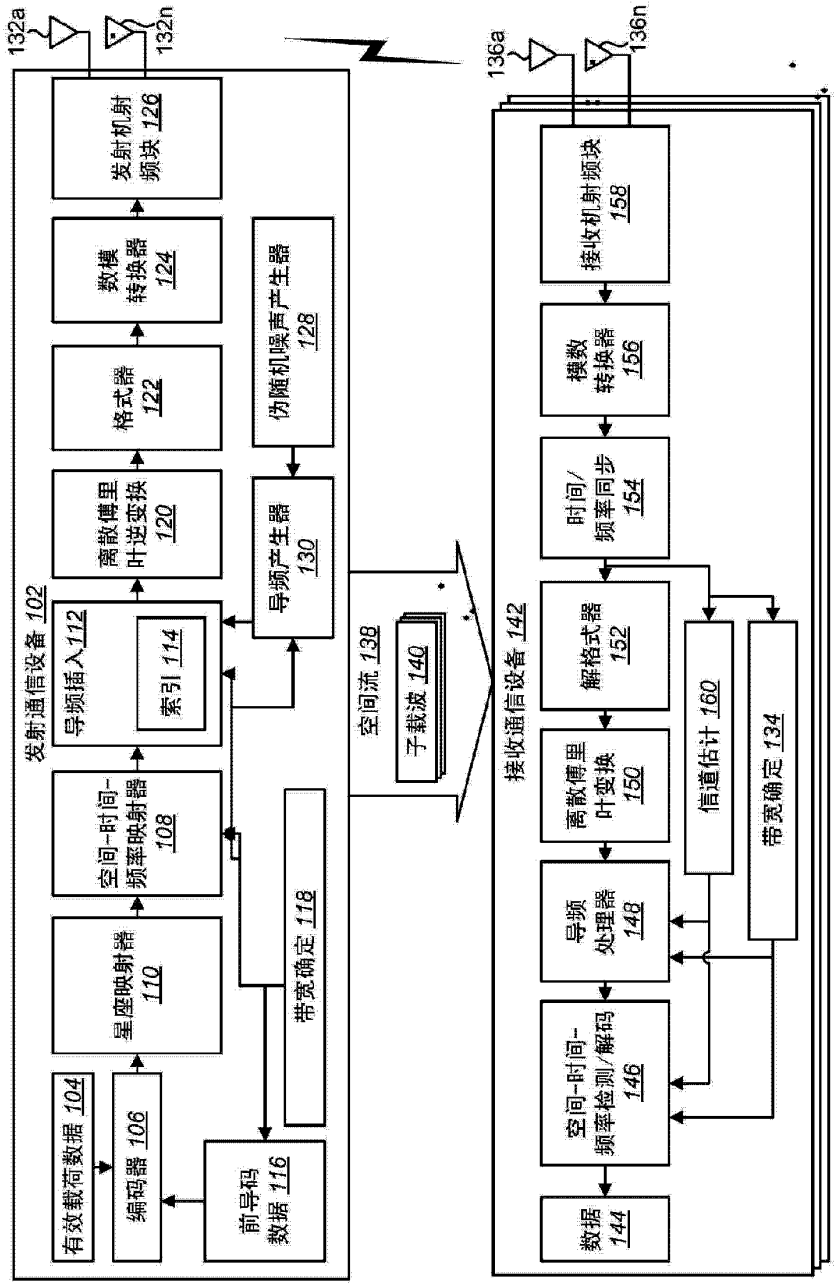

132a
132n
136a
136n
发射通信设备 102
有效载荷数据 104
编码器 106
星座映射器 110
空间-时间-频率映射器 108
导频插入 112
索引 114
离散傅里叶逆变换 120
格式器 122
数模转换器 124
发射机射频块 126
前导码数据 116
带宽确定 118
导频产生器 130
伪随机噪声产生器 128
空间流 138
子载波 140
接收通信设备 142
接收机射频块 158
模数转换器 156
时间/频率同步 154
解格式器 152
离散傅里叶变换 150
导频处理器 148
空间-时间-频率检测/解码 146
数据 144
信道估计 160
带宽确定 134

图 1

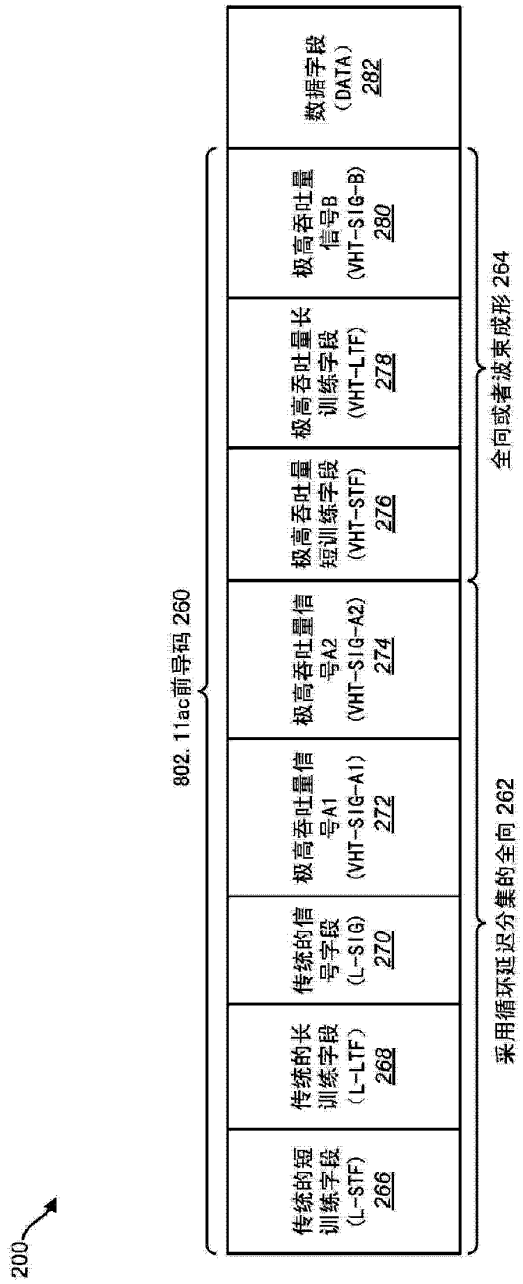

200
传统的短训练字段 (L-STF) 266
传统的长训练字段 (L-LTF) 268
传统的信号字段 (L-SIG) 270
极高吞吐量信号A1 (VHT-SIG-A1) 272
极高吞吐量信号A2 (VHT-SIG-A2) 274
极高吞吐量短训练字段 (VHT-STF) 276
极高吞吐量长训练字段 (VHT-LTF) 278
极高吞吐量信号B (VHT-SIG-B) 280
数据字段 (DATA) 282
802.11ac前导码 260
采用循环延迟分集的全向 262
全向或者波束成形 264

图 2

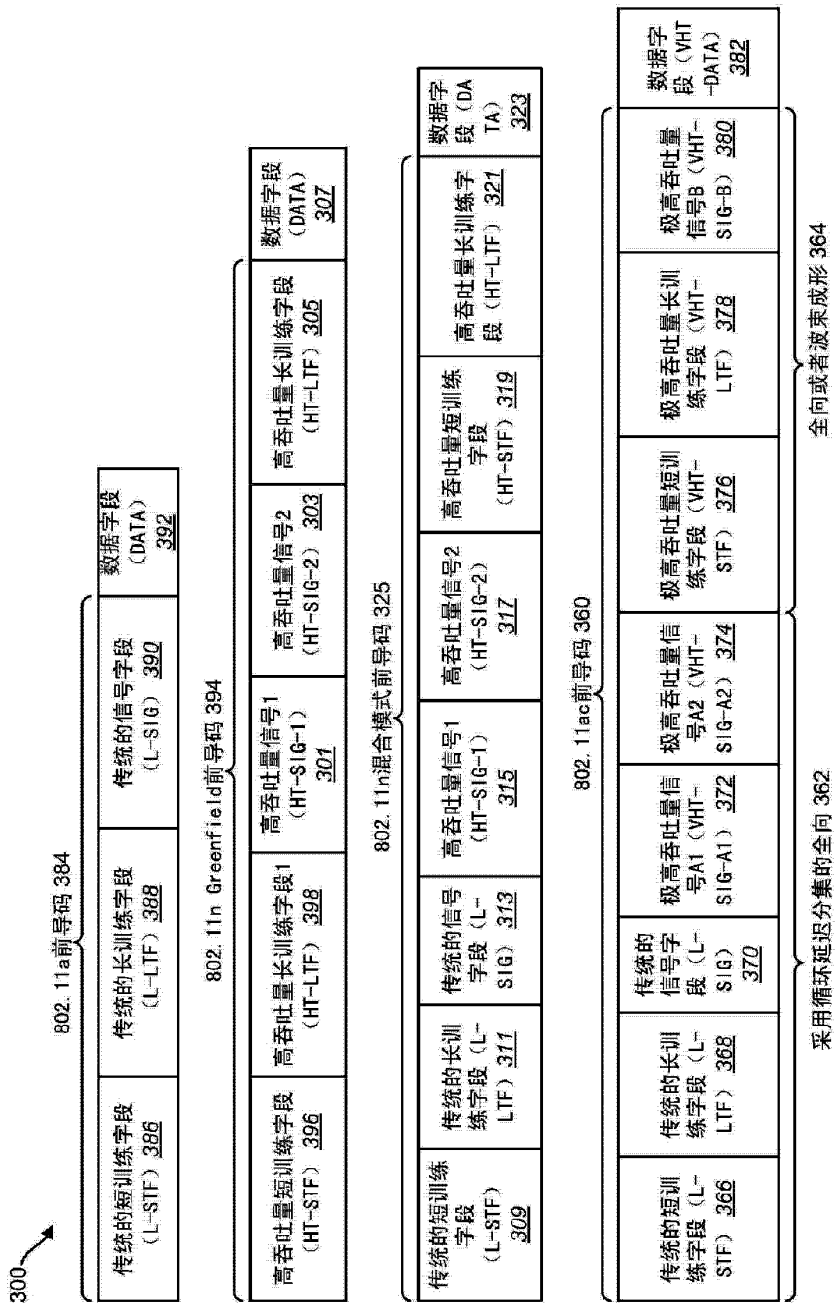

300
802.11a前导码 384
传统的短训练字段（L-STF）386
传统的长训练字段（L-LTF）388
传统的信号字段（L-SIG）390
数据字段（DATA）392
802.11n Greenfield前导码 394
高吞吐量短训练字段（HT-STF）396
高吞吐量长训练字段1（HT-LTF）398
高吞吐量信号1（HT-SIG-1）301
高吞吐量信号2（HT-SIG-2）303
高吞吐量长训练字段（HT-LTF）305
数据字段（DATA）307
802.11n混合模式前导码 325
传统的短训练字段（L-STF）309
传统的长训练字段（L-LTF）311
传统的信号字段（L-SIG）313
高吞吐量信号1（HT-SIG-1）315
高吞吐量信号2（HT-SIG-2）317
高吞吐量短训练字段（HT-STF）319
高吞吐量长训练字段（HT-LTF）321
数据字段（DATA）323
802.11ac前导码 360
传统的短训练字段（L-STF）366
传统的长训练字段（L-LTF）368
传统的信号字段（L-SIG）370
极高吞吐量信号A1（VHT-SIG-A1）372
极高吞吐量信号A2（VHT-SIG-A2）374
极高吞吐量短训练字段（VHT-STF）376
极高吞吐量长训练字段（VHT-LTF）378
极高吞吐量信号B（VHT-SIG-B）380
数据字段（VHT-DATA）382
采用循环延迟分集的全向 362
全向或者波束成形 364

图 3

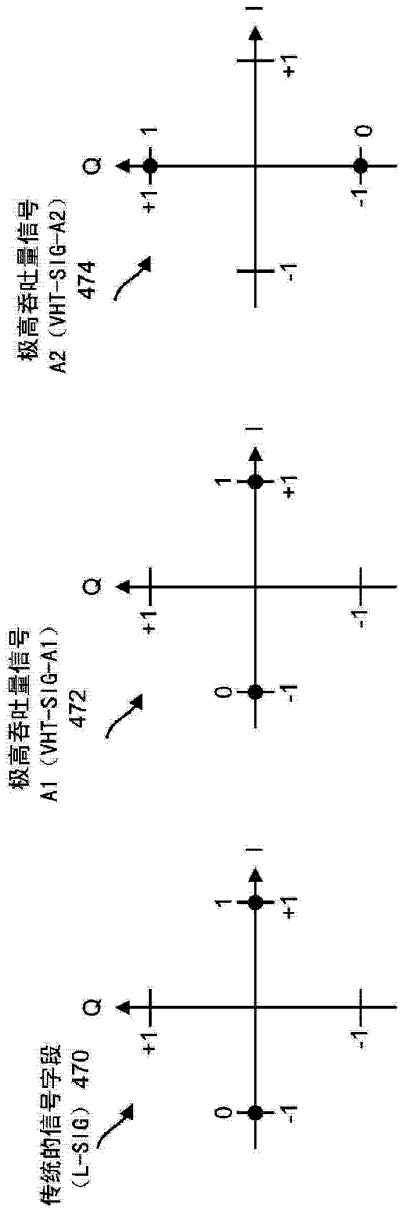

传统的信号字段
（L-SIG）470
极高吞吐量信号
A1（VHT-SIG-A1）
472
极高吞吐量信号
A2（VHT-SIG-A2）
474
I
Q
+1
-1
0
1

图 4

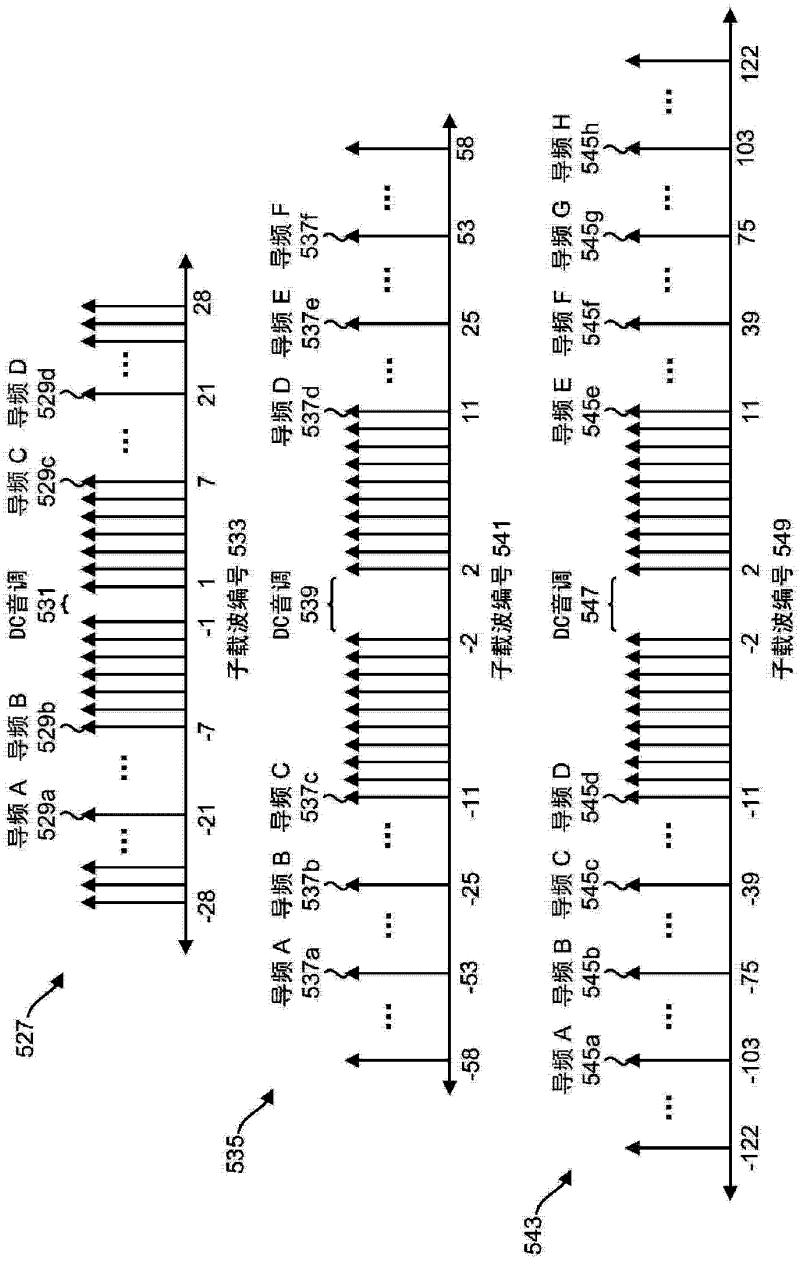

527
导频 A 529a
导频 B 529b
DC音调 531
导频 C 529c
导频 D 529d
-28 -21 -7 -1 1 7 21 28
子载波编号 533
535
导频 A 537a
导频 B 537b
导频 C 537c
DC音调 539
导频 D 537d
导频 E 537e
导频 F 537f
-58 -53 -25 -11 -2 2 11 25 53 58
子载波编号 541
543
导频 A 545a
导频 B 545b
导频 C 545c
导频 D 545d
DC音调 547
导频 E 545e
导频 F 545f
导频 G 545g
导频 H 545h
-122 -103 -75 -39 -11 -2 2 11 39 75 103 122
子载波编号 549

图 5

47

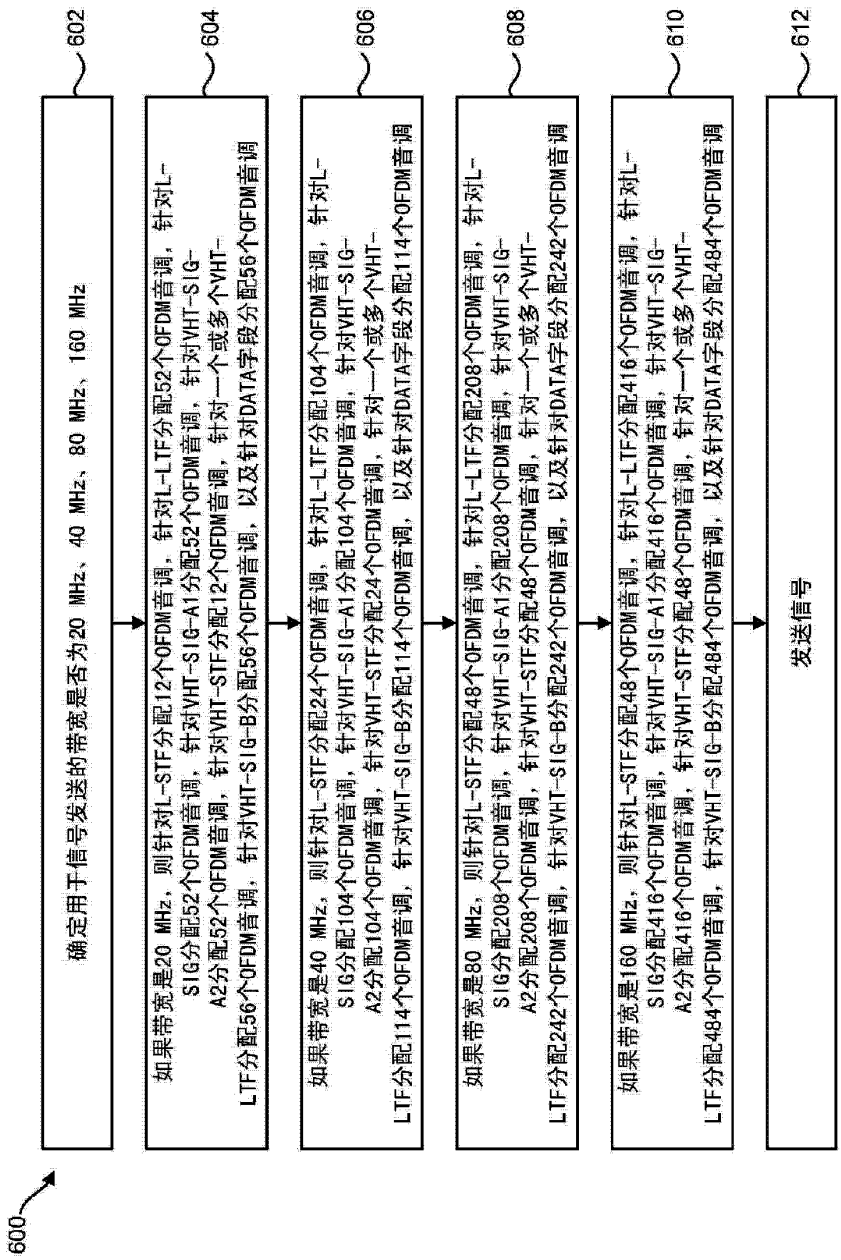

600
602
确定用于信号发送的带宽是否为20 MHz、40 MHz、80 MHz、160 MHz
604
如果带宽是20 MHz，则针对L-STF分配12个OFDM音调，针对L-LTF分配52个OFDM音调，针对L-SIG分配52个OFDM音调，针对VHT-SIG-A1分配52个OFDM音调，针对VHT-SIG-A2分配52个OFDM音调，针对VHT-STF分配12个OFDM音调，针对一个或多个VHT-LTF分配56个OFDM音调，针对VHT-SIG-B分配56个OFDM音调，以及针对DATA字段分配56个OFDM音调
606
如果带宽是40 MHz，则针对L-STF分配24个OFDM音调，针对L-LTF分配104个OFDM音调，针对L-SIG分配104个OFDM音调，针对VHT-SIG-A1分配104个OFDM音调，针对VHT-SIG-A2分配104个OFDM音调，针对VHT-STF分配24个OFDM音调，针对一个或多个VHT-LTF分配114个OFDM音调，针对VHT-SIG-B分配114个OFDM音调，以及针对DATA字段分配114个OFDM音调
608
如果带宽是80 MHz，则针对L-STF分配48个OFDM音调，针对L-LTF分配208个OFDM音调，针对L-SIG分配208个OFDM音调，针对VHT-SIG-A1分配208个OFDM音调，针对VHT-SIG-A2分配208个OFDM音调，针对VHT-STF分配48个OFDM音调，针对一个或多个VHT-LTF分配242个OFDM音调，针对VHT-SIG-B分配242个OFDM音调，以及针对DATA字段分配242个OFDM音调
610
如果带宽是160 MHz，则针对L-STF分配48个OFDM音调，针对L-LTF分配416个OFDM音调，针对L-SIG分配416个OFDM音调，针对VHT-SIG-A1分配416个OFDM音调，针对VHT-SIG-A2分配416个OFDM音调，针对VHT-STF分配48个OFDM音调，针对一个或多个VHT-LTF分配484个OFDM音调，针对VHT-SIG-B分配484个OFDM音调，以及针对DATA字段分配484个OFDM音调
612
发送信号

图 6

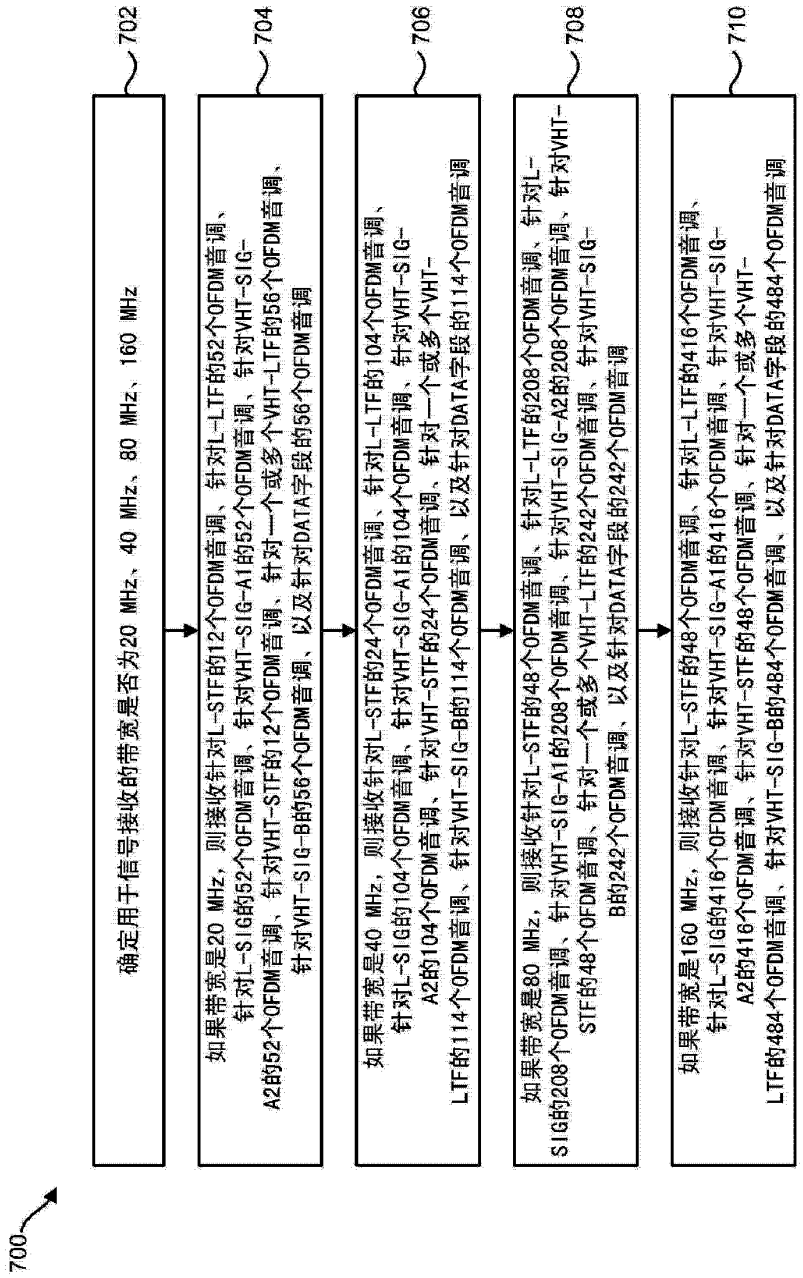

700
702
确定用于信号接收的带宽是否为20 MHz、40 MHz、80 MHz、160 MHz
704
如果带宽是20 MHz，则接收针对L-STF的12个OFDM音调、针对L-LTF的52个OFDM音调、针对L-SIG的52个OFDM音调、针对VHT-SIG-A1的52个OFDM音调、针对VHT-SIG-A2的52个OFDM音调、针对VHT-STF的12个OFDM音调、针对一个或多个VHT-LTF的56个OFDM音调、针对VHT-SIG-B的56个OFDM音调、以及针对DATA字段的56个OFDM音调
706
如果带宽是40 MHz，则接收针对L-STF的24个OFDM音调、针对L-LTF的104个OFDM音调、针对L-SIG的104个OFDM音调、针对VHT-SIG-A1的104个OFDM音调、针对VHT-SIG-A2的104个OFDM音调、针对VHT-STF的24个OFDM音调、针对一个或多个VHT-LTF的114个OFDM音调、针对VHT-SIG-B的114个OFDM音调、以及针对DATA字段的114个OFDM音调
708
如果带宽是80 MHz，则接收针对L-STF的48个OFDM音调、针对L-LTF的208个OFDM音调、针对L-SIG的208个OFDM音调、针对VHT-SIG-A1的208个OFDM音调、针对VHT-SIG-A2的208个OFDM音调、针对VHT-STF的48个OFDM音调、针对一个或多个VHT-LTF的242个OFDM音调、针对VHT-SIG-B的242个OFDM音调、以及针对DATA字段的242个OFDM音调
710
如果带宽是160 MHz，则接收针对L-STF的48个OFDM音调、针对L-LTF的416个OFDM音调、针对L-SIG的416个OFDM音调、针对VHT-SIG-A1的416个OFDM音调、针对VHT-SIG-A2的416个OFDM音调、针对VHT-STF的48个OFDM音调、针对一个或多个VHT-LTF的484个OFDM音调、针对VHT-SIG-B的484个OFDM音调、以及针对DATA字段的484个OFDM音调

图 7

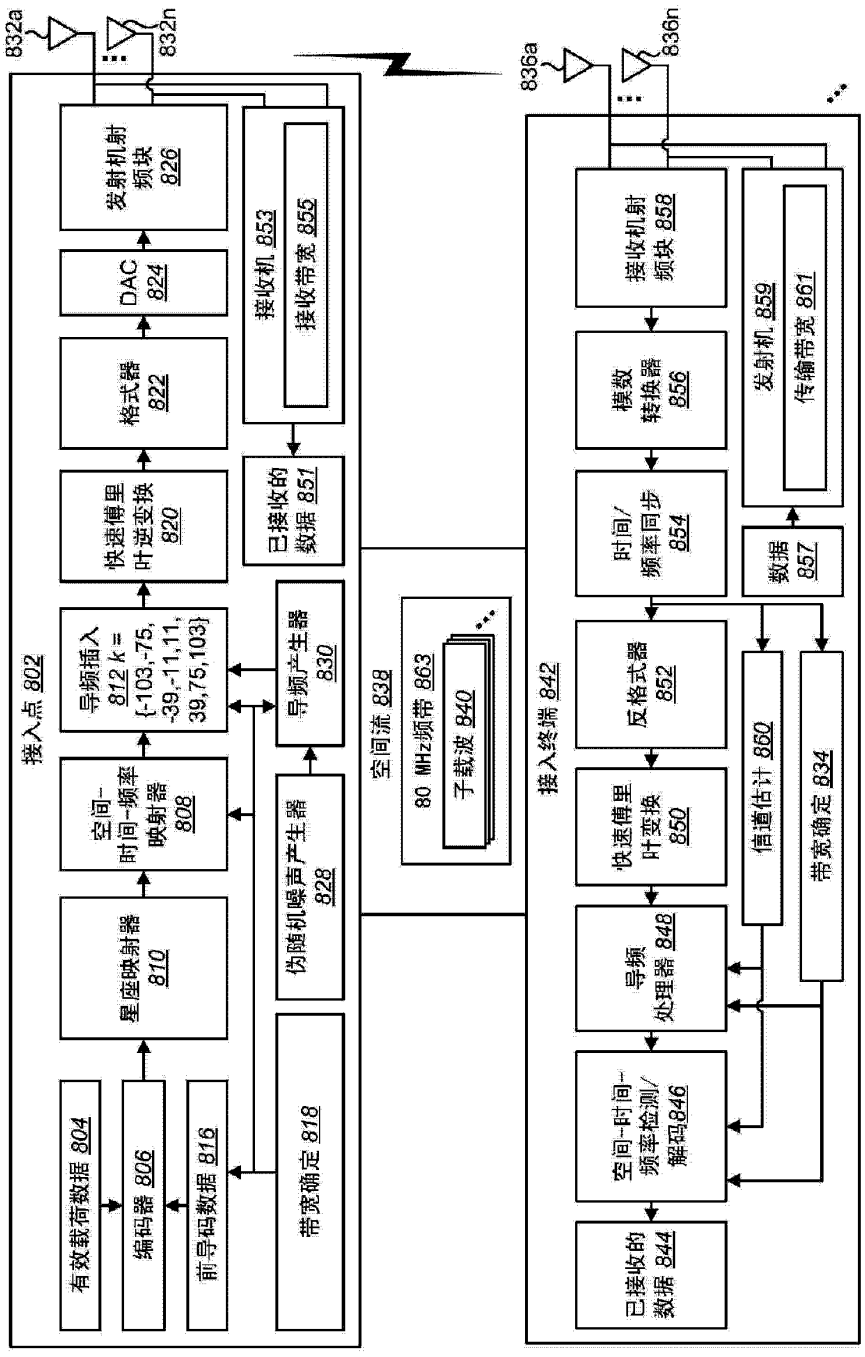

832a
832n
836a
836n
接入点 802
有效载荷数据 804
编码器 806
前导码数据 816
星座映射器 810
空间-时间-频率映射器 808
导频插入 812 k = {-103,-75,-39,-11,11,39,75,103}
快速傅里叶逆变换 820
格式器 822
DAC 824
发射机射频块 826
带宽确定 818
伪随机噪声产生器 828
导频产生器 830
空间流 838
80 MHz频带 863
子载波 840
接收机 853
接收带宽 855
已接收的数据 851
接入终端 842
接收机射频块 858
模数转换器 856
时间/频率同步 854
反格式器 852
快速傅里叶变换 850
导频处理器 848
空间-时间-频率检测/解码 846
已接收的数据 844
发射机 859
传输带宽 861
数据 857
信道估计 860
带宽确定 834

图 8

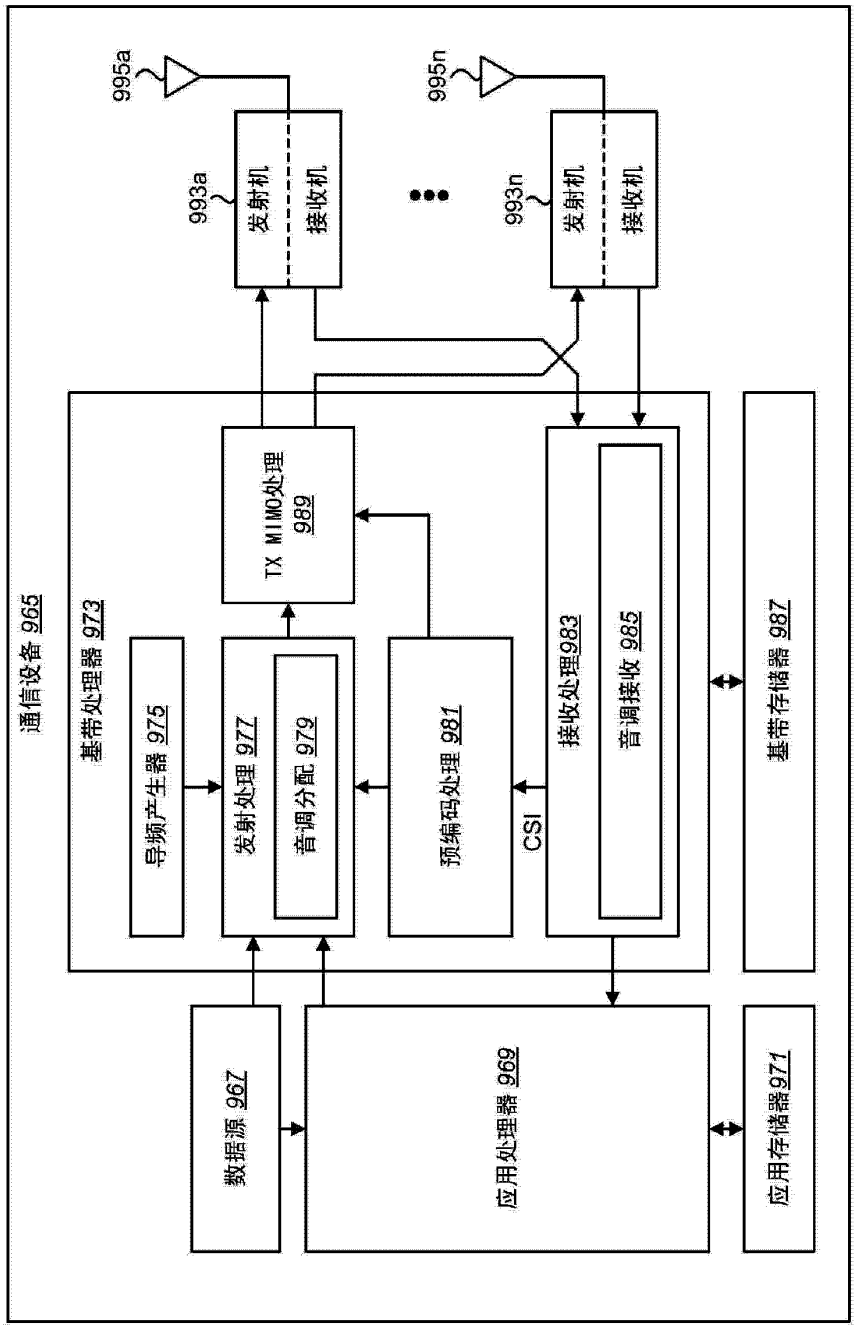

通信设备 965
995a
995n
993a
发射机
接收机
993n
发射机
接收机
基带处理器 973
TX MIMO处理 989
导频产生器 975
发射处理 977
音调分配 979
预编码处理 981
CSI
接收处理983
音调接收 985
基带存储器 987
数据源 967
应用处理器 969
应用存储器971

图 9

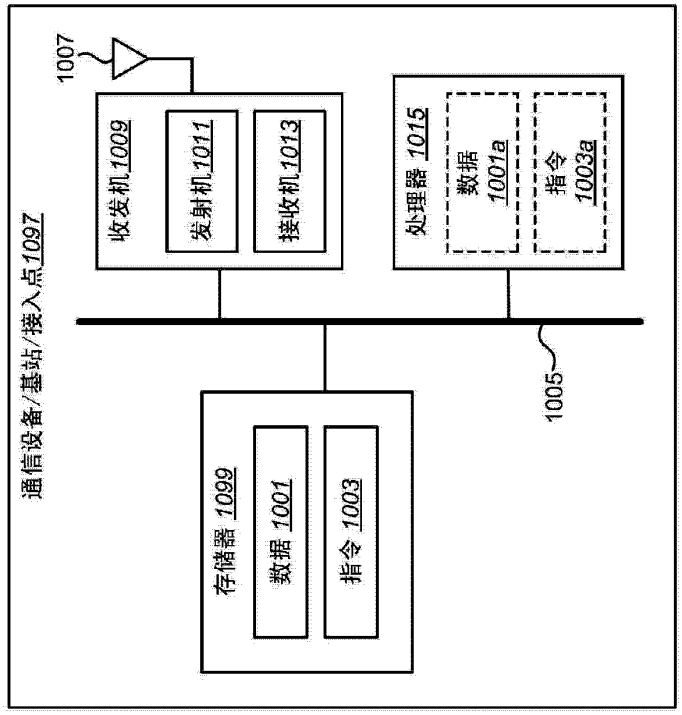

通信设备/基站/接入点1097
1007
收发机1009
发射机1011
接收机1013
处理器 1015
数据 1001a
指令 1003a
1005
存储器 1099
数据 1001
指令 1003

图 10

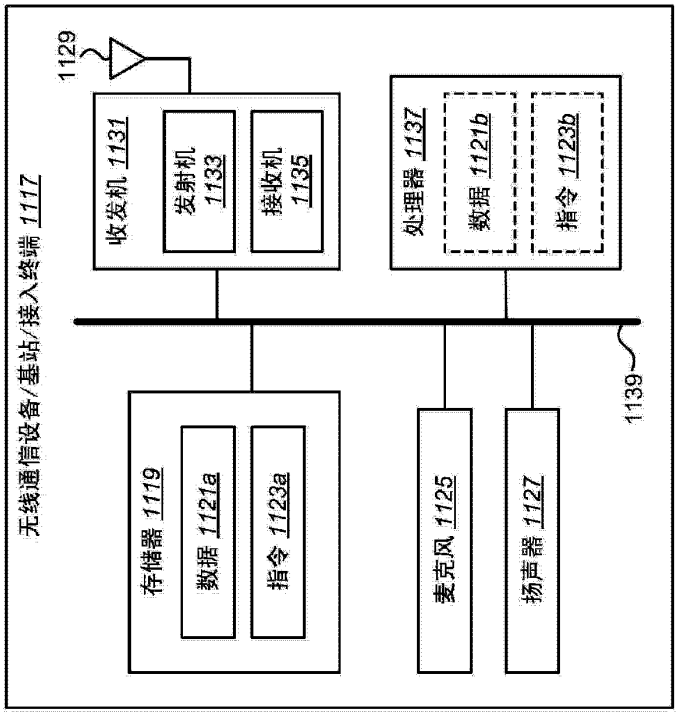

无线通信设备/基站/接入终端 1117
1129
收发机 1131
发射机 1133
接收机 1135
处理器 1137
数据 1121b
指令 1123b
存储器 1119
数据 1121a
指令 1123a
麦克风 1125
扬声器 1127
1139

图 11

Espacenet

## Bibliographic data: CN104995982 (A) — 2015-10-21

# Method and device for transmitting/receiving frame in accordance with bandwidth thereof in WLAN system

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**Applicant(s):** LG ELECTRONICS INC ± (LG ELECTRONICS INC, ; LG电子株式会社)

**Classification:** - international: *H04W74/08; H04W84/12*
- cooperative: **H04L1/1671 (US); H04L1/188 (EP); H04L27/0006 (EP, CN, US); H04W72/0406 (US); H04W72/044 (US); H04W72/0446 (US); H04W74/0808 (EP, US); H04W74/0816 (US);** H04L12/2856 (RU); H04L5/0053 (EP, CN, US); H04W74/08 (RU); H04W74/0808 (CN); H04W80/02 (US); H04W84/12 (US)

**Application number:** CN20138072907 20131030 Global Dossier

**Priority number(s):** WO2013KR09730 20131030 ; US201361765060P 20130215 ; US201361766114P 20130218 ; US201361803073P 20130318 ; US201361842959P 20130703

**Also published as:** CN104995982 (B) AU2013378208 (A1) AU2013378208 (B2) CA2897744 (A1) CA2897744 (C) more

Abstract of CN104995982 (A)

The present invention relates to a wireless communication system and, more specifically, provides a method and device for transmitting/receiving a frame in accordance with the bandwidth thereof in a WLAN system. The method for performing a response process in a WLAN system according to one embodiment of the present invention may comprise: a step in which a first station (STA) transmits a frame requesting a response frame to a second STA; and a step in which the first STA awaits the response frame for an ACKTimeout interval. The value of the ACKTimeout interval may be determined differently according to the preamble channel bandwidth type of the frame.

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## CLAIMS CN104995982A

1.

A method for performing response processing in a wireless local area network (WLAN) system, the method comprising:

Send the frame requesting the response frame to the second STA through the first station (STA); and

By the first STA, waiting for the response frame during the ACKTimeout interval,

Wherein, the ACKTimeout interval is set to a different value according to the preamble channel bandwidth type of the frame, and

Wherein, the preamble channel bandwidth of the response frame is set equal to the value of the preamble channel bandwidth type of the frame.

2.

According to the method of claim 1,

Wherein, if the preamble channel bandwidth type of the frame is a 1MHz preamble type, the ACKTimeout interval is calculated based on the aPHY-RX-START-Delay value used for the 1MHz preamble,

The aPHY-RX-START-Delay value indicates the delay time until PHY-RXSTART.indication is issued, and

The PHY-RXSTART.indication indicates that a physical layer convergence process (PLCP) packet data unit (PPDU) with a valid PLCP header has started to be received.

3.

According to the method of claim 1,

Wherein, if the preamble channel bandwidth type of the frame is a preamble type of 2 MHz or more, the ACKTimeout interval is calculated based on the aPHY-RX-START-Delay value used for the preamble of 2 MHz or more,

The aPHY-RX-START-Delay indicates the delay time until the PHY-RXSTART.indication is issued, and

The PHY-RXSTART.indication indicates that a physical layer convergence process (PLCP) packet data unit (PPDU) with a valid PLCP header has started to be received.

4.

According to the method of claim 1,

Wherein, if the frame has a preamble type of 2 MHz or more, the response frame has a type other than the preamble type of 1 MHz.

5.

According to the method of claim 1,

Wherein, if the frame has a preamble type of 2 MHz or more, the response frame has a preamble type of 2 MHz.

6.

According to the method of claim 1,

Wherein, if the frame has a preamble type of 1 MHz or more, the response frame has a preamble type of 1 MHz.

7.

According to the method of claim 1,

Wherein, if the response frame is received during the ACKTimeout interval, the transmission of the frame is determined to be successful.

8.

According to the method of claim 1,

Wherein, if the response frame is not received during the ACKTimeout interval, the transmission of the frame is determined to be failed and the backoff process is performed by the first STA when the ACKTimeout interval is ended.

9.

According to the method of claim 1,

Wherein, the frame is one of a data frame, a request to send (RTS) frame, and a power saving polling (PS-polling) frame.

10.

According to the method of claim 1,

Wherein, the response frame is one of an acknowledgement (ACK) frame, a clear to send (CTS) frame, and a data frame.

11.

According to the method of claim 1,

Wherein, the STA is an STA operating in a sub-1 GHz (S1G) frequency band.

12.

A station (STA) for performing response processing in a wireless local area network (WLAN) system, the STA includes:

Transceiver; and

processor,

Wherein, the processor is configured to send a frame requiring a response frame to the second STA through the transceiver; and wait for the response frame during the ACKTimeout interval, and

Wherein, the ACKTimeout interval is set to a different value according to the preamble channel bandwidth type of the frame.

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# DESCRIPTION CN104995982A

The present invention relates to a wireless communication system, and more specifically, provides a method and apparatus for transmitting/receiving frames according to its bandwidth in a WLAN system. A method for performing a response process in a WLAN system according to an embodiment of the present invention may include: a step in which a first station (STA) sends a frame requesting a response frame to a second STA; and a step in which the first STA is in ACKTimeout The step of waiting for the response frame within the interval. The value of the ACKTimeout interval can be determined differently according to the preamble channel bandwidth type of the frame.

Method and device for sending/receiving frames according to bandwidth in WLAN system

Technical field

The following description relates to a wireless communication system, and more specifically, to a method and apparatus for transmitting and receiving frames according to bandwidth in a wireless local area network (WLAN) system.

Background technique

With the rapid development of information communication technology, various wireless communication technology systems have been developed. Among wireless communication technologies, WLAN technology is based on radio frequency (RF) technology, allowing the use of personal digital assistants (PDA), laptop computers, portable multimedia players (PMP), etc. at home or in enterprises or in specific service supply areas. Wireless internet access.

In order to eliminate one of the shortcomings of WLAN, the limited communication speed, recent technical standards have proposed an evolution system that can increase the speed and reliability of the network while expanding the coverage area of the wireless network. For example, the Institute of Electrical and Electronics Engineers (IEEE) 802.11n enables data processing speeds to support high throughput (HT) of up to 540 Mbps. In addition, multiple input and multiple output (MIMO) technology has recently been applied to transmitters and receivers to minimize transmission errors and optimize data transmission rates.

Summary of the invention

technical problem

Machine-to-machine (M2M) communication technology has been discussed as a next-generation communication technology. The technical standard supporting M2M communication in IEEE 802.11 WLAN has been developed into IEEE 802.11ah. M2M communication can consider a scenario where a small amount of data can be communicated infrequently at a low speed in an environment including a large number of devices.

The object of the present invention is to provide a solution for preventing resource waste and correctly performing frame switching by waiting for a response frame or delaying channel access in consideration of the response frame type and/or channel bandwidth.

It will be understood that from the following description, it is obvious to one of ordinary skill in the art to which the present invention belongs, that the technical objectives achieved by the present invention are not limited to the foregoing technical

objectives and other not mentioned here. Technical purpose.

Technical solutions

The object of the present invention can be achieved by providing a method for performing response processing in a wireless local area network (WLAN) system, the method including: transmitting a frame requiring a response frame to a second STA through a first station (STA); and The first STA waits for a response frame during the ACKTimeout interval. According to the preamble channel bandwidth type of the frame, the ACKTimeout interval can be set to a different value. The preamble channel bandwidth of the response frame may be set to a value equal to the preamble channel bandwidth type of the frame.

In another aspect of the present invention, there is provided a station (STA) for performing response processing in a wireless local area network (WLAN) system, including a transceiver and a processor. The processor may be configured to transmit a frame requiring a response frame to the second STA through the transceiver and wait for the response frame during the ACKTimeout interval. According to the preamble channel bandwidth type of the frame, the ACKTimeout interval can be set to a different value. The preamble channel bandwidth of the response frame may be set to a value equal to the preamble channel bandwidth type of the frame.

According to the embodiments of the present invention, the following can be commonly applied.

If the preamble channel bandwidth type of the frame is the 1 MHz preamble type, the ACKTimeout interval can be calculated based on the aPHY-RX-START-Delay value for the 1 MHz preamble. The aPHY-RX-START-Delay value may indicate the delay time until the PHY-RXSTART.indication is issued. PHY-RXSTART.indication may indicate that a physical layer convergence process (PLCP) packet data unit (PPDU) with a valid PLCP header is beginning to be received.

If the preamble channel bandwidth type of the frame is a preamble type of 2 MHz or more, the ACKTimeout interval may be calculated based on the aPHY-RX-START-Delay value for the preamble of 2 MHz or more. aPHY-RX-START-Delay can indicate the delay time until PHY-RXSTART.indication is issued. PHY-RXSTART.indication may indicate that a physical layer convergence process (PLCP) packet data unit (PPDU) with a valid PLCP header is beginning to be received.

If the frame has a preamble type of 2 MHz or more, the response frame may have a type other than the preamble type of 1 MHz.

If the frame has a preamble type of 2 MHz or more, the response frame may have a preamble type of 2 MHz.

If the frame has a preamble type of 1 MHz or more, the response frame may have a preamble type of 1 MHz.

If the response frame is received during the ACKTimeout interval, the transmission of the frame may be determined to be successful.

If the response frame is not received during the ACKTimeout interval, the transmission of the frame may be determined to be failed and the backoff process is performed by the first STA when the ACKTimeout interval is ended.

The frame may be one of a data frame, a request to send (RTS) frame, and a power saving polling (PS-polling) frame.

The response frame may be one of an acknowledgement (ACK) frame, a clear to send (CTS) frame, and a data frame.

The STA may be an STA operating in the sub-1 GHz (S1G) frequency band.

It is to be understood that the foregoing general description of the present invention and the following detailed description are both exemplary and illustrative and are intended to provide further explanation of the present invention as claimed.

Beneficial effect

According to the present invention, considering the response frame and/or channel bandwidth, by providing a method and device for waiting for a response frame or delaying channel access, it is possible to prevent resource waste and to correctly perform frame switching.

Those skilled in the art will understand that the effects that can be achieved with the present invention are not limited to the effects that have been specifically described above, and other advantages of the present invention will be more clearly understood from the following detailed description in conjunction with the accompanying drawings.

Description of the drawings

The accompanying drawings are included to provide a further understanding of the present invention, and the accompanying drawings illustrate embodiments of the present invention, and together with the description serve to explain the principles of the

present invention. In the attached picture:

Fig. 1 exemplarily shows an IEEE 802.11 system according to an embodiment of the present invention.

Fig. 2 exemplarily shows an IEEE 802.11 system according to another embodiment of the present invention.

Fig. 3 exemplarily shows an IEEE 802.11 system according to another embodiment of the present invention.

Fig. 4 is a conceptual diagram illustrating a WLAN system.

Fig. 5 is a flowchart illustrating a link setup process for use in a WLAN system.

Fig. 6 is a conceptual diagram illustrating the back-off process.

FIG. 7 is a conceptual diagram illustrating hidden nodes and exposed nodes.

FIG. 8 is a conceptual diagram illustrating RTS (request to send) and CTS (clear to send).

Fig. 9 is a diagram for explaining an exemplary frame structure used in the IEEE 802.11 system.

FIG. 10 is a diagram illustrating an exemplary S1G 1MHz format

FIG. 11 is a diagram illustrating an exemplary short format of S1G greater than or equal to 2 MHz.

FIG. 12 is a diagram illustrating an exemplary long format of S1G greater than or equal to 2 MHz.

Fig. 13 is a diagram for explaining the ACK process.

FIG. 14 is a diagram for explaining whether to allow a frame exchange sequence according to the present invention.

FIG. 15 is a diagram for explaining an example of the present invention using the response frame type field of the SIG field of the PLCP header.

Fig. 16 is a diagram for explaining an exemplary method of the present invention.

Fig. 17 is a block diagram of a wireless device according to an embodiment of the present invention.

detailed description

The preferred embodiments of the present invention will now be described in detail, examples of which are illustrated in the accompanying drawings. The detailed description will be given below with reference to the accompanying drawings, which is intended to explain exemplary embodiments of the present invention, rather than to show only embodiments that can be implemented according to the present invention. The following detailed description includes specific details to provide an in-depth understanding of the present invention. However, it is obvious to those skilled in the art that the present invention can be practiced without these specific details.

The following embodiments are proposed by combining the constituent components and characteristics of the present invention according to a predetermined format. In the absence of additional remarks, individual constituent components or characteristics shall be regarded as optional factors. As needed, there is no need to combine individual constituent components or characteristics with other components or characteristics. In addition, some constituent components and/or characteristics may be combined to implement the embodiments of the present invention. The order of operations to be disclosed in the embodiments of the present invention may be changed. Some components or characteristics of any embodiment may also be included in other embodiments, or may be replaced by other embodiments when necessary.

It should be noted that for the convenience of description and a better understanding of the present invention, specific terms disclosed in the present invention are proposed, and the use of these specific terms can be changed into other formats within the technical scope or spirit of the present invention.

In some instances, to avoid obscuring the concept of the present invention, well-known structures and devices are omitted and important functions of the structures and devices are shown in the form of block diagrams. The same reference numbers will be used throughout the drawings to designate the same or similar parts.

Exemplary embodiments of the present invention are composed of the Institute of Electrical and Electronics Engineers (IEEE) 802 system, the Third Generation Partnership Project (3GPP) system, the 3GPP Long Term Evolution (LTE) system, the LTE-Advanced (LTE-A) system, and the 3GPP2 system. Supported by at least one published standard document in the wireless access system. Specifically, steps or parts that are not described in the embodiments of the present invention to clearly

demonstrate the technical idea of the present invention may be supported by the above documents. All terms used here can be supported by at least one of the above-mentioned documents.

The following embodiments of the present invention can be applied to various wireless access technologies, for example, CDMA (Code Division Multiple Access), FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access), OFDMA (Orthogonal Frequency Division Multiple Access) , SC-FDMA (Single Carrier Frequency Division Multiple Access) and so on. CDMA can be implemented by wireless (or radio) technology, such as UTRA (Universal Terrestrial Radio Access) or CDMA2000. TDMA can be implemented through wireless (or radio) technologies, such as GSM (Global System for Mobile Phones)/GPRS (General Packet Radio Service)/EDGE (Enhanced Data Rate for GSM Evolution). OFDMA can be implemented through wireless (or radio) technologies, such as Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, and E-UTRA (Evolved UTRA). For clarity, the following description mainly focuses on the IEEE 802.11 system. However, the technical features of the present invention are not limited to this.

WLAN system structure

Fig. 1 exemplarily shows an IEEE 802.11 system according to an embodiment of the present invention.

The structure of the IEEE 802.11 system can include multiple components. A WLAN that supports transparent STA mobility to higher layers can be provided through the interoperation of components. The basic service set (BSS) can correspond to the basic building blocks in IEEE 802.11 LAN. In FIG. 1, two BSSs (BSS1 and BSS2) are shown, and two STAs are included in each of the BSSs (ie, STA1 and STA2 are included in BSS1, and STA3 and STA4 are included in BSS2) . The ellipse indicating the BSS in FIG. 1 may be understood as a coverage area in which STAs included in the corresponding BSS maintain communication. This area can be called the basic service area (BSA). If the STA moves outside the BSA, the STA cannot directly communicate with other STAs in the corresponding BSA.

In IEEE 802.11 LAN, the most basic BSS is independent BSS (IBSS). For example, the IBSS may have the simplest form consisting of only two STAs. The BSS (BSS1 or BSS2) in FIG. 1 is the simplest form and other components are omitted, and may correspond to a typical example of IBSS. When STAs can communicate directly with each other, the above configuration is allowable. This type of LAN is not scheduled in advance and can be configured when the LAN is necessary. This can be called a self-organizing network.

When the STA is turned on or off or the STA enters or leaves the BSS area, the membership of the STA in the BSS can be dynamically changed. The STA can join the BSS using the synchronization process. In order to access all services of the BSS infrastructure, the STA should be associated with the BSS. Such associations can be dynamically configured and can include the use of distributed system services (DSS).

Fig. 2 is a schematic diagram showing another exemplary structure of an IEEE 802.11 system to which the present invention is applicable. In FIG. 2, components such as a distributed system (DS), a distributed system medium (DSM), and an access point (AP) are added to the structure of FIG. 1.

The direct STA to STA distance in the LAN may be limited by the PHY performance. Sometimes, such a distance limitation may be sufficient for communication. However, in other cases, communication between STAs over long distances may be necessary. DS can be configured to support extended coverage.

DS refers to the structure in which BSSs are connected to each other. Specifically, the BSS can be configured as a component of an expanded form of network composed of multiple BSSs, instead of the independent configuration shown in FIG. 1.

DS is a logical concept and can be specified by the characteristics of DSM. In this regard, wireless media (WM) and DSM are logically distinguished in IEEE 802.11. Corresponding logical media are used for different purposes and used by different components. In the definition of IEEE 802.11, such media are not limited to the same or different media. The flexibility of the IEEE 802.11 LAN architecture (DS architecture or other network architectures) can be interpreted as that multiple media are logically different. That is, the IEEE 802.11 LAN architecture can be implemented differently, and can be independently specified by the physical characteristics of each implementation.

DS can support mobile devices by providing seamless integration of multiple BSSs and providing logical services necessary to manipulate addressing to destinations.

AP refers to an entity that enables associated STAs to access DS through WM and has STA functions. Data can be moved between BSS and DS through AP. For example, STA2 and STA3 shown in FIG. 2 have STA functions, and provide a function of allowing associated STAs (STA1 and STA4) to access the DS. In addition, since all APs basically correspond to STAs, all APs are addressable entities. The address used by the AP for communication on WM need not always be the same as the address

used by the AP for communication on DSM.

The data sent from one of the STAs associated with the AP to the STA address of the AP can always be received by an uncontrolled port, and can be processed by the IEEE 802.1X port access entity. If the controlled port is authenticated, the transmission data (or frame) can be sent to the DS.

Fig. 3 is a schematic diagram showing another exemplary structure of the IEEE 802.11 system to which the present invention is applicable. In addition to the structure of FIG. 2, FIG. 3 conceptually illustrates an extended service set (ESS) for providing a wide coverage.

A wireless network of any size and complexity can be composed of DS and BSS. In the IEEE 802.11 system, this type of network is called an ESS network. ESS can correspond to a set of BSSs connected to a DS. However, ESS does not include DS. The ESS network is characterized in that the ESS network appears as an IBSS network in the logical link control (LLC) layer. The STAs included in the ESS can communicate with each other, and the mobile STA is transparently movable from one BSS to another BSS (within the same ESS) in the LLC.

In IEEE 802.11, no relative physical location of the BSS in Figure 3 is assumed, and the following forms are all allowable. BSS can partially overlap, and this form is usually used to provide continuous coverage. BSSs may not be physically connected, and there is no limit to the logical distance between BSSs. The BSS can be located in the same physical location, and this form can be used to provide redundancy. One or more IBSS or ESS networks can be physically located in the same space as one or more ESS networks. This can correspond to a situation where a peer-to-peer network operates in a location where an ESS network exists, a situation where IEEE 802.11 networks of different organizations physically overlap, or when two or more different access and security policies are in place. The same location is the ESS network form under necessary circumstances.

Fig. 4 is a schematic diagram showing an exemplary structure of a WLAN system. In FIG. 4, an example of an infrastructure BSS including DS is shown.

In the example of Figure 4, BSS1 and BSS2 constitute an ESS. In the WLAN system, the STA is a device that operates according to the IEEE 802.11 MAC/PHY rules. STA includes AP STA and non-AP STA. A non-AP STA corresponds to a device directly manipulated by the user, such as a laptop computer or a mobile phone. In Figure 4, STA1, STA3, and STA4 correspond to non-AP STAs, and STA2 and STA5 correspond to AP STAs.

In the following description, a non-AP STA may be referred to as a terminal, a wireless transmission/reception unit (WTRU), a user equipment (UE), a mobile station (MS), a mobile terminal, or a mobile subscriber station (MSS). In other wireless communication fields, AP is a concept corresponding to a base station (BS), a node B, an evolved node B (e-NB), a base transceiver system (BTS), or a femto BS.

Layer structure

In the WLAN system, the operation of the AP and/or STA in the present invention can be described from the viewpoint of layer structure. The processor can realize the layer structure in terms of device configuration. The AP or STA may have multiple layer structures. For example, the 802.11 standard specification mainly deals with the medium access control (MAC) sublayer of the data link layer (DLL) and the physical (PHY) layer. The PHY layer may include a physical layer convergence protocol (PLCP) entity and a physical medium independent (PMD) entity. Both the MAC sublayer and the PHY layer conceptually include associated entities, which are called MAC sublayer management entity (MLME) and PHY layer management entity (PLME), respectively. These entities provide layer management service interfaces through which layer management functions can be called.

In order to provide correct MAC operation, a station management entity (SME) exists in each of the AP and STA. SME is a layer-independent entity that can be regarded as existing in a separate management plane or as far away from the side. The precise function of the SME is not described in detail, but generally this entity can be regarded as a function such as collecting information about the independent state of the layer from various layer management entities (LME) and similarly setting the value of layer-specific parameters. SMEs can usually perform such functions on behalf of general system management entities and can implement standard management protocols.

The aforementioned entities interact in various ways. For example, entities can interact by exchanging GET/SET primitives. The XX-GET.request primitive is used to request the value of a given MIB attribute (attribute information based on management information). If the status is set = "success", the XX-GET.confirm primitive returns the appropriate MIB attribute value and otherwise, returns the error indication in the status field. The XX-SET.request primitive is used to request the indicated MIB attribute that is set to a given value. If the MIB attribute implies a specific action, the request can perform the action. If the status

is set = "success", the XX-SET.confirm primitive confirms that the indicated MIB attribute has been set to the requested value, and otherwise, the XX-SET.confirm primitive returns to the error condition in the status field . If the MIB atiribute means a specific action, then this confirmation action has been performed.

MLME and SME can exchange various primitives MLME_GET/SET primitives via MLME_SAP (Service Access Point). In addition, various PLMEM_GET/SET primitives can be exchanged between PLME and SME via PLME_SAP and between MLME and PLME via MLME-PLME_SAP.

Link setup process

FIG. 5 is a flowchart explaining a general link setting process according to an exemplary embodiment of the present invention.

In order to allow the STA to establish link settings on the network and send/receive data through the network, the STA must perform such link settings through the process of network discovery, authentication, and association, and must establish association and perform security authentication. The link setting process may also be referred to as a session initiation process or a session setting process. In addition, the association step is a general term used for the discovery, authentication, association, and security setting steps of the link setting process.

An exemplary link setting process is described with reference to FIG. 5.

In step S510, the STA may perform a network discovery action. The network discovery action may include an STA scanning action. That is, the STA must search for available networks in order to access the network. The STA must identify compatible networks before participating in the wireless network. Here, the process of identifying the network contained in a specific area is called a scanning process.

The scanning scheme is divided into active scanning and passive scanning.

Figure 5 illustrates a flowchart of a network discovery action including an active scanning process. In the case of active scanning, the STA configured to perform scanning sends a probe request frame and waits for a response to the probe request frame, so that the STA can move between channels and at the same time can determine which AP exists in the peripheral area (access point). The responder sends a probe response frame used as a response to the probe request frame to the STA that has sent the probe request frame. In this case, the responder may be the STA that has transmitted the beacon frame last in the BSS of the scanned channel. In BSS, since the AP sends a beacon frame, the AP operates as a responder. In IBSS, because STAs of IBSS sequentially send beacon frames, the responder is not constant. For example, an STA that has transmitted a probe request frame on channel #1 and has received a probe response frame on channel #1 stores the BSS related information contained in the received probe response frame, and moves to the next channel (e.g., channel #2 ), so that the STA can use the same method to perform scanning (that is, the transmission/reception of the probe request/response at channel #2).

Although not shown in FIG. 5, passive scanning may also be used to perform scanning actions. An STA configured to perform scanning in a passive scanning mode waits for a beacon frame while moving from one channel to another channel. The beacon frame is one of the management frames in IEEE 802.11, indicating the existence of a wireless network, so that the STA performing scanning can search for the wireless network, and is periodically sent in a way that the STA can participate in the wireless network. In BSS, the AP is configured to periodically send beacon frames. In IBSS, the STAs of the IBSS are configured to send beacon frames sequentially. If each TA used for scanning receives a beacon frame, the STA stores the BSS information contained in the beacon frame, and moves to another channel, and records the beacon frame information on each channel. The STA that has received the beacon frame stores the information associated with the BSS contained in the received beacon frame, moves to the next channel, and thereby performs scanning using the same method.

Comparing between active scanning and passive scanning, active scanning is more advantageous than passive scanning in terms of delay and power consumption.

After the STA discovers the network, the STA may perform an authentication process in step S520. This authentication process may be referred to as the first authentication process. In this way, the authentication process can be clearly distinguished from the security setting process of step S540.

The authentication process may include sending an authentication request frame to the AP through the STA, and sending an authentication response frame to the STA in response to the authentication request frame through the AP. The authentication frame used for authentication request/response may correspond to a management frame.

The authentication frame may include information such as authentication algorithm number, authentication transaction serial number, status code, challenge text, robust security network (RSN), limited loop group, and so on. The above-mentioned

information contained in the authentication frame may correspond to some parts of the information that can be contained in the authentication request/response frame, may be replaced with other information, or may include additional information.

The STA can send an authentication request frame to the AP. The AP may decide whether to authenticate the corresponding STA based on the information contained in the received authentication request frame. The AP can provide the authentication result to the STA through the authentication response frame.

After the STA has been successfully authenticated, the association process may be performed in step S630. The association process may involve sending an association request frame to the AP through the STA, and sending an association response frame to the STA through the AP in response to the association request frame.

For example, the association request frame may include various capabilities, beacon listening interval, service set identifier (SSID), support rate, support channel, RSN, mobile domain, supported operation category, TIM (Service Indication Mapping) broadcast request, interworking service capabilities and other related information.

For example, the association response frame may include various capabilities, status codes, association ID (AID), support rate, enhanced distributed channel access (EDCA) parameter set, received channel power index (RCPI), received signal versus noise Index (RSNI), mobile domain, timeout interval (associated reply time), overlapping BSS scanning parameters, TIM broadcast response, QoS mapping, and other related information.

The above-mentioned information may correspond to some parts of the information that can be included in the association request/response frame, may be replaced with other information, or may include additional information.

After the STA has been successfully associated with the network, a security setting process may be performed in step S540. The security setting process of step S540 may be referred to as an authentication process based on Robust Security Network Association (RSNA) request/response. The authentication process of step S520 may be referred to as a first authentication process, and the security setting process of step S540 may be simply referred to as an authentication process.

For example, the security setting process of step S540 may include a private key setting process through a 4-way handshake based on the Extensible Authentication Protocol (EAPOL) on the LAN frame. In addition, the security setting process can also be implemented according to other security schemes not defined in the IEEE 802.11 standard.

WLAN evolution

In order to avoid restrictions on the communication speed of WLAN, IEEE 802.11n has recently been established as a communication standard. The purpose of IEEE 802.11n is to improve network speed and reliability and expand the coverage area of wireless networks. In more detail, IEEE 802.11n supports high throughput (HT) of up to 540 Mbps and is based on MIMO technology in which multiple antennas are installed in each of the transmitter and the receiver.

With the widespread use of WLAN technology and the diversification of WLAN applications, it is necessary to develop a new WLAN system that can support a higher throughput (HT) than the data processing rate supported by IEEE 802.11n. The next-generation WLAN system for supporting very high throughput (VHT) is the next version of the IEEE 802.11n WLAN system (for example, IEEE 802.11ac), and is recently proposed in MAC SAP (Media Access Control Service Access Point) ) is one of the IEEE 802.11 WLAN systems that support data processing speeds above 1Gbps.

In order to efficiently utilize radio frequency (RF) channels, the next-generation WLAN system supports MU-MIMO (Multi-User Multiple Input Multiple Output) transmission in which multiple STAs can simultaneously access the channel. According to the MU-MIMO transmission scheme, the AP can simultaneously send packets to at least one MIMO paired STA.

In addition, techniques for supporting WLAN system operations in white space have been discussed recently. For example, a technology for introducing a WLAN system in a white space (TV WS) such as a free frequency band (for example, 54-698 MHz band) left due to the transition to digital TV has been discussed under the IEEE 802.11af standard. However, the information mentioned above is disclosed only for illustrative purposes, and the white space may be a license band that can be used mainly only by licensed users. The licensed user may be a user who has the right to use the license band, and may also be called a licensed device, a master user, an incumbent user, and so on.

For example, APs and/or STAs operating in white space (WS) must provide functions for protecting permitted users. For example, assuming that a licensed user such as a microphone has already used a specific WS channel of a specified frequency band in a manner that occupies a specific bandwidth of the WS band, the AP and/or STA cannot use the frequency band corresponding to the corresponding WS channel for protection Licensed users. In addition, under the condition that the user is permitted to use the frequency band used for the transmission and/or reception of the current frame, the AP and/or STA must

stop using the corresponding frequency band.

Therefore, the AP and/or STA must determine whether to use a specific frequency band of the WS band. In other words, the AP and/or STA must determine the existence or non-existence of the current user or permitted user in the channel. A scheme for determining the presence or absence of an incumbent user in a specific frequency band is called a spectrum sensing scheme. Energy detection schemes, signature detection schemes, etc. can be used as the spectrum sensing mechanism. If the strength of the received signal exceeds a predetermined value, or when a DTV preamble is detected, the AP and/or STA can determine that the current user is using the frequency band.

M2M (Machine to Machine) communication technology has been discussed as the next generation communication technology. The technical standard used to support M2M communication in the IEEE 802.11 WLAN system has been developed into IEEE 802.11ah. M2M communication refers to a communication scheme including one or more machines, or may also be referred to as machine-type communication (MTC) or machine-to-machine (M2M) communication. In this case, the machine may be an entity that does not require the user's direct manipulation and intervention. For example, not only a meter or a vending machine including an RF module, but also a user equipment (UE) (such as a smart phone) capable of performing communication through automatic access to the network without user intervention/processing, may be an example of such a machine . M2M communication may include device-to-device (D2D) communication, communication between a device and an application server, and so on. As an example of the communication between the device and the application server, there are communication between the vending machine and the application server, the communication between the point of sale (POS) device and the application server, and the communication between the electricity meter, gas meter or water meter and the application Communication between servers. Applications based on M2M communication can include security, transportation, medical care, and so on. In consideration of the above-mentioned application examples, M2M communication must support a method of sometimes transmitting/receiving a small amount of data at a low speed in an environment including a large number of devices.

In more detail, M2M communication must support a large number of STAs. Although the current WLAN system assumes that one AP is associated with a maximum of 2007 STAs, in M2M communication, it has recently been discussed to support other situations in which more STAs (for example, about 6000 STAs) are associated with one AP. Various methods. In addition, it is expected that many applications for supporting/requesting low transfer rates exist in M2M communication. In order to smoothly support many STAs, the WLAN system can recognize the presence or absence of data to be transmitted to the STA based on TIM (Traffic Indication Mapping), and various methods for reducing the bitmap size of the TIM have been discussed recently. In addition, it is expected that a lot of service data with a very long transmission/reception interval exists in M2M communication. For example, in M2M communication, a very small amount of data (e.g., electricity/gas/water metering) needs to be transmitted at long intervals (e.g., monthly). Therefore, despite the increase in the number of STAs associated with an AP in the WLAN system, many developers and companies are able to efficiently support the existence of data frames to be received from the AP during a beacon period. In-depth study of the WLAN system with a very small number of STAs.

As mentioned above, WLAN technology is developing rapidly, and not only the exemplary technologies mentioned above, but also support such as direct link setting, improvement of media flow throughput, high-speed and/or large-scale initial session setting , And other technologies supporting the expansion of bandwidth and operating frequency are in deep development.

Medium access mechanism

In a WLAN system based on IEEE 802.11, the basic access mechanism of MAC (Media Access Control) is Carrier Sense Multiple Access with a collision avoidance (CSMA/CA) mechanism. The CSMA/CA mechanism is also called the IEEE 802.11 MAC distributed coordination function (DCF), and basically includes the "listen before talk" access mechanism. According to the access mechanism mentioned above, prior to data transmission, the AP and/or STA can perform a function for sensing the idleness of the RF channel or the medium during a predetermined time interval (for example, the DCF Inter-Frame Space (DIFS)) Channel Assessment (CCA). If it is determined that the medium is in an idle state, frame transmission through the corresponding medium starts. On the other hand, if it is determined that the medium is in an occupied state, the corresponding AP and/or STA does not start its own transmission, establishes a delay time for medium access (for example, a random backoff period), and waits for a predetermined time before trying to start Frame transmission. Through the application of the random back-off period, it is expected that after waiting for different times, multiple STAs will try to start frame transmission, resulting in minimizing collisions.

In addition, the IEEE 802.11 MAC protocol provides hybrid coordination function (HCF). HCF is based on DCF and Point Coordination Function (PCF). PCF refers to a synchronous access scheme based on polling, in which periodic polling is performed in such a way that all receiving (Rx) APs and/or STAs can receive data frames. In addition, HCF includes Enhanced Distributed Channel Access (EDCA) and HCF Controlled Channel Access (HCCA). EDCA is realized when the access plan

provided by the provider to multiple users is based on competition. Based on the polling mechanism, HCCA is realized through a contention-free channel access scheme. In addition, the HCF includes a medium access mechanism for improving the quality of service (QoS) of the WLAN, and can transmit QoS data in both a contention period (CP) and a contention free period (CFP).

Fig. 6 is a conceptual diagram illustrating the back-off process.

Hereinafter, the operation based on the random back-off period will be described with reference to FIG. 6. If the medium in the occupied or busy state changes to the idle state, the STA may try to send data (or frame). As a method for achieving the minimum number of collisions, each STA selects a random backoff count, waits for the time slot time corresponding to the selected backoff count, and then tries to start data transmission. The random backoff count is a pseudo-random integer, and can be set to one of 0 to CW values. In this case, CW refers to the contention window parameter value. Although the initial value of the CW parameter is represented by CWmin, the initial value may be doubled in the case of transmission failure (for example, in the case where the ACK of the transmission frame is not received). If the CW parameter value is represented by CWmax, CWmax is maintained until the data transmission is successful, and at the same time, it is possible to try to start the data transmission. If the data transmission is successful, the CW parameter value is reset to CWmin. Preferably, CW, CWmin and CWmax are set to 2 <n> -1 (where n=0, 1, 2, ...).

If the random backoff process starts to operate, the STA continuously monitors the medium while decrementing backoff slots in response to the decided backoff count value. If the medium is monitored as occupied, stop counting down and wait for a predetermined time. If the medium is idle, the remaining countdown is resel.

As shown in the example of FIG. 6, if a packet sent to the MAC of STA3 arrives at STA3, STA3 confirms that the medium is in an idle state during DIFS and can directly start frame transmission. At the same time, the remaining STAs monitor whether the medium is in a busy state, and wait for a predetermined time. During the predetermined time, the data to be transmitted may appear in each of STA1, STA2, and STA5. If the medium is in an idle state, each STA waits for the DIFS time, and then performs a countdown of the backoff slot in response to the random backoff count value selected by each STA. The example of FIG. 6 shows that STA2 selects the lowest backoff count value, and STA1 selects the highest backoff count value. That is, after STA2 completes the back-off count, the residual back-off time of STA5 at the frame transmission start time is shorter than that of STA1. When STA2 occupies the medium, each of STA1 and STA5 temporarily stops counting down, and waits for a predetermined time. If the occupation of STA2 is completed and the medium returns to the idle state, each of STA1 and STA5 waits for a predetermined time DIFS, and restarts backoff counting. That is, after the residual back-off time slot, as long as the residual back-off time is counted down, the frame transmission can start operation. Because the residual backoff time of STA5 is shorter than that of STA1, STA5 starts frame transmission. At the same time, when STA2 occupies the medium, the data to be sent may appear in STA4. In this case, when the medium is in an idle state, STA4 waits for the DIFS time, performs countdown in response to the random backoff count value selected by STA4, and then starts frame transmission. FIG. 6 exemplarily shows a situation where the residual backoff time of STA5 is accidentally the same as the random backoff count value selected by STA4. In such a situation, an unexpected conflict may occur between STA4 and STA5. If a conflict occurs between STA4 and STA5, each of STA4 and STA5 does not receive ACK, resulting in data transmission failure. In this case, each of STA4 and STA5 increases the CW value by two times, and STA4 or STA5 may select a random backoff count value, and then perform countdown. Meanwhile, when the medium is in an occupied state due to the transmission of STA4 and STA5, STA1 waits for a predetermined time. In this case, if the medium returns to the idle state, STA1 waits for the DIFS time, and then starts frame transmission after the elapse of the remaining back-off time.

STA sensing operation

As described above, the CSMA/CA mechanism includes not only a physical carrier sensing medium in which the AP and/or STA can directly sense the medium, but also a virtual carrier sensing mechanism. The virtual carrier sensing mechanism can solve some problems encountered in medium access (such as hidden node problems). For virtual carrier sensing, the MAC of the WLAN system can utilize a network allocation vector (NAV). In more detail, with the aid of the NAV value, each of the APs and/or STAs currently using the medium or having the right to use the medium can notify the other AP and/or another STA of the remaining time available for the medium. Therefore, the NAV value may correspond to a reserved period in which the medium will be used by the AP and/or STA configured to transmit the corresponding frame. The STA that has received the NAV value may prohibit medium access (or channel access) during the corresponding reserved period. For example, NAV can be set according to the value of the "Duration" field of the MAC header of the frame.

A robust conflict detection mechanism has been proposed to reduce the probability of such a conflict, and a detailed description thereof will be described with reference to FIGS. 7 and 8. Although the actual carrier sensing range is different from the transmission range, for the convenience of description and a better understanding of the present invention, it is assumed that the actual sensing range is the same as the transmission range.

FIG. 7 is a conceptual diagram illustrating hidden nodes and exposed nodes.

Figure 7(a) exemplarily shows hidden nodes. In Figure 7(a), STA A communicates with STA B, and STA C has information to send. In FIG. 7(a), under the condition that STA A sends information to STA B, when carrier sensing is performed before data is sent to STA B, STA C can determine that the medium is in an idle state. Because the transmission of STA A (that is, occupying the medium) cannot be detected at the position of STA C, it is determined that the medium is in an idle state. In this case, STA B receives the information of STA A and the information of STA C at the same time, resulting in the occurrence of conflicts. Here, STA A can be regarded as the hidden node of STA C.

Figure 7(b) exemplarily shows an exposed node. In Figure 7(b), under the condition that STA B sends data to STA A, STA C has information to be sent to STA D. If STA C performs carrier sensing, it can be determined that the medium is occupied due to STA B's transmission. Therefore, although STA C has information to be sent to STA D, it senses the state of medium occupation, so that STA C must wait a predetermined time (ie, standby mode) until the medium is in an idle state. However, because STA A is actually outside the transmission range of STA C, from the perspective of STA A, the transmission from STA C may not conflict with the transmission from STA B, so that STA C does not have to enter standby mode until STA B stops transmission. Here, STA C is called the exposed node of STA B.

FIG. 8 is a conceptual view illustrating RTS (request to send) and CTS (clear to send).

In order to efficiently use the collision avoidance mechanism in the above-mentioned situation of FIG. 7, short message packets such as RTS (request to send) and CTS (clear to send) can be used. The peripheral STA can listen to the RTS/CTS between two STAs, so that the peripheral STA can consider whether information is communicated between the two STAs. For example, if an STA to be used for data transmission sends an RTS frame to an STA that has received data, the STA that has received data sends a CTS frame to a peripheral STA, and may notify the peripheral STA that the STA is about to receive data.

Figure 8(a) exemplarily shows a method for solving the hidden node problem. In Figure 8(a), it is assumed that each of STA A and STA C is ready to send data to STA B. If STA A sends RTS to STA B, STA B sends CTS to each of STA A and STA C located near STA B. As a result, STA C must wait a predetermined time until STA A and STA B stop data transmission, so as to prevent collisions from occurring.

Fig. 8(b) exemplarily shows a method for solving the problem of exposed nodes. STA C performs oversight of the RTS/CTS transmission between STA A and STA B, so that STA C can determine that there is no conflict, even though it sends data to another STA (for example, STA D). That is, the STA sends the RTS to all peripheral STAs, and only the STA A that has data to be actually sent can send the CTS. STA C only receives the RTS and does not receive the CTS of STA A, so that it can be recognized that STA A is outside the carrier sensing range of STA C.

Frame structure

Fig. 9 is a diagram for explaining an exemplary frame structure used in the IEEE 802.11 system.

The physical layer convergence protocol (PLCP) packet data unit (PPDU) frame format may include a short training field (STF), a long training field (LTF), a signal (SIG) field, and a data (DATA) field. The most basic (e.g., non-high throughput (HT)) PPDU frame format may only include the traditional STF (L-STF) field, the traditional LTF (L-LTF) field, the SIG field, and the DATA field. According to the PPDU frame format type (for example, HT mixed format PPDU, HT undeveloped format PPDU, very high throughput (VHT) PPDU, etc.), additional (or another type) STE, LTF, and SIG fields can be included Between the SIG field and the DATA field.

STF is a field of signals used for signal detection, automatic gain control (AGC), diversity selection, precise time synchronization, and so on. LTF is a field of signals used for channel estimation, frequency error estimation, and so on. Both STF and LTF can be referred to as PCLP preamble. The PLCP preamble may be a signal used for OFDM physical layer synchronization and channel estimation.

The SIG field may include a rate field and a length field. The rate field may include information about the data modulation scheme and coding rate. The length field may include information about the length of the data. In addition, the SIG field may further include a parity field, SIG tail bits, and so on.

The data field may include a service field, a PLCP service data unit (PSDU), and PPDU tail bits and may further include padding (PAD) bits if necessary. Some bits in the service field can be used for synchronization of the descrambler in the receiver. The PSDU may correspond to a MAC packet data unit (PDU) defined in the MAC layer, and include data generated/used in a higher layer. The PPDU tail bit can be used to return the encoder to a zero state. The PAD bit can be used to adjust the length of the data field to a predetermined unit.

The MAC header may include a frame control field, a duration/ID field, an address field, etc. The frame control field may include control information necessary for frame transmission/reception. The duration/ID field can be set to the time for transmitting the corresponding frame. For a detailed description of the sequence control, QoS control, and HT control subfields of the MAC header, refer to the IEEE 802.11-1012 standard specification.

The frame control field of the MAC header may include protocol version type, subtype, to DS, from DS, more segmentation, retry, power management, more data, and protected frame sequence subfields. For the description of the frame control field and the subfields of the frame control field, refer to the IEEE 802.11-1012 standard specification.

Meanwhile, the Null Data Packet (NDP) frame format refers to a frame format that does not include data packets. That is, the NDP frame only includes the PLCP header of the normal PPDU format (ie, STF, LTF, and SIG fields), and does not include other parts (ie, data fields). The NDP frame format may also be referred to as the short frame format.

S1G frame format

In order to support applications such as M2M, Internet of Things (IoT), smart grid, etc., low-power communication is required. For this reason, a communication protocol using a channel bandwidth of 1MHz/2MHz/4MHz/8MHz/16MHz in a frequency band of 1GHz or lower (sub-1GHz: S1G) (for example, 902 to 928MHz) is under discussion.

Three types of formats are defined for S1G PPDU, the short format used in the S1G bandwidth greater than or equal to 2MHz, the long format used in the S1G bandwidth greater than or equal to 2MHz, and the S1G 1MHz bandwidth used format.

Fig. 10 is a diagram showing the S1G 1MHz format.

The S1G 1MHz format can be used for 1MHz PPDU single user (SU) transmission.

Like the undeveloped field format defined by IEEE 802.11n, the S1G 1MHz format illustrated in FIG. 10 includes STF, LTF1, SIG, LTF2-LTFN LTF, and data fields. However, compared with the undeveloped field format, the transmission time of the preamble part of the S1G 1MHz format is increased twice or more by repetition.

Although the STF field of FIG. 10 has the same periodicity as the STF (2 symbol length) of the PPDU in a bandwidth of 2MHz or more, the STF field is repeated twice in time (rep2) and therefore has a 4 symbol length (for example, 160μs). Therefore a 3-dB power boost can be applied.

The LTF1 field of FIG. 10 is designed to be orthogonal to the LTF1 field (having a 2-symbol length) of a PPDU in a bandwidth of 2 MHz or more in the frequency domain and may be repeated twice in time to have a 4-symbol length. The LTF1 field may include dual guard interval (DGI), long training sequence (LTS), LTS, guard interval (GI), LTS, GI, and LTS subfields.

The SIG field of FIG. 15 may be repeatedly encoded. The lowest modulation and coding scheme (MCS) (ie, binary phase shift keying (BPSK)) and repeat coding (rep2) can be applied to the SIG field. The SIG field can be configured to have a ratio of 1/2 and is defined as a length of 6 symbols.

In the case of MIMO, the LTF2 to LTFN LTF fields of FIG. 10 may be included. Each LTF field can be one symbol long.

In the preamble format of the 1-MHz PPDU in Figure 10, the STF, LTEF1, SIG, and LTF2-LTFN LTF fields correspond to the omniportion transmitted in each direction and are transmitted without beamforming such that All STAs can receive the field.

FIG. 11 illustrates an exemplary short format of S1G greater than or equal to 2 MHz.

The S1G short format greater than or equal to 2MHz can be used for SU transmission in 2MHz, 4MHz, 8MHz, or 16MHz PPDU.

The STF field of FIG. 11 may have a length of 2 symbols.

The LTF1 field of FIG. 11 may have a length of 2 symbols, and include DGI, LTS, and LTS.

The SIG field of FIG. 11 may be subjected to orthogonal PSK (QPSK), BPSK, etc. as MCS.

Each of the LTF2 to LTFN LTF fields of FIG. 11 may have a length of one symbol.

FIG. 12 illustrates an exemplary long format of S1G greater than or equal to 2 MHz.

The long format of S1G equal to or greater than 2MHz can be used for MU transmission and SU beamforming transmission in 2MHz, 4MHz, 8MHz, or 16MHz. The long format of S1G that is greater than or equal to 2MHz may include all parts transmitted in omnidirectional so that all STAs can receive the format subjected to beamforming and the data part so that a specific STA can receive the format.

In the long format SIG greater than or equal to 2 MHz, the entire part may include STF, LTF1, and signal A (SIG-A) fields.

The STF field of FIG. 12 may have a length of 2 symbols.

The LTF1 field of FIG. 12 may have a length of 2 symbols and include DGI, LTS, and LTS.

The SIG-A field of FIG. 12 may be subjected to QPSK, BPSK, etc. as MCS and has a length of 2 symbols.

In a long format SIG greater than or equal to 2MHz, the data part may include a short training field (D-STF) for data, a long training field (D-LTF) for data, and signal-B (SIF-B) And data fields. The data part in the PPDU format of FIG. 12 may be referred to as the MU part. In this sense, D-STF may be referred to as MU-STF and D-LTF may be referred to as MU-LTF.

The D-STF field of FIG. 12 may have a length of 1 symbol.

Each subfield of the D-LTF field of FIG. 12, that is, each of D-LTF1 to D-LTFN LTF may have a length of 1 symbol.

The SIG-B field of FIG. 12 may have a length of 1 symbol.

Each field of the preamble format of the SIG greater than or equal to 2 MHz as described above will now be described in more detail.

In the whole part, the STF, STF1, and SIG-A fields can be sent as a single stream with respect to each subcarrier. This can be indicated as follows.

[Equation 1]

In Equation 1, k represents the sub-carrier (or tone) index, xk represents the signal transmitted in the sub-carrier k, N TX represents the number of transmission antennas, and Q k represents the encoding (for example, spatial mapping) in the sub-carrier The column vector of the signal transmitted in k, and dk represents the data input to the encoder. In Equation 1, cyclic shift delay (CSD) in the time domain can be applied to Q k. CSD in the time domain indicates phase rotation or phase shift in the frequency domain. Therefore, Q k may include the phase shift value in the tone k generated by CSD in the time domain.

When the frame format as illustrated in FIG. 12 is used, STF, LTF-1, and SIG-A fields can be received through all STAs and each of the STAs can decode SIG-A through channel estimation based on the STF and LTF1 fields Field.

The SIG-A field may include information about length/duration, channel bandwidth, number of spatial streams, and so on. The SIG-A field has a length of two OFDM symbols. One OFDM symbol uses BPSK modulation related to 48 data tones, and therefore 24 bits of information can be carried on one OFDM symbol. Then, the SIG-A field may include 48 bits of information.

The following [Table 1] shows an exemplary bit allocation of the SIG-A field for each of the SU frame and the MU frame.

[Table 1]

In Table 1, the SU/MU indication field is used to distinguish between the SU frame format and the MU frame format.

The length/duration field indicates the number of OFDM symbols (i.e., duration) or the number of bytes (i.e., length) of the frame. In the SU frame, when the value of the aggregation field is 1, the length/duration field is interpreted as the duration field. Meanwhile, when the value of the aggregate field is 0, the length/duration field is interpreted as a length field. In the MU frame, because the aggregation field is not defined and the MU frame is configured to always apply aggregation, the length/duration field is interpreted as a duration field.

The MCS field indicates the MCS used for PSDU transmission. The MCS field is sent through the SIG-A field only in the SU frame. If another STA (ie, a third-party STA that is not directly associated with transmission and reception between two STAs (ie, a third-party STA (also referred to as a third STA)) receives the SU frame, it may be based on the length/duration field The length value of and the value of the MCS field calculate the duration of the currently received SU frame (ie, the SU beamformed frame in which the aggregation field is set to 0). Meanwhile, the MCS field of the MCS frame is not included in the SIG-A field but in the SIG-B field that carries user-specific information, and the MCS can be independently applied to each user.

The BW field indicates the channel bandwidth of the transmitted SU frame or MU frame. For example, the BW field may be set to a value indicating one of 2MHz, 4MHz, 8MHz, 16MHz, and 8+8MHz.

The aggregation field indicates whether to aggregate the PSDU in the form of aggregated MAC PDU (ie, A-MPDU). If the aggregation field is set to 1, this indicates that the PSDU is aggregated and transmitted in the form of A-MPDU. If the aggregation field is set to 0, this means that the PSDU is transmitted without aggregation. In the MU frame, because the PSDU is always transmitted in the form of A-MPDU, the aggregation field does not need to be signaled and therefore the aggregation

field is not included in the SIG-A field.

The space-time block coding (STBC) field indicates whether STBC is applied to the SU frame or the MU frame.

The coding field indicates the coding scheme used for the SU frame or the MU frame. A binary convolutional coding (BCC) scheme or a low density parity check (LDPC) scheme may be used for the SU frame. On the other hand, an independent coding scheme for each user can be applied and, in order to support this scheme, the coding field can be defined by a size of 2 or more bits.

The short guard interval (SGI) field indicates whether SGI is used for PSDU transmission of SU frames or MU frames. If SGI is used for MU frames, this may indicate that SGI is commonly applied to all users belonging to the MU-MIMO group.

The group identifier (GID) field indicates MU group information in the MU frame. In the SU frame, because there is no need to define user groups, the GID field is not included in the SIG-A field.

The number of time/space streams (Nsts) field indicates the number of spatial streams in the SU frame or the MU frame. In the MU frame, the Nsts field indicates the number of spatial streams for each STA belonging to the MU group, and for this, eight bits are required. Specifically, one MU group can include up to four users and up to four spatial streams can be sent to each user. In order to support this correctly, eight bits are required.

The partial AID (PAID) field indicates the STA ID used to identify the receiving STA in the SU frame. In an uplink (UL) frame, the value of PAID may be composed of a part of a basic service set ID (BSSID). In a downlink (DL) frame, the value of PAID may be set as a composite value of the AID of the hash STA. For example, the BSSID may have a length of 48 bits, the AID may have a length of 16 bits, and the PAID may have a length of 9 bits.

Alternatively, in the UL frame, the PAID may be set as a composite value of a part of the hashed BSSID and, in a DL frame, the PAID may be set as a composite value of the part of the hashed AID and the part of the BSSID.

The acknowledgement (ACK) indication field of Table 1 indicates the type of ACK sent after the SU frame or the MU frame. For example, if the ACK indication field is set to 00, this indicates a normal ACK, and if it is set to 01, this may indicate that ACK is blocked. If the ACK indication field is set to 10, this may indicate no ACK. It should be noted that the type of ACK is not always restricted by three types and can be classified into more than three types according to the properties of the response frame.

Although not included in Table 1, the SIG field may include a DL/UL indication field (for example, one bit size) for explicitly indicating whether the corresponding frame is a DL frame or a UL frame. The DL/UL indication field can be defined only in the SU field, and cannot be defined in the MU frame so that the MU frame can be predetermined to be always used only as a DL frame. Alternatively. The DL/UL indication field can be included, regardless of SU frame or MU frame.

Meanwhile, as in the MU frame illustrated in FIG. 12, the SIG-B field may include user-specific information. Table 2 exemplarily shows the fields constituting the SIG-B field in the MU frame. [Table 2] also exemplarily shows various parameters mapped to the PPDU with a bandwidth of 2, 4, 8 or 16 MHz.

[Table 2]

[image]

In Table 2, the MCS field indicates the MCS value of the PPDU sent to each user in the form of MU frames.

The tail bit can be used to return the encoder to a zero state.

The Cyclic Redundancy Check (CRC) field may be used to detect errors in the STA receiving the MU frame.

Bandwidth selection scheme for S1G direct response frames

The present invention proposes a method of selecting the bandwidth of a direct response frame in a WLAN system operating in the S1G frequency band (for example, 902 to 928 MHz).

When a transmitting STA sends a control frame or a data frame and the receiving STA that has received the data frame sends a response frame to the transmitting STA after a short interframe space (SIFS), the response frame is called a direct response frame.

Determine the SIFS as the value of aRxRFDelay+aRxPLCPDelay+aMACProcessingDelay+aRxTxTurnaroundTimer. aRxRFDelay indicates the radio frequency propagation delay, aRxPLCPDelay indicates the PLCP reception delay, and aMACProcessingDelay indicates the processing delay for event processing in the MAC. aRxTxTurnaroundTimer indicates the

transition time necessary to switch from the receive (Rx) mode to the transmission (Tx) mode.

The direct response scheme can be operated as follows by means of an example. The transmitting STA can send a data frame, and the receiving STA that has successfully received the data frame can send an ACK frame after SIFS. In addition, the transmitting STA may send an RTS frame, and the receiving STA may send a CTS frame after SIFS as a response to the RTS frame. In addition, the transmitting STA may send a power saving polling (PS-Poll) frame, and the receiving STA may send an ACK frame or a buffered data frame after SIFS as a response to the PS-Poll frame.

Now the ACK process related to the direct response scheme will be specifically described as an example.

Fig. 13 is a diagram for explaining the ACK process.

After sending an MPDU requesting an ACK frame as a response, the STA waits for an interval of ACKTimeout. The ACKTimeout can be determined based on the value of aSIFSTime+aSLotTime+aPHY-RX-START-Delay, and start at the value of the PHY-TXEND.confirm primitive. In this case, SIFSTime indicates the normal time required when the MAC layer and PHY layer on the air interface receive the last symbol of the frame, process the frame, and send the first symbol of the earliest response frame available on the air interface . SlotTime is a time unit used in the MAC layer to define the point coordination function (PCF) interframe space (PIFS) and DIFS. aPHY-RX-START-Delay indicates the delay time until the time when the PHY-RXSTART.indication primitive is issued. The PHY-RXSTART.indication primitive is a primitive that notifies the local MAC layer PLCP to start receiving PPDUs with a valid PLCP header through its PHY layer.

In Figure 13, ACKTimeout is simplified as ACKTimeout=SIFS+slot time+PHY-RX-START-Delay. That is, the ACKTimeout may be the time necessary for the STA that has received the data frame to transmit the ACK frame after the SIFS and can be calculated in consideration of the time slot time.

The time slot time is determined as the value of aCCATime+aRxTxTurnarunTime+aAirPropagationTime+aMACProcessingDelay. aCCATime indicates the maximum time during which the STA can access the medium in each time slot to determine whether the medium is in a busy state or an idle state according to the CCA mechanism. aRxTxTurnaroundTimer indicates the necessary transition time to switch from Rx mode to Tx mode. aAirPropagationTime indicates the double time that is consumed when the signal is propagated to the maximum distance through the farthest available STA signal among the time slot synchronized STAs. aMACProcessingDelay indicates the processing delay for event processing in the MAC layer.

Among the factors for determining the ACKTimeout, the PHY-RX-START-Delay is used to confirm whether the direct response frame has been successfully triggered, such as the time of the AC frame, and usually considers the time consumed until the SIG field of the PLCP frame header is decoded.

In other words, assuming that the transmitting STA sends a data frame and the receiving STA has successfully received the data frame, the longest time before the PLCP frame header of the ACK frame sent by the receiving STA is sent to the transmitting STA is used as the ACKTimeout.

If the PHY-RXSTART.indication primitive does not appear during the ACKTimeout interval, the STA concludes that the transmission of the MPDU has failed, and calls the backoff procedure after the expiration of the ACKTimeout interval.

If the PHY-RXSTART.indication primitive appears during the ACKTimeout interval, the STA can wait for the PHY-RXEND.indication primitive to determine whether the MPDU transmission is successful. The PHY-RXEND.indication primitive is a primitive that notifies the MAC layer of the completion of the current PSDU reception through its PHY layer.

If a valid ACK frame sent by the receiving STA corresponding to the PHYRXEND.indication primitive is identified, this can be interpreted as a successful ACK. Then, the frame sequence may be allowed to continue or may be ended without retry according to a scheme suitable for the particular frame sequence in progress.

If other frames including another valid frame are identified, this is interpreted as a failure of MPDU transmission. In this case, the STA needs to invoke the backoff procedure in the PHY-RXEND.indication primitive and can process the received frame. Exceptionally, if a valid data frame sent by the receiving side of the PS polling frame is identified, this can be interpreted as a successful ACK for the PS polling frame.

In short, the STA that has sent the data frame waits for the ACK to be sent by the STA that received the data frame, and when the PHY-RXSTART.indication primitive is not generated during the ACKTimeout interval, the transmission of the data frame is regarded as a failure, and then the discovery process (That is, re-execute the backoff process and try to resend the data frame processing).

As shown in FIG. 13, PHY-RX-START-Delay is considered in determining the value of ACKTimeout. PHY-RX-START-Delay can

be different according to the channel bandwidth of the frame. For example, the PHY-RX-START-Delay in the S1G 1MHz format shown in FIG. 10 and the PHY-RX-START-Delay in the data format of S1G greater than or equal to 2MHz shown in FIG. 11 or FIG. Delay can be different.

In order to compare the length of the PHY-RX-START-Delay according to the channel bandwidth, it is assumed that the PHY-RX-START-Delay is the time until the SIG field of the PLCP header is decoded as described above.

In the case of a 1-MHz PPDU, the STF, LTE1, and SIG fields of the PLCP header include a total of 14 OFDM symbols. Assuming that the time slot time of an OFDM symbol is about 40 μs, the PHY-RX-START-Delay for 1-MHz PPDU is about 560 μs (=14x40 μs).

In the case of a PPDU greater than or equal to 2 MHz (ie, 2, 4, 6, 8 or 16 MHz), the STF, LTE1, and SIG-A fields of the PLCP header include a total of 6 OFDM symbols. Therefore, the PHY-RX-START-Delay used for 2MHz PPDU is approximately 240μs (=6x40μs).

Therefore, the ACKTimeout needs to be set differently according to whether the direct response frame is sent in a 1-MHz PPDU or a PPDU equal to or greater than 2MHz. For example, if the direct response frame sent by the receiving STA is a 1MHz PPDU, the ACKTimeout of the transmitting STA needs to be much larger than or equal to the PPDU of 2MHz.

If a fixed ACKTimeout value is used regardless of the channel bandwidth of the direct response frame, the PHY-RX-START-Delay should be set to at least 560 μs (or 560 μs + delay margin) as the default value. In such a case, if the direct response frame sent by the receiving STA is a PPDU equal to or greater than 2MHz, ACKTimeout is not set because 560μs is necessary when the transmitting STA decodes the field including the SIG field of the direct response frame. problem. However, if the direct response frame sent by the receiving STA is a 1 MHz PPDU, the ACKTimeout is set for unnecessary 320 μs in addition to the time necessary for the transmitting STA to decode the field including the SIG field of the direct response frame. Then, a time consumption corresponding to about 320 μs or an unnecessary time delay occurs after the transmission of the transmission STA fails, and thus a problem of low efficiency in overall throughput and energy consumption occurs.

For reference, assume that the time of a back-off slot in the back-off process is 52 μs, because the unnecessary overhead of 320 μs corresponds to about 6 times the difference in the back-off timer (or back-off count value), and the channel access of the actual STA In terms of efficiency, this time difference can be interpreted as a significant time delay.

Therefore, the present invention proposes a direct response frame channel bandwidth selection scheme and a direct response process based on the channel bandwidth selection scheme in a system supporting two or more types of channel bandwidths.

In the present invention, supporting two or more types of channel bandwidth means that when the same MCS is assumed, it can be transmitted during a unit time (for example, the duration of one OFDM symbol) for each channel bandwidth. The information bits are different, or the duration of the unit time used for each channel bandwidth (for example, the duration of one OFDM symbol) is the same. Therefore, when the channel bandwidth of 20 MHz is down-converted to 1/10 or 1/20, this is not included in the case of supporting two or more types of channel bandwidths.

In addition, in the present invention, a frame that triggers a direct response frame is called a direct trigger frame. The direct trigger frame may include, for example, a data frame with a normal ACK policy, an RTS frame, and a PS polling frame as in the foregoing example. In this case, the direct response frame may correspond to an ACK frame, a CTS frame, or a data frame.

When the transmission of the direct trigger frame is completed, the STA sending the direct trigger frame can set the direct response timer to start. That is, after completing the transmission of the direct trigger frame, the transmitting STA may operate the direct response timer during aSIFSTime+aSlotTime+aPHY-RX-START-Delay time starting from the occurrence time of the PHY-TXEND.confirm primitive.

If the PHY-RXSTART.indication primitive is not generated before there is a timeout in the direct response timer, the transmitting STA can conclude that the receiving STA has not sent a direct response frame and perform the recovery process (or backoff process).

According to the channel bandwidth as previously described, the direct trigger frame is sent in the form of two or more PPDUs with different PHY-RX-START-Delay values.

For example, assume that a PPDU using a first channel bandwidth (for example, 1MHz) has A as the PHY-RX-START-Delay value, and a second channel bandwidth, a third channel bandwidth, etc. (for example, 2MHz, 4MHz, etc.) are used The PPDU has B as the PHY-RX-START-Delay value. Assume that A and B are set to different values and A is greater than B.

According to the present invention, from the viewpoint of the receiving STA, the channel bandwidth of the PPDU to be used as

the direct response frame should be determined so that the PPDU-based PHY-RX-START-Delay value to be used as the direct response frame is equal to or less than The PHY-RX-START-Delay value determined based on the received PPDU of the directly triggered frame.

For example, if the transmitting STA uses the first channel bandwidth to send the direct trigger frame, the receiving STA can use the first channel bandwidth to send the direct response frame.

In addition, when the transmitting STA uses the second channel bandwidth or the third channel bandwidth to send the direct trigger frame, the receiving STA should not use the first channel bandwidth after sending the direct response frame. From the viewpoint of the receiving STA, the channel bandwidth of the PPDU to be used as the direct response frame should be determined so that the PHY-RX-START-Delay value determined based on the PPDU to be used as the direct response frame is equal to or less than B, which is The PHY-RX-START-Delay value determined based on the received PPDU of the directly triggered frame. If the transmitting STA uses the second channel bandwidth or the third channel bandwidth to send the direct trigger frame, there is no problem when the receiving STA uses the second channel bandwidth or the third channel bandwidth to send the direct response frame because of the PHY-RX-START-Delay value Equal to B. However, if the receiving STA uses the PPDU of the first channel bandwidth to send a direct response frame, the PHY-RX-START-Delay value becomes A which is greater than B.

In addition, if a PPDU with the same PHY-RX-START-Delay value of the channel bandwidth (for example, the second channel bandwidth, the third channel bandwidth, etc.) is used to send a direct response frame, the channel bandwidth of the direct response frame should be equal to or less than Directly trigger the channel bandwidth of the frame.

If the above rule is applied when the receiving STA selects the bandwidth of the direct response frame, the transmitting STA that has sent the direct trigger frame will set the direct response timeout value of the direct response timer to aSIFSTime+aSlotTime+aPHY-RX-START-Delay. aPHY-RX-START-Delay is set to the aPHY-RX-START-Delay value of the directly triggered frame sent by the transmission STA. This means that the direct response timeout value can vary with the channel bandwidth of the direct trigger frame sent by the transmitting STA.

In the following, an example of applying the direct response procedure defined in the present invention to an S1G WLAN system (or a system following the IEEE 802.11ah standard) will be described.

After sending an MPDU requesting an ACK frame as a response, the STA waits during the ACKTimeout interval. The ACKTimeout can be determined based on the value of aSIFSTimeout+aSlotTime+aPHY-RX-START-Delay, and start at the value of the PHY-TXEND.confirm primitive.

In this case, the aPHY-RX-START-Delay is determined by the CH_BANDWIDTH (or preamble type) parameter of TXVECTOR. If the CH_BANDWIDTH parameter of TXVECTOR corresponds to (replicated) 1 MHz, then aPHY-RX-START-Delay is set to 601 μs. If the CH_BANDWIDTH parameter of TXVECTOR corresponds to (copied) 2MHz/4MHz/8MHz/16MHz, then aPHY-RX-START-Delay is set to 281μs.

The S1G STA that sends a control frame (i.e., response frame) in response to the frame sent through the S1G PPDU may be configured such that the TXVECTOR parameter CH_BANDWIDTH indicates the same channel bandwidth as the channel bandwidth indicated by the RXVECTOR parameter CH_BANDWIDTH of the frame that derives the response frame .

In addition, S1G STA is not allowed to send a 1MHz preamble as a response to a preamble greater than or equal to 2MHz (>=2MHz preamble).

Fig. 14 is a diagram for explaining whether a frame exchange sequence is allowed according to the present invention.

In FIG. 14, an operation for receiving an ACK frame after data frame transmission is illustrated. Fig. 14(a) illustrates a case where the reception of an ACK frame is allowed and Fig. 14(b) illustrates a case where the reception of an ACK frame is not allowed.

As illustrated in Figure 14(a), after the data frame of the 4MHz PPDU is sent, it is allowed to receive the ACK frame of the duplicated 2MHz PPDU. In addition, after the 2MHz PPDU data frame is sent, it is allowed to receive the 2MHz PPDU ACK frame. After sending 1MHz PPDU data frame, it is also allowed to receive 1MHz PPDU ACK frame.

At the same time, as illustrated in FIG. 14(b), it is not allowed to receive the copied 1MHz PPDU ACK frame after sending the 4MHz PPDU ACK frame. In addition, after sending the 2MHz PPDU data frame, it is not allowed to receive the copied 1MHz PPDU ACK frame.

The STA that has sent a data frame with a channel bandwidth of 2MHz or 4MHz expects a preamble PPDU with a channel

bandwidth of 2MHz as a response frame to the data frame, regards aPHY-RX-START-Delay as approximately 281μs to calculate the timeout value, and receives and Process response frames.

If a response frame of a PPDU with a preamble of 1 MHz channel bandwidth is received in response to a data frame with a channel bandwidth of 2 MHz or 4 MHz as illustrated in FIG. 14(b), it should be based on aPHY-RX-START-Delay of approximately 601 μs Calculate the timeout value used to correctly decode the response frame. However, because the transmitting STA calculates the timeout value based on the aPHY-RX-START-Delay of about 281 μs and receives and processes the response frame, the transmitting STA cannot receive the response frame correctly.

In the foregoing various examples of the present invention, the value of aPHY-RX-START-Delay such as 601 μs or 281 μs is only exemplary and provided only for the sake of clear description. Therefore, the scope of the present invention is not limited to such a specific number.

VCM mechanism

The carrier sensing (CS) mechanism is used for channel access and refers to an operation for determining the busy/idle state of the corresponding channel.

The existing NAV configuration scheme is based on the duration field of the frame received by any STA from another STA to determine to use the channel through another STA during a prescribed duration, and perform operations according to the determined result (ie, in No medium access was attempted during the specified duration). This operation can be referred to as a virtual CS (VCS) mechanism, because the corresponding medium appears to be determined to be occupied as a result of performing CS (although the medium is physically idle compared to the determination as to whether the medium is occupied by performing physical CS) State).

For example, a third-party STA other than the destination STA of the received frame determines that the received frame has an error when the CRC value of the received frame is invalid. The STA that receives the frame with the error may wait during the extended inter-frame space (EIFS) and then resume the backoff process when the channel is in the idle state. Generally, EIFS is calculated based on aSIFSTime+DIFS+ACKTxTime.

In this case, ACKTxTime indicates the time required for the STA to send the ACK frame. According to the above-mentioned bandwidth selection scheme of the response frame proposed in the present invention, the channel bandwidth of the ACK frame is determined depending on the channel bandwidth of the frame in which the ACK frame is called (for example, the direct trigger frame). For example, if the direct trigger frame has a preamble type of 2 MHz or greater, the direct response frame does not allow the 1 MHz preamble type. In addition, the preamble channel bandwidth type of the direct response frame is configured to be the same as the preamble channel bandwidth type of the direct trigger frame.

Therefore, after receiving the wrong frame, the third-party STA needs to confirm the channel bandwidth of the received frame in order to delay channel access during EIFS. If the PPDU received through the first channel bandwidth has an error, the ACKTxTime of EIFS is calculated by assuming the value of aRHY-RX-START-Delay for the same channel bandwidth as the first channel bandwidth (as described above, it is used to identify Whether a direct response frame such as an ACK frame has been successfully triggered and usually consider the time consumed before decoding the SIG field of the PLCP header).

This is because the first channel bandwidth is also used to transmit the ACK frame for the PPDU received through the first channel bandwidth and the value of aPHY-RX-START-Delay for the first channel bandwidth should be applied to the ACK frame. If the second channel bandwidth or the third bandwidth other than the first channel bandwidth has an error, the ACKTxTime of EIFS is calculated by assuming the value of aPHY-RX-START-Delay for the second channel bandwidth or the third channel bandwidth.

If the CRC value of the received frame is valid, a third-party STA other than the destination STA of the received frame determines that the received frame does not have errors. The STA that has received the error-free frame sets the NAV during the time corresponding to the value indicated by the duration field included in the MAC header of the received frame. The duration field of the MAC header in any frame is set to a value indicating the frame transmission time for protecting the frame to be sent subsequently.

Meanwhile, frames such as short MAC frames do not include the duration field in the MAC header in order to reduce MAC header overhead. Therefore, the scheme for setting NAV using the duration field as described above cannot be applied.

In any case where a short MAC frame is received or a normal MAC frame is received, information about the subsequently transmitted frame needs to be transmitted through a part other than the MAC header in order for the STA to set the NAV value correctly.

Unlike the existing VCS mechanism for setting the NAV value based on the duration field of the received frame, the VCS mechanism proposed in the present invention operates based on specific information other than the duration field. Therefore, the value set based on the specific information of the received frame as proposed in the present invention (ie, the value set by a similar use to the existing NAV value) is called "VCS time length value" because the value is the duration during which the channel is determined to be busy as a result of VCS. However, the concept of the VCS time length value proposed in the present invention does not exclude setting the NAV value based on information other than the duration field.

For example, the response frame type field in the PLCP SIG field of any frame (this field may be called ACK indicator parameter or response indicator parameter) NAV value (or VCS time length value) can be set. For example, because the type of the subsequent frame can be learned according to the indication of the response frame type parameter of any frame, if the frame includes a duration field, the value of the duration field can be assumed and the NAV value (or VCS) can be determined based on the assumed value. Time length value). Obviously, compared with the existing NAV configuration mechanism, it is not necessary to predict/assume the value of the duration field and is used for the purpose of understanding the present invention.

The response frame type parameter may be configured to indicate one of types such as no response, NDP control response, normal control response, long response, and so on.

FIG. 15 is a diagram for explaining an example of the present invention using the response frame type field of the SIG field of the PLCP header.

In the example of FIG. 15, the response frame type field (or response indication parameter) among the information included in the SIG field of the PLCP header of the data frame may be set to indicate according to the type of the ACK frame sent after the data frame The value of any one of no response, NDP control response, normal control response, and long response.

If the response frame type is no response, it can estimate/assume that the value of the duration field of the MAC header of the received frame will be 0 if there is. Therefore, if the value of the response indication parameter indicates no response, the NAV value (or the VCS time length value) is set to zero.

If the response frame type is NDP control response, it can estimate/assume that if it exists, the value of the duration field of the MAC header of the received frame will be the value of PCLP header transmission time + SIFS (PLCP header transmission time + SIFS) . Since the NDP frame indicates a frame composed only of the PLCP header, the PLCP header transmission time can be expressed as the NDP frame transmission time (ie, NDPTxTime). Therefore, if the value of the response indication parameter indicates an NDP control response, the NAV value (or VCS time length value) is set to NDPTxTime+aSIFSTime.

If the response frame type is a normal control response, it is estimated/assumed that if it exists, the value of the duration field of the MAC header of the received frame will be CTS/ACK/block ACK transmission time + SIFS (CTS/ACK/block ACK transmission time plus SIFS) value. Because the CTS/ACK/block ACK frame transmission corresponds to a normal frame, the CTS/ACK/block ACK transmission time can be interpreted as the normal frame transmission time (ie, NoramlTxTime). Therefore, if the value of the response indicating parameter indicates a normal control response, the NAV value (or the VCS time length value) is set to NormalTxTime+aSIFSTime.

If the response frame type is a long response, it is estimated/assumed that if it exists, the value of the duration field of the MAC header of the received frame will be the value of the maximum PPDU transmission time + SIFS (MAX_PPDU transmission time plus SIFS), in order to indicate any response frames. Therefore, if the value of the response indication parameter indicates a long response, the NAV value (or the VCS time length value) is set to MaxPPDUTxTime+aSIFSTime.

In this way, although the type of the frame to be sent subsequently can be estimated/presumed by the information about the response frame type included in the received frame, the transmission time length of the response frame should be determined so that the third-party STA can correctly set the NAV value ( Or VCS time length value). This is because the transmission time of each frame varies according to the channel bandwidth.

Specifically, in order for a third-party STA to set the NAV value (or VCS time length value), the transmission time length of the MPDU part of the response frame and the transmission time length of the preamble part of the response frame should be correctly determined.

The transmission time length of the MPDU part of the response frame is determined based on the response frame type of the PLCP SIG field of the received frame. For example, if the response frame type indicates any one of no response, NDP control response, normal control response, and long response, the MPDU value is determined according to the indicated type.

The transmission time length of the preamble part of the response frame is determined by the channel bandwidth. For example, in the preamble type of 1 MHz channel bandwidth and the preamble type of channel bandwidth greater than or equal to 2 MHz,

the time length of the preamble part of the response frame is determined differently/individually (refer to FIGS. 10 to 12). In addition, the channel bandwidth of the response frame is determined by the channel bandwidth of the frame received by the third-party STA.

Therefore, the channel bandwidth of the response frame (or the preamble type of the response frame determined according to the channel bandwidth of the received frame) and the value of the response frame type field included in the PLCP header of the received frame (or the response indication parameter Value) determines the NAV value (or VCS time length value) set by the third-party STA. In other words, the response frame type is determined based on the value of the response frame type field (or the response indication parameter value) included in the PLCP header of the frame received through the third-party STA, and the response frame type is determined by the channel bandwidth of the received frame The length/type of the preamble and the NAV value (or the VCS time length value) including the time required to transmit the response frame can be determined based on the channel bandwidth and value of the response frame type. Then, the third-party STA can correctly set the NAV value (or VCS time length value) regardless of the type of the received frame (for example, short MAC frame or other frames (ie, in the frame without the duration field or with the duration) Field).

In implementing the above-mentioned VCS mechanism, the STA can use a parameter (for example, NAV value (or VCS time length value) to design the protocol or according to information used as a basis for determining the VCS time length value (for example, the duration field of the MAC header or PLCP The response frame type field of the header) is designed to be a protocol distinguished by a separate parameter. In the foregoing example of the present invention, although one parameter (ie, NAV value or VCS time length value) is used to implement the VCS mechanism, the NAV value is set based on the value of the duration field as in the conventional scheme and based on the response The case where the value of the frame type field (also based on the channel bandwidth) sets an additional VCS time length value is included in the embodiment of the present invention.

Third-party STA detection solution

In a frame such as a short MAC frame, an AID other than the MAC address can be used in the receiver address (RA) field and the transmitter address (TA) field (AID is the local ID assigned to the associated STA through the AP ) In order to reduce the MAC header overhead. For example, the MAC header of the UL short MAC frame sent to the AP through the STA includes the MAC address of the AP in the RA field (for example, the address 1 (A1) field) and includes the MAC address in the TA field (for example, the address 2 (A2) field) The AID of the STA. On the contrary, the MAC header of the DL short MAC frame sent to the STA through the AP includes the AID of the STA in the RA field (or A1 field) and includes the MAC address of the STA in the TA field (or A2 field). Since the MAC address is defined by the length of 6 bytes and the AID is defined by the length of 2 octets, the MAC header overhead corresponding to the length difference can be reduced.

The STA determines whether the STA that has received the short MAC frame sets the NAV value (or VCS time length value) according to whether the STA is the destination of the corresponding frame. When the CRC value of the received frame is valid, third-party STAs other than the destination STA treat the received frame as an error-free frame and the STA that has received the error-free frame sets the NAV value (or VCS time Length value).

If the STA receives the frame, whether the STA is the destination STA of the frame that should be determined.

If the RA of the short MAC frame received by the STA is composed of MAC addresses, the STA compares the RA with its MAC address. If the addresses are equal, the STA can determine that it is the destination STA and, otherwise, the STA can determine that it is a third-party STA.

If the RA of the short MAC frame received by the STA is composed of AID, the STA compares the RA with its AID. If the addresses are different, the STA can determine that it is a third-party STA.

At the same time, if the RA of the short MAC frame received by the STA is composed of AID, the STA should not determine that it is the destination STA, although the RA is equal to the AID of the STA as the result of the comparison. This is because, even when the AID values are equal, if the APs to which the AID values are assigned are different, the destination STAs of the frame may be different. Therefore, if the RA of the short MAC frame received by the STA is composed of AID, the STA compares the RA with its AID. If the addresses are equal, the STA compares the TA of the short MAC frame with the MAC address of the associated AP. If the TA of the short MAC frame received by the STA is equal to the MAC address of the AP with which the STA is associated, the STA can determine that it is the destination STA and, otherwise, the STA can determine that it is a third-party STA.

If the STA receives a short MAC frame in a state in which the STA is not associated with the AP (ie, a pre-associated state), no application is made to determine whether the STA is the destination based on the RA value composed of AID and the TA value

composed of MAC address The above scheme of STA or third-party STA. This is because the AP cannot send a short MAC frame (ie, a MAC frame in which the RA field or the TA field is composed of AID) to STAs that are not associated with the AP. Therefore, if the STA receives a short MAC frame in a pre-associated state, the STA should determine that it is not a destination STA but a third-party STA.

Therefore, if the STA that has received the frame determines that it is a third-party STA, the STA can set the NAV value (or VCS time length value) according to the specific field of the received frame as described in the present invention.

In addition, even when any STA should determine that it is an STA that should transmit a direct response frame (for example, an ACK frame transmitted in response to a short MAC data frame), the above-mentioned third-party STA determination scheme can be applied. For example, if the RA of the short MAC data frame received by the STA is equal to the AID of the STA, the STA may additionally compare the TA with the MAC address of the AP of the associated STA and determine that it is the destination STA only when the addresses are equal. Next, the STA can send a direct response frame.

That is, in the case where the RA of the received short MAC frame corresponds to the AID, the STA compares the RA with the AID. If RA is equal to the AID of the STA, the STA compares the TA with the MAC address. Only when the TA of the received short MAC frame is equal to the MAC address of the AP with which the STA is associated, the STA determines that it is the destination STA and sends a direct response frame such as an ACK frame.

Fig. 16 is a diagram for explaining an exemplary method of the present invention.

In the example of FIG. 16, the operation of the first STA STA1 is related to the above-mentioned bandwidth selection scheme (or response process) for the S1G direct response frame of the present invention. In addition, in the example of FIG. 16, the operation of the third STA STA3 is related to the VCS mechanism of the present invention. The operation of the STA may be understood as a separate operation, although the description is given with reference to one figure for convenience of description.

In step S1610, the first STA STA1 may send the frame to the second STA STA2. This frame can be a direct trigger frame sent through a direct response frame. STA2 that has received the frame from STA1 may send a response frame (for example, a direct response frame).

In this case, the channel bandwidth type of the response frame transmitted through STA2 may be configured to be the same as the channel bandwidth type of the frame transmitted through STA1. If the frame transmitted through STA1 has a preamble type of 2 MHz or more, the response frame transmitted through STA2 may be limited to types other than the 1 MHz preamble type (ie, the 1 MHz preamble type is not allowed).

In addition, in step S1610, STA1 may wait for a response frame to be transmitted by STA2 during the ACKTimeout interval. The ACKTimeout interval is determined to be a different value according to the preamble channel bandwidth type of the frame. In other words, because the preamble channel bandwidth of the response frame is different according to the preamble channel bandwidth of the frame, the ACKTimeout interval can be set in consideration of the preamble channel bandwidth of the frame.

In step S1620, STA1 may receive a response frame from STA2. If the response frame is received within the ACKTimeout interval, it is determined that the frame has been successfully transmitted and, otherwise, it is determined that the transmission of the frame has failed. If the ACKTimeout interval has elapsed, STA1 may perform a back-off procedure (not shown).

Meanwhile, as in step S1630, a third-party STA (for example, STA3) may receive a frame sent to another STA (for example, STA2) through another STA (for example, STA1).

In step S1640, the STA3 may receive the NAV value (or the VCS time length value) based on the response indication parameter (or the response frame type field) and/or the channel bandwidth type of the received frame. STA3 can postpone channel access during a time period corresponding to the NAV value (or VCS time length value).

The channel bandwidth type indicates the channel bandwidth type of the response frame. The channel bandwidth type of the response frame may be set to be the same as the channel bandwidth type of the frame (for example, a frame sent from STA1 to STA2).

For example, the NAV value (or the VCS time length value) is basically determined according to one of no response, normal response, NDP response, and long response indicated by the response long indication parameter. In addition, the NAV value (or the VCS time length value) can be specifically determined according to the channel bandwidth.

Although the exemplary method illustrated in FIG. 16 is represented as a series of steps for simplicity of description, this does not limit the nature of the steps. When necessary, some steps can be performed simultaneously or in a different order. In

addition, all the steps illustrated in FIG. 16 are not necessary to implement the proposed method of the present invention.

The foregoing various embodiments of the present invention can be implemented by singly or in combination of two or more to execute the method of the present invention illustrated in FIG. 16.

Fig. 17 is a block diagram of a wireless device according to an embodiment of the present invention.

The STA 110 may include a processor 11, a memory 12, and a transceiver 13. The transceiver 13 can send/receive wireless signals, for example, to implement the physical layer of the IEEE 802 system. The processor 11 is connected to the transceiver 13 and implements the physical layer and/or MAC layer of the IEEE 802 system. The processor 11 may be configured to perform operations according to the aforementioned various embodiments of the present invention. In addition, modules for performing operations according to various embodiments of the present invention may be stored in the memory 12 and executed by the processor 11. The memory 12 may be located inside or outside the processor 11 and connected to the processor 11 through a known device.

In FIG. 17, the STA 10 according to an embodiment of the present invention may be configured to perform response processing. The processor 11 may be configured to transmit a frame requesting a response frame to another STA through the transceiver 13. The processor 11 may be configured to wait for a response frame during the ACKTimeout interval. The ACKTimeout interval can be set to different values according to the preamble channel bandwidth type of the frame.

The STA 10 of FIG. 17 according to another embodiment of the present invention may be configured to perform VCS. The processor 11 of the third STA may be configured to receive the frame sent from the first STA to the second STA through the transceiver 12. The processor 11 may be configured to determine the VCS time length based on the response indication parameter or the channel bandwidth type. The processor 11 may be configured to delay channel access caused by the third STA during a time corresponding to the VCS time length value.

The specific configuration of the above-mentioned device may be implemented such that the foregoing various embodiments of the present invention may be independently applied, or two or more thereof may be simultaneously applied. The repeated description is omitted for clarity.

The embodiments of the present invention can be implemented by various means, for example, hardware, firmware, software, or a combination thereof.

In the hardware configuration, one or more application specific integrated circuits (ASIC), digital signal processor (DSP), digital signal processing device (DSPD), programmable logic device (PLD), field programmable gate array (FPGA) can be used , Processors, controllers, microcontrollers, microprocessors, etc., to implement the methods according to the embodiments of the present invention.

In the case of firmware or software configuration, the methods according to the embodiments of the present invention can be implemented with modules, programs, functions, etc. that perform the functions or operations described above. The software codes can be stored in a memory unit and executed by a processor. The memory unit may be located inside or outside the processor, and may transmit data to and receive data from the processor via various known means.

The detailed description of the preferred embodiments of the present invention has been given to enable those skilled in the art to realize and implement the present invention. Although the present invention has been described with reference to the preferred embodiments, those skilled in the art can understand that various modifications can be made in the present invention without departing from the spirit or scope of the invention described in the appended claims. And change. Therefore, the present invention should not be limited to the specific embodiments described herein, but should conform to the widest scope consistent with the principles and novel features disclosed herein.

Industrial applicability

Although various embodiments of the present invention have been described in the context of the IEEE 802.11 system, the present invention can also be applied to various mobile communication systems through the same solution.

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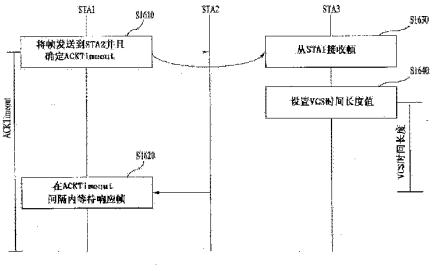
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(54)发明名称

在WLAN系统中根据带宽发送/接收帧的方法和装置

(57)摘要

本发明涉及一种无线通信系统，并且更加具体地，提供一种用于在WLAN系统中根据其带宽发送/接收帧的方法和装置。根据本发明的一个实施例的用于在WLAN系统中执行响应过程的方法可以包括：其中第一站(STA)将请求响应帧的帧发送到第二STA的步骤；以及其中第一STA在ACKTimeout间隔内等待响应帧的步骤。根据帧的前导信道带宽类型可以不同地确定ACKTimeout间隔的值。




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1.一种在无线局域网(WLAN)系统中执行响应处理的方法,所述方法包括:

通过第一站(STA)将要求响应帧的帧发送到第二STA;以及

通过所述第一STA,在ACKTimeout间隔期间等待所述响应帧,

其中,根据所述帧的前导信道带宽类型,所述ACKTimeout间隔被设置为不同的值,以及

其中,所述响应帧的前导信道带宽被设置为等于所述帧的前导信道带宽类型的值。

2.根据权利要求1所述的方法,

其中,如果所述帧的前导信道带宽类型是1MHz的前导类型,则基于用于1MHz的前导的aPHY-RX-START-Delay值来计算所述ACKTimeout间隔,

所述aPHY-RX-START-Delay值指示直到发布PHY-RXSTART.indication的延迟时间,以及

所述PHY-RXSTART.indication表示具有有效的PLCP报头的物理层会聚过程(PLCP)分组数据单元(PPDU)开始被接收。

3.根据权利要求1所述的方法,

其中,如果所述帧的前导信道带宽类型是2MHz或者更多的前导类型,则基于用于2MHz或者更多的前导的aPHY-RX-START-Delay值来计算所述ACKTimeout间隔,

所述aPHY-RX-START-Delay指示直到发布PHY-RXSTART.indication的延迟时间,以及

所述PHY-RXSTART.indication表示具有有效的PLCP报头的物理层会聚过程(PLCP)分组数据单元(PPDU)开始被接收。

4.根据权利要求1所述的方法,

其中,如果所述帧具有2MHz或者更多的前导类型,则所述响应帧具有除了1MHz的前导类型之外的类型。

5.根据权利要求1所述的方法,

其中,如果所述帧具有2MHz或者更多的前导类型,则所述响应帧具有2MHz的前导类型。

6.根据权利要求1所述的方法,

其中,如果所述帧具有1MHz或者更多的前导类型,则所述响应帧具有1MHz的前导类型。

7.根据权利要求1所述的方法,

其中,如果在所述ACKTimeout间隔期间接收到所述响应帧,则所述帧的传输被确定为是成功的。

8.根据权利要求1所述的方法,

其中,如果在所述ACKTimeout间隔期间没有接收到所述响应帧,则所述帧的传输被确定为是失败的并且当所述ACKTimeout间隔被结束时通过所述第一STA来执行退避过程。

9.根据权利要求1所述的方法,

其中,所述帧是数据帧、请求发送(RTS)帧和省电轮询(PS-轮询)帧中的一个。

10.根据权利要求1所述的方法,

其中,所述响应帧是肯定应答(ACK)帧、清除发送(CTS)帧以及数据帧中的一个。

11.根据权利要求1所述的方法,

其中，所述 STA 是在子 1GHz(S1G) 频带中操作的 STA。

12. 一种用于在无线局域网 (WLAN) 系统中执行响应处理的站 (STA)，所述 STA 包括：

收发器；以及

处理器，

其中，所述处理器被配置成通过所述收发器将要求响应帧的帧发送到第二 STA；以及在 ACKTimeout 间隔期间等待所述响应帧，以及

其中，根据所述帧的前导信道带宽类型，所述 ACKTimeout 间隔被设置为不同的值。

# 在 WLAN 系统中根据带宽发送 / 接收帧的方法和装置

## 技术领域

[0001] 下面的描述涉及一种无线通信系统，并且更加具体地，涉及一种用于在无线局域网 (WLAN) 系统中根据带宽发送和接收帧的方法和设备。

## 背景技术

[0002] 随着信息通信技术的快速发展，已经开发了各种无线通信技术系统。无线通信技术之中的 WLAN 技术基于射频 (RF) 技术允许使用诸如个人数字助理 (PDA)、膝上型计算机、便携式多媒体播放器 (PMP) 等在家或者在企业或者在特定的服务供应区域处进行无线互联网接入。

[0003] 为了消除 WLAN 的缺点之一，受限的通信速度，最近的技术标准已经提出能够增加网络的速度和可靠性同时扩展无线网络的覆盖区域的演进系统。例如，电气和电子工程师协会 (IEEE)802.11n 使数据处理速度能够支持最高 540Mbps 的高吞吐量 (HT)。另外，多输入和多输出 (MIMO) 技术最近已经被应用于发射器和接收器使得最小化传输误差以及优化数据传输速率。

## 发明内容

[0004] 技术问题

[0005] 机器对机器 (M2M) 通信技术已经作为下一代通信技术被论述。在 IEEE 802.11 WLAN 中的支持 M2M 通信的技术标准已经被发展成 IEEE 802.11ah。M2M 通信可以考虑能够在包括大量设备的环境下以低速不频繁地通信少量数据的场景。

[0006] 本发明的目的是为了提供一种用于考虑到响应帧类型和 / 或信道带宽通过等待响应帧或者推迟信道接入防止资源浪费并且正确地执行帧切换的方案。

[0007] 将被理解的是，从下面的描述对于本发明属于的本领域的普通技术人员之一来说显然的是，通过本发明实现的技术目的不限于前述的技术目的和在此没有提及的其他技术目的。

[0008] 技术方案

[0009] 通过提供一种用于在无线局域网 (WLAN) 系统中执行响应处理的方法能够实现本发明的目的，该方法包括：通过第一站 (STA) 将要求响应帧的帧发送到第二 STA；以及通过第一 STA 在 ACKTimeout 间隔期间等待响应帧。根据帧的前导信道带宽类型，ACKTimeout 间隔可以被设置为不同的值。响应帧的前导信道带宽可以被设置为等于帧的前导信道带宽类型的值。

[0010] 在本发明的另一方面中，在此提供一种用于在无线局域网 (WLAN) 系统中执行响应处理的站 (STA)，包括收发器和处理器。该处理器可以被配置成通过收发器将要求响应帧的帧发送到第二 STA 并且在 ACKTimeout 间隔期间等待响应帧。根据帧的前导信道带宽类型，ACKTimeout 间隔可以被设置为不同的值。响应帧的前导信道带宽可以被设置为等于帧的前导信道带宽类型的值。

[0011] 根据本发明的实施例，可以共同地应用下述。

[0012] 如果帧的前导信道带宽类型是 1MHz 的前导类型，则可以基于用于 1MHz 的前导的 aPHY-RX-START-Delay 值来计算 ACKTimeout 间隔。aPHY-RX-START-Delay 值可以指示直到发布 PHY-RXSTART.indication 的延迟时间。PHY-RXSTART.indication 可以表示具有有效的 PLCP 报头的物理层会聚过程 (PLCP) 分组数据单元 (PPDU) 开始被接收。

[0013] 如果帧的前导信道带宽类型是 2MHz 或者更多的前导类型，则可以基于用于 2MHz 或者更多的前导的 aPHY-RX-START-Delay 值来计算 ACKTimeout 间隔。aPHY-RX-START-Delay 可以指示直到发布 PHY-RXSTART.indication 的延迟时间。PHY-RXSTART.indication 可以表示具有有效的 PLCP 报头的物理层会聚过程 (PLCP) 分组数据单元 (PPDU) 开始被接收。

[0014] 如果帧具有 2MHz 或者更多的前导类型，则响应帧可以具有除了 1MHz 的前导类型之外的类型。

[0015] 如果帧具有 2MHz 或者更多的前导类型，则响应帧可以具有 2MHz 的前导类型。

[0016] 如果帧具有 1MHz 或者更多的前导类型，则响应帧可以具有 1MHz 的前导类型。

[0017] 如果在 ACKTimeout 间隔期间接收到响应帧，则帧的传输可以被确定为是成功的。

[0018] 如果在 ACKTimeout 间隔期间没有接收到响应帧，则帧的传输可以被确定为是失败的并且当 ACKTimeout 间隔被结束时通过第一 STA 执行退避过程。

[0019] 帧可以是数据帧、请求发送 (RTS) 帧和省电轮询 (PS- 轮询 ) 帧中的一个。

[0020] 响应帧可以是肯定应答 (ACK) 帧、清除发送 (CTS) 帧以及数据帧中的一个。

[0021] STA 可以是在子 1GHz(S1G) 频带中操作的 STA。

[0022] 要理解的是，本发明的前述的总体描述和下面的详细描述都是示例性的和说明性的并且旨在提供对如所要保护的本发明的进一步解释。

[0023] 有益效果

[0024] 根据本发明，考虑到响应帧和 / 或信道带宽通过提供等待响应帧或者推迟信道接入的方法和设备能够防止资源浪费并且能够正确地执行帧切换。

[0025] 本领域的技术人员将会理解，能够利用本发明实现的效果不限于已在上文具体描述的效果，并且从结合附图进行的下面的具体描述将更清楚地理解本发明的其他优点。

## 附图说明

[0026] 附图被包括以提供对本发明进一步的理解，附图图示本发明的实施例，并且与说明书一起用于解释本发明的原理。在附图中：

[0027] 图 1 示例性地示出根据本发明的一个实施例的 IEEE 802.11 系统。

[0028] 图 2 示例性地示出根据本发明的另一实施例的 IEEE 802.11 系统。

[0029] 图 3 示例性地示出根据本发明的又一实施例的 IEEE 802.11 系统。

[0030] 图 4 是图示 WLAN 系统的概念图。

[0031] 图 5 是图示对于在 WLAN 系统中使用的链路设立过程的流程图。

[0032] 图 6 是图示退避过程的概念图。

[0033] 图 7 是图示隐藏节点和暴露节点的概念图。

[0034] 图 8 是图示 RTS( 请求发送 ) 和 CTS( 清除发送 ) 的概念图。

[0035] 图 9 是用于解释在 IEEE 802.11 系统中使用的示例性帧结构的图。

[0036] 图 10 是图示示例性的 S1G 1MHz 格式的图

[0037] 图 11 是图示大于或者等于 2MHz 的 S1G 的示例性短格式的图。

[0038] 图 12 是图示大于或者等于 2MHz 的 S1G 的示例性长格式的图。

[0039] 图 13 是用于解释 ACK 过程的图。

[0040] 图 14 是用于解释根据本发明的是否允许帧交换序列的图。

[0041] 图 15 是用于解释使用 PLCP 报头的 SIG 字段的响应帧类型字段的本发明的示例的图。

[0042] 图 16 是用于解释本发明的示例性方法的图。

[0043] 图 17 是根据本发明的实施例的无线装置的框图。

## 具体实施方式

[0044] 现在将详细地介绍本发明的优选实施例，其示例在附图中图示。该详细说明将在下面参考附图给出，其意欲解释本发明示例性实施例，而不是示出根据本发明仅能够实现的实施例。以下的详细说明包括特定的细节以便对本发明提供深入理解。但是，对于本领域技术人员来说显而易见，本发明可以无需这些特定的细节来实践。

[0045] 根据预定的格式通过组合本发明的构成组件和特性提出下面的实施例。在不存在附加的备注的情况下，单独的构成组件或者特性应被视为可选的因素。根据需要，不需要将单独的构成组件或者特性与其他组件或者特性相组合。另外，可以组合一些构成组件和 / 或特性以实现本发明的实施例。可以改变要在本发明的实施例中公开的操作的顺序。任何实施例的一些组件或者特性也可以被包括在其他实施例中，或者必要时可以被其他实施例的替代。

[0046] 应注意的是，为了便于描述和更好地理解本发明，提出在本发明中公开的特定术语，并且在本发明的技术范围或者精神内这些特定术语的使用可以变成其他格式。

[0047] 在一些实例中，为了避免晦涩本发明的概念，公知的结构和设备被省略并且以框图的形式示出结构和设备的重要功能。在整个附图中将会使用相同的附图标记以指定相同或者相似的部件。

[0048] 本发明的示例性实施例由对于包括电气与电子工程师协会 (IEEE)802 系统、第三代合作计划 (3GPP) 系统、3GPP 长期演进 (LTE) 系统、高级 LTE(LTE-A) 系统和 3GPP2 系统的无线接入系统中的至少一个公开的标准文献支持。具体地，在本发明的实施例中没有描述以清楚展现本发明的技术理念的步骤或者部分可以由以上的文献支持。在此处使用的所有术语可以由上面提及的文献的至少一个支持。

[0049] 本发明的以下实施例能够适用于各种无线接入技术，例如，CDMA（码分多址）、FDMA（频分多址）、TDMA（时分多址）、OFDMA（正交频分多址）、SC-FDMA（单个载波频分多址）等等。CDMA 可以通过无线（或者无线电）技术，诸如，UTRA（通用陆上无线电接入）或者 CDMA2000 来实现。TDMA 可以通过无线（或者无线电）技术实现，诸如 GSM（全球数字移动电话系统）/GPRS（通用分组无线电服务）/EDGE（用于 GSM 演进的增强数据速率）来实现。OFDMA 可以通过无线（或者无线电）技术，诸如电气与电子工程师协会 (IEEE)802.11(Wi-Fi)、IEEE 802.16(WiMAX)、IEEE 802-20 和 E-UTRA（演进的 UTRA) 来实

现。为了清楚，以下的描述主要地集中于 IEEE 802.11 系统。然而，本发明的技术特征不受限于此。

[0050] WLAN 系统结构

[0051] 图 1 是示例性地示出根据本发明的一个实施例的 IEEE 802.11 系统。

[0052] IEEE 802.11 系统的结构可以包括多个组件。可以通过组件的相互操作来提供对于更高层支持透明的 STA 移动性的 WLAN。基本服务集 (BSS) 可以对应于在 IEEE 802.11 LAN 中的基本组成块。在图 1 中，示出了两个 BSS(BSS1 和 BSS2)，并且在 BSS 的每一个中包括两个 STA(即，STA1 和 STA2 被包括在 BSS1 中，并且 STA3 和 STA4 被包括在 BSS2 中)。在图 1 中指示 BSS 的椭圆形可以被理解为相对应一个的 BSS 中包括的 STA 在其中保持通信的覆盖范围。这个区域可以称为基本服务区域 (BSA)。如果 STA 移动到 BSA 以外，则 STA 无法直接与在相应的 BSA 内的其他 STA 通信。

[0053] 在 IEEE 802.11 LAN 中，最基本型的 BSS 是独立 BSS(IBSS)。例如，IBSS 可以具有仅由两个 STA 组成的最简形式。图 1 的 BSS(BSS1 或者 BSS2)，是最简形式并且其中省略了其他组件，可以对应于 IBSS 的典型示例。当 STA 能够互相直接通信时，上述的配置是可允许的。这种类型的 LAN 没有被预先调度，并且当 LAN 是必要时可以被配置。这可以称为自组织网络。

[0054] 当 STA 接通或者关闭或者 STA 进入或者离开 BSS 区域时，在 BSS 中 STA 的成员可以动态地变化。STA 可以使用同步过程加入 BSS。为了接入 BSS 基础结构的所有服务，STA 应当与 BSS 相关联。这样的关联可以动态地配置，并且可以包括分布系统服务 (DSS) 的使用。

[0055] 图 2 是示出本发明可适用于的 IEEE 802.11 系统的另一个示例性结构的示意图。在图 2 中，诸如分布系统 (DS)、分布系统介质 (DSM) 和接入点 (AP) 的组件被增加给图 1 的结构。

[0056] 在 LAN 中直接 STA 到 STA 距离可能受 PHY 性能的限制。有时候，这样的距离限制可能对于通信是足够的。但是，在其他情况下，经长距离在 STA 之间的通信可能是必要的。DS 可以被配置为支持扩展的覆盖范围。

[0057] DS 指的是 BSS 被相互连接的结构。具体地，BSS 可以被配置为由多个 BSS 组成的扩展形式的网络的组件，替代如图 1 所示的独立的配置。

[0058] DS 是一个逻辑概念，并且可以由 DSM 的特征指定。关于此，无线介质 (WM) 和 DSM 在 IEEE 802.11 中在逻辑上被区分。相应的逻辑介质用于不同的目的，并且由不同的组件使用。在 IEEE 802.11 的定义中，这样的介质不局限于相同的或者不同的介质。IEEE 802.11 LAN 架构 (DS 架构或者其他网络架构) 的灵活性能够被解释为在于多个介质逻辑上是不同的。即，IEEE 802.11 LAN 架构能够不同地实现，并且可以由每种实现的物理特性独立地指定。

[0059] DS 可以通过提供多个 BSS 的无缝集成并且提供操纵到目的地的寻址所必需的逻辑服务来支持移动设备。

[0060] AP 指的是使得相关联的 STA 能够通过 WM 接入 DS 并且具有 STA 功能的实体。数据可以通过 AP 在 BSS 和 DS 之间移动。例如，在图 2 中示出的 STA2 和 STA3 具有 STA 功能，并且提供使相关联的 STA(STA1 和 STA4) 接入 DS 的功能。另外，由于所有 AP 基本上对应于

STA，所以所有 AP 是可寻址的实体。由 AP 用于在 WM 上通信使用的地址不需要始终与由 AP 用于在 DSM 上通信使用的地址相同。

[0061] 从与 AP 相关联的 STA 的一个发送到 AP 的 STA 地址的数据可以始终由不受控制的端口接收，并且可以由 IEEE 802.1X 端口接入实体处理。如果受控制的端口被认证，则传输数据（或者帧）可以被发送到 DS。

[0062] 图 3 是示出本发明可适用于的 IEEE 802.11 系统的又一个示例性结构的示意图。除了图 2 的结构之外，图 3 概念地示出用于提供宽的覆盖范围的扩展的服务集 (ESS)。

[0063] 具有任意大小和复杂度的无线网络可以由 DS 和 BSS 组成。在 IEEE 802.11 系统中，这种类型的网络称为 ESS 网络。ESS 可以对应于连接到一个 DS 的 BSS 集合。但是，ESS 不包括 DS。ESS 网络特征在于 ESS 网络在逻辑链路控制 (LLC) 层中作为 IBSS 网络出现。包括在 ESS 中的 STA 可以互相通信，并且移动 STA 在 LLC 中从一个 BSS 到另一个 BSS（在相同的 ESS 内）透明地可移动。

[0064] 在 IEEE 802.11 中，不假定在图 3 中的 BSS 的任何相对物理位置，并且以下的形式都是可允许的。BSS 可以部分地重叠，并且这种形式通常用于提供连续的覆盖范围。BSS 可以不物理地连接，并且在 BSS 之间的逻辑距离没有限制。BSS 可以位于相同的物理位置，并且这种形式可用于提供冗余。一个或多个 IBSS 或者 ESS 网络可以物理地位于与一个或多个 ESS 网络相同的空间之中。这可以对应于在点对点网络在其中存在 ESS 网络的位置中操作的情形下，在不同组织的 IEEE 802.11 网络物理上重叠的情形下，或者在两个或更多个不同的接入和安全策略在相同的位置中是必要的情形下的 ESS 网络形式。

[0065] 图 4 是示出 WLAN 系统的示例性结构的示意图。在图 4 中，示出包括 DS 的基础结构 BSS 的示例。

[0066] 在图 4 的示例中，BSS1 和 BSS2 构成 ESS。在 WLAN 系统中，STA 是根据 IEEE 802.11 的 MAC/PHY 规则操作的设备。STA 包括 AP STA 和非 AP STA。非 AP STA 对应于由用户直接操纵的设备，诸如膝上计算机或者移动电话。在图 4 中，STA1、STA3 和 STA4 对应于非 AP STA，并且 STA2 和 STA5 对应于 AP STA。

[0067] 在以下描述中，非 AP STA 可以称作终端、无线发送 / 接收单元 (WTRU)、用户设备 (UE)、移动站 (MS)、移动终端，或者移动订户站 (MSS)。在其他无线通信领域中，AP 是对应于基站 (BS)、节点 B、演进的节点 B(e-NB)、基站收发器系统 (BTS) 或者毫微微 BS 的概念。

[0068] 层结构

[0069] 在 WLAN 系统中，从层结构的观点可以描述本发明中的 AP 和 / 或 STA 的操作。通过处理器可以实现在装置配置方面的层结构。AP 或者 STA 可以具有多个层结构。例如，802.11 标准说明书主要处理数据链路层 (DLL) 和物理 (PHY) 层的介质接入控制 (MAC) 子层。PHY 层可以包括物理层会聚协议 (PLCP) 实体和物理介质独立 (PMD) 实体。MAC 子层和 PHY 层两者在概念上包括关联实体，分别称为 MAC 子层管理实体 (MLME) 和 PHY 层管理实体 (PLME)。这些实体提供层管理服务接口，通过其可以调用层管理功能。

[0070] 为了提供正确的 MAC 操作，在 AP 和 STA 的每一个内存在站管理实体 (SME)。SME 是可以被视为存在于单独的管理面中或者被视为远离侧面的层独立实体。没有详细地描述 SME 的精确的功能，但是通常此实体可以被视为负责诸如从各种层管理实体 (LME) 收集关于层独立的状态的信息并且类似地设置层特定的参数的值的功能。SME 通常可以执行代表

一般系统管理实体的这样的功能并且可以实现标准管理协议。

[0071] 前述的实体以各种方式相互作用。例如，实体可以通过交换 GET/SET 基元相互作用。XX-GET.request 基元被用于请求给定的 MIB 属性的值（基于管理信息的属性信息）。如果状态被设置＝“成功”则 XX-GET.confirm 基元返回适当的 MIB 属性值并且否则，返回状态字段中的错误指示。XX-SET.request 基元被用于请求被设置为给定值的被指示的 MIB 属性。如果 MIB 属性意味着特定的动作，则此请求可以执行动作。如果状态被设置＝“成功”，则 XX-SET.confirm 基元确认被指示的 MIB 属性已经被设置为被请求的值，并且否则，XX-SET.confirm 基元返回到状态字段中的错误条件。如果 MIB 属性意味着特定的动作，则此确认动作已经被执行。

[0072] MLME 和 SME 可以经由 MLME_SAP（服务接入点）交换各种基元 MLME_GET/SET 基元。另外，经由 PLME_SAP 在 PLME 和 SME 之间并且经由 MLME-PLME_SAP 在 MLME 和 PLME 之间可以交换各种 PLMEM_GET/SET 基元。

[0073] 链路设定过程

[0074] 图 5 是解释根据本发明的示例性实施例的一般的链路设定过程的流程图。

[0075] 为了允许 STA 在网络上建立链路设定以及通过网络发送 / 接收数据，STA 必须通过网络发现、认证和关联的过程执行这样的链路设定，并且必须建立关联并且执行安全认证。链路设定过程也可以称为会话启动过程或者会话设定过程。此外，关联步骤是用于链路设定过程的发现、认证、关联和安全设定步骤的通用术语。

[0076] 参考图 5 描述示例性链路设定过程。

[0077] 在步骤 S510 中，STA 可以执行网络发现动作。网络发现动作可以包括 STA 扫描动作。即，STA 必须搜索可用的网络以便接入网络。STA 必须在参与无线网络之前识别兼容的网络。在此处，对于识别在特定区域中包含的网络的过程称为扫描过程。

[0078] 扫描方案被划分为主动扫描和被动扫描。

[0079] 图 5 图示包括主动扫描过程的网络发现动作的流程图。在主动扫描的情况下，配置为执行扫描的 STA 发送探测请求帧，并且等待对探测请求帧的响应，使得 STA 能够在信道之间移动并且同时能够确定在外围区域之中存在哪个 AP（接入点）。响应者将用作对探测请求帧的响应的探测响应帧发送给已经发送探测请求帧的 STA。在这样的情况下，响应者可以是在扫描的信道的 BSS 中最后已经发送信标帧的 STA。在 BSS 中，由于 AP 发送信标帧，所以 AP 作为响应者进行操作。在 IBSS 中，因为 IBSS 的 STA 顺序地发送信标帧，所以响应者不是恒定的。例如，已经在信道 #1 发送探测请求帧并且已经在信道 #1 接收探测响应帧的 STA，存储包含在接收的探测响应帧中的 BSS 相关信息，并且移动到下一个信道（例如，信道 #2），使得 STA 可以使用相同的方法执行扫描（即，在信道 #2 处的探测请求 / 响应的发送 / 接收）。

[0080] 虽然在图 5 中未示出，但是也可以使用被动扫描执行扫描动作。配置为以被动扫描模式执行扫描的 STA 等待信标帧，同时从一个信道移动到另一个信道。该信标帧，是在 IEEE 802.11 中管理帧的一个，指示无线网络的存在，使得执行扫描的 STA 能够搜索无线网络，并且以 STA 能够参与无线网络的方式被周期地发送。在 BSS 中，AP 被配置为周期地发送信标帧。在 IBSS 中，IBSS 的 STA 被配置为顺序地发送信标帧。如果用于扫描的每个 TA 接收信标帧，则 STA 存储被包含在信标帧中 BSS 信息，并且移动到另一个信道，并且在每个

信道上记录信标帧信息。已经接收信标帧的 STA 存储包含在接收的信标帧中的 BSS 相关联的信息，移动到下一个信道，并且从而使用相同的方法执行扫描。

[0081] 在主动扫描和被动扫描之间比较，就延迟和功率消耗而言，主动扫描比被动扫描更加有利。

[0082] 在 STA 发现网络之后，STA 可以在步骤 S520 中执行认证过程。此认证过程可以称为第一认证过程，以此这样的方式该认证过程能够与步骤 S540 的安全设定过程清楚地区分。

[0083] 认证过程可以包括通过 STA 发送认证请求帧给 AP，并且通过 AP 响应于认证请求帧而发送认证响应帧给 STA。用于认证请求 / 响应的认证帧可以对应于管理帧。

[0084] 认证帧可以包括认证算法编号、认证交易序列号、状态码、挑战文本、稳健安全网络 (RSN)、有限循环群等等的信息。在认证帧中包含的在上面提及的信息可以对应于能够被包含在认证请求 / 响应帧中信息的一些部分，可以替换为其他信息，或者可以包括附加信息。

[0085] STA 可以发送认证请求帧给 AP。AP 可以基于在接收的认证请求帧中包含的信息决定是否认证相应的 STA。AP 可以通过认证响应帧提供认证结果给 STA。

[0086] 在 STA 已经被成功认证之后，可以在步骤 S630 中执行关联过程。关联过程可以涉及通过 STA 发送关联请求帧给 AP，并且响应于关联请求帧通过 AP 发送关联响应帧给 STA。

[0087] 例如，关联请求帧可以包括与各种能力、信标收听间隔、服务集标识符 (SSID)、支持速率、支持信道、RSN、移动域、支持的操作类别、TIM( 业务指示映射 ) 广播请求、交互工作服务能力等等相关联的信息。

[0088] 例如，关联响应帧可以包括与各种能力、状态码、关联 ID(AID)、支持速率、增强的分布信道接入 (EDCA) 参数集、接收的信道功率指标 (RCPI)、接收的信号对噪声指标 (RSNI)、移动域、超时间隔 ( 关联回复时间 )、重叠 BSS 扫描参数、TIM 广播响应、QoS 映射等等相关联的信息。

[0089] 上面提到的信息，可以对应于能够被包含在关联请求 / 响应帧中的信息的某些部分，可以以其他信息替换，或者可以包括附加信息。

[0090] 在 STA 已经被成功地与网络关联之后，可以在步骤 S540 中执行安全设定过程。步骤 S540 的安全设定过程可以称为基于稳健安全网络关联 (RSNA) 请求 / 响应的认证过程。步骤 S520 的认证过程可以称为第一认证过程，并且步骤 S540 的安全设定过程可以简称为认证过程。

[0091] 例如，步骤 S540 的安全设定过程可以包括基于在 LAN 帧上的可扩展认证协议 (EAPOL) 通过 4 路握手的私钥设定过程。此外，该安全设定过程也可以根据未在 IEEE 802.11 标准中定义的其他安全方案实现。

[0092] WLAN 演进

[0093] 为了避免在 WLAN 通信速度方面的限制，IEEE 802.11n 近来已经作为通信标准被建立。IEEE 802.11n 目的在于提高网络速度和可靠性以及扩展无线网络的覆盖区域。更加详细地，IEEE 802.11n 支持最多 540Mbps 的高吞吐量 (HT)，并且基于多个天线被安装到发射器和接收器中的每一个中的 MIMO 技术。

[0094] 随着 WLAN 技术的广泛使用和 WLAN 应用的多样化，需要开发能够支持比由 IEEE

802.11n 支持的数据处理速率更高的高吞吐量 (HT) 的新 WLAN 系统。用于支持非常高吞吐量 (VHT) 的下一代 WLAN 系统是 IEEE 802.11n WLAN 系统的下一个版本 ( 例如，IEEE 802.11ac)，并且是近来提出的在 MAC SAP( 媒介接入控制服务接入点 ) 处支持 1Gbps 以上的数据处理速度的 IEEE 802.11 WLAN 系统的一个。

[0095] 为了有效率地利用射频 (RF) 信道，下一代 WLAN 系统支持其中多个 STA 能够同时接入信道的 MU-MIMO( 多用户多输入多输出 ) 传输。根据 MU-MIMO 传输方案，AP 可以同时发送分组给至少一个 MIMO 配对的 STA。

[0096] 此外，近来已经论述了用于在白空间中支持 WLAN 系统操作的技术。例如，已经在 IEEE 802.11af 标准下论述用于在诸如由于到数字 TV 的转变而留下的空闲频带 ( 例如，54 ～ 698MHz 带 ) 的白空间 (TV WS) 中引入 WLAN 系统的技术。但是，仅为了说明性目的公开在上面提及的信息，并且白空间可以是能够主要地仅由许可用户使用的许可带。许可用户可以是具有权限使用许可带的用户，并且也可以称为许可设备、主用户、现任用户等等。

[0097] 例如，在白空间 (WS) 中操作的 AP 和 / 或 STA 必须提供用于保护许可用户的功能。例如，假定在诸如麦克风的许可用户以占用 WS 带的特定带宽的方式已经使用按规定划分的频带的特定的 WS 信道，AP 和 / 或 STA 不能够使用与相应的 WS 信道相对应的频带以便保护许可用户。此外，在许可用户使用被用于当前帧的传输和 / 或接收的频带的条件下，AP 和 / 或 STA 必须停止使用相应的频带。

[0098] 因此，AP 和 / 或 STA 必须确定是否使用 WS 带的特定的频带。换言之，AP 和 / 或 STA 必须确定频道中现任用户或者许可用户的存在或者不存在。用于在特定频带中确定现任用户的存在或者不存在的方案被称为频谱感测方案。能量检测方案、签名检测方案等等可以被用作频谱感测机制。如果接收信号的强度超过预定值，或者当检测到 DTV 前导时，AP 和 / 或 STA 可以确定现任用户正在使用该频带。

[0099] M2M( 机器对机器 ) 通信技术已经作为下一代通信技术被论述。在 IEEE 802.11 WLAN 系统中用于支持 M2M 通信的技术标准已经被发展成 IEEE 802.11ah。M2M 通信指的是包括一个或多个机器的通信方案，或者也可以称为机器型通信 (MTC) 或者机器对机器 (M2M) 通信。在这样的情况下，机器可以是不要求用户的直接操纵和干涉的实体。例如，不仅包括 RF 模块的测量计或者售货机，而且能够在没有用户干涉 / 处理的情况下通过自动接入网络执行通信的用户设备 (UE)( 诸如智能电话 )，可以是这样的机器的示例。M2M 通信可以包括设备对设备 (D2D) 通信、以及在设备与应用服务器之间的通信等等。作为在设备与应用服务器之间的通信的示例，存在在售货机和应用服务器之间的通信，在销售点 (POS) 设备和应用服务器之间的通信，以及在电表、煤气表或者水表与应用服务器之间通信。基于 M2M 通信的应用可以包括安全、运输、医疗等等。在考虑到在上面提到的应用示例的情况下，M2M 通信必须支持在包括大量设备的环境下有时候以低速度发送 / 接收少量的数据的方法。

[0100] 更加详细地，M2M 通信必须支持大量的 STA。虽然当前的 WLAN 系统假设一个 AP 与最多 2007 个 STA 相关联，但是在 M2M 通信中最近已经论述了用于支持其中更多的 STA( 例如，大约 6000 个 STA) 与一个 AP 相关联的其他情形的各种方法。此外，所期待的是，用于支持 / 请求低传送速率的许多应用存在于 M2M 通信中。为了平滑地支持许多 STA，WLAN 系统可以基于 TIM( 业务指示映射 ) 识别要向 STA 发送的数据的存在与否，并且最近已经论述了用于减小 TIM 的位图大小的各种方法。此外，所期待的是，具有非常长的发送 / 接收间隔的

很多业务数据存在于M2M通信中。例如，在M2M通信中，非常少量的数据（例如，电/气/水计量）需要以长的间隔（例如，每月）发送。因此，尽管在WLAN系统中与一个AP相关联的STA的数目增加，但是许多的开发者和公司对能够有效率地支持存在其每一个具有在一个信标时段期间要从AP接收的数据帧的非常少量的STA的情况的WLAN系统进行深入研究。

[0101] 如上所述，WLAN技术正在迅速地发展，并且不仅在上面提到的示例性技术，而且诸如直接链路设定、介质流吞吐量的改进、高速和/或大规模的初始会话设定的支持、以及扩展带宽和工作频率的支持的其他技术正在深入地发展中。

[0102] 介质接入机制

[0103] 在基于IEEE 802.11的WLAN系统中，MAC(介质接入控制)的基本接入机制是具有冲突避免(CSMA/CA)机制的载波监听多址接入。CSMA/CA机制，也称为IEEE 802.11 MAC的分布协调功能(DCF)，并且基本上包括“先听后讲”接入机制。根据在上面提及的接入机制，在数据传输之前，AP和/或STA可以在预先确定的时间间隔期间(例如，DCF帧间间隔(DIFS))执行用于感测RF信道或者介质的空闲信道评估(CCA)。如果确定介质是处于空闲状态，则通过相应的介质的帧传输开始。另一方面，如果确定介质处于占用状态，则相应的AP和/或STA没有开始其自己的传输，建立用于介质接入的延迟时间(例如，随机退避时段)，并且等待预定时间之后尝试开始帧传输。通过随机退避时段的应用，所期待的是，在等待不同的时间之后，多个STA将尝试开始帧传输，导致将冲突降到最小。

[0104] 此外，IEEE 802.11 MAC协议提供混合协调功能(HCF)。HCF基于DCF和点协调功能(PCF)。PCF指的是基于轮询的同步接入方案，其中以所有接收(Rx)AP和/或STA能够接收数据帧的方式执行定期的轮询。此外，HCF包括增强的分布信道接入(EDCA)和HCF控制的信道接入(HCCA)。当由提供商提供给多个用户的接入方案是以竞争为基础时实现EDCA。基于轮询机制，通过基于无竞争信道接入方案实现HCCA。此外，HCF包括用于改善WLAN的服务质量(QoS)的介质接入机制，并且可以在竞争时段(CP)和无竞争时段(CFP)两者中发送QoS数据。

[0105] 图6是图示退避过程的概念图。

[0106] 在下文中将会参考图6描述基于随机退避时段的操作。如果占用或者忙碌状态的介质转换为空闲状态，则STA可以尝试发送数据(或者帧)。作为用于实现最小数目的冲突的方法，每个STA选择随机退避计数，等待对应于选择的退避计数的时隙时间，并且然后尝试开始数据传输。随机退避计数是伪随机整数，并且可以被设置为0至CW值中的一个。在这样的情况下，CW指的是竞争窗口参数值。虽然通过CWmin表示CW参数的初始值，在传输失败的情况下(例如，在没有接收到传输帧的ACK的情况下)初始值可以被加倍。如果通过CWmax表示CW参数值，则维持CWmax直至数据传输成功，并且同时能够尝试开始数据传输。如果数据传输成功，则CW参数值被重置为CWmin。优选地，CW、CWmin和CWmax被设置为$2^n-1$(这里n＝0、1、2、…)。

[0107] 如果随机退避过程开始操作，则STA连续地监测介质，同时响应于决定的退避计数值递减计数退避时隙。如果介质被监测为占用状态，则停止递减计数并且等待预定的时间。如果介质处于空闲状态，则剩余的递减计数重置。

[0108] 如在图6的示例中所示，如果发送到STA3的MAC的分组到达STA3，则STA3确认在DIFS期间该介质处于空闲状态中，并且可以直接开始帧传输。同时，剩余的STA监测是否介

质处于忙碌状态中，并且等待预定的时间。在预定的时间期间，要发送的数据可能在 STA1、STA2 和 STA5 的每一个中出现。如果介质处于空闲状态中，则每个 STA 等待 DIFS 时间，并且然后响应于由每个 STA 选择的随机退避计数值执行退避时隙的递减计数。图 6 的示例示出，STA2 选择最低的退避计数值，并且 STA1 选择最高的退避计数值。即，在 STA2 完成退避计数之后，在帧传输开始时间 STA5 的残留退避时间比 STA1 的残留退避时间短。当 STA2 占用介质时 STA1 和 STA5 中的每一个临时地停止递减计数，并且等待预定的时间。如果 STA2 的占用完成，并且介质返回到空闲状态，则 STA1 和 STA5 中的每一个等待预定的时间 DIFS，并且重新开始退避计数。即，在残留退避时隙之后，只要残留退避时间被递减计数，则帧传输可以开始操作。因为 STA5 的残留退避时间比 STA1 的更短，所以 STA5 开始帧传输。同时，在 STA2 占用介质时，要发送的数据可能出现在 STA4 中。在这样的情况下，当介质处于空闲状态时，STA4 等待 DIFS 时间，响应于由 STA4 选择的随机退避计数值执行递减计数，然后开始帧传输。图 6 示例性地示出 STA5 的残留退避时间偶然与 STA4 选择的随机退避计数值相同的情况。在这样的情况下，可能在 STA4 和 STA5 之间出现不可期待的冲突。如果冲突在 STA4 和 STA5 之间出现，则 STA4 和 STA5 中的每一个没有接收 ACK，导致数据传输失败的发生。在这样的情况下，STA4 和 STA5 中的每一个增加 CW 值到两倍，并且 STA4 或者 STA5 可以选择随机退避计数值，并且然后执行递减计数。同时，当由于 STA4 和 STA5 的传输导致介质处于占用状态时，STA1 等待预定的时间。在这样的情况下，如果介质返回到空闲状态，则 STA1 等待 DIFS 时间，并且然后在残留退避时间的经过之后开始帧传输。

[0109] STA 感测操作

[0110] 如上所述，CSMA/CA 机制不仅包括 AP 和 / 或 STA 能够直接地感测介质的物理载波感测介质，而且包括虚拟载波感测机制。虚拟载波感测机制能够解决在介质接入中遇到的一些问题（诸如隐藏节点问题）。对于虚拟载波感测，WLAN 系统的 MAC 能够利用网络分配矢量 (NAV)。更加详细地，借助于 NAV 值，其中的每一个当前使用介质或者具有使用介质权限的 AP 和 / 或 STA，可以向另一 AP 和 / 或另一 STA 通知介质可用的剩余时间。因此，NAV 值可以对应于其中介质将由被配置成发送相对应帧的 AP 和 / 或 STA 使用的预留的时段。已经接收到 NAV 值的 STA 可以在相应的预留的时段期间禁止介质接入（或信道接入）。例如，NAV 可以根据帧的 MAC 报头的“持续时间”字段的值来设置。

[0111] 稳健冲突检测机制已经被提出以降低这样的冲突的概率，并且将会参考图 7 和 8 描述其详细描述。尽管实际的载波感测范围不同于传输范围，但是为了描述方便并且更好地理解本发明假定实际感测范围与传输范围相同。

[0112] 图 7 是图示隐藏节点和暴露节点的概念图。

[0113] 图 7(a) 示例性地示出隐藏节点。在图 7(a) 中，STA A 与 STA B 通信，并且 STA C 具有要发送的信息。在图 7(a) 中，在 STA A 将信息发送到 STA B 的条件下，当在数据被发送到 STA B 之前执行载波感测时，STA C 可以确定介质处于空闲状态中。因为在 STA C 的位置处不可以检测到 STA A（即，占用介质）的传输，所以确定介质是处于空闲状态下。在这样的情况下，STA B 同时接收 STA A 的信息和 STA C 的信息，导致冲突的发生。在此，STA A 可以被认为是 STA C 的隐藏节点。

[0114] 图 7(b) 示例性地示出暴露节点。在图 7(b) 中，在 STA B 将数据发送给 STA A 的条件下，STA C 具有要发送到 STA D 的信息。如果 STA C 执行载波感测，可以确定由于 STA

B 的传输导致介质被占用。因此，虽然 STA C 具有要发送到 STA D 的信息，但是感测到介质占用的状态，使得 STA C 必须等待预定的时间（即，待机模式）直到介质处于空闲状态。然而，因为 STA A 实际上位于 STA C 的传输范围之外，所以从 STA A 的观点来看，来自 STA C 的传输可能不与来自 STA B 的传输冲突，使得 STA C 没有必要进入待机模式直到 STA B 停止传输。在这里，STA C 被称为 STA B 的暴露节点。

[0115] 图 8 是图示 RTS（请求发送）和 CTS（清除发送）的概念视图。

[0116] 为了在上面提及的图 7 的情形下有效率地利用冲突避免机制，能够使用短信令分组，诸如 RTS（请求发送）和 CTS（清除发送）。可以通过外围 STA 旁听在两个 STA 之间的 RTS/CTS，使得外围 STA 可以考虑信息是否在两个 STA 之间通信。例如，如果要被用于数据传输的 STA 将 RTS 帧发送到已经接收数据的 STA，则已经接收数据的 STA 将 CTS 帧发送给外围 STA，并且可以通知外围 STA 该 STA 将要接收数据。

[0117] 图 8(a) 示例性地示出用于解决隐藏节点问题的方法。在图 8(a) 中，假定 STA A 和 STA C 的每一个准备将数据发送给 STA B。如果 STA A 将 RTS 发送给 STA B，则 STA B 将 CTS 发送给位于 STA B 附近的 STA A 和 STA C 中的每一个。结果，STA C 必须等待预定的时间直到 STA A 和 STA B 停止数据传输，使得防止冲突发生。

[0118] 图 8(b) 示例性地示出用于解决暴露节点的问题的方法。STA C 执行在 STA A 和 STA B 之间的 RTS/CTS 传输的旁听，使得 STA C 可以确定没有冲突，尽管其将数据发送给另一个 STA（例如，STA D）。即，STA 将 RTS 发送给所有外围 STA，并且仅具有要被实际发送的数据的 STA A 能够发送 CTS。STA C 仅接收 RTS 并且不接收 STA A 的 CTS，使得能够识别 STA A 位于 STA C 的载波感测范围的外部。

[0119] 帧结构

[0120] 图 9 是用于解释在 IEEE 802.11 系统中使用的示例性帧结构的图。

[0121] 物理层会聚协议 (PLCP) 分组数据单元 (PPDU) 帧格式可以包括短训练字段 (STF)、长训练字段 (LTF)、信号 (SIG) 字段、以及数据 (DATA) 字段。最基本的（例如，非高吞吐量 (HT)）PPDU 帧格式可以仅包括传统 STF(L-STF) 字段、传统 LTF(L-LTF) 字段、SIG 字段、以及 DATA 字段。根据 PPDU 帧格式类型（例如，HT 混合格式 PPDU、HT 未开发格式 PPDU、非常高吞吐量 (VHT)PPDU 等等），附加的（或者另一类型的）STE、LTF、以及 SIG 字段可以被包括在 SIG 字段和 DATA 字段之间。

[0122] STF 是用于信号检测、自动增益控制 (AGC)、分集选择、精确的时间同步等等的信号的字段。LTF 是用于信道估计、频率误差估计等等的信号的字段。STF 和 LTF 两者可以被称为 PCLP 前导。PLCP 前导可以是用于 OFDM 物理层同步和信道估计的信号。

[0123] SIG 字段可以包括速率字段和长度字段。速率字段可以包括关于数据调制方案和编码速率的信息。长度字段可以包括关于数据长度的信息。另外，SIG 字段可以进一步包括奇偶字段、SIG 尾部比特等等。

[0124] 数据字段可以包括服务字段、PLCP 服务数据单元 (PSDU)、以及 PPDU 尾部比特并且必要时可以进一步包括填充 (PAD) 比特。服务字段中的一些比特可以被用于在接收器中的解扰器的同步。PSDU 可以对应于在 MAC 层中定义的 MAC 分组数据单元 (PDU)，并且包括在较高层中产生 / 使用的数据。PPDU 尾部比特可以被用于将编码器返回到 0 的状态。PAD 比特可以被用于将数据字段的长度调节成预定的单元。

[0125] MAC 报头可以包括帧控制字段、持续时间 /ID 字段、地址字段等。帧控制字段可以包括对于帧发送 / 接收所必需的控制信息。持续时间 /ID 字段可以被设置为用于发送相应的帧的时间。对于 MAC 报头的序列控制、QoS 控制和 HT 控制子字段的详细描述，参考 IEEE 802.11-1012 标准规范。

[0126] MAC 报头的帧控制字段可以包括协议版本类型、子类型、到 DS、来自 DS、更多分段、重试、功率管理、更多数据、以及保护的帧顺序子字段。对于帧控制字段和帧控制字段的子字段的描述，参考 IEEE 802.11-1012 标准规范。

[0127] 同时，空数据分组 (NDP) 帧格式指的是不包括数据分组的帧格式。即，NDP 帧仅包括正常的 PPDU 格式的 PLCP 报头（即，STF、LTF、以及 SIG 字段），并且不包括其他部分（即，数据字段）。NDP 帧格式也可以被称为短帧格式。

[0128] S1G 帧格式

[0129] 为了支持诸如 M2M、物联网 (IoT)、智能电网等等的应用，要求低功率通信。为此，在 1GHz 或者更低（子 1GHz ;S1G)（例如，902 至 928MHz) 的频带中使用 1MHz/2MHz/4MHz/8MHz/16MHz 的信道带宽的通信协议正在讨论中。

[0130] 对于 S1G PPDU 定义了三种类型的格式，在大于或者等于 2MHz 的 S1G 的带宽中使用的短格式、在大于或者等于 2MHz 的 S1G 的带宽中使用的长格式、以及在 S1G 1MHz 的带宽中使用的格式。

[0131] 图 10 是示出 S1G 1MHz 格式的图。

[0132] S1G 1MHz 格式可以被用于 1MHz PPDU 单用户 (SU) 传输。

[0133] 像通过 IEEE 802.11n 定义的未开发字段格式一样，在图 10 中图示的 S1G 1MHz 格式包括 STF、LTF1、SIG、LTF2-LTFN$_{LTF}$以及数据字段。然而，与未开发字段格式相比较，S1G 1MHz 格式的前导部分的传输时间通过重复增加了两倍或者更多倍。

[0134] 虽然图 10 的 STF 字段具有与 2MHz 或者以上的带宽中的 PPDU 的 STF(2 符号长度）相同的周期性，但是 STF 字段在时间上被重复两次 (rep2) 并且因此具有 4 符号长度（例如，160 μs)。因此可以应用 3-dB 功率升高。

[0135] 图 10 的 LTF1 字段被设计为与频域中的 2MHz 或者以上的带宽中的 PPDU 的 LTF1 字段（具有 2 符号长度）正交并且在时间上可以被重复两次以具有 4 符号长度。LTF1 字段可以包括双保护间隔 (DGI)、长训练序列 (LTS)、LTS、保护间隔 (GI)、LTS、GI 以及 LTS 子字段。

[0136] 图 15 的 SIG 字段可以被重复地编码。最低的调制和编译方案 (MCS)（即，二进制相移键控 (BPSK)) 和重复编译 (rep2) 可以被应用于 SIG 字段。SIG 字段可以被配置成具有 1/2 的比率并且被定义为 6 个符号的长度。

[0137] 在 MIMO 的情况下，可以包括图 10 的 LTF2 至 LTFN$_{LTF}$字段。每个 LTF 字段可以是一个符号长。

[0138] 在图 10 中的 1-MHz PPDU 的前导格式中，STF、LTEF1、SIG 以及 LTF2-LTFN$_{LTF}$字段对应于在每个方向中发送的全部分 (omni portion) 并且在没有波束形成的情况下发送使得所有的 STA 可以接收字段。

[0139] 图 11 图示大于或者等于 2MHz 的 S1G 的示例性的短格式。

[0140] 大于或者等于 2MHz 的 S1G 的短格式可以被用于 2MHz、4MHz、8MHz 或者 16MHz 的

PPDU 中的 SU 传输。

[0141] 图 11 的 STF 字段可以具有 2 个符号的长度。

[0142] 图 11 的 LTF1 字段可以具有 2 个符号的长度，并且包括 DGI、LTS 以及 LTS。

[0143] 图 11 的 SIG 字段可以被经历正交 PSK(QPSK)、BPSK 等等作为 MCS。

[0144] 图 11 的 LTF2 至 $LTFN_{LTF}$字段中的每一个可以具有一个符号的长度。

[0145] 图 12 图示大于或者等于 2MHz 的 S1G 的示例性长格式。

[0146] 等于或者大于 2MHz 的 S1G 的长格式可以被用于 2MHz、4MHz、8MHz、或者 16MHz 中的 MU 传输和 SU 波束形成的传输。大于或者等于 2MHz 的 S1G 的长格式可以包括在全向中发送的全部分使得所有的 STA 可以接收经历波束形成的格式和数据部分使得特定的 STA 可以接收格式。

[0147] 在大于或者等于 2MHz 的长格式的 SIG 中，全部分可以包括 STF、LTF1 以及信号 A(SIG-A) 字段。

[0148] 图 12 的 STF 字段可以具有 2 个符号的长度。

[0149] 图 12 的 LTF1 字段可以具有 2 个符号的长度并且包括 DGI、LTS 以及 LTS。

[0150] 图 12 的 SIG-A 字段可以被经历 QPSK、BPSK 等等作为 MCS 并且具有 2 个符号的长度。

[0151] 在大于或者等于 2MHz 的长格式的 SIG 中，数据部分可以包括用于数据的短训练字段 (D-STF)、用于数据的长训练字段 (D-LTF)、信号 -B(SIF-B) 以及数据字段。在图 12 的 PPDU 格式中的数据部分可以被称为 MU 部分。在此意义上，D-STF 可以被称为 MU-STF 并且 D-LTF 可以被称为 MU-LTF。

[0152] 图 12 的 D-STF 字段可以具有 1 个符号的长度。

[0153] 图 12 的 D-LTF 字段的每个子字段，即，D-LTF1 至 $D\text{-}LTFN_{LTF}$中的每一个可以具有 1 个符号的长度。

[0154] 图 12 的 SIG-B 字段可以具有 1 个符号的长度。

[0155] 现在将会更加详细地描述如上所述的大于或者等于 2MHz 的 SIG 的前导格式的每个字段。

[0156] 在全部分中，相对于各个子载波可以发送 STF、STF1 以及 SIG-A 字段作为单个流。这可以被如下地指示。

[0157] [ 等式 1]

[0158] $$[\mathbf{x}_k]_{N_{TX}\times 1} = [\mathbf{Q}_k]_{N_{TX}\times 1} d_k$$

[0159] 在等式 1 中，k 表示子载波（或者音调）索引，$x_k$表示在子载波 k 中发送的信号，$N_{TX}$表示传输天线的数目，$Q_k$表示用于编码（例如，空间映射）在子载波 k 中发送的信号的列矢量，并且 $d_k$表示输入到编码器的数据。在等式 1 中，在时域中的循环移位延迟 (CSD) 可以被应用于 $Q_k$。时域中的 CSD 指示频域中的相位旋转或者相位移位。因此，$Q_k$可以包括通过时域中的 CSD 产生的音调 k 中的相位移位值。

[0160] 当如在图 12 中图示的帧格式被使用时，通过所有的 STA 可以接收 STF、LTF-1 以及 SIG-A 字段并且 STA 中的每一个可以基于 STF 和 LTF1 字段通过信道估计解码 SIG-A 字段。

[0161] SIG-A 字段可以包括关于长度 / 持续时间、信道带宽、空间流的数目等等的信息。

SIG-A 字段具有两个 OFDM 符号的长度。一个 OFDM 符号使用与 48 个数据音调有关的 BPSK 调制，并且因此 24 个比特的信息可以在一个 OFDM 符号上被承载。然后，SIG-A 字段可以包括 48 比特信息。

[0162] 下面的 [ 表 1] 示出用于 SU 帧和 MU 帧中的每一个的 SIG-A 字段的示例性比特分配。

[0163] [ 表 1]

[0164]

| | SU | MU |
|---|---|---|
| SU/MU 指示 | 1 | 1 |
| 长度 / 持续时间 | 9 | 9 |
| MCS | 4 | |
| BW | 2 | 2 |
| 聚合 | 1 | |
| STBC | 1 | 1 |
| 编译 | 2 | 5 |
| SG1 | 1 | 1 |
| GID | | 6 |
| Nsts | 2 | 8 |
| PAID | 9 | |
| ACK 指示 | 2 | 2 |
| 保留 | 3 | 3 |
| CRC | 4 | 4 |
| 尾部 | 6 | 6 |
| 总共 | 48 | 48 |

[0165] 在表 1 中，SU/MU 指示字段被用于在 SU 帧格式与 MU 帧格式之间进行区分。

[0166] 长度 / 持续时间字段指示帧的 OFDM 符号的数目（即，持续时间）或者字节的数目（即，长度）。在 SU 帧中，当聚合字段的值是 1 时，长度 / 持续时间字段被解释为持续时间字段。同时，当聚合字段的值是 0 时，长度 / 持续时间字段被解释为长度字段。在 MU 帧中，因为聚合字段没有被定义，并且 MU 帧被配置成始终应用聚合，所以长度 / 持续时间字段被

解释为持续时间字段。

[0167] MCS 字段指示用于 PSDU 传输的 MCS。仅在 SU 帧中通过 SIG-A 字段发送 MCS 字段。如果其他 STA(即,与两个 STA 之间的传输和接收不直接关联的第三方 STA(即,第三方 STA(也被称为第三 STA) 接收 SU 帧,则可以基于长度 / 持续时间字段的长度值和 MCS 字段的值计算当前接收到的 SU 帧(即,其中聚合字段被设置为 0 的 SU 波束形成的帧)的持续时间。同时,MCS 帧的 MCS 字段没有被包括在 SIG-A 字段中而在承载用户特定的信息的 SIG-B 字段中,并且 MCS 可以被独立地应用于每个用户。

[0168] BW 字段指示发送的 SU 帧或者 MU 帧的信道带宽。例如,BW 字段可以被设置为指示 2MHz、4MHz、8MHz、16MHz 以及 8+8MHz 中的一个的值。

[0169] 聚合字段指示是否以聚合 MAC PDU(即,A-MPDU) 的形式聚合 PSDU。如果聚合字段被设置为 1,则这指示 PSDU 被以 A-MPDU 的形式聚合并且发送。如果聚合字段被设置为 0,则这表示在没有聚合的情况下发送 PSDU。在 MU 帧中,因为以 A-MPDU 的形式始终发送 PSDU,则聚合字段不需要被用信号发送并且因此聚合字段没有被包括在 SIG-A 字段中。

[0170] 空间时间块编译 (STBC) 字段指示是否 STBC 被应用于 SU 帧或者 MU 帧。

[0171] 编译字段指示用于 SU 帧或者 MU 帧的编译方案。二进制卷积编译 (BCC) 方案或者低密度奇偶检验 (LDPC) 方案可以被用于 SU 帧。另一方面,可以应用每个用户的独立的编译方案并且,为了支持此方案,编译字段可以通过 2 个或者更多个比特的大小来定义。

[0172] 短保护间隔 (SGI) 字段指示是否 SGI 被用于 SU 帧或者 MU 帧的 PSDU 传输。如果 SGI 被用于 MU 帧,则这可以指示 SGI 被共同地应用于属于 MU-MIMO 组的所有用户。

[0173] 组标识符 (GID) 字段指示在 MU 帧中的 MU 组信息。在 SU 帧中,因为不需要定义用户组,所以 GID 字段没有被包括在 SIG-A 字段中。

[0174] 时 / 空流的数目 (Nsts) 字段指示在 SU 帧或者 MU 帧中的空间流的数目。在 MU 帧中,Nsts 字段指示用于属于 MU 组的每个 STA 的空间流的数目,并且为此,需要八个比特。具体地,一个 MU 组可以包括最多四个用户并且最多四个空间流能够被发送给每个用户。为了正确地支持此,需要八个比特。

[0175] 部分 AID(PAID) 字段指示用于识别 SU 帧中的接收 STA 的 STA ID。在上行链路 (UL) 帧中,PAID 的值可以是由基本服务集 ID(BSSID) 的部分组成。在下行链路 (DL) 帧中,PAID 的值可以被设置为散列 STA 的 AID 的合成值。例如,BSSID 可以具有 48 个比特的长度,AID 可以具有 16 个比特的长度,并且 PAID 可以具有 9 个比特的长度。

[0176] 可替选地,在 UL 帧中,PAID 可以被设置为散列 BSS ID 的一部分的合成值并且,在 DL 帧中,PAID 可以被设置为散列 AID 的部分和 BSSID 的部分的合成值。

[0177] 表 1 的肯定应答 (ACK) 指示字段指示在 SU 帧或者 MU 帧之后发送的 ACK 的类型。例如,如果 ACK 指示字段被设置为 00,则这指示正常的 ACK,并且如果被设置为 01,则这可以指示阻止 ACK。如果 ACK 指示字段被设置为 10,则这可以指示无 ACK。应注意的是,ACK 的类型没有始终受到三种类型的限制并且根据响应帧的属性可以被分类成三种以上的类型。

[0178] 虽然在表 1 中未包括,但是 SIG 字段可以包括用于显式地指示是否相应的帧是 DL 帧或者 UL 帧的 DL/UL 指示字段(例如,一个比特大小)。DL/UL 指示字段仅在 SU 字段中可以定义,并且不可以在 MU 帧中定义使得 MU 帧可以被预先确定以被始终仅用作 DL 帧。可替选地。DL/UL 指示字段可以被包括,不考虑 SU 帧或 MU 帧。

[0179] 同时，如在图 12 中图示的 MU 帧中，SIG-B 字段可以包括用户特定的信息。表 2 示例性地示出 MU 帧中的组成 SIG-B 字段的字段。[ 表 2] 也示例性地示出以 2、4、8 或 16MHz 的带宽映射到 PPDU 的各种参数。

[0180] [ 表 2]

[0181]

| | BW | | | |
|---|---|---|---|---|
| | 2 MHz | 4 MHz | 8 MHz | 16 MHz |
| MCS | 4 | 4 | 4 | 4 |
| 尾部 | 6 | 6 | 6 | 6 |
| CRC | 8 | 8 | 8 | 8 |
| 保留 | 8 | 9 | 11 | 11 |
| 总共 | 26 | 27 | 29 | 29 |

[0182] 在表 2 中，MCS 字段指示以 MU 帧的形式发送到每个用户的 PPDU 的 MCS 值。

[0183] 尾部比特可以被用于将编码器返回到 0 的状态。

[0184] 循环冗余校验 (CRC) 字段可以被用于检测在接收 MU 帧的 STA 中的错误。

[0185] 用于 S1G 直接响应帧的带宽选择方案

[0186] 本发明提出一种在 S1G 频带 ( 例如，902 至 928MHz) 中操作的 WLAN 系统中选择直接响应帧的带宽的方法。

[0187] 当传输 STA 发送控制帧或数据帧并且已经接收数据帧的接收 STA 在短帧间间隔 (SIFS) 后向传输 STA 发送响应帧时，将响应帧称为直接响应帧。

[0188] 将 SIFS 确定为 aRxRFDelay+aRxPLCPDelay+aMACProcessingDelay+aRxTxTurnaroundTimer 的值。aRxRFDelay 指示射频传播延迟，aRxPLCPDelay 指示 PLCP 接收延迟，并且 aMACProcessingDelay 指示用于在 MAC 中事件处理的处理延迟。aRxTxTurnaroundTimer 指示从接收 (Rx) 模式转换为传输 (Tx) 模式所必需的转换时间。

[0189] 直接响应方案可以借助于示例如下地操作。传输 STA 可以发送数据帧，并且已经成功地接收了数据帧的接收 STA 可以在 SIFS 之后发送 ACK 帧。此外，传输 STA 可以发送 RTS 帧，并且接收 STA 可以在 SIFS 之后发送 CTS 帧作为对 RTS 帧的响应。另外，传输 STA 可以发送省电轮询 (PS-Poll) 帧，并且接收 STA 可以在 SIFS 后发送 ACK 帧或者缓冲的数据帧作为对 PS 轮询帧的响应。

[0190] 现在与直接响应方案有关的 ACK 过程将会被具体地描述为示例。

[0191] 图 13 是用于解释 ACK 过程的图。

[0192] 在发送作为响应的要求 ACK 帧的 MPDU 后，STA 等待 ACKTimeout 的间隔。可以基于 aSIFSTime+aSLotTime+aPHY-RX-START-Delay 的值确定 ACKTimeout，并且在 PHY-TXEND.confirm 基元的值处开始。在这样的情况下，SIFSTime 指示当在空中接口上 MAC 层和 PHY 层接收帧的最后符号、处理该帧，以及发送在空中接口上可用的最早的响应帧的第一符号时所要求的正常时间。SlotTime 是在 MAC 层使用的时间单位，以定义点协调函数 (PCF) 帧

间空间 (PIFS) 和 DIFS。aPHY-RX-START-Delay 指示直到当发布 PHY-RXSTART.indication 基元时的时间的延迟时间。PHY-RXSTART.indication 基元是通过其 PHY 层通知本地 MAC 层 PLCP 开始接收具有有效的 PLCP 报头的 PPDU 的基元。

[0193] 在图 13 中，ACKTimeout 被简化为 ACKTimeout = SIFS+ 时隙时间 +PHY-RX-START-Delay。即，ACKTimeout 可以是对于已经接收到数据帧的 STA 的来说在 SIFS 之后发送 ACK 帧所必需的时间并且考虑到时隙时间可以计算。

[0194] 时隙时间被确定为 aCCATime+aRxTxTurnarunTime+aAirPropagationTime+aMACProcessingDelay 的值。aCCATime 指示最大时间，在其期间 STA 能够在每个时隙中接入介质以便根据 CCA 机制确定介质是否处于忙碌状态或者空闲状态。aRxTxTurnaroundTimer 指示从 Rx 模式切换到 Tx 模式所必需的转换时间。aAirPropagationTime 指示当信号通过时隙同步的 STA 当中的最远的可用的 STA 信号被传播到最大距离时所消耗的时间的双倍时间。aMACProcessingDelay 指示用于在 MAC 层中的事件处理的处理延迟。

[0195] 在确定 ACKTimeout 的因素当中，PHY-RX-START-Delay 是用于确认是否已经成功触发直接响应帧，诸如 AC 帧的时间，并且通常考虑直到对 PLCP 帧头的 SIG 字段解码所消耗的时间。

[0196] 换句话说，在假定传输 STA 发送数据帧并且接收 STA 已经成功地接收数据帧将通过接收 STA 发送的 ACK 帧的 PLCP 帧头发送到传输 STA 之前的最长时间被用作 ACKTimeout。

[0197] 如果在 ACKTimeout 间隔期间没有出现 PHY-RXSTART.indication 基元，则 STA 断定 MPDU 的传输已经失败，并且在 ACKTimeout 间隔的期满之后调用退避过程。

[0198] 如果在 ACKTimeout 间隔期间出现 PHY-RXSTART.indication 基元，则 STA 可以等待 PHY-RXEND.indication 基元，以确定 MPDU 发送是否成功。PHY-RXEND.indication 基元是通过其 PHY 层通知 MAC 层完成了当前 PSDU 接收的基元。

[0199] 如果识别与 PHYRXEND.indication 基元相对应的通过接收 STA 发送的有效的 ACK 帧，则这可以被解释为成功的 ACK。然后，帧序列可以被允许继续或者可以根据适合于进行中的特定帧序列的方案在没有重试的情况下被结束。

[0200] 如果识别包括另一有效帧的其他帧，则这被解释为 MPDU 传输的失败。在这样的情况下，STA 需要在 PHY-RXEND.indication 基元中调用退避过程，并且可以处理接收到的帧。例外地，如果识别 PS 轮询帧的接收侧发送的有效的数据帧，则这可以被解释为用于 PS 轮询帧的成功的 ACK。

[0201] 总之，在已经发送数据帧的 STA 等待 ACK 以通过接收数据帧的 STA 被发送，当在 ACKTimeout 间隔期间没有产生 PHY-RXSTART.indication 基元时将数据帧的传输视为失败，并且然后执行发现过程（即，重新执行退避过程并且尝试重发数据帧的处理）。

[0202] 如图 13 中所示，在确定 ACKTimeout 的值中考虑 PHY-RX-START-Delay。PHY-RX-START-Delay 可以根据帧的信道带宽而不同。例如，如在图 10 中所示的以 S1G 1MHz 格式的 PHY-RX-START-Delay 与在图 11 或图 12 中所示的以大于或者等于 2MHz 的 S1G 的数据格式的 PHY-RX-START-Delay 可以不同。

[0203] 为了根据信道带宽比较 PHY-RX-START-Delay 的长度，如上所述地假定 PHY-RX-START-Delay 是直到解码 PLCP 报头的 SIG 字段所消耗的时间。

[0204] 在 1-MHz 的 PPDU 的情况下，PLCP 报头的 STF、LTE1 和 SIG 字段包括总共 14 个 OFDM

符号。假定一个OFDM符号的时隙时间约为40μs,用于1-MHz PPDU的PHY-RX-START-Delay约为560μs(=14x40μs)。

[0205] 在大于或等于2MHz(即,2、4、6、8或16MHz)的PPDU的情况下,PLCP报头的STF、LTE1和SIG-A字段包括总共6个OFDM符号。因此,用于2MHz PPDU的PHY-RX-START-Delay近似为240μs(=6x40μs)。

[0206] 因此,根据是否以1-MHz PPDU或等于或大于2MHz的PPDU发送直接响应帧而需要不同地设置ACKTimeout。例如,如果通过接收STA发送的直接响应帧是1MHz PPDU,则传输STA的ACKTimeout需要远远大于大于或者等于2MHz的PPDU。

[0207] 如果与直接响应帧的信道带宽无关使用一个固定ACKTimeout值,则应将PHY-RX-START-Delay设置为至少560μs(或者560μs+延迟裕度)作为默认值。在这样的情况下,如果接收STA发送的直接响应帧是等于或大于2MHz的PPDU,则因为考虑到当传输STA解码包括直接响应帧的SIG字段的字段时是必需的560μs设置ACKTimeout,所以ACKTimeout不是问题。然而,如果接收STA发送的直接响应帧是1MHz PPDU,则进一步考虑到除了对于传输STA解码包括直接响应帧的SIG字段的字段必需的时间之外的不必要的320μs设置ACKTimeout。然后,在传输STA的传输失败之后与大约320μs相对应的时间消耗或者不必要的时间延迟出现,并且因此在整个吞吐量和能量消耗方面效率低的问题出现。

[0208] 为了参考,假定在退避过程中的一个退避时隙时间是52μs,因为320μs的不必要的开销对应于退避定时器(或者退避计数值)中的大约6倍的差,在实际STA的信道接入效率方面此时间差可以被解释为显著的时间延迟。

[0209] 因此,本发明提出一种在支持两种或更多种类型的信道带宽的系统中的直接响应帧的信道带宽选择方案和基于信道带宽选择方案的直接响应过程。

[0210] 在本发明中,支持两种或更多种类型的信道带宽意指,当假定相同的MCS时能够在用于每个信道带宽的单位时间(例如,一个OFDM符号的持续时间)期间被发送的信息比特不同,或者用于每个信道带宽的单位时间的持续时间(例如,一个OFDM符号的持续时间)相等。因此,当20MHz的信道带宽被降频到1/10或者1/20时,这没有被包括在支持两个或者多种类型的信道带宽的情况中。

[0211] 另外,在本发明中,触发直接响应帧的帧被称为直接触发帧。直接触发帧可以包括,例如,具有正常的ACK政策的数据帧、RTS帧、如在前述示例中的PS轮询帧。在这样的情况下,直接响应帧可以对应于ACK帧、CTS帧或数据帧。

[0212] 当完成直接触发帧的传输时,发送直接触发帧的STA可以设置直接响应定时器开始。即,在完成直接触发帧的传输之后,传输STA可以在从PHY-TXEND.confirm基元的发生时间开始的aSIFSTime+aSlotTime+aPHY-RX-START-Delay时间期间操作直接响应定时器。

[0213] 如果在直接响应定时器中存在超时之前没有产生PHY-RXSTART.indication基元,则传输STA可以断定通过接收STA没有发送直接响应帧并且执行恢复过程(或者退避过程)。

[0214] 根据如先前所描述的信道带宽,以具有不同PHY-RX-START-Delay值的两个或更多个PPDU的形式发送直接触发帧。

[0215] 例如,假定使用第一信道带宽(例如,1MHz)的PPDU具有作为PHY-RX-START-Delay

值的 A，并且使用第二信道带宽、第三信道带宽等等（例如，2MHz、4MHz 等等）的 PPDU 具有作为 PHY-RX-START-Delay 值的 B。假定 A 和 B 被设置为不同的值并且 A 大于 B。

[0216] 根据本发明，在接收 STA 的观点上，要被用作直接响应帧的 PPDU 的信道带宽应被确定使得要被用作直接响应帧的基于 PPDU 确定的 PHY-RX-START-Delay 值等于或者小于基于接收到的直接触发帧的 PPDU 确定的 PHY-RX-START-Delay 值。

[0217] 例如，如果传输 STA 使用第一信道带宽发送直接触发帧，则接收 STA 可以使用第一信道带宽发送直接响应帧。

[0218] 另外，当传输 STA 使用第二信道带宽或第三信道带宽发送直接触发帧时，接收 STA 在发送直接响应帧之后不应使用第一信道带宽。在接收 STA 的观点上，要被用作直接响应帧的 PPDU 的信道带宽应被确定使得基于要被用作直接响应帧的 PPDU 确定的 PHY-RX-START-Delay 值等于或者小于 B，其是基于接收到的直接触发帧的 PPDU 确定的 PHY-RX-START-Delay 值。如果传输 STA 使用第二信道带宽或者第三信道带宽发送直接触发帧，则当接收 STA 使用第二信道带宽或者第三信道带宽发送直接响应帧时不存在问题，因为 PHY-RX-START-Delay 值等于 B。然而，如果接收 STA 使用第一信道带宽的 PPDU 发送直接响应帧，则 PHY-RX-START-Delay 值变成大于 B 的 A。

[0219] 另外，如果使用具有相同 PHY-RX-START-Delay 值的信道带宽（例如，第二信道带宽、第三信道带宽等等）的 PPDU 发送直接响应帧，则直接响应帧的信道带宽应等于或小于直接触发帧的信道带宽。

[0220] 如果当接收 STA 选择直接响应帧的带宽时应用上面的规则，则已经发送直接触发帧的传输 STA 将直接响应定时器的直接响应超时值设置为 aSIFSTime+aSlotTime+aPHY-RX-START-Delay。aPHY-RX-START-Delay 被设置为通过传输 STA 发送的直接触发帧的 aPHY-RX-START-Delay 值。这意指直接响应超时值可以随着通过传输 STA 发送的直接触发帧的信道带宽而变化。

[0221] 在下文中将会描述将在本发明中定义的直接响应过程应用于 S1G WLAN 系统（或者遵循 IEEE 802.11ah 标准的系统）的示例。

[0222] 在发送作为响应的要求 ACK 帧的 MPDU 之后，STA 在 ACKTimeout 间隔期间等待。可以基于 aSIFSTimeout+aSlotTime+aPHY-RX-START-Delay 的值确定 ACKTimeout，并且在 PHY-TXEND.confirm 基元的值处开始。

[0223] 在这样的情况下，通过 TXVECTOR 的 CH_BANDWIDTH（或者前导类型）参数确定 aPHY-RX-START-Delay。如果 TXVECTOR 的 CH_BANDWIDTH 参数对应于（被复制的）1MHz，则 aPHY-RX-START-Delay 被设置为 601μs。如果 TXVECTOR 的 CH_BANDWIDTH 参数对应于（被复制的）2MHz/4MHz/8MHz/16MHz，则 aPHY-RX-START-Delay 被设置为 281μs。

[0224] 响应于通过 S1G PPDU 发送的帧发送控制帧（即，响应帧）的 S1G STA 可以被配置成使得通过 TXVECTOR 参数 CH_BANDWIDTH 指示与通过得出响应帧的帧的 RXVECTOR 参数 CH_BANDWIDTH 指示的信道带宽相同的信道带宽。

[0225] 另外，不允许 S1G STA 发送 1MHz 前导作为对大于或者等于 2MHz 的前导（> = 2MHz 前导）的响应。

[0226] 图 14 是用于解释根据本发明是否允许帧交换序列的图。

[0227] 在图 14 中，图示用于在数据帧传输之后接收 ACK 帧的操作。图 14(a) 图示其中允

许 ACK 帧的接收的情况并且图 14(b) 图示其中不允许 ACK 帧的接收的情况。

[0228] 如在图 14(a) 中所图示，在 4MHz PPDU 的数据帧被发送之后，允许接收复制的 2MHz PPDU 的 ACK 帧。另外，在 2MHz PPDU 的数据帧被发送之后，允许接收 2MHz PPDU 的 ACK 帧。在发送 1MHz PPDU 的数据帧之后也允许接收 1MHz PPDU 的 ACK 帧。

[0229] 同时，如在图 14(b) 中所图示，在发送 4MHz PPDU 的 ACK 帧之后不允许接收被复制的 1MHz PPDU 的 ACK 帧。另外，在发送 2MHz PPDU 的数据帧之后不允许接收被复制的 1MHz PPDU 的 ACK 帧。

[0230] 已经发送 2MHz 或者 4MHz 的信道带宽的数据帧的 STA 期待具有 2MHz 信道带宽的前导的 PPDU 作为对数据帧的响应帧，将 aPHY-RX-START-Delay 视为大约 281μs 以计算超时值，并且接收和处理响应帧。

[0231] 如果响应于如在图 14(b) 中所图示的 2MHz 或者 4MHz 信道带宽的数据帧接收到具有 1MHz 信道带宽的前导的 PPDU 的响应帧，则应基于大约 601μs 的 aPHY-RX-START-Delay 计算用于正确地解码响应帧的超时值。然而，因为传输 STA 基于大约 281μs 的 aPHY-RX-START-Delay 计算超时值并且接收和处理响应帧，所以传输 STA 不能够正确地接收响应帧。

[0232] 在本发明的前述各种示例中，诸如 601μs 或者 281μs 的 aPHY-RX-START-Delay 的值仅是示例性的并且仅为了清楚描述起见提供。因此，本发明的范围不限于这样的特定的数目。

[0233] VCM 机制

[0234] 载波感测 (CS) 机制被用于信道接入并且指的是用于确定相对应信道的忙碌 / 空闲状态的操作。

[0235] 现有的 NAV 配置方案基于通过来自于另一 STA 的任何 STA 接收到的帧的持续时间字段确定在规定的持续时间期间通过另一 STA 使用信道，并且根据被确定的结果执行操作 ( 即，在规定的持续时间期间没有尝试介质接入 )。此操作可以被称为虚拟 CS(VCS) 机制，因为与关于是否通过执行物理 CS 占用介质的确定相比较相应的介质看起来被确定为被占用作为执行 CS 的结果 ( 尽管介质在物理上处于空闲状态下 )。

[0236] 例如，除了接收到的帧的目的地 STA 之外的第三方 STA 确定当接收到的帧的 CRC 值是无效时接收到的帧具有错误。接收到具有错误的帧的 STA 可以在扩展的帧间空间 (EIFS) 期间等待并且然后当信道处于空闲状态时恢复退避过程。通常，基于 aSIFSTime+DIFS+ACKTxTime 计算 EIFS。

[0237] 在这样的情况下，ACKTxTime 指示 STA 发送 ACK 帧所要求的时间。根据在本发明中提出的响应帧的上述带宽选择方案，取决于调用 ACK 帧的帧 ( 例如，直接触发帧 ) 的信道带宽确定 ACK 帧的信道带宽。例如，如果直接触发帧具有 2MHz 或者更大的前导类型，则直接响应帧不允许 1MHz 前导类型。另外，直接响应帧的前导信道带宽类型被配置成与直接触发帧的前导信道带宽类型相同。

[0238] 因此，在接收错误的帧之后，第三方 STA 需要确认接收到的帧的信道带宽以便于在 EIFS 期间推迟信道接入。如果通过第一信道带宽接收到的 PPDU 具有错误，则通过假定用于与第一信道带宽相同的信道带宽的 aRHY-RX-START-Delay 的值计算 EIFS 的 ACKTxTime ( 如上所述，是用于识别是否诸如 ACK 帧的直接响应帧已经被成功地触发的时间

并且通常考虑在解码 PLCP 报头的 SIG 字段之前消耗的时间）。

[0239] 这是因为也使用第一信道带宽发送通过第一信道带宽接收到的用于 PPDU 的 ACK 帧并且用于第一信道带宽的 aPHY-RX-START-Delay 的值应被应用于 ACK 帧。如果除了第一信道带宽之外的第二信道带宽或者第三带宽具有错误，则通过假定用于第二信道带宽或者第三信道带宽的 aPHY-RX-START-Delay 的值计算 EIFS 的 ACKTxTime。

[0240] 如果接收到的帧的 CRC 值是有效的，则除了接收到的帧的目的地 STA 之外的第三方 STA 确定接收到的帧不具有错误。已经接收到无错误的帧的 STA 在与通过被包括在接收到的帧的 MAC 报头中的持续时间字段指示的值相对应的时间期间设置 NAV。在任何帧中的 MAC 报头的持续时间字段被设置为指示用于保护随后要被发送的帧的帧传输时间的值。

[0241] 同时，诸如短 MAC 帧的帧不包括 MAC 报头中的持续时间字段以便于减少 MAC 报头开销。因此，用于使用如上所述的持续时间字段设置 NAV 的方案不能够被应用。

[0242] 在短 MAC 帧被接收或者正常的 MAC 帧被接收的任何情况下，关于随后发送的帧的信息需要通过除了 MAC 报头之外的一部分被发送以便于 STA 正确地设置 NAV 值。

[0243] 不同于用于基于接收到的帧的持续时间字段设置 NAV 值的现有的 VCS 机制，在本发明中提出的 VCS 机制基于除了持续时间字段之外的特定信息操作。因此，基于如在本发明中提出的接收到的帧的特定信息设置的值（即，通过与现有的 NAV 值相似的用途设置的值）被称为“VCS 时间长度值”，因为该值是持续时间，在其期间信道被确定为处于忙碌状态下作为 VCS 的结果。然而，在本发明中提出的 VCS 时间长度值的概念没有排除基于除了持续时间字段之外的信息设置 NAV 值。

[0244] 例如，使用任何帧的 PLCP SIG 字段中的响应帧类型字段（此字段可以被称为 ACK 指示参数或者响应指示参数）NAV 值（或者 VCS 时间长度值）可以被设置。例如，因为根据任何帧的响应帧类型参数的指示能够获知后续帧的类型，所以如果帧包括持续时间字段，则持续时间字段的值可以被假定并且基于被假定的值可以确定 NAV 值（或者 VCS 时间长度值）。显然地，与现有的 NAV 配置机制相比较不必预测 / 假定持续时间字段的值并且被用于旨在理解本发明。

[0245] 响应帧类型参数可以被配置成指示诸如无响应、NDP 控制响应、正常控制响应、长响应等等的类型之一。

[0246] 图 15 是用于解释使用 PLCP 报头的 SIG 字段的响应帧类型字段的本发明的示例的图。

[0247] 在图 15 的示例中，在被包括在数据帧的 PLCP 报头的 SIG 字段中的信息当中的响应帧类型字段（或者响应指示参数）可以根据继数据帧之后发送的 ACK 帧的类型被设置为指示无响应、NDP 控制响应、正常控制响应以及长响应中的任意一个的值。

[0248] 如果响应帧类型是无响应，则其可以估计 / 假定如果存在接收到的帧的 MAC 报头的持续时间字段的值将会是 0。因此，如果响应指示参数的值指示无响应，则 NAV 值（或者 VCS 时间长度值）被设置为 0。

[0249] 如果响应帧类型是 NDP 控制响应，则其可以估计 / 假定如果存在则接收到的帧的 MAC 报头的持续时间字段的值将会是 PCLP 报头传输时间 +SIFS(PLCP 报头传输时间 +SIFS) 的值。因为 NDP 帧指示仅由 PLCP 报头组成的帧，则 PLCP 报头传输时间可以被表达为 NDP 帧传输时间（即，NDPTxTime）。因此，如果响应指示参数的值指示 NDP 控制响应，则 NAV 值

（或者 VCS 时间长度值）被设置为 NDPTxTime+aSIFSTime。

[0250] 如果响应帧类型是正常控制响应，则其被估计 / 假定如果存在则接收到的帧的 MAC 报头的持续时间字段的值将会是 CTS/ACK/ 阻止 ACK 传输时间 +SIFS(CTS/ACK/ 阻止 ACK 传输时间加上 SIFS) 的值。因为 CTS/ACK/ 阻止 ACK 帧传输对应于正常的帧，则 CTS/ACK/ 阻止 ACK 传输时间可以被解释为正常帧传输时间（即，NoramlTxTime)。因此，如果响应指示参数的值指示正常控制响应，则 NAV 值（或者 VCS 时间长度值）被设置为 NormalTxTime+aSIFSTime。

[0251] 如果响应帧类型是长响应，则其被估计 / 假定如果存在则接收到的帧的 MAC 报头的持续时间字段的值将会是最大 PPDU 传输时间 +SIFS(MAX_PPDU 传输时间加上 SIFS) 的值，以便指示任何响应帧。因此，如果响应指示参数的值指示长响应，则 NAV 值（或者 VCS 时间长度值）被设置为 MaxPPDUTxTime+aSIFSTime。

[0252] 这样，虽然通过关于被包括在接收到的帧中的响应帧类型的信息可以估计 / 假定随后要发送的帧的类型，应确定响应帧的传输时间长度以便于第三方 STA 正确地设置 NAV 值（或者 VCS 时间长度值）。这是因为每个帧的传输时间根据信道带宽不同。

[0253] 具体地，为了让第三方 STA 设置 NAV 值（或者 VCS 时间长度值），应正确地确定响应帧的 MPDU 部分的传输时间长度和响应帧的前导部分的传输时间长度。

[0254] 基于接收到的帧的 PLCP SIG 字段的响应帧类型确定响应帧的 MPDU 部分的传输时间长度。例如，如果响应帧类型指示无响应、NDP 控制响应、正常控制响应以及长响应中的任意一个，则根据被指示的类型确定 MPDU 值。

[0255] 通过信道带宽确定响应帧的前导部分的传输时间长度。例如，在 1MHz 信道带宽的前导类型和大于或者等于 2MHz 的信道带宽的前导类型中，响应帧的前导部分的时间长度被不同地 / 单独地确定（参考图 10 至图 12)。另外，通过由第三方 STA 接收到的帧的信道带宽确定响应帧的信道带宽。

[0256] 因此，通过响应帧的信道带宽（或者根据接收到的帧的信道带宽确定的响应帧的前导类型）和被包括在接收到的帧的 PLCP 报头中的响应帧类型字段的值（或者响应指示参数值）确定通过第三方 STA 设置的 NAV 值（或者 VCS 时间长度值）。换言之，基于被包括在通过第三方 STA 接收到的帧的 PLCP 报头中的响应帧类型字段的值（或者响应指示参数值）确定响应帧类型，通过接收到的帧的信道带宽确定响应帧类型中的前导的长度 / 类型，并且基于响应帧类型的信道带宽和值可以确定包括发送响应帧所需的时间的 NAV 值（或者 VCS 时间长度值）。然后，第三方 STA 能够正确地设置 NAV 值（或者 VCS 时间长度值）而不在接收到的帧的类型（例如，短 MAC 帧或者其他帧（即，在不具有持续时间字段的帧或者具有持续时间字段的帧）之间区分。

[0257] 在实现上述 VCS 机制中，STA 可以使用一个参数（例如，NAV 值（或者 VCS 时间长度值）设计协议或者根据用作确定 VCS 时间长度值的基础的信息（例如，MAC 报头的持续时间字段或者 PLCP 报头的响应帧类型字段）设计通过单独的参数区分的协议。在本发明的前述示例中，虽然一个参数（即，NAV 值或者 VCS 时间长度值）被用于实现 VCS 机制，但是其中基于如在传统的方案中的持续时间字段的值设置 NAV 值并且基于响应帧类型字段（也基于信道带宽）的值设置附加的 VCS 时间长度值的情况被包括在本发明的实施例中。

[0258] 第三方 STA 检测方案

[0259] 在诸如短 MAC 帧的帧中，在接收器地址 (RA) 字段和发射器地址 (TA) 字段的部分中可以使用除了 MAC 地址之外的 AID(AID 是通过 AP 分配给关联的 STA 的本地 ID) 以便于减少 MAC 报头开销。例如，通过 STA 发送到 AP 的 UL 短 MAC 帧的 MAC 报头包括 RA 字段（例如，地址 1(A1) 字段）中的 AP 的 MAC 地址并且包括 TA 字段（例如，地址 2(A2) 字段）中的 STA 的 AID。相反地，通过 AP 发送到 STA 的 DL 短 MAC 帧的 MAC 报头包括 RA 字段（或者 A1 字段）中的 STA 的 AID 并且包括 TA 字段（或者 A2 字段）中的 STA 的 MAC 地址。因为通过 6 个字节的长度定义 MAC 地址并且通过 2 个八位字节的长度定义 AID，所以与长度差相对应的 MAC 报头开销能够被减少。

[0260] 根据是否 STA 是相应的帧的目的地 STA 确定是否已经接收到短 MAC 帧的 STA 设置 NAV 值（或者 VCS 时间长度值）。当接收到的帧的 CRC 值是有效的时除了目的地 STA 之外的第三方 STA 将接收到的帧视为无错误的帧并且已经接收到无错误的帧的 STA 设置 NAV 值（或者 VCS 时间长度值）。

[0261] 如果 STA 接收帧，则是否 STA 是应被确定的帧的目的地 STA。

[0262] 如果通过 STA 接收到的短 MAC 帧的 RA 是由 MAC 地址组成，则 STA 将 RA 与其 MAC 地址相比较。如果地址是相等的，则 STA 可以确定其是目的地 STA 并且，否则，STA 可以确定其是第三方 STA。

[0263] 如果通过 STA 接收到的短 MAC 帧的 RA 是由 AID 组成，则 STA 将 RA 与其 AID 进行比较。如果地址是不同的，则 STA 可以确定其是第三方 STA。

[0264] 同时，如果通过 STA 接收到的短 MAC 帧的 RA 是由 AID 组成，则 STA 不应确定其是目的地 STA，尽管 RA 等于 STA 的 AID 作为比较的结果。这是因为，即使当 AID 值是相等的，如果分配 AID 值的 AP 是不同的，则帧的目的地 STA 可以不同。因此，如果通过 STA 接收到的短 MAC 帧的 RA 是由 AID 组成，则 STA 将 RA 与其 AID 进行比较。如果地址是相等的，则 STA 将短 MAC 帧的 TA 与被关联的 AP 的 MAC 地址进行比较。如果通过 STA 接收到的短 MAC 帧的 TA 等于 STA 关联的 AP 的 MAC 地址，则 STA 可以确定其是目的地 STA 并且，否则，STA 可以确定其是第三方 STA。

[0265] 如果 STA 在其中 STA 与 AP 不相关联的状态（即，预先关联的状态）下接收短 MAC 帧，则没有应用基于由 AID 组成的 RA 值和由 MAC 地址组成的 TA 值确定是否 STA 是目的地 STA 或者第三方 STA 的上述方案。这是因为 AP 不能够将短 MAC 帧（即，其中 RA 字段或 TA 字段是由 AID 组成的 MAC 帧）发送到不关联 AP 的 STA。因此，如果 STA 在预先关联的状态下接收短 MAC 帧，则 STA 应确定其不是目的地 STA 而是第三方 STA。

[0266] 因此，如果已经接收到帧的 STA 确定其是第三方 STA，则 STA 可以根据如在本发明中描述的接收到的帧的特定字段设置 NAV 值（或者 VCS 时间长度值）。

[0267] 另外，即使当任何 STA 应确定其是应发送直接响应帧（例如，响应于短 MAC 数据帧发送的 ACK 帧）的 STA 时，上述第三方 STA 确定方案可以被应用。例如，如果通过 STA 接收到的短 MAC 数据帧的 RA 等于 STA 的 AID，则 STA 可以另外将 TA 与关联 STA 的 AP 的 MAC 地址进行比较并且仅当地址是相等的时确定其是目的地 STA。接下来，STA 可以发送直接响应帧。

[0268] 即，在其中接收到的短的 MAC 帧的 RA 对应于 AID 的情况下，STA 将 RA 与 AID 进行比较。如果 RA 等于 STA 的 AID，则 STA 将 TA 与 MAC 地址进行比较。仅当接收到的短 MAC 帧

的 TA 等于 STA 关联的 AP 的 MAC 地址时，STA 确定其是目的地 STA 并且发送诸如 ACK 帧的直接响应帧。

[0269] 图 16 是用于解释本发明的示例性方法的图。

[0270] 在图 16 的示例中，第一 STA STA1 的操作与用于本发明的 S1G 直接响应帧的上述带宽选择方案（或者响应过程）有关。另外，在图 16 的示例中，第三 STA STA3 的操作与本发明的 VCS 机制有关。STA 的操作可以被理解为单独的操作，尽管为了方便描述参考一个附图给出描述。

[0271] 在步骤 S1610 中，第一 STA STA1 可以将帧发送到第二 STA STA2。此帧可以是通过直接响应帧发送的直接触发帧。已经从 STA1 接收到帧的 STA2 可以发送响应帧（例如，直接响应帧）。

[0272] 在这样的情况下，通过 STA2 发送的响应帧的信道带宽类型可以被配置成与通过 STA1 发送的帧的信道带宽类型相同。如果通过 STA1 发送的帧具有 2MHz 或者更多的前导类型，则通过 STA2 发送的响应帧可以被限于除了 1MHz 前导类型之外的类型（即，不允许 1MHz 前导类型）。

[0273] 另外，在步骤 S1610 中，STA1 可以在 ACKTimeout 间隔期间等待要通过 STA2 发送的响应帧。根据帧的前导信道带宽类型 ACKTimeout 间隔被确定为不同的值。换言之，因为根据帧的前导信道带宽响应帧的前导信道带宽不同，所以考虑到帧的前导信道带宽 ACKTimeout 间隔可以被设置。

[0274] 在步骤 S1620 中，STA1 可以从 STA2 接收响应帧。如果在 ACKTimeout 间隔内接收到响应帧，则其被确定已经成功地发送帧并且，否则，确定帧的传输失败。如果 ACKTimeout 间隔已经经过，则 STA1 可以执行退避过程（未示出）。

[0275] 同时，如在步骤 S1630 中一样，第三方 STA（例如，STA3）可以接收通过另一 STA（例如，STA1）发送到又一 STA（例如，STA2）的帧。

[0276] 在步骤 S1640 中，STA3 可以基于接收到的帧的响应指示参数（或者响应帧类型字段）和 / 或信道带宽类型接收 NAV 值（或者 VCS 时间长度值）。STA3 可以在与 NAV 值（或者 VCS 时间长度值）相对应的时间期间推迟信道接入。

[0277] 信道带宽类型指示响应帧的信道带宽类型。响应帧的信道带宽类型可以被设置为与帧（例如，从 STA1 发送到 STA2 的帧）的信道带宽类型相同。

[0278] 例如，根据响应长指示参数指示的无响应、正常响应、NDP 响应以及长响应中的一个基本上确定 NAV 值（或者 VCS 时间长度值）。另外，根据信道带宽 NAV 值（或者 VCS 时间长度值）可以被特定地确定。

[0279] 虽然为了描述的简单起见在图 16 中图示的示例性方法被表示为一系列的步骤，但是这没有限制步骤的属性。必要时，可以同时或者以不同的顺序执行一些步骤。此外，在图 16 中图示的所有步骤不是必要的以实现本发明的被提出的方法。

[0280] 可以通过单独地或者两个或者更多个的组合实现本发明的前述各种实施例执行在图 16 中图示的本发明的方法。

[0281] 图 17 是根据本发明的实施例的无线设备的框图。

[0282] STA110 可以包括处理器 11、存储器 12 以及收发器 13。收发器 13 可以发送 / 接收无线信号，例如实现 IEEE 802 系统的物理层。处理器 11 被连接到收发器 13，并且实现

IEEE 802 系统的物理层和 / 或 MAC 层。处理器 11 可以被配置为根据本发明的前述各种实施例执行操作。此外，用于根据本发明的各种实施例执行操作的模块可以被存储在存储器 12 中并且通过处理器 11 执行。存储器 12 可以位于处理器 11 的内部或者外部并且通过已知的装置被连接到处理器 11。

[0283] 在图 17 中，根据本发明的实施例的 STA 10 可以被配置成执行响应处理。处理器 11 可以被配置成通过收发器 13 将请求响应帧的帧发送到另一 STA。处理器 11 可以被配置成在 ACKTimeout 间隔期间等待响应帧。根据帧的前导信道带宽类型 ACKTimeout 间隔可以被设置为不同的值。

[0284] 根据本发明的另一实施例的图 17 的 STA 10 可以被配置成执行 VCS。第三 STA 的处理器 11 可以被配置成通过收发器 12 接收从第一 STA 发送到第二 STA 的帧。处理器 11 可以被配置成基于响应指示参数或者信道带宽类型确定 VCS 时间长度。处理器 11 可以被配置成在与 VCS 时间长度值相对应的时间期间推迟通过第三 STA 引起的信道接入。

[0285] 上述设备的具体配置可以被实现为使得本发明的前述各种实施例可以被独立地应用，或者其两个或者更多个可以被同时应用。为了清楚期间省略被重复的描述

[0286] 通过各种手段，例如，硬件、固件、软件、或者其组合能够实现本发明的实施例。

[0287] 在硬件配置中，可以通过一个或多个专用集成电路 (ASIC)、数字信号处理器 (DSP)、数字信号处理器件 (DSPD)、可编程逻辑器件 (PLD)、现场可编程门阵列 (FPGA)、处理器、控制器、微控制器、微处理器等来实现根据本发明的实施例的方法。

[0288] 在固件或软件配置的情况下，可以以执行如上所述的功能或操作的模块、程序、功能等来实现根据本发明的实施例的方法。软件代码可以被存储在存储器单元中，并且通过处理器执行。存储器单元可以位于处理器内部或外部，并且可以经由通过各种已知的手段来向处理器发送数据和从处理器接收数据。

[0289] 已经给出了本发明的优选实施例的详细描述以使得本领域内的技术人员能够实现和实施本发明。虽然已经参考优选实施例描述了本发明，但是本领域内的技术人员能够明白，在不偏离所附权利要求中描述的本发明的精神或范围的情况下，可以在本发明中进行各种修改和改变。因此，本发明应当不限于在此所述的特定实施例，而是应当符合与在此公开的原理和新颖特征一致的最宽范围。

[0290] 工业实用性

[0291] 虽然已经在 IEEE 802.11 系统的背景下描述了本发明的各种实施例，但是通过相同的方案本发明也可应用于各种移动通信系统。

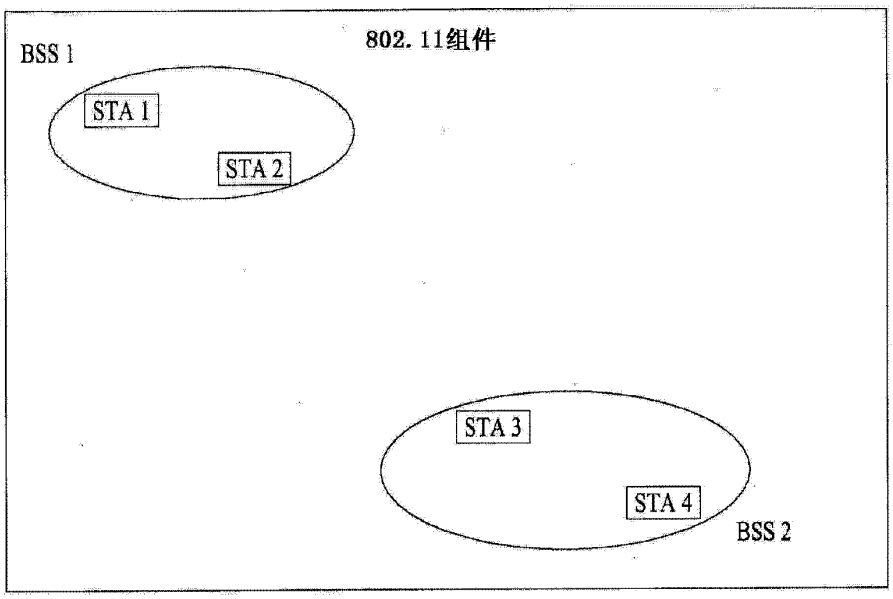

802.11组件
BSS 1
STA 1
STA 2
STA 3
STA 4
BSS 2

图 1

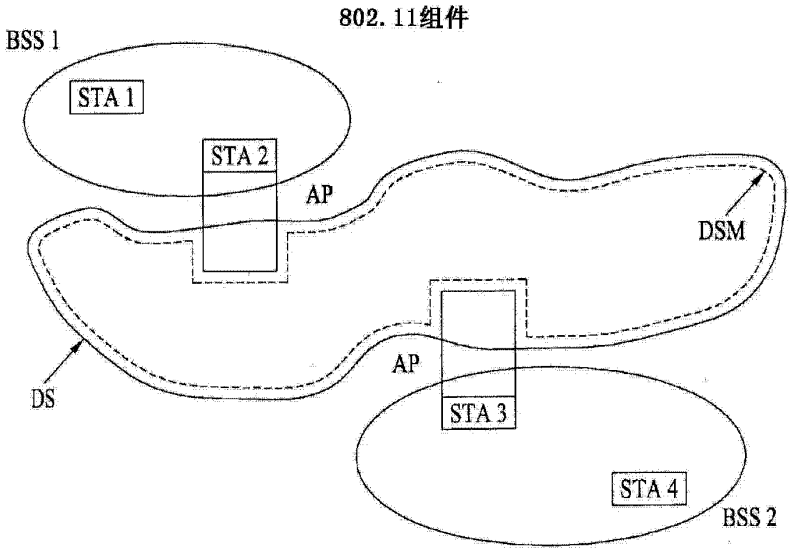

802.11组件
BSS 1
STA 1
STA 2
AP
DSM
DS
AP
STA 3
STA 4
BSS 2

图 2

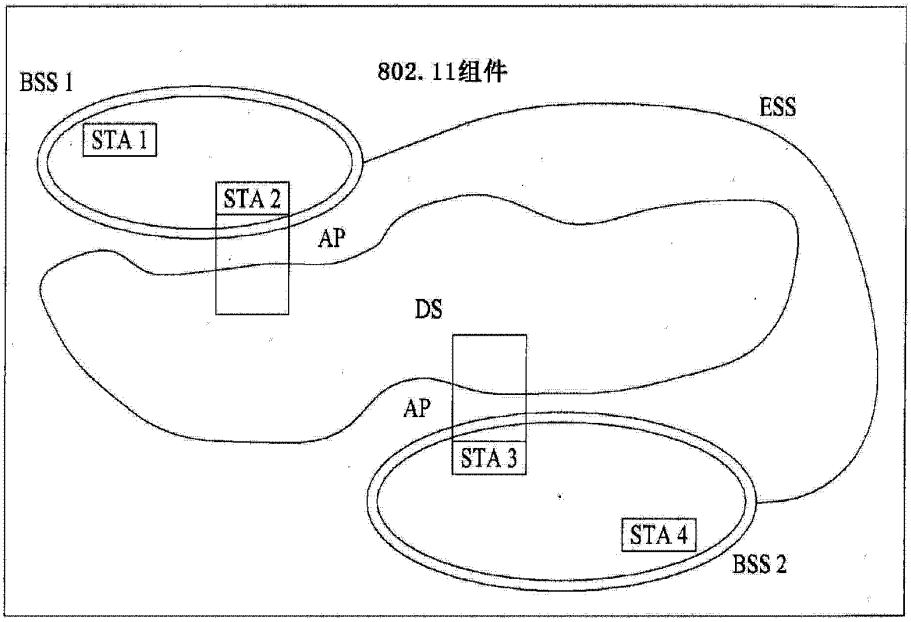



图 3

30

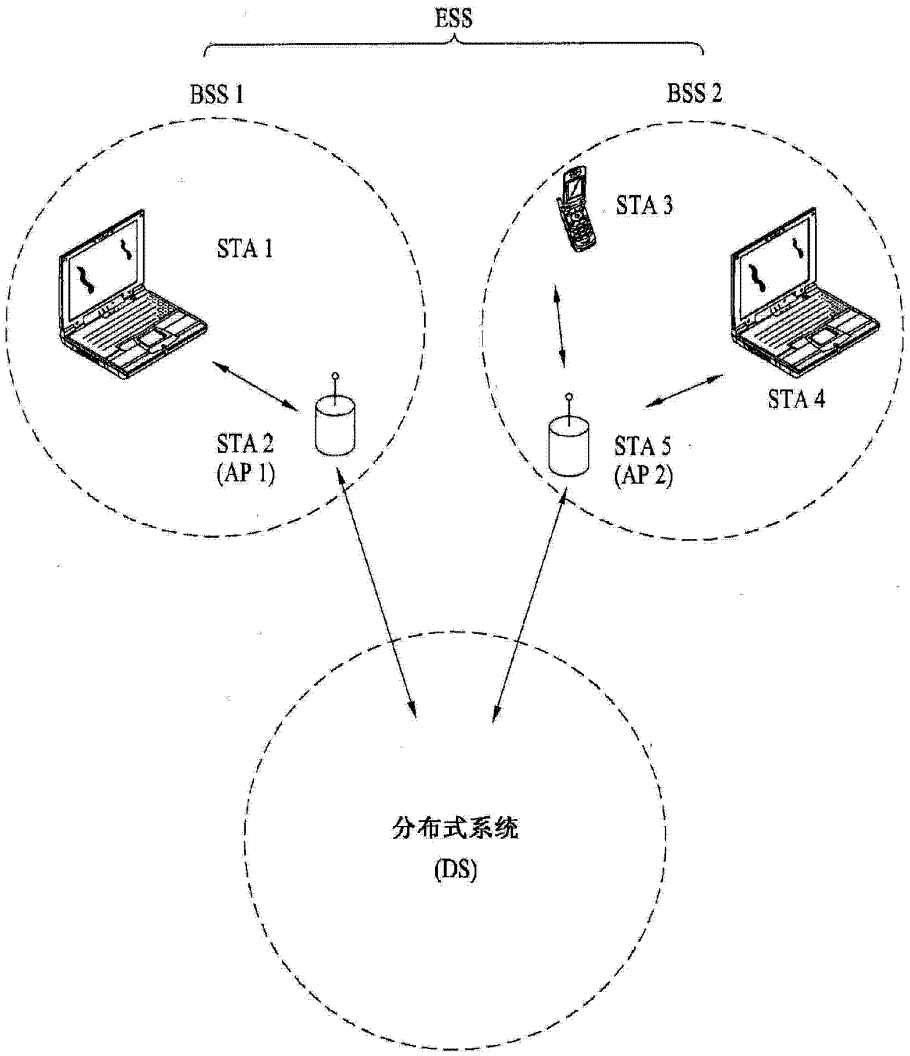



图 4

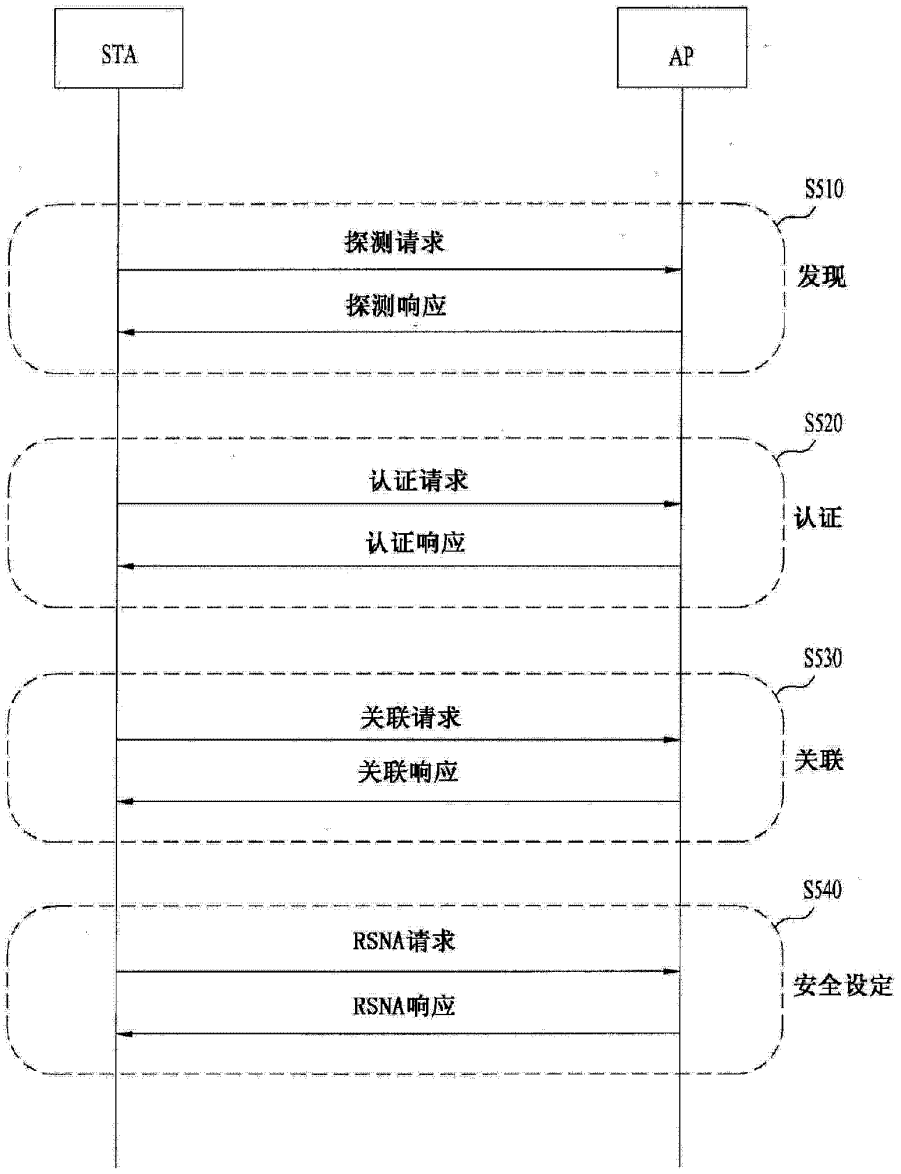

STA
AP
S510
探测请求
探测响应
发现
S520
认证请求
认证响应
认证
S530
关联请求
关联响应
关联
S540
RSNA请求
RSNA响应
安全设定

图 5

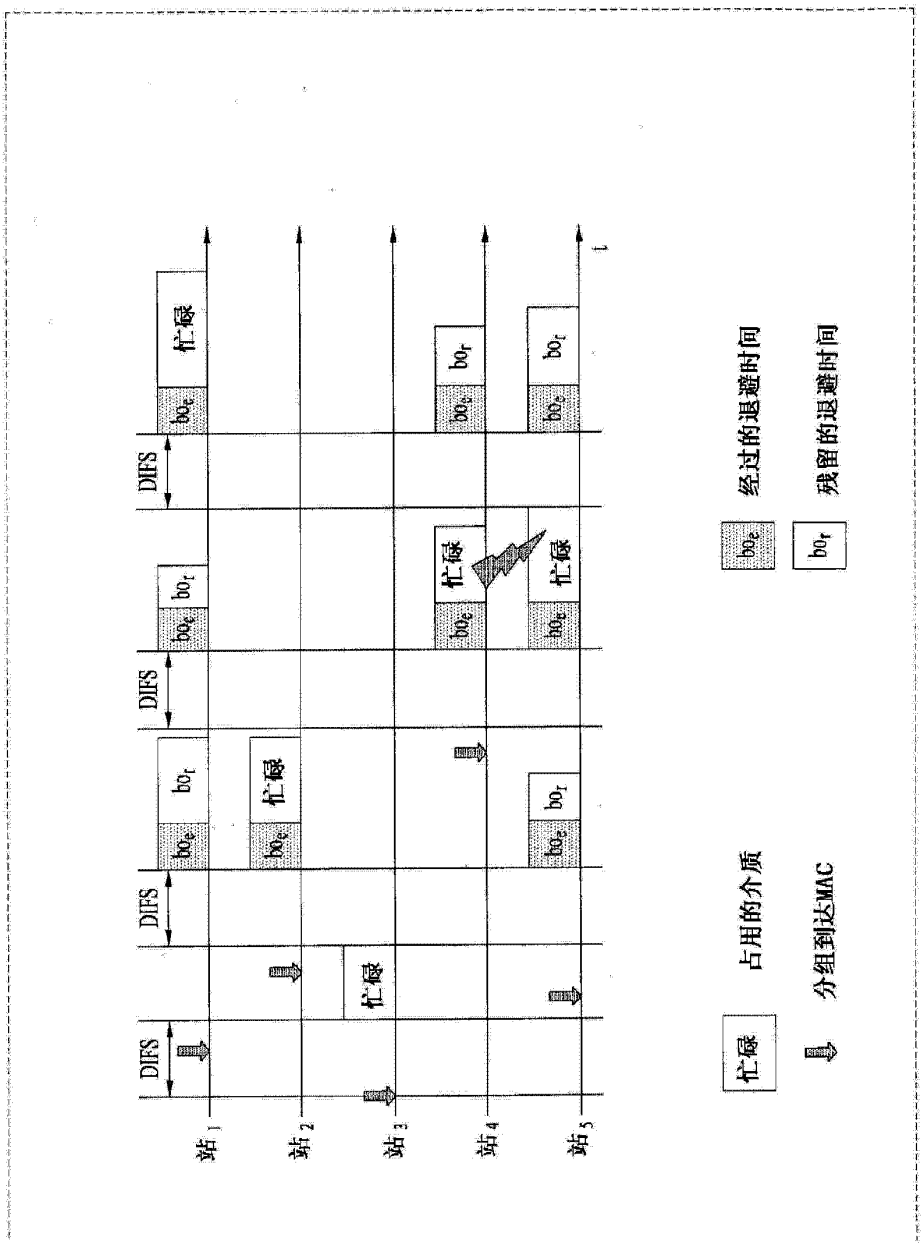



图 6

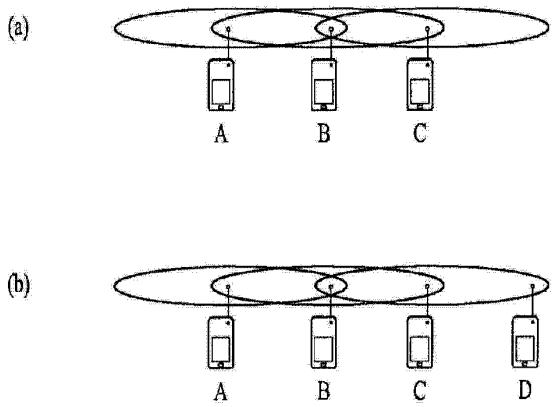



图 7

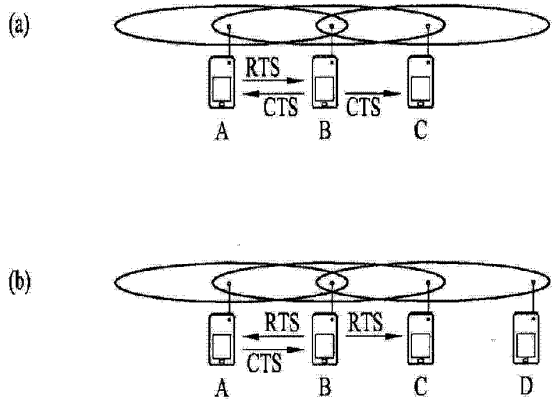



图 8

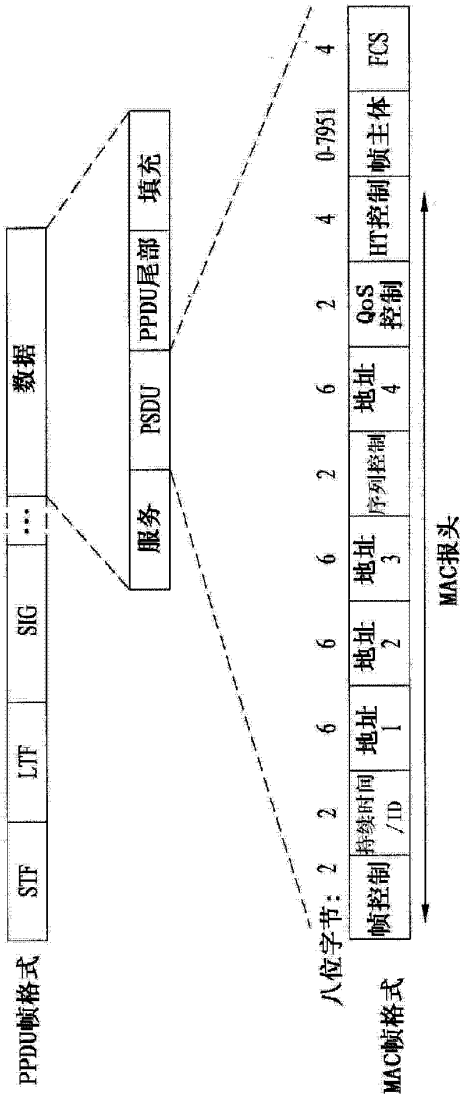

PPDU帧格式
STF
LTF
SIG
...
数据
服务
PSDU
PPDU尾部
填充
八位字节：
2
2
6
6
6
2
6
2
4
4
0-7951
4
帧控制
持续时间/ID
地址1
地址2
地址3
序列控制
地址4
QoS控制
HT控制
帧主体
FCS
MAC帧格式
MAC报头

图 9

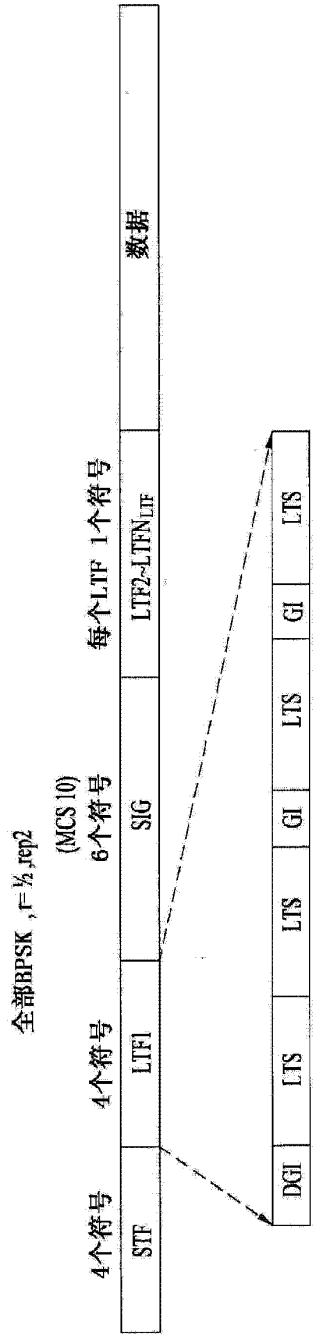

全部BPSK，r=½,rep2
(MCS 10)
4个符号
4个符号
6个符号
每个LTF 1个符号
STF
LTF1
SIG
LTF2~LTFN_LTF
数据
DGI
LTS
LTS
GI
LTS
GI
LTS

图 10

35

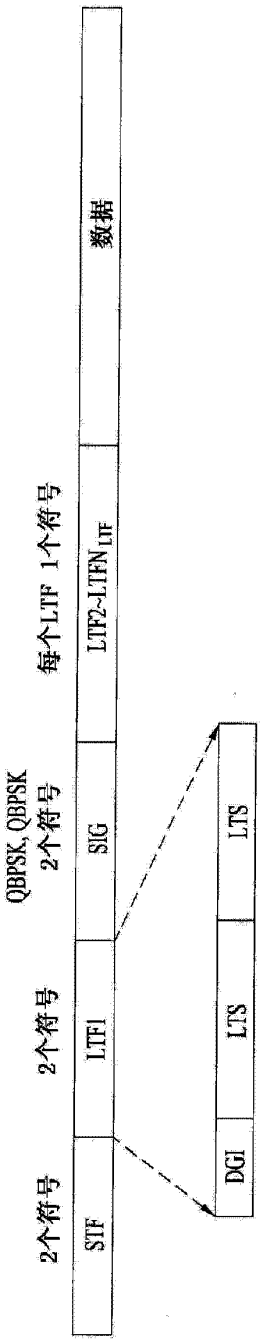

2个符号
STF
2个符号
LTF1
QBPSK, QBPSK
2个符号
SIG
每个LTF 1个符号
LTF2~LTFN LTF
数据
DGI
LTS
LTS

图 11

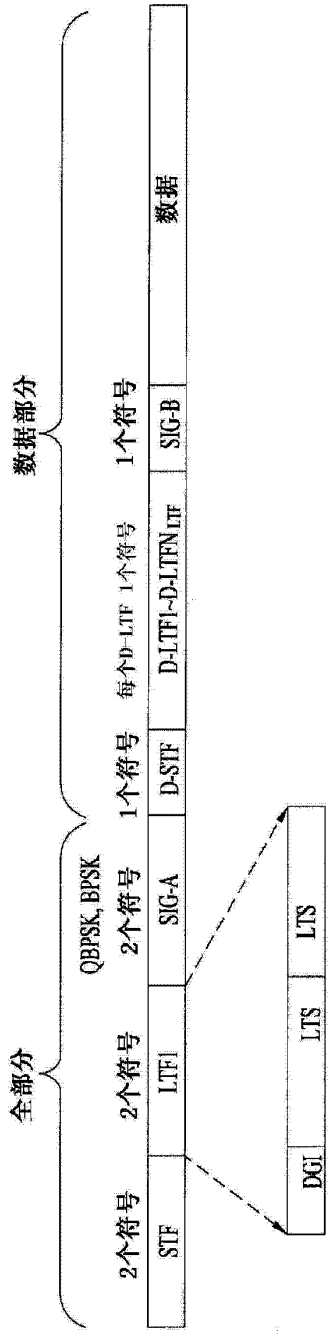
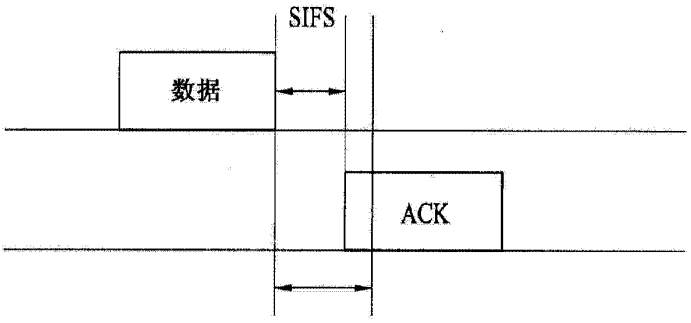

全部分
数据部分
2个符号
STF
2个符号
LTF1
QBPSK, BPSK
2个符号
SIG-A
1个符号
D-STF
每个D-LTF 1个符号
D-LTF1~D-LTFN LTF
1个符号
SIG-B
数据
DGI
LTS
LTS

图 12




ACKTimeout = SIFS + Slot Time + PHY - RX - START -Delay

图 13

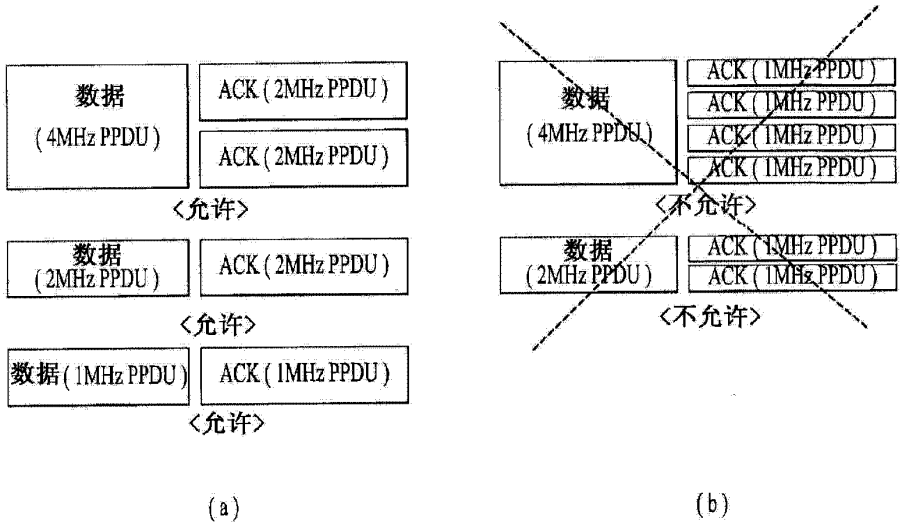



图 14

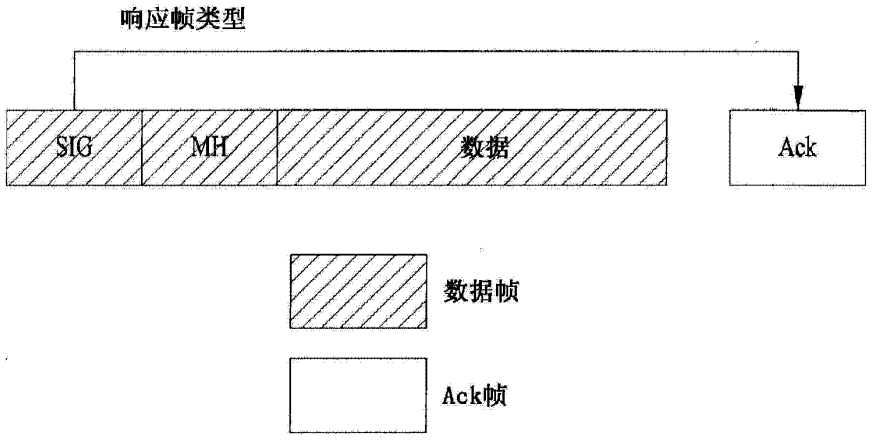



图 15

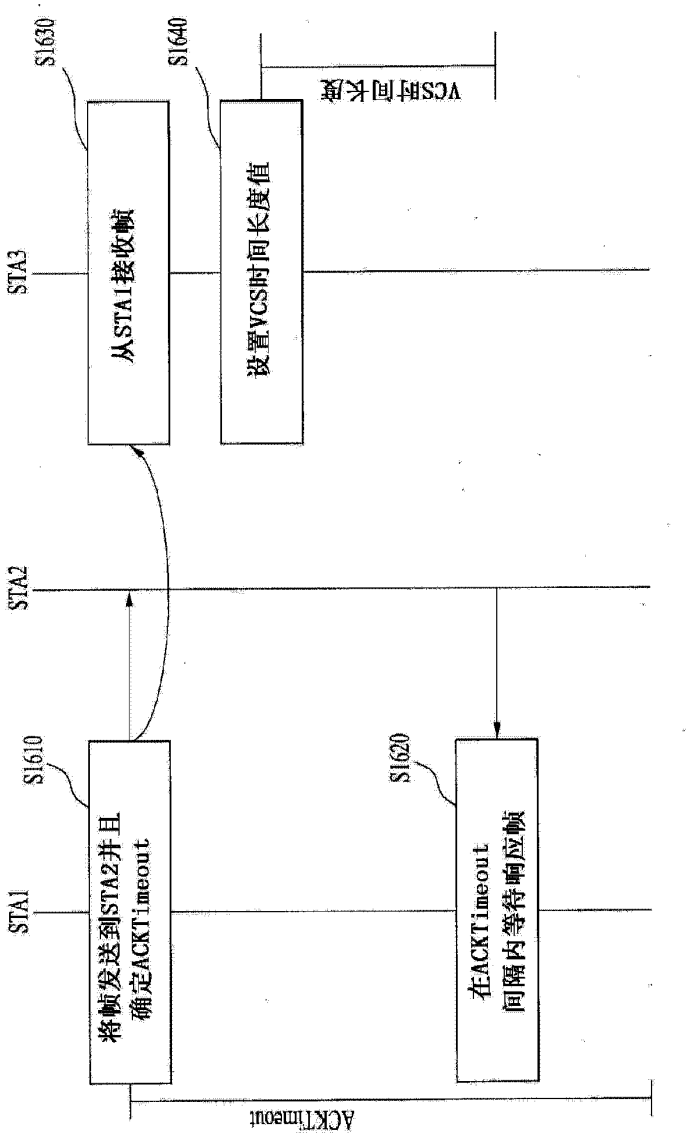

S1630
S1640
VCS时间长度
STA3
从STA1接收帧
设置VCS时间长度值
STA2
S1610
S1620
STA1
将帧发送到STA2并且
确定ACKTimeout
在ACKTimeout
间隔内等待响应帧
ACKTimeout

图 16

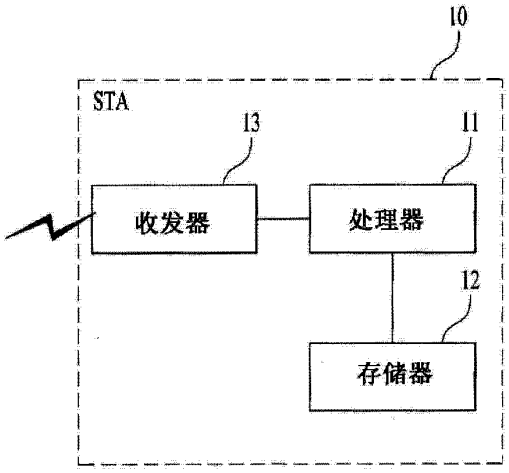



图 17

40

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 40257823 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo/Azatuhi Chinaryan |
| **Filer Authorized By:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 12-AUG-2020 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 01:50:47 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 2020-08-11_632642_IDS.pdf | 218415<br>6b15d80cdea50b0bde3adf1c73f15875360d398f | yes | 4 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | Document Description | | Start | End | |
| | Transmittal Letter | | 1 | 3 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 4 | 4 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Other Reference-Patent/App/Search documents | Ref1_EP168794345_NOA.pdf | 451364<br>62f60be66b4e15775c8933d22b55749a84ae307e | no | 7 |
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| **Information:** | | | | | |
| 3 | Other Reference-Patent/App/Search documents | Ref2_IN201827026123_1stOA.pdf | 211751<br>f446f43adaaee1e6b47f58cdceacce31fa8cbea1 | no | 5 |
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| **Information:** | | | | | |
| 4 | Other Reference-Patent/App/Search documents | Ref4_CN2016800761194_1stOA.pdf | 712938<br>8bfd2bcb6382a918118ede70fff1b2b8dd7c140b | no | 13 |
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| 5 | Foreign Reference | Ref5_CN105165055.pdf | 4234698<br>5a220ab80d6a0eb70b06a4d649ae15052bf55c62 | no | 48 |
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| 6 | Foreign Reference | Ref6_CN105120520.pdf | 2474243<br>aa80428a901a2cf54e38a1090ae4b89f5ac1fdc0 | no | 30 |
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| 7 | Foreign Reference | Ref7_CN105122754.pdf | 3470924<br>f9d8d4bc5d93b8bf685f2788de4e6e53f15335c6 | no | 46 |
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| **Information:** | | | | | |
| 8 | Foreign Reference | Ref8_CN102835061.pdf | 8465891<br>3793cdcb7f260d684b27cb3af898dc479bb60bca | no | 87 |
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| **Information:** | | | | | |
| 9 | Foreign Reference | Ref9_CN104995982.pdf | 5368212<br>58a8a351b55ec8fb22df793a7b87b8a3591d4eaf | no | 65 |
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| **Information:** | | | | | |
| 10 | Non Patent Literature | Ref10_IEEE802-11ac_NPL.pdf | 2258897<br>402d49d763d846de49d5245b97a80ca9232e4329 | no | 4 |
| **Warnings:** | | | | | |
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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

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**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | Examiner: Mesfin, Yemane |
| Serial No.: 16/868,525 | Art Unit: 2462 |
| Filing or 371 (c) Date: May 6, 2020 | Conf. No.: 6523 |
| For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" | Our Ref: B-9493CON1 632642-0 |
| Date: August 11, 2020 | Re: ***Information Disclosure Statement*** |

**INFORMATION DISCLOSURE STATEMENT**

**Mail Stop Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

*Timing and Fees*

This IDS is being filed:

[ ] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[x] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

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[ ] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

- [ ] accompanied by the fee set forth in § 1.17(p), or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

---

[ ] After the periods described above, and is accompanied by the fee set forth in § 1.17(p), and is

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

*Items Disclosed*

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

[ ] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

*Additional Information*

[x] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[x] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on May 6, 2020 and therefore are not submitted in this IDS.

[ ] Other:

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

August 11, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE** ***Patent***

| | | |
|---|---|---|
| Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | ) | ***Re.: Preliminary Amendment*** |
| | ) | Group: 2464 |
| USSN: 16/868,525 | ) | Examiner: Ngo, Ricky Quoc |
| Filing Date: May 6, 2020 | ) | Our Ref.: B-9493CON1 632642-0 |
| For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" | ) | Date: June 3, 2020 |

**PRELIMINARY AMENDMENT**

Sir:

Prior to examination of the above-identified U.S. patent application, please enter the following amendments and remarks into the prosecution history of the above-identified U.S. patent application without prejudice or disclaimer.

**Amendments to the Specification** begin on page 2 of this paper.
**Amendments to the Claims** begin on page 3 of this paper
**Remarks** begin on page 7 of this paper.

## AMENDMENTS TO THE SPECIFICATION

Please insert the following paragraph and section entitled "CROSS-REFERENCE TO RELATED APPLICATIONS" on page 1, immediately after the title "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" and before the section entitled "Technical Field", to read as follows:

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of US Patent Application No. 16/016,520 filed on June 22, 2018, which is a continuation of the International Patent Application No. PCT/KR2016/015297 filed on December 26, 2016, which claims the priority to Korean Patent Application No. 10-2015-0186871 filed in the Korean Intellectual Property Office on December 24, 2015, Korean Patent Application No. 10-2016-0004471 filed in the Korean Intellectual Property Office on January 13, 2016, Korean Patent Application No. 10-2016-0005835 filed in the Korean Intellectual Property Office on January 18, 2016, Korean Patent Application No. 10-2016-0026683 filed in the Korean Intellectual Property Office on March 4, 2016, Korean Patent Application No. 10-2016-0030006 filed in the Korean Intellectual Property Office on March 13, 2016, Korean Patent Application No. 10-2016-0059182 filed in the Korean Intellectual Property Office on May 14, 2016, Korean Patent Application No. 10-2016-0062422 filed in the Korean Intellectual Property Office on May 20, 2016, and Korean Patent Application No. 10-2016-0083756 filed in the Korean Intellectual Property Office on July 1, 2016, the entire contents of which are incorporated herein by reference.

* * *

## AMENDMENTS TO THE CLAIMS

Please amend the claims to read as indicated in the following list of claims:

**Listing of claims**

1-18. (Cancelled).

19. (New) A wireless communication terminal, the terminal comprising:

a processor; and

a communication unit,

wherein the processor is configured to:

receive a wireless packet including an High Efficiency Signal A(HE-SIG-A) field and an High Efficiency Signal B(HE-SIG-B) field through the communication unit,

obtain bandwidth information indicated by a bandwidth field included in the HE-SIG-A field,

obtain information of an unassigned resource unit by a subfield included in the HE-SIG-B field,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and is used to obtain the information of the unassigned resource unit, and

decode a data of the received wireless packet based on the bandwidth information and the information of the unassigned resource unit,

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more, the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz.

20. (New) The wireless communication terminal of claim 19,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

21. (New) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

22. (New) The wireless communication terminal of claim 21, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

23. (New) The wireless communication terminal of claim 20, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

24. (New) The wireless communication terminal of claim 23,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

25. (New) A wireless communication method of a wireless communication terminal, the method comprising:

receiving a wireless packet including an high efficiency(HE)-signal(SIG)-A and HE-SIG-B through the communication unit;

obtaining bandwidth information indicated by a bandwidth field included in the HE-SIG-A;

obtaining information of an unassigned resource unit by a subfield included in the HE-SIG-B,

wherein the bandwidth field is related to bandwidth over which the received wireless packet is transmitted, and

wherein the bandwidth field of HE-SIG-A is used to obtain the information of the unassigned resource unit; and

decoding a data of the received wireless packet based on the total bandwidth information and the information of the unassigned resource unit,

wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz or more, the information of the unassigned resource unit includes information of a C26 field indicating whether a user is allocated to a center 26-tone resource unit of 80 MHz.

26. (New) The wireless communication method of claim 25,

wherein the HE-SIG-B field consists of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz respectively, and

wherein the C26 field is carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

27. (New) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

28. (New) The wireless communication method of claim 27, wherein when the C26 field indicates that a user is allocated to the center 26-tone resource unit, a user field corresponding to

the center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1.

29. (New) The wireless communication method of claim 26, wherein when the received wireless packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth includes a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 indicates whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 indicates whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

30. (New) The wireless communication method of claim 29,

wherein when the first C26 field indicates that a user is allocated to the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 1, and

wherein when the second C26 field indicates that a user is allocated to the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit is carried in a user specific field of the HE-SIG-B content channel 2.

## REMARKS

In this Preliminary Amendment, the section of the "CROSS-REFERENCE TO RELATED APPLICATIONS" is inserted to include reference to the earlier applications. This amendment is to comply with 37 C.F.R. §1.77. A substitute specification should not be required as this amendment only adds a benefit claim.

Claims 1-18 are cancelled and new claims 19-30 are added.

Amendment of the subject application is respectfully requested.

* * *

*No Disclaimers or Disavowals*

Although the present communication may include alterations to the application or claims, or may contain characterizations of claim scope or referenced art, the Applicant is not conceding that any previously pending claims are unpatentable in view of the cited reference(s). Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent child or related prosecution history shall not reasonably infer that the Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

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June 3, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 39633611 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo/Azatuhi Chinaryan |
| **Filer Authorized By:** | Young Seok Koo |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 04-JUN-2020 |
| **Filing Date:** | 06-MAY-2020 |
| **Time Stamp:** | 22:28:40 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 2020-06-04_632642_Preliminary_Amendment.pdf | 127195<br>db5964cb50fc9e16d1335cc19c4df91be5ffd3c0 | yes | 8 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Preliminary Amendment | 1 | 1 |
| | Specification | 2 | 2 |
| | Claims | 3 | 6 |
| | Applicant Arguments/Remarks Made in an Amendment | 7 | 8 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 127195 | |

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>16/868,525 | Filing Date<br>05/06/2020 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☑ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED - PART I

| FOR | (Column 1)<br>NUMBER FILED | (Column 2)<br>NUMBER EXTRA | | RATE ($) | FEE ($) |
|---|---|---|---|---|---|
| ☐ BASIC FEE<br>(37 CFR 1.16(a), (b), or (c)) | N/A | N/A | | N/A | |
| ☐ SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m)) | N/A | N/A | | N/A | |
| ☐ EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q)) | N/A | N/A | | N/A | |
| TOTAL CLAIMS<br>(37 CFR 1.16(i)) | minus 20 = | * | | x $100 = | |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h)) | minus 3 = | * | | x $460 = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | | TOTAL | |

## APPLICATION AS AMENDED - PART II

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | 06/04/2020 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * 12 | Minus | ** 20 | = 0 | | x $100 = | 0 |
| | Independent<br>(37 CFR 1.16(h)) | * 2 | Minus | *** 3 | = 0 | | x $460 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | 0 |

| | | (Column 1) | | (Column 2) | (Column 3) | | | |
|---|---|---|---|---|---|---|---|---|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | | RATE ($) | ADDITIONAL FEE ($) |
| | Total<br>(37 CFR 1.16(i)) | * | Minus | ** | = | | x $0 = | |
| | Independent<br>(37 CFR 1.16(h)) | * | Minus | *** | = | | x $0 = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | |
| | | | | | | | TOTAL ADD'L FEE | |

| | |
|---|---|
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. | LIE |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". | /LAVINIA D JOHNSON/ |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". | |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. | |

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| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 16/868,525 | 05/06/2020 | 2642 | 2120 | B-9493CON1 632642-0 | 18 | 2 |

**CONFIRMATION NO. 6523**

**FILING RECEIPT**

158747
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4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

OC000000118971112

Date Mailed: 05/14/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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**Inventor(s)**

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Jinsam KWAK, Gyeonggi-do, KOREA, REPUBLIC OF;
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**Applicant(s)**

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., Gyeonggi-do, KOREA, REPUBLIC OF;
SK TELECOM CO., LTD., Seoul, KOREA, REPUBLIC OF;

**Power of Attorney:** The patent practitioners associated with Customer Number 158747

**Domestic Priority data as claimed by applicant**

This application is a CON of 16/016,520 06/22/2018
which is a CON of PCT/KR2016/015297 12/26/2016

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

REPUBLIC OF KOREA 10-2015-0186871 12/24/2015 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0004471 01/13/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0005835 01/18/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0026683 03/04/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0030006 03/13/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0059182 05/14/2016 No Access Code Provided

REPUBLIC OF KOREA 10-2016-0062422 05/20/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0083756 07/01/2016 No Access Code Provided

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/868,525**
**Projected Publication Date:** 08/20/2020
**Non-Publication Request:** No
**Early Publication Request:** No
**Title**

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

**Preliminary Class**

455

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

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## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/868,525

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | | | N/A | 300 |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | 660 |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | 760 |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 18 minus 20 = | * | | | OR | x 100 = | 0.00 |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 2 minus 3 = | * | | | | x 460 = | 0.00 |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | 400 |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | 0.00 |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | 2120 |

### APPLICATION AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE($) | ADDITIONAL FEE($) | OR | RATE($) | ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

DocCode – SCORE

# SCORE Placeholder Sheet for IFW Content

Application Number: 16868525 Document Date: 05/06/2020

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Form Revision Date: March 1, 2019

| Form PTO-1449 (Modified)<br>Page 1 of 1 | ATTY DOCKET NO.<br>B-9493CON1 632642-0 | U.S. SERIAL NO.<br>N/A |
|---|---|---|
| LIST OF PATENTS AND PUBLICATIONS STATEMENT | APPLICANT<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | FILING DATE OR 371 (C) DATE<br>Concurrently Herewith |
| | | GROUP NO.<br>N/A |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | ISSUE/PUBL. DATE | NAME | CLASS | SUB-CLASS | REMARKS |
|---|---|---|---|---|---|---|---|
| | 1. | 10,219,271 | Feb. 26, 2019 | Hedayat et el. | | | |
| | 2. | 2017/0006608 | Jan. 5, 2017 | Josiam et al. | | | |
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| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT NUMBER | PUBLICATION DATE | COUNTRY | CLASS | SUB-CLASS | TRANSLATION |
|---|---|---|---|---|---|---|---|
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| | 11. | 10-2015-0044875 | Apr. 27, 2015 | KR | | | KIPRIS |
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| | 14. | 2015/119374 | Aug. 13, 2015 | WO | | | Espacenet |
| | 15. | 2015-527780 | Sep. 17, 2015 | JP | | | Espacenet |
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**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| EXAMINER INITIAL | REFERENCE NUMBER | DOCUMENT |
|---|---|---|
| | 17. | International Search Report for PCT/KR2016/015297 mailed on April 13, 2017 and its English translation from WIPO (published as WO 2017/111567) |
| | 18. | Written Opinion of the International Searching Authority for PCT/KR2016/015297 mailed on April 13, 2017 and its English from WIPO (published as WO 2017/111567) |
| | 19. | International Preliminary Report on Patentability for PCT/KR2016/015297 issued on June 26, 2018 and its English translation from WIPO (published as WO 2017/111567) |

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| | 20. | Office Action dated June 11, 2019 for Japanese Patent Application No. 2018-553036 and its English translation provided by Applicant's foreign council |
| | 21. | Communication dated June 24, 2019 for EP Application No. 16879434.5 |
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| | 26. | Notice of Allowance dated February 5, 2020 for U.S. Patent Application No. 16/016.520 (now published as U.S. 2018/0302858) |
| | 27. | Non-Final Office Action dated September 27, 2019 for U.S. Patent Application No. 16/016.520 (now published as U.S. 2018/0302858) |

| ***EXAMINER*** | ***DATE CONSIDERED*** |
|---|---|
| | |

**EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. sInclude copy of this form with next communication to applicant.**

KIPO

Unexamined Patent Publication(A)

## Bibliographic Data


| | |
|---|---|
| **Int.Cl.** | H04L 27/26 \| H04L 5/00 \| H04W 56/00 |
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| **Application Date** | 20140411 |
| **Unexamined Publication No.** | 1020150143748 |
| **Unexamined Publication Date** | 20151223 |
| **Priority Claims** | 61/812,136 \| 20130415 \| US<br>61/819,028 \| 20130503 \| US<br>61/847,525 \| 20130717 \| US<br>61/871,267 \| 20130828 \| US<br>61/898,809 \| 20131101 \| US<br>14/250,252 \| 20140410 \| US |
| **Requested Date of Examination** | 20160825 |
| **Agent.** | NAM & NAM World Patent & Law Firm |
| **Inventor** | VERMANI,Sameer \| TANDRA,Rahul \| MERLIN,Simone \| SAMPATH,Hemanth |
| **Applicant** | QUALCOMM INCORPORATED |
| **Rightholder** | QUALCOMM INCORPORATED |


## 발명의 명칭

다중 액세스 무선 통신에 대한 하위-호환가능한 프리앰블 포맷들을 위한 시스템들 및 방법들

## Title of Invention

SYSTEMS AND METHODS FOR BACKWARDS-COMPATIBLE PREAMBLE FORMATS FOR MULTIPLE ACCESS WIRELESS COMMUNICATION

## 요약

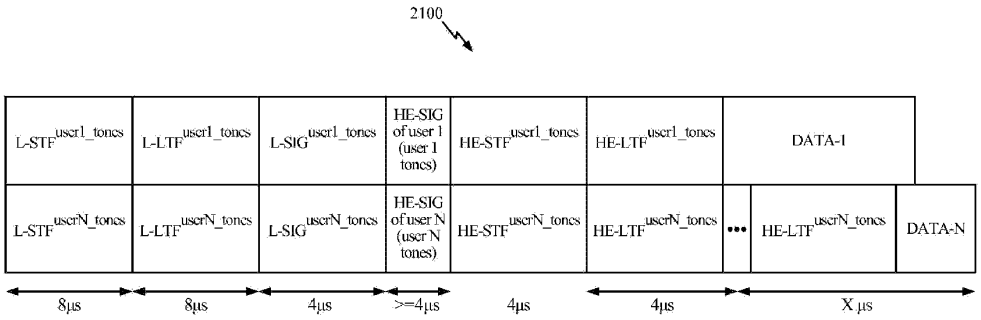
무선 통신을 위한 시스템들, 방법들 및 디바이스들이 본 명세서에 개시된다. 본 개시의 일 양상은 무선 통신 네트워크 상에서 통신하는 방법을 제공한다. 방법은, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법을 제공한다. 방법은, 제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 단계; 제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 단계; 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하는 단계 —제 1 부분은 제 1 데이터 섹션을 포함하여 제 1 무선 디바이스에 의해 송신됨—; 및 대역폭의 제 2 섹션에서 송신의 제 2 부분을 동시에 수신하는 단계를 포함하고, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 데이터 섹션을 포함한다.

## Abstract

Disclosed is the systems for the wireless communication the methods and devices. The method in which one aspect of the disclosure communicates on the wireless communication network is provided. The method provides the method for receiving the transmission from two or more wireless communication devices. The method comprises the step of receiving the first preamble transmitted with the first wireless device; the step of receiving the second preamble transmitted with the second radio device; the second section of the bandwidth is the first section of the bandwidth the step — first part receiving the first part of the transmission by the first section of the bandwidth includes it is transmitted, and the step of simultaneously receiving the second part of the transmission by the second section of th

e bandwidth including the first data section with the fir st wireless device; and the second part is the second data section the second part is transmitted with the se cond radio device it does not overlap.

## 대표도면(Representative drawing)




## 청구의 범위

**청구 1항:**

둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법으로서,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 단계;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 단계;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하는 단계 ―상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨―; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하는 단계를 포함하고,

상기 대역폭의 제 2 섹션은 상기 대역폭의 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구 2항:**

제 1 항에 있어서,

상기 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함하고, 상기 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

## Scope of Claims

**Claim 1:**

As the method for receiving the transmission from two or more wireless communication devices, the method fo r receiving the transmission from two or more wireless communication devices including the second part is the second data section the second part is transmitted wit h the second radio device the step — first part receivin g the first part of the transmission by the first section of the step :

bandwidth receiving the second preamble transmitted with the step :

second radio device receiving the first preamble transm itted with

first wireless device includes it is transmitted, and the step of simultaneously receiving the second part of the transmission by the second section of the bandwidth in cluding the first data section with the first wireless dev ice ; and the second section of

bandwidth does not overlap with the first section of th e bandwidth.

**Claim 2:**

As for claim 1, the method it further includes the second section transmitted with wireless devices using the interpretable second format ; the second preamble includes the third section transmitted with wireless dev ices having the first set of the capabilities using the int erpretable first format ; and for receiving the transmissi on which further includes the fourth section transmitte d with wireless devices having the second set of the c apabilities using the interpretable second format from t wo or more wireless communication devices wherein

the first preamble has the second set of the capabilitie s the first section is included that are transmitted usin

g the interpretable first format by wireless devices havi ng the first set of the capabilities.

청구 **3**항:

제 2 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션 및 상기 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 3:**

As for claim 2, the method wherein the first section of

the first preamble and the third section of the second preamble receive the transmission from two or more wir eless communication devices that include the training fi eld and the signal field used for the training field used f or the automatic gain control of the first type, the exa ct frequency offset estimation, and the time synchroni zation and channel estimation of the second type.

청구 **4**항:

제 2 항에 있어서,

상기 제 1 프리앰블의 제 2 섹션 및 상기 제 2 프리앰블의 제 4 섹션 각각은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 4:**

As for claim 2, the method wherein the second section of

the first preamble and fourth section of the second pre amble receive the transmission from two or more wirele ss communication devices that include at least one trai ning fields of the second type.

청구 **5**항:

제 4 항에 있어서,

특정 디바이스로부터의 상기 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 상기 특정 무선 디바이스에 할당된 공간적 스트림들의 양에 기초하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 5:**

As for claim 4, the method which amount of at least one training field of the second type from

specific devices receives the transmission which it is b ased on amount of spatial streams allocated in the spe cific wireless device from two or more wireless communi cation devices.

청구 **6**항:

제 4 항에 있어서,

상기 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 가장 많은 공간적 스트림들을 할당받은 무선 디바이스에 할당된 공간적 스트림들의 양에 기초하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 6:**

As for claim 4, the method wherein the amount of at least one training fields of

second type receive the transmission which it is based on amount of spatial streams allocated in the wireless device from two or more wireless communication device s that are allocated most many spatial streams.

청구 **7**항:

제 1 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션은 상기 제 1 타입의 제 1 트레이닝 필드를 포함하고, 상기 제 1 프리앰블의 제 2 섹션은, 상기 제 1 타입의 제 1 트레이닝 필드보다 큰 사이클릭 시프트들을 포함하는 제 1 타입의 제 2 트레이닝 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 7:**

The method for receiving the transmission including the second training field of the first type from two or more wireless communication devices of claim 1, wherein the first section of

the first preamble comprises the first training field of th e first type, and the second section of the first preamb le comprise cyclic shifts which are greater than the firs t training field of the first type.

청구 **8**항:

제 1 항에 있어서,

상기 제 1 프리앰블은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드를 포함하고, 상기 제 2 프리앰블은, 제 1

**Claim 8:**

The method of claim 1, wherein

the first preamble comprises the training field of the firs t type, and the subsequent signal field in at least one t raining fields of the subsequent second type in that th

타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함하고, 상기 제 2 프리앰블의 제 2 타입의 상기 트레이닝 필드들의 수는 상기 제 1 프리앰블의 제 2 타입의 상기 트레이닝 필드들의 수와 동일한, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

at, and the second preamble receives the transmission in which the number of training fields of the second type of the second preamble it includes is the training field of the first type, at least one training fields of the subsequent second type in that, the subsequent signal field in that, and the that, immediately, subsequent data identical with the number of training fields of the second type of the first preamble from two or more wireless communication devices.

청구 **9**항:

**Claim 9:**

제 1 항에 있어서,

As for claim 1, the method wherein

상기 제 1 프리앰블은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

the first preamble receives the transmission from two or more wireless communication devices that includes the training field of the first type, the subsequent signal field in at least one training fields of the subsequent second type in that that, and that immediately subsequent data.

청구 **10**항:

**Claim 10:**

제 1 항에 있어서,

The method for receiving the transmission from two or more wireless communication devices of claim 1, wherein

상기 제 1 프리앰블은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 제 2 프리앰블은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 제 1 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들은, 상기 제 2 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들에 대해 시간, 주파수에서 또는 코드를 통해 직교하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

the first preamble comprises at least one training fields of the second type, and the second preamble includes ; and or is orthogonal to at least one training field of the second type of the first preambles about at least one training fields of the second type of the second preamble in time, and frequency through the code at least one training fields of the second type.

청구 **11**항:

**Claim 11:**

제 1 항에 있어서,

The method for receiving the transmission which is transmitted in order to transmit the symbol known through frequency tones, from two or more wireless communication devices of claim 1, wherein

상기 제 1 프리앰블은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 송신은, 다수의 톤들 및 다수의 공간적 스트림들 상에서 전송되는 데이터 섹션을 포함하고, 상기 제 2 타입의 하나 이상의 트레이닝 필드들은, 상기 공간적 스트림들 각각이 상기 제 1 섹션 및 상기 대역폭의 제 2 섹션 둘 모두에 걸쳐 있는 주파수 톤들을 통해 공지된 심볼을 송신하도록 전송되는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

the first preamble comprise at least one training fields of the second type, and the transmission includes ; and the spatial stream has at least one training field of the second types through the second section both of the bandwidth and the first section the data section transmitted on the multiple tones and multiple spatial streams.

청구 **12**항:

**Claim 12:**

제 1 항에 있어서,

As for claim 1, the method wherein

상기 제 1 프리앰블 및 상기 제 2 프리앰블 각각은 신호 필드, 그에 후속하는 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 다른 신호 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

the first preamble and the second preamble receive the transmission from two or more wireless communication devices that include the signal field, the training field of the subsequent first type in that, and the subsequent dissimilar signal field in at least one training fields of the subsequent second type in that that.

청구 **13**항:

**Claim 13:**

제 1 항에 있어서,

As for claim 1, the method wherein

상기 제 1 프리앰블 및 상기 제 2 프리앰블 각각은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 상기 송신의 제 1 부분 및 제 2 부분을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

the first preamble and the second preamble receive the transmission from two or more wireless communication devices that include the training field of the first type, the subsequent signal field in at least one training field s of the subsequent second type in that that, and that immediately the first part and the second part of the s ubsequent transmission.

**청구 14항:**

제 1 항에 있어서,

상기 제 1 프리앰블은 상기 대역폭의 제 1 섹션에서만 전송되는 심볼들을 포함하고, 상기 제 2 프리앰블은 상기 대역폭의 제 2 섹션에서만 전송되는 심볼들을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 14:**

The method for receiving the transmission from two or more wireless communication devices of claim 1, wherei n

the first preamble comprises symbols transmitted from t he first section of the bandwidth, and the second prea mble comprise symbols transmitted from the second se ction of the bandwidth.

**청구 15항:**

제 14 항에 있어서,

상기 대역폭의 제 1 섹션 및 상기 대역폭의 제 2 섹션 각각은 톤들의 중첩하지 않는 세트를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**Claim 15:**

As for claim 14, the method wherein the first section of

bandwidth and the second section of the bandwidth re ceive the transmission from two or more wireless comm unication devices that include the set which does not overlap of the tones.

**청구 16항:**

무선 통신을 위한 장치로서,

대역폭을 걸친 송신을 수신하도록 구성되는 수신기를 포함하고,

상기 송신을 수신하는 것은,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 것;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 것;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하는 것—상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨—; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하는 것을 포함하고,

상기 대역폭의 제 2 섹션은 상기 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 무선 통신을 위한 장치.

**Claim 16:**

As the apparatus for the wireless communication, the apparatus for the wireless communication including the second part is the second data section the second par t is transmitted with the second radio device the recei ver which is configured to receive the transmission spa nning

bandwidth is included ; it includes to receive

transmission the first preamble transmitted with

first wireless device is received the second preamble tr ansmitted with :

second radio device is received the first part of the tra nsmission is received by the first section of :

bandwidth — first part is transmitted including the first data section with the first wireless device simultaneous ly receiving the second part of the transmission by the second section of the bandwidth and :

; and the second section of

bandwidth does not overlap with the first section.

**청구 17항:**

제 16 항에 있어서,

상기 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들

**Claim 17:**

As for claim 16, the apparatus it further includes the second section transmitted with wireless devices using the interpretable second format ; the second preamble includes the third section transmitted with wireless dev ices having the first set of the capabilities using the int

에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함하고, 상기 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함하는, 무선 통신을 위한 장치.

erpretable first format ; and further including the fourth section transmitted with wireless devices having the second set of the capabilities using the interpretable second format. For the wireless communication wherein

the first preamble has the second set of the capabilities the first section is included that are transmitted using the interpretable first format by wireless devices having the first set of the capabilities.

청구 **18**항:

제 17 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션 및 상기 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함하는, 무선 통신을 위한 장치.

**Claim 18:**

The apparatus for the wireless communication of claim 17, wherein the first section of

the first preamble and the third section of the second preamble comprise the training field used for the automatic gain control of the first type, the exact frequency offset estimation, and the time synchronization and the training field and the signal field used for the channel estimation of the second type.

청구 **19**항:

제 16 항에 있어서,

상기 제 1 프리앰블의 제 2 섹션 및 상기 제 2 프리앰블의 제 4 섹션 각각은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하는, 무선 통신을 위한 장치.

**Claim 19:**

The apparatus for the wireless communication of claim 16, wherein the second section of

the first preamble and fourth section of the second preamble comprise at least one training fields of the second type.

청구 **20**항:

무선 통신을 위한 장치로서,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하기 위한 수단;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하기 위한 수단;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하기 위한 수단 —상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨—; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하기 위한 수단을 포함하고,

상기 대역폭의 제 2 섹션은 상기 대역폭의 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 무선 통신을 위한 장치.

**Claim 20:**

As the apparatus for the wireless communication, the apparatus for the wireless communication including the second part is the second data section the second part is transmitted with the second radio device the means — first part for receiving the first part of the transmission by the first section of the means :

bandwidth for receiving the second preamble transmitted with the means :

second radio device for receiving the first preamble transmitted with

first wireless device includes it is transmitted, and the means for simultaneously receiving the second part of the transmission by the second section of the bandwidth including the first data section with the first wireless device ; and the second section of

bandwidth does not overlap with the first section of the bandwidth.

## 기술분야

[0001] 본 출원은 일반적으로 무선 통신들에 관한 것이고, 더 구체적으로는, 하위-호환가능한 다중 액세스 무선 통신을 가능하게 하는 시스템들, 방법들 및 디바이스들에 관한 것이다. 본 명세서의 특정 양상들은, 특히 IEEE 802.11 무선 통신 표준군의 직교 주파수-분할 다중 액세스(OFDMA) 통신들에 관한 것이다.

## Technical Field

[0001] The application relates to the system which the generally is wireless communications and makes the multiple-access wireless communication which is more specifically compatible low rank - possible. The methods and devices. The certain aspects of this specification relates to multiple-access (OFDMA) communications indignant with especially, orthogonal frequency - of the IEEE 802.11 wireless communication standard group.

## 배경기술

[0002] 많은 전기통신 시스템들에서, 통신 네트워크들은, 몇몇 상호작용하는 공간적으로 분리된 디바이스들 사이에서 메시지들을 교환하는데 이용된다. 네트워크들은 지리적 범위에 따라 분류될 수 있고, 지리적 범위는, 예를 들어, 대도시 영역, 로컬 영역 또는 개인 영역일 수 있다. 이러한 네트워크들은, 광역 네트워크(WAN), 대도시 영역 네트워크(MAN), 로컬 영역 네트워크(LAN) 또는 개인 영역 네트워크(PAN)로서 각각 지정될 수 있다. 네트워크들은 또한, 다양한 네트워크 노드들 및 디바이스들을 상호접속하는데 이용되는 교환/라우팅 기술(예를 들어, 회선 교환 대 패킷 교환), 송신을 위해 이용되는 물리적 매체의 타입(예를 들어, 유선 대 무선), 및 이용되는 통신 프로토콜들의 세트(예를 들어, 인터넷 프로토콜 세트(suite), SONET(Synchronous Optical Networking), 이더넷 등)에 따라 상이하다.

[0003] 무선 네트워크들은, 네트워크 엘리먼트들이 이동식이어서 동적 접속 필요성들을 갖는 경우, 또는 네트워크 아키텍쳐가 고정식보다는 애드혹(ad hoc) 토폴로지로 형성되는 경우 종종 선호된다. 무선 네트워크들은, 라디오, 마이크로파, 적외선, 광학 등의 주파수 대역들에서 전자기파들을 이용하여, 가이드되지 않은 전파 모드로 무형의(intangible) 물리적 매체를 이용한다. 무선 네트워크들은 유리하게는, 고정식 유선 네트워크들에 비해 빠른 필드 전개 및 사용자 이동성을 용이하게 한다.

## 발명을 실시하기 위한 구체적인 내용

[0046] 이하, 신규한 시스템들, 장치들 및 방법들의 다양한 양상들을 첨부한 도면들을 참조하여 더 상세히 설명한다. 그러나, 본 교시들의 개시는 다수의 다른 형태들로 구현될 수 있고, 본 개시 전체에 제시되는 임의의 특정한 구조 또는 기능에 제한되는 것으로 해석되어서는 안된다. 오히려, 이 양상들은, 본 개시가 철저하고 완전해지도록 제공되고, 본 개시의 범위를 당업자들에게 완전하게 전달할 것이다. 본 명세서의 교시들에 기초하여, 당업자는, 본 개시의 범위가 본 발명의 임의의 다른 양상과 결합되어 구현되든 독립적으로 구현되든, 본 명세서에 개시된 신규한 시스템들, 장치들 및 방법들의 임의의 양상을 커버하도록 의도됨을 인식해야 한다. 예를 들어, 본 명세서에 기술된 양상들 중 임의의 수의 양상들을 이용하여 장치가 구현될 수 있고, 또는 방법이 실시될 수 있다. 또한, 본 발명의 범위는, 본 명세서에 기술된 본 발명의 다양한 양상들에 부가하여 또는 그 이외의 다른 구조, 기능, 또는 구조 및 기능을 이용하여 실시되는 이러한 장치 또는 방법을 커버하도록 의도된다. 본 명세서에 개시된 임의의 양상은 청구항의 하나 이상의 엘리먼트들에 의해 구현될 수 있음을 이해해야 한다.

## Background Art

[0002] The communication network in many electrical communication system is used when messages are exchanged between devices interacting and are spatially separated. Networks can be classified according to the geometrical range and the geometrical range can be for example, the metropolitan area, and the local area or the private section. Such networks can be designated as the wide area network (WAN), the metropolitan area network (MAN), and the local area network (LAN) or the personal area network (PAN). It is different according to the network nodes in which networks are moreover various and the exchange / routing technique (for example, the call switching large packet exchange) that is used to interconnect devices, and the type (for example, the wire large wireless) of the physical media used for the transmission and set (for example, the internet protocol set (suite), the SONET (Synchronous Optical Networking), the Ethernet etc) of the used communication protocols.

[0003] In that case, the case or the network architecture in which network elements are the transportable and having dynamic connection necessities is often preferred to the fixed type wireless networks are formed into the ad hoc topology. In the frequency bands of the radio, the microwave, the infrared ray, the optical etc, wireless networks use the physical media of the shapelessness (intangible) as the propagation mode which is not guided using electromagnetic waves. In comparison with the fixed type wired network ⬭ in which wireless networks are advantageous and the field development and the fast user mobility are facilitated.

## Description of Embodiments

[0046] Hereinafter, the various modes of the system which is novel the apparatus and methods are more particularly illustrated with reference to attached drawings. But the initiation of these teachingses can be implemented as multiple dissimilar forms and with it is limited in the specific structure or the function of being presented in the disclosure whole it should not be interpreted. Rather, these modes are provided in order to the disclosure be thorough and be perfect and it completely will deliver the range of the disclosure to person skilled in the arts. The range of the disclosure is combined with the dissimilar mode of the invention and the person skilled in the art is implemented or it is independently implemented based on the teachingses of this specification or the person skilled in the art has to recognize being intended in this specification in order to cover the disclosed systems which are novel, and the arbitrary mode of the methods and apparatuses. For example, the apparatus can be implemented among modes described in this specification using the modes of the arbitrary number and or the method can be executed. Moreover, the scope of the present invention is or intended in addition to the various modes of the invention described in this specification in order to cover such apparatus or the method for being performed using the structure of being different of the except, and the function or the structure

and function. It has to understand that the disclosed a rbitrary mode can be implemented by at least one elem ents of claim in this specification.

[0047] 특정한 양상들이 본 명세서에서 설명되지만, 이 양상들의 많은 번화들 및 치환들은 본 개시의 범위 내에 속한다. 선호되는 양상들의 몇몇 이익들 및 이점들이 언급되지만, 본 개시의 범위는 특정한 이점들, 이용들 또는 목적들로 제한되도록 의도되지 않는다. 오히려, 본 개시의 양상들은, 상이한 무선 기술들, 시스템 구성들, 네트워크들 및 송신 프로토콜들에 광범위하게 적용가능하도록 의도되고, 이들 중 일부는, 선호되는 양상들의 하기 설명 및 도면들에서 예시의 방식으로 예시된다. 상세한 설명 및 도면들은 제한적이기 보다는 본 개시의 단지 예시이고, 본 개시의 범위는 첨부된 청구항들 및 이들의 균등물들에 의해 정의된다.

[0047] The specific modes is explained in this specification. However many change and the substituti on of these phases belong within the range of the discl osure. Some benefits and the preferred advantages of the modes are mentioned. However it is not intended s o that the range of the disclosure is limited within the s pecific advantages, and the usages or the purposes. R ather, it is intended in order to the extensively be appli cable to the different wireless technology the system c onfiguration the network and transmission protocols an d it is exemplified in terms of the exemplary mode in th e following description and the drawings in which the p art is among these preferred of the modes. The only th e detailed explanation and drawings are the example th an the restrictive sharp-edged tool of the disclosure an d it is defined with claims and their equivalents in whic h the range of the disclosure is attached.

[0048] 무선 네트워크 기술들은 다양한 타입들의 무선 로컬 영역 네트워크들(WLAN들)을 포함할 수 있다. WLAN은, 광범위하게 이용된 네트워킹 프로토콜들을 이용하여, 인근의 디바이스들을 서로 상호접속시키는데 이용될 수 있다. 본 명세서에서 설명되는 다양한 양상들은 임의의 통신 표준, 예를 들어, WiFi 또는 더 일반적으로 무선 프로토콜들의 IEEE 802.11 군의 임의의 멤버에 적용될 수 있다. 예를 들어, 본 명세서에서 설명되는 다양한 양상들은, 직교 주파수-분할 다중 액세스(OFDMA) 통신들을 지원하는 802.11 프로토콜과 같은 IEEE 802.11 프로토콜의 일부로서 이용될 수 있다.

[0048] Wireless network techniques may include the various types of wireless local area networks (WLANs). WLAN is used when the devices of the nearby are inter connected to each other using extensively used netwo rking protocols. Generally generally various modes whic h are explained in this specification can be more applie d to the arbitrary member of the IEEE 802.11 group of the radio protocols. For example, various modes which are explained in this specification can be used as the p art of the IEEE 802.11 protocol like 802.11 protocol sup porting multiple-access (OFDMA) communications indig nant with orthogonal frequency -.

[0049] STA들과 같은 다수의 디바이스들이 AP와 동시에 통신하도록 허용하는 것은 유리할 수 있다. 예를 들어, 이것은, 다수의 STA들이 더 짧은 시간에 AP로부터의 응답을 수신하도록 허용할 수 있고, 더 적은 지연으로 AP로부터 데이터를 수신 및 송신할 수 있도록 허용할 수 있다. 이것은 또한, AP가 더 많은 수의 디바이스들과 전반적으로 통신하도록 허용할 수 있고, 또한 대역폭 이용량을 더 효율적이 되게 할 수 있다. 다중 액세스 통신들을 이용함으로써, AP는, 예를 들어, 80 MHz 대역폭에 걸쳐 한번에 4개의 디바이스들에 OFDM 심볼들을 멀티플렉싱할 수 있고, 여기서 각각의 디바이스는 20 MHz 대역폭을 활용한다. 따라서, 다중 액세스는 몇몇 양상들에서 유리할 수 있는데, 이는, AP가 자신에게 이용가능한 스펙트럼을 더 효율적으로 이용하도록 허용할 수 있기 때문이다.

[0049] It can be advantageous to allow so that a plurality of devices such as STAs simultaneously comm unicates with AP. For example, as to this, it can allow so that multiple STAs receive the response from AP in t he time to be shorter and in order to receive data from AP and it transmits to the delay which is more little it c an allow. This can allow on the whole, so that moreove r, AP communicates with the greater number of devices and it is more efficient moreover, the bandwidth use a mount is become. Multiple-access communications are used. In that way at a time AP can multiplex OFDM sy mbols in the devices of 4 through for example, 80 MHz bandwidth and here each device utilizes 20 MHz bandwi dth. Therefore, the multiple-access can be advantageo us in some modes. It allow more efficiently, so that this uses the spectrum in which AP is available to the ones elf.

[0050] AP와 STA들 사이에서 송신되는 심볼들의 상이한 서브캐리어들(또는 톤들)을 상이한 STA들에 할당함으로써, 802.11 군과 같은 OFDM 시스템에서 이러한 다중 액세스 프로토콜들을 구현하는 것이 제안되었다. 이러한 방식으로, AP는 단일 송신된 OFDM 심볼로 다수의 STA들과 통신할 수 있고, 여기서 심볼의 상이한 톤들이 상이한 STA들에 의해 디코딩 및 프로세싱되어, 다수의 STA들로의 동시 데이터 전송을 허용한다. 이러한 시스템들은 때때로 OFDMA 시스템들로 지칭된다.

[0050] The different subcarrier (or, tones) of the transmitted symbols was assigned to different STAs be tween AP and STAs. In that way it was proposed to im plement such multiple access protocols in the OFDM sy stem like 802.11 group. In this way, it can communicat e to the OFDM symbol in which single AP is transmitted with multiple STAs and it is processed with STAs in whi ch here the different tones of the symbol are different with the decoding and the same time data transmission to the multiple STAs is allowed. Such systems are from time to time called OFDMA systems.

[0051] 이러한 톤 할당 방식은 본 명세서에서 #34#고효율 #34#(HE) 시스템으로 지칭되고, 이러한 다중 톤 할당 시스템에서 송신되는 데이터 패킷들은 고효율(HE) 패킷들로 지칭될 수 있다. 하위-호환가능한 프리앰블 필드들을 포함하는 이러한 패킷들의 다양한 구조들이 아래에서 상세히 설명된다.

[0051] In such tone assignment mode is this specification, it is called the " high efficiency #34 # (HE) system and data packets transmitted in such multiple tone assignment system can be called high efficiency (HE) packets. It is particularly explained in the various structures lower part of such packets including preamble fields which are compatible low rank -.

[0052] 이하, 신규한 시스템들, 장치들 및 방법들의 다양한 양상들을 첨부한 도면들을 참조하여 더 상세히 설명한다. 그러나, 이러한 개시는 다수의 다른 형태들로 구현될 수 있고, 본 개시 전체에 제시되는 임의의 특정한 구조 또는 기능에 제한되는 것으로 해석되어서는 안된다. 오히려, 이 양상들은, 본 개시가 철저하고 완전해지도록 제공되고, 본 개시의 범위를 당업자들에게 완전하게 전달할 것이다. 본 명세서의 교시들에 기초하여, 당업자는, 본 개시의 범위가 본 발명의 임의의 다른 양상과 결합되어 구현되든 독립적으로 구현되든, 본 명세서에 개시된 신규한 시스템들, 장치들 및 방법들의 임의의 양상을 커버하도록 의도됨을 인식해야 한다. 예를 들어, 본 명세서에 기술된 양상들 중 임의의 수의 양상들을 이용하여 장치가 구현될 수 있고, 또는 방법이 실시될 수 있다. 또한, 본 발명의 범위는, 본 명세서에 기술된 본 발명의 다양한 양상들에 부가하여 또는 그 이외의 다른 구조, 기능, 또는 구조 및 기능을 이용하여 실시되는 이러한 장치 또는 방법을 커버하도록 의도된다. 본 명세서에 개시된 임의의 양상은 청구항의 하나 이상의 엘리먼트들에 의해 구현될 수 있음을 이해해야 한다.

[0052] Hereinafter, the various modes of the system which is novel the apparatus and methods are more particularly illustrated with reference to attached drawings. But such initiation can be implemented as multiple dissimilar forms and with it is limited in the specific structure or the function of being presented in the disclosure whole it should not be interpreted. Rather, these modes are provided in order to the disclosure be thorough and be perfect and it completely will deliver the range of the disclosure to person skilled in the arts. The range of the disclosure is combined with the dissimilar mode of the invention and the person skilled in the art is implemented or it is independently implemented based on the teachingses of this specification or the person skilled in the art has to recognize being intended in this specification in order to cover the disclosed systems which are novel, and the arbitrary mode of the methods and apparatuses. For example, the apparatus can be implemented among modes described in this specification using the modes of the arbitrary number and or the method can be executed. Moreover, the scope of the present invention is or intended in addition to the various modes of the invention described in this specification in order to cover such apparatus or the method for being performed using the structure of being different of the except, and the function or the structure and function. It has to understand that the disclosed arbitrary mode can be implemented by at least one elements of claim in this specification.

[0053] 특정한 양상들이 본 명세서에서 설명되지만, 이 양상들의 많은 변화들 및 치환들은 본 개시의 범위 내에 속한다. 선호되는 양상들의 몇몇 이익들 및 이점들이 언급되지만, 본 개시의 범위는 특정한 이점들, 이용들 또는 목적들로 제한되도록 의도되지 않는다. 오히려, 본 개시의 양상들은, 상이한 무선 기술들, 시스템 구성들, 네트워크들 및 송신 프로토콜들에 광범위하게 적용가능하도록 의도되고, 이들 중 일부는, 선호되는 양상들의 하기 설명 및 도면들에서 예시의 방식으로 예시된다. 상세한 설명 및 도면들은 제한적이기 보다는 본 개시의 단지 예시이고, 본 개시의 범위는 첨부된 청구항들 및 이들의 균등물들에 의해 정의된다.

[0053] The specific modes is explained in this specification. However many change and the substitution of these phases belong within the range of the disclosure. Some benefits and the preferred advantages of the modes are mentioned. However it is not intended so that the range of the disclosure is limited within the specific advantages, and the usages or the purposes. Rather, the modes of the disclosure are intended in order to the extensively be applicable to the different wireless technology the system configuration the network and transmission protocols and it is exemplified in terms of the exemplary mode in the following description and the drawings in which the part is among these preferred of the modes. The only the detailed explanation and drawings are the example than the restrictive sharp-edged tool of the disclosure and it is defined with claims and their equivalents in which the range of the disclosure is attached.

[0054] 대중적인 무선 네트워크 기술들은 다양한 타입들의 무선 로컬 영역 네트워크들(WLAN들)을 포함할 수 있다. WLAN은, 광범위하게 이용된 네트워킹 프로토콜들을 이용하여, 인근의 디바이스들을 서로 상호접속시키는데 이용될 수 있다. 본 명세서에서 설명되는 다양한 양상들은 임의의 통신 표준, 예를 들어, 무선 프로토콜에 적용될 수 있다.

[0054] Popular wireless network techniques may include the various types of wireless local area networks (WLANs). WLAN is used when the devices of the nearby are interconnected to each other using extensively used networking protocols. Various modes which are explained in this specification can be applied to the arbitrary communication standard, for example, the radio protocol.

[0055] 몇몇 양상들에서, 무선 신호들은 802.11 프로토콜에 따라 송신될 수 있다. 몇몇 구현들에서, WLAN은, 무선 네트워크에 액세스하는 컴포넌트들인 다양한 디바이스들을 포함한다. 예를 들어, 2가지 타입들의 디바이스들, 즉 액세스 포인트들(AP들) 및 클라이언트들(또한, 스테이션들 또는 STA들로 지칭됨)이 존재할 수 있다. 일반적으로, AP는 WLAN에 대한 허브 또는 기지국으로 기능하고, STA는 WLAN의 사용자로서 기능할 수 있다. 예를 들어, STA는 랩탑 컴퓨터, 개인 휴대 정보 단말(PDA), 모바일 폰 등일 수 있다. 일례에서, STA는, 인터넷에 대한 또는 다른 광역 네트워크들에 대한 일반적 접속을 획득하기 위해, WiFi 준수(compliant) 무선 링크를 통해 AP에 접속한다. 몇몇 구현들에서, STA는 또한 AP로서 이용될 수 있다.

[0055] In some modes, it can be transmitted to radio signals according to 802.11 protocol. In some implementations, WLAN includes various devices which are components accessed in the wireless network. For example, the devices of 2 kinds types in other words the access point (APs) and client (it is moreover called the stations or STAs) can exist. Generally, AP functions to the herb about WLAN or the base station and STA can function as the user of WLAN. For example, STA can be the laptop computer, the personal digital assistant (PDA), the mobile phone etc. In one example, or in order that STA obtains the general connection about the dissimilar wide area networks about the internet it connects to AP through the WiFi observance (compliant) radio link. In some implementations, STA can be used as moreover, AP.

[0056] 액세스 포인트(AP)는 또한, 기지국, 무선 액세스 포인트, 액세스 노드 또는 유사한 용어를 포함하거나, 이들로 구현되거나 또는 이들로 공지될 수 있다.

[0056] The access point (AP) includes moreover, the base station, wireless access point, and the access node or the term or it is implemented as these or it can be known as these. The access node or the term is similar.

[0057] 스테이션 #34#STA#34#는 또한 액세스 단말(#34#AT#34#), 가입자국, 가입자 유닛, 모바일 스테이션, 원격국, 원격 단말, 사용자 단말, 사용자 에이전트, 사용자 디바이스, 사용자 장비 또는 몇몇 다른 용어를 포함하거나, 이들로 구현되거나 또는 이들로 공지될 수 있다. 따라서, 본 명세서에 교시된 하나 이상의 양상들은 폰(예를 들어, 셀룰러 폰 또는 스마트폰), 컴퓨터(예를 들어, 랩탑), 휴대용 통신 디바이스, 헤드셋, 휴대용 컴퓨팅 디바이스(예를 들어, 개인 휴대 정보 단말), 오락 디바이스(예를 들어, 음악 또는 비디오 디바이스 또는 위성 라디오), 게이밍 디바이스 또는 시스템, 글로벌 측위 시스템 디바이스, 또는 무선 매체를 통한 네트워크 통신을 위해 구성되는 임의의 다른 적절한 디바이스에 통합될 수 있다.

[0057] The station "STA" includes moreover, the access terminal ("AT"), subscriber station, subscriber unit, mobile station, remote station, remote terminal, user terminal, user agent, user device, user equipment or the dissimilar term or it is implemented as these or it can be known as these. Therefore, at least one modes taught in this specification can be integrated with the dissimilar proper device which is formed for the phone (for example, the cellular phone or the smartphone), the computer (for example, the laptop), portable communication device, head set, the portable computing device (for example, the personal digital assistant), the entertainment device (for example, music, the video device, or the satellite radio), gaming device or the system, and the network communication through the global positioning system device or the wireless medium.

[0058] 앞서 논의된 바와 같이, 본 명세서에서 설명되는 특정 디바이스들은, 예를 들어, 802.11 표준을 구현할 수 있다. 이러한 디바이스들은, STA로 이용되든 또는 AP로 이용되든 또는 다른 디바이스로 이용되든, 스마트 계측을 위해 또는 스마트 그리드 네트워크에서 이용될 수 있다. 이러한 디바이스들은 센서 애플리케이션들을 제공할 수 있거나 홈 오토메이션(home automation)에서 이용될 수 있다. 디바이스들은 그 대신 또는 추가적으로, 예를 들어, 개인 건강관리를 위한 건강관리 상황에서 이용될 수 있다. 디바이스들은 또한, 확장된 범위의 인터넷 접속을 가능하게 하기 위해(예를 들어, 핫스팟들로 이용하기 위해) 또는 머신-투-머신 통신들을 구현하기 위해, 감시를 위해 이용될 수 있다.

[0058] Before, specific devices which as shown are discussed are explained in this specification can implement 802.11 standard for example. Such devices may be used in the smart grid network it is used as STA. Such devices may be used in the home automation sensor applications can be provided. Devices may be used in the Representation, additionally, for example, the health management situation for the private health administration. Or in order that machine - - machine communications are implemented in order to make the internet connection of the range that devices are moreover expanded possible (it uses as hot spots for example) it is able to make use for the monitoring.

[0059] 도 1은, 802.11 시스템들에 대해 이용가능한 채널들에 대한 채널 할당을 예시한다. 다양한 IEEE 802.11 시스템들은, 5, 10, 20, 40, 80 및 160 MHz 채널들과 같은 다수의 상이한 크기들의 채널들을 지원한다. 예를 들어, 802.11ac 디바

[0059] Fig. 1 exemplifies the channel allocation about the channels which are available about 802.11 systems. The channels of a plurality of different sizes such as various IEEE 802.11 systems is 5, 10, 20, 40, 80 and 1

이스는 20, 40 및 80 MHz 채널 대역폭 수신 및 송신을 지원할 수 있다. 더 큰 채널은 2개의 인접한 더 작은 채널들을 포함할 수 있다. 예를 들어, 80 MHz 채널은 2개의 인접한 40 MHz 채널들을 포함할 수 있다. 현재 구현된 IEEE 802.11 시스템들에서, 20 MHz 채널은, 서로 312.5 kHz만큼 분리된 64개의 서브캐리어들을 포함한다. 이러한 서브캐리어들 중, 더 작은 수가 데이터를 반송하기 위해 이용될 수 있다. 예를 들어, 20 MHz 채널은 -1 내지 -28 및 1 내지 28로 넘버링된 송신 서브캐리어들, 즉, 56개의 서브캐리어들을 포함할 수 있다. 이러한 캐리어들 중 일부는 또한 파일럿 신호들을 송신하기 위해 이용될 수 있다. 수년간, IEEE 802.11 표준은 몇몇 버전들에 걸쳐 진화해왔다. 구 버전들은 11a/g 및 11n 버전들을 포함한다. 가장 최근에는 802.11ac 버전이 릴리즈되었다.

60 MHz channels are supported. For example, 802.11ac device can support 20, 40 and 80 MHz channel bandwidth reception and transmission. The greater channel may include the adjacent channels which are smaller of 2. For example, 80 MHz channel may include adjacent 40 MHz channels of 2. In the current implemented IEEE 802.11 systems, 20 MHz channel includes the subcarriers separated as 312.5 kHz of 64. Among such subcarriers, data can be used so that the small number more return data. For example, 20 MHz channel comprises -1 through -28 and transmission subcarriers numbered to 1 to 28 in other words the subcarriers of 56. The part can be used among such carriers in order to transmit moreover, pilot signals. For several years , and the IEEE 802.11 standard had been evolving through some versions. Older versions includes 11a / g and 11n versions. Most, recently, 802.11ac version was released.

[0060] 도 2, 도 3 및 도 4는 몇몇 현재 존재하는 IEEE 802.11 표준들에 대한 데이터 패킷 포맷들을 예시한다. 먼저 도 2를 참조하면, IEEE 802.11a, 11b 및 11g에 대한 패킷 포맷이 예시된다. 이러한 프레임은 숏 트레이닝 필드(22), 롱 트레이닝 필드(24) 및 신호 필드(26)를 포함한다. 트레이닝 필드들은 데이터를 송신하지 않지만, 데이터 필드(28)의 데이터를 디코딩하기 위해 AP와 수신 STA들 사이의 동기화를 허용한다.

[0060] Fig. 2 , and figures 3 and 4 exemplify data packet formats about the current IEEE 802.11 standards existing. The first the IEEE 802.11a, and the packet format for 11g and 11b are exemplified with reference to 2. Such frame comprises the shot training field (22), the long training field (24), and the signal field (26). Training fields does not transmit data. However the synchronization between reception STAs and AP are permitted in order to decode data of the data field (28).

[0061] 신호 필드(26)는, 전달되고 있는 패킷의 성질에 정보를 AP로부터 STA들로 전달한다. IEEE 802.11a/b/g 디바이스들에서, 이러한 신호 필드는 24 비트의 길이를 갖고, 1/2의 코드 레이트 및 BPSK 변조를 이용하여 6 Mb/s 레이트에서 단일 OFDM 심볼로 송신된다. SIG 필드(26)의 정보는, 패킷의 데이터의 변조 방식을 설명하는 4 비트(예를 들어, BPSK, 16 QAM, 64QAM 등), 및 패킷 길이에 대한 12 비트를 포함한다. 이 정보는, 패킷이 STA에 의도된 경우 패킷의 데이터를 디코딩하기 위해 그 STA에 의해 이용된다. 패킷이 특정 STA에 의도되지 않은 경우, STA는 SIG 심볼(26)의 길이 필드에서 정의되는 시간 기간 동안 임의의 통신 시도들을 연기할 것이고, 전력을 절감하기 위해, 약 5.5 msec까지의 패킷 기간 동안 수면 모드에 진입할 수 있다.

[0061] The signal field (26) delivers the information to the property of the delivered packet from AP to STAs. In IEEE 802.11a / b / g devices, such signal field has the length of 24 bit and it is transmitted to the single OFDM symbol using the code rate of 1/2 and BPSK modulation in 6 Mb/s rate. The information of the SIG field (26) includes four bits (for example, BPSK, 16QAM, 64QAM etc) explaining the modulation system of data of the packet and 12 bit about the packet length. As to this information, in order to decode data of the packet in case the packet is intended in STA data is used with the STA. In case the packet is not intended in the specific STA STA will play the role of arbitrary communication trials in the length field of the SIG symbol (26) for the defined time period and in order that electricity is felt keenly it can enter the sleep mode for the packet period to about 5.5 msec.

[0062] 특징들이 IEEE 802.11에 추가됨에 따라, STA들에 추가적인 정보를 제공하기 위해, 데이터 패킷들의 SIG 필드들의 포맷에 대한 변경들이 개발되었다. 도 3은, IEEE 802.11n 패킷에 대한 패킷 구조를 도시한다. IEEE.802.11 표준에의 11n 추가는 IEEE.802.11 호환가능한 디바이스들에 MIMO 기능을 추가하였다. IEEE 802.11a/b/g 디바이스들 및 IEEE 802.11n 디바이스들 둘 모두를 포함하는 시스템들에 대해 하위-호환성을 제공하기 위해, IEEE 802.11n 시스템들에 대한 데이터 패킷은 또한, L-STF 22, L-LTF 24, 및 L-SIG 26으로 표기된, 이러한 더 앞선 시스템들의 STF, LTF 및 SIG 필드들을 포함하며, 프리픽스 L은 이들이 #34#레거시#34# 필드들임을 표기한다. IEEE 802.11n 환경에서 STA들에 필요한 정보를 제공하기 위해, 2개의 추가적인 신호 심볼들(140 및 142)이 IEEE 802.11n 데이터 패킷에 추가되었다. 그러나, SIG 필드 및 L-SIG 필드(26)와는 반대로, 이러한 신호 필드들은 회전된 BPSK 변조(또한 QBPSK 변조로 지칭됨)를 이용하였다. IEEE 802.11a/b/g와 동작하도록 구성된 레거시 디바이스가 이러한 패킷을 수신하는 경우, 디바이스는 L-SIG 필드(26)를 수신하

[0062] As characteristics were added to the IEEE 802.11 in order that the additional information was provided to STAs the changes about the format of SIG fields of data packets were developed. Figure 3 shows the packet format about the IEEE 802.11n packet. 11n addition of the IEEE.802.11 standard added the MIMO function to devices which were compatible the IEEE.802.11. In order that the low rank - compatibility is provided concerning IEEE 802.11a / b / g devices and the systems including both the IEEE 802.11n device two STF of systems in which data packet about IEEE 802.11n systems is written in moreover, the L-STF 22, and the L-LTF 24 and L-SIG 26 and which more precede, and LTF and SIG fields are comprised and the prefix L inscribes that these are " legacy " fields. In the IEEE 802.11n environment, in order that the necessary information was provided to STAs additional signal symbol (140 and 142) of 2 were added to the IEEE 802.11n data packet. But the BPSK modulation (it is moreover called the QBPSK

고 이를 정규의 11a/b/g 패킷으로 표기할 것이다. 그러나, 디바이스가 추가적인 비트들을 디코딩하는 것을 계속함에 따라, 비트들은 성공적으로 디코딩되지 않을 것인데, 이는, L-SIG 필드(26) 이후의 데이터 패킷의 포맷은 11a/b/g 패킷의 포맷과는 상이하고, 이러한 프로세스 동안 디바이스에 의해 수행되는 CRC 체크가 실패할 것이기 때문이다. 이것은, 이러한 레거시 디바이스들이 패킷의 프로세싱을 중지할 뿐만 아니라, 초기에 디코딩된 L-SIG의 길이 필드에 의해 정의된 시간 기간이 경과할 때까지 임의의 추가적인 동작들을 연기하게 한다. 반대로, IEEE 802.11n과 호환가능한 새로운 디바이스들은 HT-SIG 필드들의 회전된 변조를 감지할 것이고, 패킷을 802.11n 패킷으로 프로세싱할 것이다. 게다가, 11n 디바이스는, 패킷이 11a/b/g 디바이스에 의도된 것을 알릴 수 있는데, 이는, 디바이스가 L-SIG(26)에 후속하는 심볼에서 QBPSK 이외의 임의의 변조를 감지하면, 이를 11a/b/g 패킷으로서 무시할 것이기 때문이다. HT-SIG1 및 SIG2 심볼들 이후, MIMO 통신에 적합한 추가적인 트레이닝 필드들이 제공되고, 데이터(28)가 후속된다.

modulation) in which such signal fields were rotated was used contrary to the SIG field and L-SIG field (26). The device will receive the L-SIG field (26) and the legacy device which is configured to operate with the IEEE 802.11a / b / g will inscribe this such packet in case the reception in the normal 11a / b / g packet. But as it continues that the device decodes the additional bits bits will not be decoded as the successfully. This the format of data packet of the L-SIG field (26) after is different from the format of 11a / b / g packet and the CRC check performed by the device for such process will fail. As to this, such legacy devices stop the processing of the packet. In addition until the time period defined in the initial with the length field of the decoded L-SIG passes it postpones the additional operations. On the contrary, compatible and new devices will sense the rotated modulation of HT-SIG fields with the IEEE 802.11n and the packet will be processed to 802.11n packet. Moreover, as to 11n device, the packet can inform to 11a / b / g device being intended. If the device as to the this, senses the arbitrary modulation except QBPSK in the L- SIG (26) from the subsequent symbol it will ignore this as 11a / b / g packet. The additional training fields which then is suitable for the MIMO communication with the HT-SIG1 and SIG2 symbol is provided and data (28) is followed by.

[0063] 도 4는, IEEE 802.11 군에 다중-사용자 MIMO 기능을 추가한 현재 존재하는 IEEE 802.11ac 표준에 대한 프레임 포맷을 예시한다. IEEE 802.11n과 유사하게, 802.11ac 프레임은, 동일한 레거시 숏 트레이닝 필드(L-STF)(22) 및 롱 트레이닝 필드(L-LTF)(24)를 포함한다. 802.11ac 프레임은 또한 앞서 설명된 바와 같이 레거시 신호 필드 L-SIG(26)를 포함한다.

[0063] Fig. 4 exemplifies the frame format about the current IEEE 802.11ac standard existing adding the multi-user MIMO function to the IEEE 802.11 group. The IEEE 802.11n, similarly, 802.11ac frame includes the same legacy shot training field (L-STF) (22) and the long training field (L-LTF) (24). The legacy signal field L- SIG (26) is included as 802.11ac frame been moreover before explained.

[0064] 다음으로, 802.11ac 프레임은, 2개의 심볼 길이인 VHT-SIG(Very High Throughput Signal)-A1(150) 및 A2(152) 필드를 포함한다. 이러한 신호 필드는, 11a/b/g 및 11n 디바이스들에는 존재하지 않는 11ac 특징들과 관련된 추가적인 구성 정보를 제공한다. VHT-SIG-A의 제 1 OFDM 심볼(150)은 BPSK를 이용하여 변조될 수 있어서, 패킷을 청취하는 임의의 802.11n 디바이스는, 그 패킷이 802.11a 패킷인 것으로 믿을 것이고, L-SIG(126)의 길이 필드에서 정의되는 패킷 길이의 지속기간 동안 패킷을 연기시킬 것이다. 11a/g에 따라 구성된 디바이스들은, L-SIG(26) 필드에 후속하는 MAC 헤더 및 서비스 필드를 예상하고 있을 것이다. 이들이 이를 디코딩하려 시도하는 경우, 11n 패킷이 11a/b/g 디바이스에 의해 수신된 경우의 절차와 유사한 방식으로 CRC 실패가 발생할 것이고, 11a/b/g 디바이스들은 또한 L-SIG 필드(26)에서 정의된 지속기간 동안 연기할 것이다. VHT-SIG-A의 제 2 심볼(152)은 90-도 회전된 BPSK로 변조된다. 이러한 회전된 제 2 심볼은, 802.11ac 디바이스가 그 패킷을 802.11ac 패킷으로 식별하도록 허용한다. VHT-SIG A1(150) 및 A2(152) 필드들은, 대역폭 모드에 대한 정보, 단일 사용자의 경우에 대한 변조 및 코딩 방식(MCS), 공간 시간 스트림들(NSTS)의 수, 및 다른 정보를 포함한다. VHT-SIG A1(150) 및 A2(152)는 또한 #34#1#34#로 설정된 다수의 예비 비트들을 포함할 수 있다. 레거시 필드들 및 VHT-SIG A1 및 A2 필드들은 이용가능한 대역폭의 각각의 20 MHz에 걸쳐 복제될 수 있다.

[0064] Next, 802.11ac frame includes the VHT- SIG (Very High Throughput Signal) -A 1 (150) which is 2 symbol lengths and a 2 (152) field. In 11a / b / g and 11n devices, such signal field provides the additional configuration information associated with nonexistent 11ac characteristics. As to the arbitrary 802.11n device which the first OFDM symbol (150) of the VHT-SIG-A can be modulated using BPSK and listens to the packet, it will believe that the packet is 802.11a packet and it will delay the packet for the duration of the packet length defined in the length field of the L- SIG (126). Devices formed according to 11a / g predict the subsequent MAC header and service field for the L- SIG (26) field. The CRC failure will be generated in case the attempts by the mode which is similar to the procedure of the case in which 11n packet is received with 11a / b / g device so that these decode this and 11a / b / g devices will postpone in moreover, the L-SIG field (26) for the defined duration. It is modulated into BPSK in which as to the second symbol (152) of the VHT-SIG-A, 90- is rotated. As to the rotated second symbol, it allows so that 802.11ac device distinguishes the packet to 802.11ac packet. The VHT-SIG A 1 (150) and A 2 (152) fields comprise the information about the bandwidth mode, the number of modulation and coding schemes (MCS) confronted in case of the single user, and space and time stream (NSTS), and the other information. The multiple reserved bits in which the VHT-SIG A 1 (150) and A 2 (152) are set up as moreover, the "1" is include might. It can be copied through each 20 MHz of the bandwidth i

n which legacy field , the VHT-SIG A1 and A2 fields are available.

[0065] VHT-STF-A 이후, 802.11ac 패킷은 VHT-STF를 포함할 수 있고, 이는, 다중입력 다중출력(MIMO) 송신에서 자동 이득 제어 추정을 개선하도록 구성된다. 802.11ac 패킷의 다음 1 내지 8개의 필드들은 VHT-LTF들일 수 있다. 이들은, MIMO 채널을 추정하고 그 다음 수신된 신호를 등화하기 위해 이용될 수 있다. 전송된 VHT-LTF들의 수는 사용자당 공간적 스트림들의 수보다 크거나 그와 동일할 수 있다. 마지막으로, 데이터 필드 전의 프리앰블의 마지막 필드는 VHT-SIG-B(154)이다. 이 필드는 BPSK 변조되고, 패킷의 유용한 데이터의 길이에 대한 정보를 제공하고, 다중 사용자(MU) MIMO 패킷의 경우, MCS를 제공한다. 단일 사용자(SU)의 경우, 이 MCS 정보가 대신 VHT-SIG A2에 포함된다. VHT-SIG-B에 후속하여 데이터 심볼들이 송신된다. 802.11ac가 802.11 군에 다양한 새로운 특징들을 도입하였고, 11a/g/n 디바이스들과 하위-호환가능한 프리앰블 설계를 갖는 데이터 패킷을 포함하였고, 또한 11ac의 새로운 특징들을 구현하기 위해 필요한 정보를 제공했지만, 다중 액세스를 위한 OFDMA 톤 할당에 대한 구성 정보는 11ac 데이터 패킷 설계에 의해 제공되지 않는다. IEEE 802.11의 임의의 장래의 버전 또는 OFDM 서브캐리어들을 이용하는 임의의 다른 무선 네트워크 프로토콜에서 이러한 특징들을 구현하기 위해 새로운 프리앰블 구성들이 필요하다. 유리한 프리앰블 설계들이 특히 도 3 내지 도 9를 참조하여 아래에서 표현된다.

[0065] 802.11ac packet then may include the VHT-STF the VHT-STF-A and this is configured to improve the automatic gain control estimation in the multiple input multiple output (MIMO) transmission. It has the next 1 of 802.11ac packet to 8 fields with the VHT-LTF farm work number. So that these estimate the MIMO channel and the next equaliz the received signal, these can be used. It is greater than the number of spatial streams per the user or the number of transmitted VHT-LTFs can be identical with that. Finally, the last field of the preamble of the data field total is the VHT-SIG- B (154). This field is modulated with BPSK and the information about the length of data which is useful of the packet is provided and MCS is provided in case of the multiuser (MU) MIMO packet. In case of the single user (SU), this MCS information is instead of included in the VHT-SIG A2. Subsequently data symbols are transmitted to the VHT-SIG-B. 802.11ac introduced various and new characteristics to 802.11 group and the data packet having the preamble design which was compatible 11a / g / n devices and low rank - was included and in order to implement moreover, the new characteristics of 11ac, the necessary information was provided. However the configuration information about the OFDMA tone assignment for the multiple-access is not provided by 11ac data packet design. In order to implement such characteristics in the dissimilar mobile network protocol using the version of the arbitrary future of the IEEE 802.11 or OFDM subcarriers, new preamble configurations are needed. Favorable preamble designs are expressed in the lower part with reference to especially, the figures 3 through 9.

[0066] 도 5는, 이러한 환경에서 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 물리-계층 패킷의 예시적인 구조를 예시한다.

[0066] In such environment, fig. 5 exemplifies the structure of being illustrative of the physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0067] 이러한 예시적인 물리-계층 패킷에는, L-STF(22), L-LTF(26) 및 L-SIG(26)를 포함하는 레거시 프리앰블이 포함된다. 이들 각각은 20 MHz를 이용하여 송신될 수 있고, AP가 이용하는 각각 20 MHz의 스펙트럼에 대해 다수의 카피들이 송신될 수 있다.

[0067] The illustrative physical - layer packet includes the L- STF (22), and the L- LTF (26) and the legacy free amble including the L- SIG (26). Each of them can be transmitted using 20 MHz and it can be transmitted to multiple copies about the spectrum of 20 MHz which AP uses.

[0068] 이 패킷은 또한, HE-SIG1 심볼(455), HE-SIG2 심볼(457) 및 하나 이상의 HE-SIG3 심볼들(459)을 포함한다. 이러한 심볼들의 구조는 IEEE 802.11a/b/g/n/ac 디바이스과 하위-호환가능해야 하고, 또한 그 패킷이 HE 패킷임을 OFDMA HE 디바이스들에 시그널링해야 한다. IEEE 802.11a/b/g/n/ac 디바이스들과 하위-호환가능하기 위해, 이러한 심볼들 각각에 대해 적절한 변조가 이용될 수 있다. 몇몇 구현들에서, 제 1 심볼 HE-SIG1(455)은 BPSK 변조로 변조될 수 있다. 이것은, BPSK 변조된 제 1 SIG 심볼을 또한 갖는 11ac 패킷들의 현재 경우에서와 동일한 효과를 11a/b/g/n 디바이스에 대해 유발시킬 것이다. 이러한 디바이스들의 경우, 후속 HE-SIG 심볼들(457, 459)에 대한 변조가 무엇인지는 중요하지 않다. 제 2 심볼(457)은 BPSK 또는 QPSK 변조될 수 있다. BPSK 변조되면, 11ac 디바이스는, 그 패킷이 11a/b/g 패킷이라고 가정할 것이고, 패킷의 프로세싱을 중지할 것이고, L-SIG(26)의 길이 필드에 의해 정의되는 시간 동안 연기할 것이다. QBPS

[0068] This packet comprises moreover, the HE-SIG1 symbol (455), the HE-SIG2 symbol (457), and at least one HE-SIG3 symbol (459). The structure of such symbols has to be compatible the IEEE 802.11a / b / g / n / ac device and low rank - and it has to signal in OFDMA HE devices that moreover, the packet is the HE packet. In order that it is compatible IEEE 802.11a / b / g / n / ac devices and low rank - the proper modulation can be used about such symbol. In some implementations, the first symbol HE-SIG 1 (455) can be modulated in to the BPSK modulation. This will cause the effect that is identical in the current in that case of 11ac packets having the first SIG symbol altered with BPSK about 11 a / b / g / n device. The non-critical the modulation about following HE-SIG symbols (457, 459) is the what in case of such devices. The second symbol (457) can be modulated with BPSK or QPSK. If it is altered with BPSK

K 변조되면, 11ac 디바이스는 프리앰블 프로세싱 동안 CRC 에러를 생성할 것이고, 또한 패킷의 프로세싱을 중지할 것이고, L-SIG의 길이 필드에 의해 정의되는 시간 동안 연기할 것이다. 이 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하기 위해, HE-SIG3(459)의 적어도 제 1 심볼은 QBPSK 변조될 수 있다.

11ac device the packet will assume as 11a / b / g packet and the processing of the packet will be suspended and it will postpone for the time to be defined with the length field of the L- SIG (26). If it is altered with QBPSK 11ac device will produce the CRC error for the preamble processing and moreover, the processing of the packet will be suspended and it will postpone for the time to be defined with the length field of the L-SIG. In order that it signals in HE devices that this packet is the HE packet at least first symbol of the HE-SIG 3 (459) can be modulated with QBPSK.

[0069] OFDMA 다중 액세스 통신을 설정하기 위해 필요한 정보는 다양한 위치들에서 HE-SIG 필드들(455, 457 및 459)에 배치될 수 있다. 도 5의 예에서, HE-SIG1(455)은 OFDMA 동작에 대한 톤 할당 정보를 포함한다. HE-SIG3(459)은 각각의 멀티플렉싱된 사용자에 대한 사용자 특정 변조 타입을 정의하는 비트들을 포함한다. 또한, HE-SIG2(457)는, 도 4의 11ac 포맷에서 제공되는 것과 같은 사용자 특정 MIMO 공간적 스트림들을 정의하는 비트들을 포함한다. 도 5의 예는, 4명의 상이한 사용자들에게 특정 서브-대역의 톤들 및 특정 수의 MIMO 공간 시간 스트림들이 각각 할당되도록 허용할 수 있다. 12 비트의 공간 시간 스트림 정보는, 4명의 사용자들 각각에 대해 3개의 비트들을 허용하여, 각각의 사용자에게 1 내지 8개의 스트림들이 할당될 수 있다. 16 비트의 변조 타입 데이터는, 4명의 사용자들 각각에 대해 4 비트들을 허용하여, 4명의 사용자들 각각에게 16개의 상이한 변조(16QAM, 64QAM 등) 중 임의의 변조의 할당을 허용한다. 12 비트의 톤 할당 데이터는, 특정 서브-대역들이 4명의 사용자들 각각에게 할당되도록 허용한다.

[0069] In order to set up the OFDMA multiple-access communication, the necessary information can be arranged in various positions in HE-SIG fields (455, 457 and 459). In the example of fig. 5, the HE-SIG 1 (455) includes the tone assignment information about the OFDMA operation. Bits in which the HE-SIG 3 (459) defines the user-specific modulation type about the multiplexed user are included. Moreover, the HE-SIG 2 (457) includes bits defining user-specific MIMO spatial streams which seem to be provided in 11ac format of fig. 4. As to the example of fig. 5, it can allow so that the tones of the specific sub-band and MIMO space and time streams of the specific number are allocated to more than 4 people different users. Space and time stream information of 12 bit respectively face more than 4 people users and it allows the bits of 3 and the streams of 1 through 8 can be allocated to each user. Modulation type data of 16 bit respectively faces more than 4 people users and it allows four bitses and it allows the allocation of the arbitrary modulation to more than 4 people user among the different modulation (16QAM, 64QAM etc) of 16. To ne assignment data of 12 bit allows in order to be allocated to the user of the specific sub-band 4 people.

[0070] 서브대역 할당을 위한 하나의 예시적인 SIG 필드 방식이 도 6에 예시된다. 이 예는, IEEE 802.11ac에서 현재 이용되는 것과 유사한 6 비트 그룹 ID 필드 뿐만 아니라 4명의 사용자들 각각에게 서브-대역 톤들을 할당하기 위한 10 비트의 정보를 포함한다. 패킷(130)을 전달하기 위해 이용되는 대역폭은 어떠한 수 MHz의 배수들로 STA들에 할당될 수 있다. 예를 들어, 대역폭은 B MHz의 배수들로 STA들에 할당될 수 있다. B의 값은 1, 2, 5, 10, 15 또는 20 MHz와 같은 값일 수 있다. B의 값들은 도 6의 2개의 비트 할당 입도 필드에 의해 제공될 수 있다. 예를 들어, HE-SIG(155)는, 4개의 가능한 B 값들을 허용하는 하나의 2비트 필드를 포함할 수 있다. 예를 들어, B의 값들은, 할당 입도 필드의 0-3 값들에 대응하는 5, 10, 15 또는 20 MHz일 수 있다. 몇몇 양상들에서, k 비트들의 필드는, 0 내지 N의 수를 정의하는 B의 값을 시그널링하기 위해 이용될 수 있고, 여기서 0은 최소 플렉서블 옵션(최대 입도)을 표현하고, N의 하이 값은 최대 플렉서블 옵션(최소 입도)을 표현한다. 각각의 B MHz 부분은 서브-대역으로 지칭될 수 있다.

[0070] One illustrative SIG field mode lice for the subband allocation is exemplified in 6. This example contains the information of 10 bit for assigning sub-band tones to the user of not only 6 bit group ID field which uses presently in the IEEE 802.11ac is similar but also 4 people. The bandwidth which is used in order to deliver the packet (130), can be allocated to the drainages of any number MHz in STAs. For example, the bandwidth can be allocated to the drainages of B MHz in STAs. The value of B can be the value such as 1, 2, 5, 10, 15 and 20 MHz. The value of Bs the bit allocation mouth of 2 of 6 can be provided by field. For example, the HE- SIG (155) may include one 2 bit field giving a permission of possible B-values of 4. For example, the values of B can be 5, corresponding to 0-3 values of the allocation granularity field 10, 15 or 20 MHz. The value can be used in order to signal the value of B defining the number of field of k bits is 0 through N in some modeses and here 0 expresses the minimum flexible option (the maximum particle size) and the high value of N expresses the maximum flexible option (the minimum particle size). Each B MHz part can be called the sub-band.

[0071] HE-SIG1은, 각각의 STA에 할당되는 서브-대역들의 수를 나타내기 위해 사용자당 2 비트를 추가로 이용할 수 있다. 이것은, 0-3 서브-대역들이 각각의 사용자에게 할당되도록 허용한다. OFDMA 패킷의 데이터를 수신할 STA들을 식별하기

[0071] 2 bit per the user can be additionally used in order to show the number of sub-bands which the HE-SIG1 is allocated in each STA. This allows in order to be allotted to 0-3 sub-band each user. In order that ST

위해, 802.11ac로부터의 그룹-id(G_ID) 개념이 이용될 수 있다. 6-비트 G_ID는, 이 예에서는, 4개까지의 STA들을 특정한 순서로 식별할 수 있다.

As receiving data of the OFDMA packet are distinguished the group - id (G ID) concept from 802.11ac can be used. In this example, 6- bit G ID can distinguish STAs to 4 to the specific order.

[0072] 이 예에서, 할당 입도 필드는 #34#00#34#으로 설정된다. 이 예에서, 할당 입도 필드는 2-비트 필드이고, 이 필드의 값들은 5, 10, 15 또는 20 MHz에 순서대로 대응할 수 있다. 예를 들어, #34#00#34#은 5 MHz의 할당 입도에 대응할 수 있다.

[0072] In this example, the allocation granularity field is set up as the "00". In this example, the allocation granularity field is 2- bit field and in order, the value of this fields can correspond to 5, 10, 15 or 20 MHz. For example, the "00" can correspond to the allocation granularity of 5 MHz.

[0073] 이 예에서, 처음 2개의 비트들은, G_ID에 의해 식별되는 제 1 사용자에 대한 서브-대역들의 수를 부여한다. 여기서, 사용자-1에는 #34#11#34# 서브-대역들이 부여된다. 이것은 사용자-1이 3개의 서브-대역들을 수신하는 것에 대응할 수 있다. 각각의 서브-대역이 5 MHz이면, 이것은, 사용자-1에게 15 MHz의 스펙트럼이 할당되는 것을 의미할 수 있다. 유사하게, 사용자-2는 또한 3개의 서브-대역들을 수신하는 한편, 사용자-3은 서브-대역들을 수신하지 않고, 사용자-4는 2개의 서브-대역들을 수신한다. 따라서, 이러한 할당은 40 MHz 신호에 대응할 수 있고, 여기서 사용자-1 및 사용자-2 둘 모두에 대해 15 MHz가 이용되는 한편, 사용자-4는 10 MHz를 수신하고, 사용자-3은 어떠한 서브-대역들도 수신하지 않는다.

[0073] In this example, the number of the sub-bands about the first user who for the first time the bit of 2 s are discriminated with G ID is given. Here, in the user -1, it is endowed with the "11" sub-band. As to the this, the user -1 receives the sub-bands of 3 it can correspond to. If each sub-band is 5 MHz this can mean that the spectrum of 15 MHz is allocated to the user -1. Similarly, the user -2 receives moreover, the sub-bands of 3. The user -3 does not receive sub-bands and the user -4 receives the sub-bands of 2. Therefore, such allocation can correspond to 40 MHz signal and here 15 MHz is used about the user -1 and user -2 the both. The user -4 receives 10 MHz and the user -3 any sub-bands does not receive.

[0074] HE-SIG 심볼들 이후 전송되는 트레이닝 필드들 및 데이터는, 각각의 STA에 할당된 톤들에 따라 AP에 의해 전달된다. 이 정보는 잠재적으로 빔포밍될 수 있다. 이러한 정보를 빔포밍하는 것은, 더 정확한 디코딩을 허용하는 것 및/또는 넌-빔포밍된 송신들보다 더 많은 범위를 제공하는 것과 같은 특정 이점들을 가질 수 있다.

[0074] It is delivered by AP according to tones in which training field and data which then is transmitted with HE-SIG symbol are allocated in each STA. This information can be potentially beam formed. It can have specific advantages which seem to provide more ranges than transmissions which hang out to air and which are beam formed allow the decoding which is more exact what such information beam is formed.

[0075] 각각의 사용자에게 할당된 공간 시간 스트림들에 따라, 상이한 사용자들은 상이한 수의 HE-LTF들(165)을 요구할 수 있다. 각각의 STA는, 그 STA와 연관된 각각의 공간적 스트림에 대한 채널 추정을 허용하는 다수의 HE-LTF들(165)을 요구할 수 있고, 이는 일반적으로 공간적 스트림들의 수와 동일하거나 그보다 많다. LTF들은 또한 주파수 오프셋 추정 및 시간 동기화를 위해 이용될 수 있다. 상이한 STA들이 상이한 수의 HE-LTF들을 수신할 수 있기 때문에, 몇몇 톤들 상에는 HE-LTF 정보를 그리고 다른 톤들 상에는 데이터를 포함하는 심볼들이 AP로부터 송신될 수 있다.

[0075] According to space and time streams allotted to each user, the HE-LTF (165) in which different users are different of the number can be demanded. Each STA is identical with the number of spatial streams it can require or it is multiple HE-LTFs (165) allowing the channel estimation about each spatial stream related to the STA many. LTFs can be used for moreover, the frequency offset estimation and time synchronization. The HE-LTFs in which different STAs are different of the number can be received. Therefore symbols including data can be the HE-LTF information transmitted on some tones on dissimilar tones from AP.

[0076] 몇몇 양상들에서, 동일한 OFDM 심볼 상에서 HE-LTF 정보 및 데이터 둘 모두를 전송하는 것은 문제가 될 수 있다. 예를 들어, 이것은, 피크-투-평균 전력비(PAPR)를 너무 높은 레벨까지 증가시킬 수 있다. 따라서, 그 대신, 각각의 STA가 적어도 요구된 수의 HE-LTF들(165)을 수신할 때까지, 송신되는 심볼들의 모든 톤들 상에서 HE-LTF들(165)을 송신하는 것이 유리할 수 있다. 예를 들어, 각각의 STA는, STA와 연관된 공간적 스트림당 하나의 HE-LTF(165)를 수신할 필요가 있을 수 있다. 따라서, AP는, 임의의 STA에 할당되는 공간적 스트림들의 최대수와 동일한 수의 HE-LTF들(165)을 각각의 STA에 송신하도록 구성될 수 있다. 예를 들어, 3개의 STA들에 단일 공간적 스트림이 할당되지만, 제 4 STA에 3개의 공간적 스트림들이 할당되면, 이러한 양상에서, AP는, 페이로드 데이터를 포함하는 심볼들을 송신하기 전에 4개의 STA들 각각에 HE-LTF 정보의 4개의 심볼들을 송신하도록 구성될 수 있다.

[0076] In some modes, it can become a problem to transmit on the same OFDM symbol both the HE-LTF information and data two. For example, this can increase the peak - - average power ratio (PAPR) to the so high level. Therefore, until the Representation, and each STA receive the HE-LTF (165) of at least required number it can be advantageous to transmit the HE-LTF (165) on all tones of the transmitted symbols. For example, each STA need to receive the HE- LTF (165) related to STA of the spatial per stream one. Therefore, AP is configured to transmit the same HE-LTF (165) as the maximum number of spatial streams allocated in the arbitrary STA of the number to each STA. For example, the single space stream is allocated in 3 STAs. However if spatial streams of 3 are allocated in the fourth STA , before AP transmits symbols including payload data the symbol

s of 4 of the HE-LTF information are configured to be r espectively transmitted in such mode with STA of 4.

[0077] 임의의 주어진 STA에 할당되는 톤들이 인접할 필요는 없다. 예를 들어, 몇몇 구현들에서, 상이한 수신 STA들의 서브-대역들은 인터리빙될 수 있다. 예를 들어, 사용자-1 및 사용자-2 각각이 3개의 서브-대역들을 수신하는 한편, 사용자-4가 2개의 서브-대역들을 수신하면, 이러한 서브-대역들은 전체 AP 대역폭에 걸쳐 인터리빙될 수 있다. 예를 들어, 이러한 서브-대역들은 1,2,4,1,2,4,1,2와 같은 순서로 인터리빙될 수 있다. 몇몇 양상들에서, 서브-대역들을 인터리빙하는 다른 방법들이 또한 이용될 수 있다. 몇몇 양상들에서, 서브-대역들을 인터리빙하는 것은, 특정 서브-대역에 대한 특정 디바이스로부터의 불량한 수신의 효과 또는 간섭들의 부정적 효과들을 감소시킬 수 있다. 몇몇 양상들에서, AP는, STA가 선호하는 서브-대역들 상에서 STA들에 송신할 수 있다. 예를 들어, 특정 STA들은 다른 서브-대역들보다 몇몇 서브-대역들에서 더 양호한 수신도를 가질 수 있다. 따라서, AP는, STA가 어느 서브-대역들에서 더 양호한 수신도를 가질 수 있는지에 적어도 부분적으로 기초하여 STA들에 송신할 수 있다. 몇몇 양상들에서, 서브-대역들은 또한 인터리빙되지 않을 수 있다. 예를 들어, 서브-대역들은 그 대신 1,1,1,2,2,2,4,4로서 송신될 수 있다. 몇몇 양상들에서, 서브-대역들이 인터리빙되는지 여부가 미리 정의될 수 있다.

[0077] The need that tones allocated in given STA are adjacent does not have. For example, in some impleme ntations, the different sub-band of reception STAs can be interleaved. For example, the user -1 and user -2 re ceive the sub-bands of 3. The user -4 the reception lo wer-side , and such sub-bands can be the sub-bands o f 2 interleaved through the whole AP bandwidth. For ex ample, such sub-bands can be interleaved to the order like 1,2,4,1,2,4,1,2. In some modes, the dissimilar meth ods interleaving sub-bands can be moreover used. In s ome modes, the negative effects of the effect of the b ad reception from the specific device about the specifi c sub-band or the interferences can be reduced to inte rleave sub-bands. In some modes, AP can transmit to STAs on sub-bands which STA prefers. For example, in some sub-bands than the sub-band in which specific S TAs are different, it can have the reception rate which is better. Therefore, in STA is a sub-bands, AP is base d at least partially about having the reception rate whi ch is better and it can transmit to STAs. In some mode s, sub-bands are not interleaved to the moreover. For example, the instead of can be transmitted to sub-ban ds as 1,1,1,2,2,2,4,4. In some modes, it is interleaved to the sub-band it can be defined in advance.

[0078] 도 5의 예에서, HE-SIG3 심볼 변조는, 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하기 위해 이용된다. 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하는 다른 방법들이 또한 이용될 수 있다. 도 7의 예에서, L-SIG(126)는, HE 프리앰블이 레거시 프리앰블에 후속할 것임을 HE 디바이스들에 지시하는 정보를 포함할 수 있다. 예를 들어, L-SIG(26)는, L-SIG(26) 동안 Q 신호에 민감한 HE 디바이스들에 후속 HE 프리앰블의 존재를 나타내는, Q-레일 상의 낮은 에너지의 1-비트 코드를 포함할 수 있다. 매우 낮은 진폭의 Q 신호가 이용될 수 있는데, 그 이유는, 패킷을 송신하기 위해 AP에 의해 이용되는 모든 톤들에 걸쳐 단일 비트 신호가 확산될 수 있기 때문이다. 이 코드는, HE-프리앰블/패킷의 존재를 검출하기 위해 고효율 디바이스들에 의해 이용될 수 있다. 레거시 디바이스들의 L-SIG(26) 검출 감도는 Q-레일 상의 이러한 낮은 에너지의 코드에 의해 현저히 영향받을 필요가 없다. 따라서, 이러한 디바이스들은 L-SIG(26)를 판독할 수 있을 것이고, 그 코드의 존재를 인식하지 못하는 한편, HE 디바이스들은 코드의 존재를 검출할 수 있을 것이다. 이러한 구현에서, HE-SIG 필드들 전부는, 원한다면, BPSK 변조될 수 있고, 레거시 호환가능성과 관련하여 본 명세서에서 설명되는 임의의 기술들이 이러한 L-SIG 시그널링과 함께 이용될 수 있다.

[0078] In the example of fig. 5, so that it signal in HE devices that the packet is the HE packet, the HE-SIG3 symbol modulation is used. The dissimilar methods signa led can be used to HE devices that the packet is the H E packet. The L- SIG (126), is the HE preamble in the e xample, of fig. 7 may include the information which indi cates to HE devices being the thing following in the leg acy free amble. For example, the L- SIG (26) may inclu de 1- bit code showing the presence of the following H E preamble in A -sensitive HE devices Q signal for the L- SIG (26) of the low energy on the Q- rail. Q signal o f the amplitude which is very low can be used. So that reason for the transmit the packet, the single bit signal be diffused through all tones used by AP. This code ca n be used with high efficiency devices in order to dete ct the presence of the HE- preamble / packet. There is no need that the L- SIG (26) detection sensitivity of th e legacy devices is remarkably affected with the code of the low energy on the Q- rail. Therefore, such devic es will be able to read the L- SIG (26) and the presenc e of the code is unable to be recognized. HE devices wi ll be able to detect the presence of the code. In such i mplementation, if the HE-SIG field whole desires it can be altered with BPSK and arbitrary technologies explain ed in connection with the legacy compatibility in this s pecification can be used with such L-SIG signaling.

[0079] 도 8은, 11ac 디바이스들에 의한 하위-호환가능성을 또한 구현하는 다른 방법을 예시한다. 이 예에서, HE-SIG-A1(455)은, 11ac 디바이스가 VHT-SIG 필드를 디코딩하는 경우 요구하는 값으로부터 플립된 값으로 설정되는 비트를 포함할 수 있다. 예를 들어, 802.11ac VHT-SIG-A 필드는, 정확하게 어셈블링된 VHT-SIG-A 필드에서 예비되고 1로 설정되

[0079] Fig. 8 exemplifies the dissimilar method for moreover implementing the low rank - compatibility by 11ac devices. In this example, the HE-SIG-A 1 (455), i s 11ac device may include the bit set up from the valu e requiring the VHT-SIG field in case the decodes as th e flipped value. For example, 802.11ac VHT-SIG-A field

는 비트들 2 및 23을 포함한다. 고효율 프리앰블 HE-SIG-A(455)에서, 이러한 비트들 중 하나 또는 둘 모두는 제로로 설정될 수 있다. 802.11ac 디바이스가, 이러한 플립된 값을 갖는 예비 비트를 포함하는 패킷을 수신하면, 11ac 디바이스는 패킷의 프로세싱을 중지하고, 이를 디코딩불가능한 것으로 취급하는 한편, L-SIG(26)에 특정된 지속기간 동안 패킷을 여전히 연기시킨다. 이러한 구현에서, 11a/b/g/n 디바이스들과의 하위-호환가능성은 HE-SIG1 심볼(455) 상에서 BPSK 변조를 이용함으로써 달성될 수 있고, HE 디바이스들에 시그널링하는 것은, HE-SIG2(457) 또는 HE-SIG3(459)의 하나 이상의 심볼들에 대해 QBPSK 변조를 이용함으로써 달성될 수 있다.

includes the Beat which is provided in the VHT-SIG-A field which the accurately is assembled and is set up as 1 and 23. In the high efficiency preamble HE-SIG- A (455), one or both can be set up as zero among such bits. If 802.11ac device receives the packet including reserved bit having the flipped value , 11ac device stops the processing of the packet and with it is impossible with decoding it handles this. It still delays the packet for the duration specified in the L- SIG (26). In such implementation, it can be achieved since the low rank - compatibility with 11a / b / g / n devices uses the BPSK modulation on the HE-SIG1 symbol (455) and by using the QBPSK modulation about at least one symbols of the HE-SIG 2 (457) or the HE-SIG 3 (459) it can be achieved in HE devices to signal.

[0080] 도 9에 예시된 예에 의해 도시된 바와 같이, HE 패킷의 구조는 802.11ac에서 활용되는 패킷 구조에 기초할 수 있다. 이 예에서, 레거시 프리앰블(22, 24, 26) 이후, 도 9에 HE-SIGA1 및 HE-GIGA2로 명명되는 2개의 심볼들이 제공된다. 이것은 도 4의 VHT-SIGA1 및 VHT-SIGA2와 동일한 구조이다. 공간 시간 스트림 할당 및 톤 할당 둘 모두를 이러한 2개의 24 비트 심볼들에 들어맞게 하기 위해, 공간 시간 스트림 옵션들에는 자유도가 거의 제공되지 않는다.

[0080] As shown in the figure, the structure of the HE packet can be based on the packet format of being used in 802.11ac with the example exemplified in fig. 9. In this example, then the symbols named the HE-SIGA1 and HE-GIGA2 of 2 are provided to fig. 9 with legacy free ambles (22, 24, 26). This is the structure of being identical with the VHT-SIGA1 of 4 and VHT-SIGA2. In order that it makes suitable for 24 bit symbols of 2 suches both space and time stream allocation and tone assignment two the degree of freedom is not nearly provided in space and time stream options.

[0081] 도 9의 예는 또한, HE 트레이닝 필드들 이후 HE-SIGB 심볼(459)을 배치하고, 이는 또한 도 4의 VHT-SIGB 필드(154)와 유사하다.

[0081] Then the example of fig. 9 arranges the HE-SIGB symbol (459) moreover, HE training fields and this is similar to moreover, the VHT-SIGB field (154) of fig. 4.

[0082] 그러나, 이러한 11ac-기반 프리앰블에 의한 하나의 잠재적 문제는, 이러한 설계가 HE-SIG-B(470)의 공간 제한들에 다다를 수 있다는 점이다. 예를 들어, HE-SIG-B(470)는 적어도 MCS(4 비트) 및 테일 비트(6 비트)를 포함할 필요가 있을 수 있다. 따라서, HE-SIG-B(470)는 적어도 10 비트의 정보를 포함할 필요가 있을 수 있다. 802.11ac 규격에서, VHT-SIG-B는 1 OFDM 심볼이다. 그러나, 각각의 서브-대역의 대역폭에 따라, 단일 OFDM 심볼에는 충분한 수의 비트들이 존재하지 않을 수 있다. 예를 들어, 아래의 표 1은 이러한 잠재적인 문제를 예시한다.

[0082] But as to one potential problem by such 11ac-base preamble, such design can arrive at the space limits of the HE-SIG- B (470). For example, the HE-SIG- B (470) includes at least MCS (four bits) and the tail bit (6 bit). Therefore, the HE-SIG- B (470) need to include the information of at least 10 bit. In 802.11ac standard, the VHT-SIG-B is 1 OFDM symbol. But according to the bandwidth of each sub-band, enough bits of the number can be nonexistent in the single OFDM symbol. For example, the following table 1 exemplifies the potential such problem.

| 사용자당 BW (MHz 단위) | 사용자/OFDM 심볼 당 비트들의 수 | 테일 비트들의 수 | MCS 필드에 대한 나머지 비트들의 수 |
|---|---|---|---|
| 10 | 13 | 6 | 7 |
| 6 | 8 | 6 | 2 |
| 5 | 6 | 6 | 0 |

| BW per the user(MHz unit) | The number of the bits per the user / OFDM symbol | The number of tail bits | The number of the remainder bits about the MCS field |
|---|---|---|---|
| 10 | 13 | 6 | 7 |
| 6 | 8 | 6 | 2 |
| 5 | 6 | 6 | 0 |

[0083] 표 1에 예시된 바와 같이, 각각의 서브-대역이 10 MHz이면, 단일 OFDM 심볼은 13 비트를 제공한다. 이러한 비트들 중 6개는 테일 비트들로서 필요하고, 따라서 MCS 필드에 대해 7 비트가 남는다. 앞서 언급된 바와 같이, MCS 필드는 4 비트를 요구한다. 따라서, 각각의 서브-대역이 적어도 10 MHz이면, HE-SIG-B(470)에 대해 단일 OFMD 심볼이 이용될 수 있고, 이것은 4 비트 MCS 필드를 포함하기에 충분할 수 있다. 그러나, 각각의 서브-대역이 그 대신 5 또는 6 MHz이면, 이것은 OFDM 심볼당 6 또는 8 비트만을 허용할 수 있다. 이러한 비트들 중 6 비트가 테일 비트이다. 따라서, MCS 필드에 대해 0 또는 2 비트만이 이용가능하다. 이것은 MCS 필드를 제공하기에는 불충분하다. 서브-대역 입도가 SIGB 필드들에서 요구

[0083] As shown in it is exemplified in the table 1 if each sub-band is 10 MHz the single OFDM symbol provides 13 bit. 6 is necessary among such bits as tail bits and therefore 7 bit remains about the MCS field. Before, as shown in it is mentioned the MCS field demands four bits. Therefore, if each sub-band is at least 10 MHz the single OFMD symbol can be used about the HE-SIG- B (470) and this is sufficient to include four bits MCS field. But if each sub-band is instead of 5 or 6 MHz this can allow only the OFDM Sim BolDang 6 or 8-bit. 6 bit is the tail bit among such bits. Therefore, it is available about the MCS field only 0 or 2 bit. This is insufficient to serve the MCS field. The OFDM symbol which is m

되는 정보를 제공하기에는 너무 작은 이러한 경우들에서, HE-SIG-B(470)에 대해 하나보다 많은 OFDM 심볼이 이용될 수 있다. 필요한 심볼들의 수는, 시스템이 허용할 최소 서브-대역과 관련될 것이다. 이것이, IEEE 802.11 군 OFDM 시스템의 13개의 톤들에 대응하는 5 MHz이면, HE-SIG-B에 대한 2개의 심볼들은, HE-SIG-B 정보 MCS 및 테일 비트들에 대한 충분할 길이인 12 비트를 제공하기 위해 BPSK 변조 및 1/2 순방향 에러 정정 코드 레이트를 허용할 것이다. 도 10은, 본 개시의 양상들이 이용될 수 있는 무선 통신 시스템(100)의 예를 예시한다. 무선 통신 시스템(100)은, 예를 들어, IEEE 802.11 표준들과 같은 무선 표준에 따라 동작할 수 있다. 무선 통신 시스템(100)은 STA들(106a, 106b, 106c 및 106d)(총괄적으로 STA들(106))과 통신하는 AP(104)를 포함할 수 있다. 네트워크는 레거시 STA들(106b) 및 고효율(HE) STA들(106a, 106c, 106d) 둘 모두를 포함할 수 있다.

ore than one can be used of such cases which are so s mall about the HE-SIG- B (470) to provide the informati on in which the sub-band particle size is required in SIG B fields. The number of necessary symbols relates to th e minimum sub-band which the system allows. If this is 5 MHz corresponding to the tones of 13 of the IEEE 80 2.11 group OFDM system in order to provide 12 bit whi ch is enough length for the tail bits and HE-SIG-B infor mation MCS the symbol of 2 about the HE-SIG-Bs will a llow the BPSK modulation and 1/2 forward error correcti on code rate. Fig. 10 shows a sign of the example of th e radio communication system (100) in which it is able to make use of the modes of the disclosure. The radio communication system (100) can operate according to for example, the radio criteria like IEEE 802.11 standard s. The radio communication system (100) comprises ST A (106a, 106b, 106c and 106d) (generally, the STA (10 6)) and the AP (104) communicating. The network may include both the legacy STA (106b) and high efficiency (HE) STA (106a, 106c, 106d) two.

[0084] AP(104)와 STA들(106) 사이의 무선 통신 시스템(100)에서 송신들을 위해 다양한 프로세스들 및 방법들이 이용될 수 있다. 예를 들어, 신호들은 OFDM/OFDMA 기술들에 따라 AP(104)와 STA들(106) 사이에서 전송 및 수신될 수 있다. 이러한 경우이면, 무선 통신 시스템(100)은 OFDM/OFDMA 시스템으로 지칭될 수 있다.

[0084] In the radio communication system (100) between the STA (106) and the AP (104), the process es and the various methods can be used for transmissi ons. For example, according to the signal is OFDM / OF DMA technologies, it can be received between the AP (104) and STA (106) with the transmission. If it is like t hat the radio communication system (100) can be calle d the OFDM / OFDMA system.

[0085] AP(104)로부터 STA들(106) 중 하나 이상으로의 송신을 용이하게 하는 통신 링크는 다운링크(DL)(108)로 지칭될 수 있고, STA들(106) 중 하나 이상으로부터 AP(104)로의 송신을 용이하게 하는 통신 링크는 업링크(UL)(110)로 지칭될 수 있다. 대안적으로, 다운링크(108)는 순방향 링크 또는 순방향 채널로 지칭될 수 있고, 업링크(110)는 역방향 링크 또는 역방향 채널로 지칭될 수 있다. 몇몇 경우들에서, 몇몇 DL(108) 통신들은 HE 패킷(130)과 같은 HE 패킷들일 수 있다. 이러한 HE 패킷들은, 802.11a 및 802.11n과 같은 규격들에 따른 프리앰블 정보와 같은 레거시 프리앰블 정보를 포함할 수 있고, 이는, 레거시 STA(106b)가 HE 패킷(130)을 인식하게 하고, 송신의 지속기간 동안 HE 패킷(130)의 송신을 연기하게 하기에 충분한 정보를 포함한다. 유사하게, HE 패킷들(130)인 DL(108) 통신들은, 앞서 논의된 바와 같이, 어느 디바이스들이 HE 패킷(130)의 정보를 수신할 수 있는지를 HE STA들(106a, 106c, 106d)에 통지하기에 충분한 정보를 포함할 수 있다.

[0085] The communication link facilitating the transmission to one or greater from the AP (104) amon g the STA (106) can be called the down-link (DL) (108) and the communication link facilitating the transmission to the AP (104) from at least one of the STA (106) can be called the up-link (UL) (110). Alternatively, the dow n-link (108) can be called the forward link or the forwar d channel and the up-link (110) can be called the rever se link or the reverse channel. In some cases, it has so me DL (108) communications with the HE packet farm work number like the HE packet (130). Such HE packet s includes the information which may include the legac y free amble information like the preamble information a ccording to the standards and as to the this, the legac y STA (106b) recognizes the HE packet (130) and post pones the transmission of the HE packet (130) for the duration of the transmission, such as 802.11a and 80 2.11n. Similarly, a devices DL (108) communications wh ich are the HE packet (130) are before discussed may i nclude the information which is sufficient to notify in H E STAs (106a, 106c, 106d) whether it can receive the i nformation of the HE packet (130) or not.

[0086] AP(104)는 기지국으로 동작하고, 기본 서비스 영역(BSA)(102)에서 무선 통신 커버리지를 제공할 수 있다. AP(104)와 연관되고 통신을 위해 AP(104)를 이용하는 STA들(106)과 함께 AP(104)는 기본 서비스 세트(BSS)로 지칭될 수 있다. 무선 통신 시스템(100)은 중앙 AP(104)를 갖지 않을 수 있지만, 오히려 STA들(106) 사이에서 피어-투-피어 네트워크로서 기능할 수 있음을 주목해야 한다. 따라서, 본 명세서에서 설명되는 AP(104)의 기능들은 대안적으로 STA들(106) 중 하나 이상에 의해 수행될 수 있다.

[0086] The AP (104) operates to the base station and the wireless communication coverage can be provided i n the basic service area (BSA) (102). The AP (104) ca n be called the basic service set (BSS) with the STA (1 06) which is related to the AP (104) and uses the AP (104) for the communication. The radio communication system (100) does not have the center AP (104). How ever it has to pay attention rather functioning as the p eer to peer network between the STA (106). Therefor e, alternatively the function of the AP (104)s explained in this specification can be performed by at least one o f the STA (106).

[0087] 도 11은, 무선 통신 시스템(100) 내에서 이용될 수 있는 무선 디바이스(202)에서 활용될 수 있는 다양한 컴포넌트들을 예시한다. 무선 디바이스(202)는, 본 명세서에서 설명되는 다양한 방법들을 구현하도록 구성될 수 있는 디바이스의 예이다. 예를 들어, 무선 디바이스(202)는 도 10의 AP(104) 또는 STA들(106) 중 하나를 포함할 수 있다. 몇몇 양상들에서, 무선 디바이스(202)는, HE 패킷(130)과 같은 HE 패킷들을 송신하도록 구성되는 AP를 포함할 수 있다.

[0087] Fig. 11 exemplifies various components which can be used in the wireless device (202) which can be used in the radio communication system (100). The wireless device (202) is the example of the device which is configured to take various methods explained in this specification. For example, the wireless device (202) may include one among the AP (104) of fig. 10 or the STA (106). In some modes, AP in which the wireless device (202) is configured to transmit HE packets like the HE packet (130) is include might.

[0088] 무선 디바이스(202)는, 무선 디바이스(202)의 동작을 제어하는 프로세서(204)를 포함할 수 있다. 프로세서(204)는 또한 중앙 프로세싱 유닛(CPU)으로 지칭될 수 있다. 판독 전용 메모리(ROM) 및 랜덤 액세스 메모리(RAM) 모두를 포함할 수 있는 메모리(206)는 프로세서(204)에 명령들 및 데이터를 제공한다. 메모리(206)의 일부는 또한 비휘발성 랜덤 액세스 메모리(NVRAM)를 포함할 수 있다. 프로세서(204)는 통상적으로, 메모리(206) 내에 저장된 프로그램 명령들에 기초하여 논리적 및 산술적 연산들을 수행한다. 메모리(206)의 명령들은 본 명세서에서 설명되는 방법들을 구현하도록 실행가능할 수 있다. 예를 들어, 무선 디바이스(202)가 AP(104)이면, 메모리(206)는, 무선 디바이스(202)가 HE 패킷(130)과 같은 HE 패킷들을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 메모리(206)는, 무선 디바이스(202)가 레거시 프리앰블, 및 그에 후속하는 HE-SIG 또는 HE-SIG-A를 포함하는 HE 프리앰블을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 몇몇 양상들에서, 무선 디바이스(202)는 프레임 포맷팅 회로(221)를 포함할 수 있고, 프레임 포맷팅 회로(221)는, 무선 디바이스(202)가 본 명세서에 개시된 실시예들에 따른 프레임을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 프레임 포맷팅 회로(221)는, 무선 디바이스(202)가, 레거시 프리앰블 및 고효율 프리앰블 둘 모두를 포함하는 패킷을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다.

[0088] The wireless device (202) may include the processor (204) controlling the operation of the wireless device (202). The processor (204) can be called moreover, the central processing unit (CPU). The read-only-memory (ROM) and the memory (206) of maying include both the random access memory (RAM) provide the commands and data to the processor (204). The part of the memory (206) may include moreover, the nonvolatile random access memory (NVRAM). The processor (204) performs logical arithmetic operations based on program instructions which generally are stored within the memory (206). In order to implement the methods explained in this specification it can be executable from the command of the memory (206)s. For example, the wireless device (202) may include commands which if it is the AP (104) the memory (206) is sufficient to allow so that the wireless device (202) transmits HE packets like the HE packet (130). For example, the memory (206) comprises the wireless device (202) is the legacy free amble and commands which it is sufficient to allow in order to transmit the HE preamble including the subsequent HE-SIG or the HE-SIG-A to that. The frame formatting circuit (221), is the wireless device (202) the wireless device (202) may include the frame formatting circuit (221) in some modes may include commands which it is sufficient to allow in order to transmit the frame according to the disclosed embodiments to this specification. For example, the frame formatting circuit (221) comprises the wireless device (202), is the legacy free amble and commands which it is sufficient to allow in order to transmit the packet including both the high efficiency preamble two.

[0089] 프로세서(204)는 하나 이상의 프로세서들로 구현되는 프로세싱 시스템의 컴포넌트를 포함하거나 컴포넌트일 수 있다. 하나 이상의 프로세서들은, 범용 마이크로프로세서들, 마이크로제어기들, 디지털 신호 프로세서들(DSP들), 필드 프로그래머블 게이트 어레이(FPGA들), 프로그래머블 로직 디바이스들(PLD들), 제어기들, 상태 머신들, 게이트된 로직, 이산 하드웨어 컴포넌트들, 전용 하드웨어 유한 상태 머신들, 또는 정보의 계산들 또는 다른 조작들을 수행할 수 있는 임의의 다른 적절한 엔티티들의 임의의 조합으로 구현될 수 있다.

[0089] The component of the processing system in which the processor (204) is implemented as at least one processors is included or it can be the component. At least one processors can be implemented as the arbitrary combination of dissimilar proper entities performing the universal microprocessors, microcontrollers, digital signal processor (DSPs), field programmable gate array (FPGAs), programmable logic device (PLDs), controllers, state machines, the gated logic, and the calculations of discrete hardware components special-purpose hardware finite state machines or the information or the dissimilar operations.

[0090] 프로세싱 시스템은 또한, 소프트웨어를 저장하기 위한 머신 판독가능 매체를 포함할 수 있다. 소프트웨어는, 소프트웨어, 펌웨어, 미들웨어, 마이크로코드, 하드웨어 설명 언어로 지칭되든 또는 이와 달리 지칭되든, 임의의 타입의 명령들을 의

[0090] The machine readable medium in which the processing system stores moreover, software is include might. Software is called the software, firmware, middleware, micro code, hardware description language or o

미하도록 넓게 해석될 것이다. 명령들은 코드를 (예를 들어, 소스 코드 포맷, 2진 코드 포맷, 실행가능한 코드 포맷 또는 코드의 임의의 다른 적절한 포맷으로) 포함할 수 있다. 명령들은, 하나 이상의 프로세서들에 의해 실행되는 경우, 프로세싱 시스템으로 하여금, 본 명세서에서 설명되는 다양한 기능들을 수행하게 한다.

n the other hand, it is called or it will be widely interpre ted in order to mean the commands of the arbitrary typ e. Commands may include the code (to for example, th e source code format, the binary code format, and the dissimilar proper format of the executable code format or the code). Commands allow to perform various functi ons which are explained in this specification to the cas e of being carried out by at least one processors, and t he processing system.

[0091] 무선 디바이스(202)는 또한, 무선 디바이스(202)와 원격의 위치 사이에서 데이터의 송신 및 수신을 허용하기 위한 송신기(210) 및 수신기(212)를 포함할 수 있는 하우징(208)을 포함할 수 있다. 송신기(210) 및 수신기(212)는 트랜시버(214)로 결합될 수 있다. 안테나(216)는 하우징(208)에 부착되고 트랜시버(214)에 전기적으로 커플링될 수 있다. 무선 디바이스(202)는 또한 다수의 송신기들, 다수의 수신기들 및 다수의 트랜시버들 및/또는 다수의 안테나들을 포함할 수 있다 (미도시).

[0091] The wireless device (202) comprises moreover, the wireless device (202) and the transmitter (210) for allowing *** of data in the between location of remote and the housing (208) maying include the receiver (21 2). The transmitter (210) and receiver (212) can be co mbined to the transceiver (214). The antenna (216) ca n be adhered to the housing (208) and the electrically can be coupled in the transceiver (214). The wireless d evice (202) comprises moreover, the multiple transmitt ers, and the multiple receivers and the multiple transcei vers and/or the multiple antennae (the not illustrated).

[0092] 무선 디바이스(202)는 또한, 트랜시버(214)에 의해 수신된 신호들의 레벨을 검출 및 정량화하기 위한 노력으로 이용될 수 있는 신호 검출기(218)를 포함할 수 있다. 신호 검출기(218)는 이러한 신호들을 총 에너지, 심볼 당 서브캐리어 당 에너지, 전력 스펙트럼 밀도 및 다른 신호들로서 검출할 수 있다. 무선 디바이스(202)는 또한 프로세싱 신호들에 이용하기 위한 디지털 신호 프로세서(DSP)(220)를 포함할 수 있다. DSP(220)는 송신을 위한 데이터 유닛을 생성하도록 구성될 수 있다. 몇몇 양상들에서, 데이터 유닛은 물리 계층 데이터 유닛(PPDU)을 포함할 수 있다. 몇몇 양상들에서, PPDU는 패킷으로 지칭된다.

[0092] The signal detector (218) which can be used as the effort of the wireless device (202) detecting the le vel of the received signals with moreover, the transcei ver (214) and quantifying is include might. The signal d etector (218) can detect such signals as signals differe nt from the total energy, the per subcarrier energy per the symbol, and the power spectrum density. The digit al signal processor (DSP) (220) which the wireless devi ce (202) uses only in moreover, processing signals is in clude might. The DSP (220) is configured to produce da ta unit for the transmission. In some modes, data unit may include the physical layer data unit (PPDU). In som e modes, PPDU is called the packet.

[0093] 무선 디바이스(202)는 몇몇 양상들에서 사용자 인터페이스(222)를 더 포함할 수 있다. 사용자 인터페이스(222)는 키패드, 마이크로폰, 스피커 및/또는 디스플레이를 포함할 수 있다. 사용자 인터페이스(222)는, 무선 디바이스(202)의 사용자에게 정보를 전달하고 그리고/또는 사용자로부터 입력을 수신하는 임의의 엘리먼트 또는 컴포넌트를 포함할 수 있다.

[0093] In the wireless device (202) is some modes, the user interface (222) is further include might. The user i nterface (222) may include the keypad, the microphon e, and the speaker and/or the display. The user interfa ce (222) may include the arbitrary element or the comp onent instructing the user of the wireless device (202) in the information and receives the input from the user.

[0094] 무선 디바이스(202)의 다양한 컴포넌트들은 버스 시스템(226)에 의해 함께 커플링될 수 있다. 버스 시스템(226)은, 예를 들어, 데이터 버스 뿐만 아니라, 데이터 버스에 부가하여 전력 버스, 제어 신호 버스 및 상태 신호 버스를 포함할 수 있다. 무선 디바이스(202)의 컴포넌트들이, 몇몇 다른 메커니즘을 이용하여 서로 커플링되거나 또는 서로에게 입력들을 제공하거나 수용할 수 있음을 이 분야의 당업자들은 인식할 것이다.

[0094] The various component of the wireless device (202)s can be coupled in the together with the bus sys tem (226). The bus system (226), for example, can co mprise the power bus in addition to the data bus not o nly the data bus, and the control signal bus and status signal bus. The components of the wireless device (20 2) are coupled in each other using the dissimilar mecha nism or the person skilled in the art of this fields will re cognize providing inputs or accommodating.

[0095] 다수의 별개의 컴포넌트들이 도 11에 도시되어 있지만, 컴포넌트들 중 하나 이상은 결합되거나 공통으로 구현될 수 있다. 예를 들어, 프로세서(204)는, 프로세서(204)에 대해 앞서 설명된 기능을 구현할 뿐만 아니라, 신호 검출기(218) 및/또는 DSP(220)에 대해 앞서 설명된 기능을 구현하기 위해 이용될 수 있다. 추가로, 도 11에 예시된 컴포넌트들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 게다가, 아래에서 설명되는 임의의 컴포넌트들, 모듈들, 회로들 등을 구현하기 위해 프로세서(204)가 이용될 수 있거나, 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다.

[0095] The multiple separate components is illustrated in fig. 11. However one or greater is combined among c omponents or it can be commonly implemented. For exa mple, the processor (204) realizes the function before explained about the processor (204). In addition in ord er to realize the function before explained about the si gnal detector (218) and/or the DSP (220) the function can be used. Additionally, the component exemplified in fig. 11 can be implemented using multiple separate ele ments. Moreover, the processor (204) can be used in o rder to implement arbitrary components illustrated belo

w the module the circuit etc. or each can be implement ed using multiple separate elements.

[0096] 도 12는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷(830)의 예시적인 구조를 예시한다. 이러한 업링크 메시지에서, 어떠한 레거시 프리앰블도 필요하지 않는데, 이는, AP의 초기 다운링크 메시지에 의해 NAV가 설정되기 때문이다. 따라서, 업링크 패킷(830)은 레거시 프리앰블을 포함하지 않는다. 업링크 패킷(830)은, AP에 의해 전송되는 UL-OFDMA-어나운스 메시지에 대한 응답으로 전송될 수 있다.

[0096] Fig. 12 exemplifies the structure of being illustrative of the up-link physical - layer packet (830) which can be used it makes multiple-access wireless co mmunications which are compatible low rank - possible. In such up-link message, any legacy free amble is not necessary. As to the this, NAV is due to be set up by t he initial downlink message of AP. Therefore, the uplink packet (830) does not include the legacy free amble. T he uplink packet (830) can be transmitted to the respo nse about the UL-OFDMA- announcement message tra nsmitted with AP.

[0097] 업링크 패킷(830)은 다수의 상이한 STA들에 의해 전송될 수 있다. 예를 들어, 다운링크 패킷에서 식별되는 각각의 STA는 업링크 패킷(830)의 일부를 송신할 수 있다. STA들 각각은, 자신이 할당받은 대역폭 또는 대역폭들에서 동시에 송신할 수 있고, 송신들은 단일 패킷으로 AP에 의해 수신될 수 있다.

[0097] The uplink packet (830) can be transmitted with multiple different STAs. For example, each STA dis criminated in the downlink packet can transmit the part of the uplink packet (830). In the bandwidth or the ban dwidths which oneself is allocated, STA can transmit a nd transmissions can be received to the single packet with AP.

[0098] 패킷(830)에서, 각각의 STA는, 앞서 논의된 바와 같이, 초기 다운링크 메시지에서 톤 할당 동안 자신에 할당된 채널들 또는 서브-채널들만을 이용한다. 이것은, AP 상에서 완전하게 직교하는 수신 프로세싱을 허용한다. 이러한 서브-대역들 각각 상에서 메시지들을 수신하기 위해, AP는 파일럿 톤들을 수신해야 한다. 이러한 파일럿 톤들은, 심볼당 위상 오프셋을 추정하여, 잔여 주파수 오프셋으로 인한 또는 위상 잡음으로 인한 데이터 심볼들에 걸친 위상 변경들을 정정하기 위해, 위상 추적을 위해 802.11 패킷들에서 이용된다. 이러한 위상 오프셋은 또한 시간 및 주파수 추적 루프들에 피딩될 수 있다.

[0098] In the packet (830), as shown in each STA is before discussed it uses only the channels or the sub-c hannels allocated in the initial downlink message for the tone assignment in the oneself. This allows the recepti on processing which is completely orthogonal on AP. In each such sub-bands phase, in order that messages ar e received AP has to receive pilot tones. Such pilot ton es may be used in 802.11 packets for the phase tracki ng or phase aliasings spanned the data symbol due to t he phase noise are corrected due to the residual frequ ency offset the Sim BolDang phase offset is estimated. Such phase offset can be fed into moreover, time and f requency tracking loops.

[0099] 파일럿 톤들을 송신하기 위해, 적어도 2개의 상이한 옵션들이 이용될 수 있다. 먼저, 각각의 사용자는, 자신의 할당된 서브-대역들에 속하는 파일럿 톤들을 송신할 수 있다. 그러나, 낮은 대역폭 OFDMA 할당들의 경우, 이것은, 몇몇 사용자들에 대해 충분한 수의 파일럿 톤들을 허용하지 않을 수 있다. 예를 들어, 802.11a/n/ac의 20 MHz 송신에는 4개의 파일럿 톤들이 존재한다. 그러나, 사용자가 오직 5 MHz만을 할당받았다면, 사용자는 자신의 서브-대역에서 오직 하나의 파일럿 톤만을 가질 수 있다. 그 파일럿 톤에서, 딥 페이딩(deep fade)과 같은 어떠한 문제가 발생하면, 양호한 위상 추정을 획득하는 것은 매우 곤란할 수 있다.

[0099] In order that pilot tones are transmitted at least 2 different options can be used. In advance, eac h user can transmit pilot tones belonging to its own allo cated sub-bands. But in case of low bandwidth OFDMA allocations, this does not allow enough pilot tones of th e number to the some users. For example, in 20 MHz tr ansmission of 802.11a / n / ac, the pilot tones of 4 exis t. But if the user was only allocated only 5 MHz , the u ser only can have in its own sub-band only one pilot to ne. In the pilot tone, if any problem like the deep fadin g (deep fade) occurs , it can be very difficult to obtain the good phase estimation.

[0100] 파일럿 톤들을 송신하는 다른 가능한 방법은, 각각의 사용자가, 단지 자신의 서브-대역에 속하는 파일럿 톤들이 아닌 모든 파일럿 톤들 상에서 송신하는 것을 수반할 수 있다. 이것은, 사용자당 더 많은 수의 파일럿 톤들이 송신되는 것을 초래할 수 있다. 그러나, 이것은, AP가 각각의 파일럿 톤을 다수의 사용자들로부터 동시에 수신하는 것을 초래할 수 있고, 이것은 AP가 프로세싱하기에 더 곤란할 수 있다. AP는 모든 사용자들에 대한 채널들을 추정할 필요가 있을 것이다. 이를 달성하기 위해, 모든 사용자들의 공간적 스트림들의 합에 대응하는 것과 같은 더 많은 LTF들이 필요할 수 있다. 예를 들어, 4명의 사용자들 각각이 2개의 공간적 스트림들과 연관되면, 이러한 접근법에서 8개의 LTF들이 이용될 수 있다.

[0100] The dissimilar and possible method for transmitting pilot tones can accompany on all pilot ton es that are not pilot tones in which each user belongs only to its own sub-band transmitting a message. As to this, it can cause that the user per greater number of pilot tones is transmitted. But as to this, it can cause t hat AP simultaneously receives each pilot tone from mu ltiple users and it can be difficult for as to the this, bec ause AP processes. AP need to estimate the channels about all users. In order that this is achieved more LTF s corresponding to the sum total of spatial streams of all users can be necessary. For example, if more than 4 people user is related to spatial streams of 2 , LTFs of 8 can be used of such approach.

[0101] 따라서, 각각의 STA는 HE-STF(835)를 송신할 수 있다. 패킷(830)에 도시된 바와 같이, HE-STF(835)는 8 ㎲ 동안 송신될 수 있고, 2개의 OFDMA 심볼들을 포함할 수 있다. 각각의 STA는 또한 하나 이상의 HE-LTF(840)를 송신할 수 있다. 패킷(830)에 도시된 바와 같이, HE-LTF(840)는 8 ㎲ 동안 송신될 수 있고, 2개의 OFDMA 심볼들을 포함할 수 있다. 예를 들어, 이전에서와 같이, 각각의 STA는, STA에 할당된 각각의 서브-대역에 대해 HE-LTF(840)를 송신할 수 있다. 각각의 STA는 또한 HE-SIG(845)를 송신할 수 있다. HE-SIG(845)의 길이는 U 각각에 대해 1 OFDMA 심볼 길이(4 ㎲)일 수 있고, 여기서 U는 송신에서 멀티플렉싱되는 STA들의 수이다. 예를 들어, 4개의 STA들이 업링크 패킷(830)을 전송하고 있으면, HE-SIG(845)는 16 ㎲일 수 있다. HE-SIG(845) 이후, 추가적인 HE-LTF들(840)이 송신될 수 있다. 마지막으로, 각각의 STA는 데이터(855)를 송신할 수 있다.

[0101] Therefore, each STA can transmit the HE- STF (835). The HE- STF (835) can be transmitted as shown in the packet (830) for 8 ㎲ and OFDMA symbols of 2 are include might. Each STA can transmit moreover, at least one HE- LTF (840). The HE- LTF (840) can be transmitted as shown in the packet (830) for 8 ㎲ and OFDMA symbols of 2 are include might. For example, the HE- LTF (840) can be transmitted the previous about each sub-band in which each STA is allocated in STA. Each STA can transmit moreover, the HE- SIG (845). It is the number of STAs in which it respectively confronts with U and the length of the HE- SIG (845) may be 1 OFDMA symbol length (4 ㎲) and here U is multiplexed in the transmission. For example, if 4 STAs transmits the uplink packet (830) , the HE- SIG (845) may be 16 ㎲. Then the additional HE-LTF (840) can be transmitted to the HE- SIG (845). Finally, each STA can transmit the data (855).

[0102] 결합된 업링크 패킷(830)을 전송하기 위하여, STA들 각각은 다른 STA들과 시간, 주파수, 및 전력적으로 서로 동기화될 수 있다. 그런 패킷에 대해 요구된 타이밍 동기화는 대략 100 ns 정도일 수 있다. 이 타이밍은 AP의 UL-OFDMA-어나운스 메시지에 응답함으로써 조정될 수 있다. 이 타이밍 정확성은 당업자들에게 알려진 몇몇 솔루션들을 사용하여 얻어질 수 있다. 예를 들어, SIFS(short interframe space)를 타이밍하기 위하여 802.11ac 및 802.11n 디바이스들에 의해 사용된 기술들은 결합된 업링크 패킷(830)을 얻기 위하여 필요한 타이밍 정확성을 제공하기에 충분할 수 있다. 이 타이밍 정확성은 또한, 업링크 클라이언트들 사이의 타이밍 에러들 및 왕복 지연 차이들을 흡수하기 위하여 업링크 OFDMA가 400 ns 가드 시간이 되도록 800 ns의 긴 가드 인터벌을 사용함으로써 유지될 수 있다.

[0102] In order that the combined uplink packet (830) is transmitted it can be synchronized from each other to STAs and the time in which STA is different, and frequency and electricity. The timing synchronization required about that packet can be about approximately, 100 ns. This timing can be adjusted upward by responding to the UL-OFDMA- announcement message of AP. It can be obtained using some solutions in which this timing accuracy is known to person skilled in the arts. For example, in order to obtain the uplink packet (830) in which technologies used by 802.11ac and 802.11n devices are combined in order to time the SIFS (short interframe space) the necessary timing accuracy is sufficient to be provided. It can be maintained by the up-link OFDMA using the long guard interval of 800 ns so that 400 ns guard time is so that this timing accuracy absorb moreover, the timing error between up-link clients and rounded trip delay differences.

[00103] 업링크 패킷(830)에 의해 처리되어야 하는 다른 기술적 문제는, 전송 디바이스들의 주파수들이 동기화되어야 하는 것이다. 업링크 패킷(830)의 것과 같은 UL-OFDMA 시스템에서 STA들 사이의 주파수-오프셋 동기화를 다루기 위하여 다수의 옵션들이 있다. 첫째, 각각의 STA는 자신의 주파수 차이들에 대해 계산 및 정정할 수 있다. 예를 들어, STA들은 STA들에 전송된 UL-OFDMA-어나운스 메시지에 기초하여 AP에 관하여 주파수 오프셋을 계산할 수 있다. 이 메시지에 기초하여, STA들은 시간-도메인 업링크 신호에 위상 램프(phase ramp)를 적용할 수 있다. AP는 또한, LTF들을 사용하여 각각의 STA에 대한 공통 위상 오프셋을 추정할 수 있다. 예를 들어, STA들에 의해 송신된 LTF들은 주파수에서 직교할 수 있다. 따라서, AP는 STA 임펄스 응답들을 분리하기 위하여 윈도우된(windowed)된 고속 푸리에 역변환(IFFT) 함수를 사용할 수 있다. 2개의 동일한 LTF 심볼들에 걸쳐 이들 임펄스 응답들의 변화는 우리에게 모든 각각의 사용자에 대한 주파수 오프셋 추정을 제공할 수 있다. 예를 들어, STA에서 주파수 오프셋은 시간에 따른 위상 램프를 유도할 수 있다. 따라서, 2개의 동일한 LTF 심볼들이 송신되면, AP는 주파수 오프셋의 추정을 얻기 위하여 2개의 임펄스 응답들에 걸쳐 위상의 기울기를 계산하도록 2개의 심볼들 사이의 차이들을 사용할 수 있을 수 있다. 이런 접근법은 당업자들에게 알려져 있을 수 있는 UL-MU-MIMO 메시지에서 제안된 톤-인터리브(tone-interleave)된 접근법과 유사할 수 있다.

[00103] The frequencies of the transfer devices as to the dissimilar technical problem, of to being processed by the uplink packet (830) have to be synchronized. In the UL-OFDMA system like of the uplink packet (830), it has multiple options in order to handle the frequency - offset synchronization between STA. Each STA can calculate about its own frequency differences and it can correct with first. For example, the frequency offset can be calculated based on the UL-OFDMA- announcement message in which STAs are transmitted in STAs about AP. STAs can apply the phase ramp to the time - domain uplink signal based on this message. AP can estimate the common phase offset about each STA using moreover, LTFs. For example, LTFs transmitted with STAs can be orthogonal in frequency. Therefore, the inverse fast Fourier transform (IFFT) function which is windowed (windowed) so that AP separate STA impulse responses can be used. The change of these impulse responses over 2 same LTF symbols provides the cage with the frequency offset estimation about all each users. For example, in STA, the frequency offset can induce the phase ramp according to time. Therefore, if 2 same LTF symbols is transmitted in order to calculate the inclination of the phase through the impulse responses of 2 so that AP obtain the estimation of the frequency offset the difference between the symbols of 2 can be used. It can be similar to the approach which becomes with t

he tone - interleave (tone-interleave) such approach is proposed in the UL-MU-MIMO message known to perso n skilled in the arts.

[00104] 도 13은 고효율 패킷을 2 이상의 무선 통신 디바이스들에 송신하는 예시 방법에 대한 프로세스 흐름도를 예시한다. 이 방법은 AP와 같은 디바이스에 의해 행해질 수 있다.

[00104] Fig. 13 exemplifies the process flow diagram about the illustrating method for transmitting the high efficiency packet to the wireless communication device more than 2. This method can be performed with the d evice like AP.

[00105] 블록(905)에서, AP는 레거시 프리앰블(legacy preamble)을 송신하고, 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 통지하기에 충분한 정보를 포함한다. 예를 들어, 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 경고하기 위하여 사용될 수 있다. 레거시 패킷은 예비 비트 또는 예비 비트들의 결합을 포함할 수 있다. 이들 예비 비트들은 고효율 프리앰블에 대한 패킷을 계속하여 청취하도록 고효율 디바이스들에게 경고하고, 또한 레거시 디바이스들이 패킷을 연기하게 한다. 몇몇 양상들에서, 레거시 프리앰블을 송신하기 위한 수단 — 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 통지하기에 충분한 정보를 포함함 —은 송신기(transmitter)를 포함할 수 있다.

[00105] In the block (905), AP transmits the legacy free amble (legacy preamble) and the information which is sufficient to notify legacy devices that the legacy fr ee amble postpones the packet is contained. For exam ple, it can be used it gives legacy devices a warning th at the legacy free amble postpones the packet. The le gacy packet may include the combination of the reserv ed bit or the reserved bits. It gives high efficiency devi ces a warning and then, so that these reserved bits lis ten to the packet about the high efficiency preamble a nd moreover, legacy devices postpone the packet. In s ome modes, the information which is sufficient to notify legacy devices that the means — legacy free amble for transmitting the legacy free amble postpones the pack et is contained the transmitter is include might.

[00106] 블록(910)에서, AP는 고효율 신호를 송신하고, 고효율 신호는 톤 할당(allocation) 정보를 포함하고, 톤 할당 정보는 2 이상의 무선 통신 디바이스들을 식별한다. 몇몇 양상들에서, 고효율 신호는 패킷 내 정보를 수신할 STA들을 식별하는 정보를 포함할 수 있고, 어느 서브-대역들이 STA들에 대해 의도되는지를 이들 STA들에게 경고할 수 있는 톤 할당 정보를 포함할 수 있다. 몇몇 양상들에서, 고효율 패킷은 또한 802.11ac 디바이스들이 패킷을 연기하게 하기에 충분한 정보를 포함할 수 있다. 몇몇 양상들에서, 고효율 신호를 송신하기 위한 수단 — 고효율 신호는 톤 할당 정보를 포함하고, 톤 할당 정보는 2 이상의 무선 통신 디바이스들을 식별함 —은 송신기를 포함할 수 있다. 몇몇 양상들에서, 고효율 신호는, 다수의 공간 스트림들의 표시가 2 이상의 무선 통신 디바이스들 각각에 할당될 수 있다는 것을 더 포함할 수 있다. 예를 들어, 2 이상의 무선 통신 디바이스들 각각에는 하나 이상의 공간 스트림이 할당될 수 있다. 몇몇 양상들에서, 하나 이상의 공간 스트림들을 2 이상의 무선 통신 디바이스들 각각에 할당하기 위한 수단은 송신기 또는 프로세서를 포함할 수 있다.

[00106] In the block (910), AP transmits the high efficiency signal and the high efficiency signal includes the tone assignment (allocation) information and the to ne assignment information distinguishes the wireless co mmunication device more than 2. In some modes, the i nformation distinguishing STAs in which the high efficie ncy signal receives inside of the packet the information is include might and the tone assignment information w hich can give these STAs a warning whether it is inten ded about a sub-band STAs or not is include might. Th e high efficiency packet in some modes moreover 802.1 1ac devices may include the information postponing th e packet. The means — high efficiency signal for some modes transmitting the high efficiency signal may inclu de the tone assignment information, and the tone assig nment information may include —— is the transmitter a t least 2 wireless communication devices is distinguishe d. In some modes, may further include that the high eff iciency signal the display of the multiple space streams can be respectively allocated with the wireless commu nication device more than 2. For example, in at least 2 wireless communication device, at least one space stre am can be allocated. In some modes, the means for res pectively assigning at least one space streams with th e wireless communication device more than 2 may inclu de the transmitter or the processor.

[00107] 블록(915)에서, AP는 데이터를 2 이상의 무선 통신 디바이스들에 동시에 송신하고, 데이터는 2 이상의 서브-대역들 상에 포함된다. 예를 들어, AP는 최대 4개의 STA들에 데이터를 송신할 수 있다. 몇몇 양상들에서, 데이터를 2 이상의 무선 통신 디바이스들에 동시에 송신하기 위한 수단 — 데이터는 2 이상의 서브-대역들 상에 포함됨 —은 송신기를 포함할 수 있다.

[00107] In the block (915), the simultaneously AP transmits data to the wireless communication device m ore than 2 and data are included on the sub-band more than 2. For example, AP can transmit data to STAs of 4 maximums. In some modes, means — data for simulta neously transmitting data to the wireless communicatio n device more than 2 is included on the sub-band more than 2 the transmitter is include might.

[00108] 일부 양상들에서, AP는, IEEE 802.11a/n/ac 디바이스와 같은 레거시 디바이스에 대한 데이터 및 하나 이상의 고효율 디바이스에 대한 데이터 모두를 포함하는 하이브리드 패

[00108] In some modes, AP can transmit the hybrid packet including whole data about data about the lega cy device like the IEEE 802.11a / n / ac device and at l

킷을 송신할 수 있다. 이러한 하이브리드 패킷은 레거시와 고효율 디바이스 모두를 포함하는 혼합된 환경에서의 대역폭의 보다 효율적인 사용을 허용할 수 있다. 예를 들면, 레거시 시스템에서 AP가 80 MHz의 사용하도록 구성된 경우, AP가 80 MHz 전체를 사용할 수 없는 디바이스에 패킷을 송신하는 경우, AP에 할당된 대역폭의 일부는 미사용될 수 있다. 이것은 고효율 패킷들의 사용에 의해 해결되는 하나의 문제이다. 그러나 STA들 중 일부가 고효율 디바이스이고 STA들 일부가 레거시 디바이스인 환경에서, AP가 사용하도록 구성된 전체 대역폭을 사용할 수 없는 레거시 디바이스로 송신할 때 대역폭은 여전히 미사용될 수 있다. 예를 들면, 이러한 시스템의 고효율 패킷들이 전체 대역폭을 사용할 수 있는 반면, 상술한 바와 같이, 레거시 패킷들은 그렇지 않을 수 있다. 따라서, 하이브리드 패킷을 제공하는 것이 유리할 수 있는데, 하이브리드 패킷에서, 레거시 디바이스는 패킷의 대역폭 중 일 부분에서 정보를 수신할 수 있는 반면, 고효율 디바이스는 패킷의 다른 부분에서 정보를 수신할 수 있다. 이러한 패킷은 하이브리드 패킷으로 지칭될 수 있는데, 그 이유는, 패킷의 일부가 IEEE 802.11a/n/ac 같은 레거시-호환 포맷에서 데이터를 송신할 수 있고, 패킷의 일부가 데이터를 고효율 디바이스들로 송신할 수 있기 때문이다.

east one high efficiency device. More effective use of the bandwidth at the mixed environment in which such hybrid packet includes both the legacy and high efficiency device can be allowed. For example, in the legacy system, in case AP is configured to use of 80 MHz the part of the bandwidth allocated in AP can be the packet not used in the device in which AP cannot use 80 MHz whole in case the transmission. It is one problem in which this is solved by the use of high efficiency packets. But when transmitting a message to the legacy device using the end to end bandwidth in which the part is configured to be the high efficiency device and which AP is configured to use in the environment in which a part of STA is the legacy device among STAs the still the bandwidth can be not used. For example, whereas high efficiency packets of such system can use the end to end bandwidth as described above, legacy packets are not so. Therefore, it can be advantageous to provide the hybrid packet. Whereas the legacy device can receive the information by the hybrid packet among the bandwidth of the packet by one part the high efficiency device can receive the information by the dissimilar part of the packet. In the legacy - compatible format such as in reason for the, the part of the packet the IEEE 802.11a / n / ac such packet can be called the hybrid packet, data can be transmitted and the part of the packet transmit data to high efficiency devices.

[00109] 예시적인 하이브리드 패킷(1400)이 도 14에 도시되어 있다. 이러한 하이브리드 패킷은 AP와 같은 무선 디바이스에 의해 송신될 수 있다. 하이브리드 패킷은 데이터가 레거시 디바이스로 송신되는 레거시 부분, 및 데이터가 고효율 디바이스로 송신되는 고효율 부분을 포함할 수 있다.

[00109] The illustrative hybrid packet (1400) Lee is illustrated in 14. Such hybrid packet can be transmitted with the wireless device like AP. The hybrid packet comprises the legacy part in which data are transmitted to the legacy device and the high efficiency part in which data are transmitted to the high efficiency device.

[00110] 하이브리드 패킷(1400)은 복수의 레거시 프리앰블들을 포함할 수 있으며, 이들 각각은 패킷의 대역폭의 일부 부분을 통해 복제된다. 예를 들면, 예시적인 하이브리드 패킷(1400)은 패킷(1400)의 대역폭의 80 MHz를 통해 복제되는 4개의 20 MHz 레거시 프리앰블을 포함하는 80 MHz의 패킷으로 설명된다. 이러한 복제는 80 MHz 대역폭의 일부에서만 동작할 수 있는 다른 장치들이 패킷을 연기하는 것을 보장하기 위해 레거시 포맷들에서 사용될 수 있다. 일부 양상들에서, 네트워크의 디바이스들 각각은 디폴트로 1차 채널만을 모니터링할 수 있다.

[00110] The hybrid packet (1400) can include multiple legacy free ambles and each of them is copied through the some part of the bandwidth of the packet. For example, it is explained with the packet of 80 MHz in which the illustrative hybrid packet (1400) includes 20 MHz legacy free amble copied through 80 MHz of the bandwidth of the packet (1400) of 4. Such reproduction may be used in legacy formats it guarantees that dissimilar apparatuses operating in the part of 80 MHz bandwidth postpone the packet. In some modes, the device of the network can monitor by default only the first channel.

[00111] 하이브리드 패킷(1400)은 IEEE 802.11a/n/ac과 같은 레거시 포맷에 규정된 것과 동일한 L-STF(1405) 및 L-LTF(1410)을 포함할 수 있다. 이들 필드는 상술된 것과 동일할 수 있다. 그러나 하이브리드 패킷(1400)의 L-SIG(1415)는 레거시 패킷의 그것과 다를 수 있다. L-SIG(1415)는 고효율 디바이스에 시그널링하기 위해 사용되는, 패킷이 하이브리드 패킷이라는 정보를 포함할 수 있다. 레거시 디바이스가 패킷에서 정보를 또한 수신할 수 있도록 하기 위해, 이 정보는 레거시 디바이스로부터 은닉되어야 해서, 이 정보는 레거시 디바이스들의 L-SIG(1415) 수신을 방해하지 않는다.

[00111] The hybrid packet (1400) comprises prescribed in the legacy format like the IEEE 802.11a / n / ac and the L- STF (1405) and the same L- LTF (1410). And these fields comprises and the information which can be identical but is used so that the L- SIG (1415) of the hybrid packet (1400) can be different from that of the legacy packet the L- SIG (1415) signal in the high efficiency device the packet is the hybrid packet. In the legacy device is the packet, in order that the information is moreover received this information has to be concealed from the legacy device and this information does not obstruct the L- SIG (1415) reception of the legacy devices.

[00112] L-SIG(1415)는, 정보에 직교하는 1비트 코드를 L-SIG(1415)에 배치함으로써 패킷이 하이브리드 패킷이라는 것을 고효율 디바이스에 시그널링할 수 있다. 예를 들면, 상술한

[00112] As to the L- SIG (1415), by arranging the single bit code which is orthogonal in the information to the L- SIG (1415) it can signal in the high efficiency de

바와 같이, 1비트 코드는 L-SIG(1415)의 Q-레일에 배치될 수 있다. 레거시 디바이스들은 1 비트 코드를 인지할 수 없을 수 있고 L-SIG(1415)를 정상적인 것으로 판독할 수 있는 반면, 고효율 디바이스는 이러한 1 비트 코드를 명확하게 찾을 수 있고 이것이 존재하는지 여부를 결정할 수 있다. 이 1 비트 코드는 하이브리드 패킷이 전송되고 있음을 고효율 디바이스에 시그널링하기 위해 사용될 수 있다. 일부 양상들에서, 1 비트 코드는, 코드를 찾도록 구성되지 않을 수 있는 레거시 디바이스들로부터 은닉되거나 레거시 디바이스들에 보이지 않을 수 있다. 일부 양상들에서, 레거시 디바이스는 1 비트 코드의 존재로 인한 어떠한 불규칙도 관측하지 않고 L-SIG(1415)를 이해할 수 있다. 일부 양상들에서 1차 채널의 L-SIG(1415)만이 고효율 디바이스가 HE-SIG(1425)에 대한 다른 채널들을 보도록 지시하는 1 비트 코드를 포함할 수 있다. 일부 양상들에서, L-SIG들(1415)의 수는 이 1 비트 표시자를 가질 수 있으며, 여기서, 표시자를 갖는 L-SIG들(1415)의 수는 레거시 패킷에 대해 사용될 채널들의 수와 동일이다. 예를 들면, 레거시 패킷이 제 1 및 제 2 채널 모두를 포함할 수 있지만, 제 3 채널은 포함하지 않으면, 제 1 및 제 2 채널의 L-SIG는 1 비트 표시자를 포함할 수 있는 반면, 제 3 채널의 L-SIG는 이러한 표시자를 포함하지 않을 수 있다. 고효율 디바이스는 1비트 코드를 포함하지 않는 L-SIG를 갖는 제 1 채널을 찾고, HE-SIG(1425)의 존재에 대해 그 채널을 모니터링하도록 구성될 수 있다. 일부 양상들에서, VHT-SIG-A(1420)의 대역폭 정보는 레거시 패킷(1430)이 얼마나 많은 대역폭을 사용할 것인지 및 그에 따라, HE 패킷(1435)이 시작할 수 있는 대역폭에 대한 정보를 포함할 수 있다. 일부 양상들에서, 1 비트 코드만이, 데이터를 HE 디바이스들에 송신하기 위해 사용될 채널들에서 송신될 L-SIG들(1415)에 포함될 수 있다. 예를 들면, 제 1 채널이 레거시 디바이스에 송신하기 위해 사용되고, 다른 세 채널들이 특정 패킷에서 HE 디바이스들에 송신하기 위해 사용되는 경우, 세 다른 채널들에서 송신되는 L-SIG들(1415) 각각은 1 비트 코드를 포함할 수 있다. 일부 양상들에서, HE 패킷에서, 각 L-SIG(1415)는 각 채널이 데이터를 HE 디바이스들에 송신하는데 이용될 수 있다는 것을 표시하기 위해 1 비트 코드를 포함할 수 있다. 일부 양상들에서, 이는 하이브리드 패킷 또는 HE 패킷의 HE 부분에 대해 사용되는 대역폭이 패킷의 L-SIG(1415)를 사용하여 시그널링되게 할 수 있다. 패킷의 HE 부분에 대해 사용된 대역폭이 L-SIG(1415)에서 시그널링되면, 이는 패킷의 HE-SIG(1425) 또는 하이브리드 패킷이 패킷의 HE 부분에 할당된 대역폭의 더 많은 부분에 걸치게 할 수 있다. 예를 들면, HE-SIG(1425)는 HE 패킷에 할당된 대역폭에 걸치게 구성될 수 있다. 일부 양상들에서, HE-SIG(1425)에 대해 20MHz만을 사용하는 것보다, HE-SIG(1425)에 대해 더 많은 대역폭을 사용하는 것은 더 많은 정보가 HE-SIG(1425)에서 송신되게 할 수 있다. 일부 양상들에서, HE-SIG(1425)의 제 1 심볼은 패킷의 HE에 할당된 대역폭의 각각의 20MHz 상에서 중복 송신될 수 있는 반면, HE-SIG(1425)의 나머지 심볼들은 패킷의 HE 부분에 할당된 전체 대역폭을 사용하여 송신될 수 있다. 예를 들면, HE-SIG(1425)의 제 1 심볼은 HE 또는 하이브리드 패킷의 HE 부분에 할당된 대역폭을 송신하는데 사용될 수 있고, 따라서, 후속 심볼들은 패킷의 HE 부분에 할당된 전체 대역폭을 통해 송신될 수 있다.

vice the packet is the hybrid packet. For example, as described above, the single bit code can be arranged in the Q- rail of the L- SIG (1415). Whereas it cannot recognize 1 bit code and with it is normal legacy devices can read the L- SIG (1415) it can determine whether the high efficiency device specifically can find such 1 bit code and this exists. So that this 1 bit code signal in the high efficiency device that the hybrid packet is transmitted it can be used. In some modes, it is concealed from legacy devices which are not formed so that 1 bit code finds the code or it is not seen in legacy devices. In some modes, any irregularity due to the presence of 1 bit code can not observe and the legacy device can understand the L- SIG (1415). The high efficiency device only the L- SIG (1415) of the first channel in some modes may include 1 bit code which it indicates in order to look at the dissimilar channels about the HE- SIG (1425). The number of L-SIG (1415) in some modeses the number of L-SIG (1415) which can have this 1 bit indicator and here has the indicator are the number of channels used about the legacy packet and identity. For example, the legacy packet may include both first and second channel. However if the third channel does not include whereas the L-SIG of first and second channel may include 1 bit indicator the L-SIG of the third channel does not include such indicator. The primary channel having the L-SIG in which the high efficiency device does not include the single bit code is sought for and the channel is configured to be monitored about the presence of the HE- SIG (1425). The bandwidth information of the VHT-SIG- A (1420) is the legacy packet (1430) in some modes may include the information about the bandwidth which the HE packet (1435) can start according to that if it uses the how many many bandwidth. In some modes, it can be included in the L-SIG (1415) transmitted in channels which are used so that it transmit data to HE devices only 1 bit code. For example, the primary channel may include the L-SIG (1415) in which it is used in order to transmit to the legacy device and dissimilar force channels are transmitted in the case of being used in order to the specific packet transmit in HE devices, and dissimilar channels. Is 1 bit code. Each L-SIG (1415) is each channel in some modes in the HE packet may include 1 bit code it indicates that data can be used to transmit data to HE devices. In some modes, it makes signaled using the L- SIG (1415) of the packet this is used about the HE part of the hybrid packet or the HE packet. If the bandwidth used about the HE part of the packet is signaled from the L- SIG (1415) this spans more parts of the bandwidth in which the HE-SIG (1425) or the hybrid packet of the packet is allocated in the HE part of the packet. For example, it can be formed to span the bandwidth in which the HE- SIG (1425) is allocated in the HE packet. In some modes, it uses against the HE- SIG (1425) only 20MHz. It makes transmitted in the HE- SIG (1425) about the HE- SIG (1425) to use more bandwidths. In some modes, where as the first symbol of the HE- SIG (1425) can be transmitted to the duplication on each 20MHz of the bandwidth allocated in HE of the packet rest symbol of the HE- SIG (1425)s can be transmitted using the end to end bandwidth allocated in the HE part of the packet. For example, the allocated in the HE part of HE or the hybrid packet bandwidth can be used to the first symbol of the HE- SIG (1425) transmit the bandwidth and following symbols can be transmitted to the therefore through

the end to end bandwidth allocated in the HE part of t he packet.

[00113] L-SIG(1415)에서 1-비트 코드를 수신하면, 고효율 디바이스들은, HE-SIG(1425)를 찾기 위해, AP에 할당된 대역폭의 보다 높은-대역폭 부분들, 이를 테면 보다 높은-대역폭 채널들에서 확인하도록 구성될 수 있다. 예를 들어, 하이브리드 패킷(1400)에서, 직교 방향으로 1-비트 코드를 갖는 L-SIG(1415)를 수신하면, 고효율 디바이스들은, 레거시 패킷과 함께, 다른 주파수 대역들에서 송신될 수 있는, HE-SIG(1425)와 같은 HE-SIG들에 대해 레거시 디바이스들에 데이터를 전달하는 채널과 떨어져있는 20 MHz 채널들에서 확인하도록 구성될 수 있다. 예를 들어, 예시적인 하이브리드 패킷(1400)에서, HE-SIG(1425)는 VHT-SIG-A(1420)와 동시에 송신되는 것으로 도시되어 있다. 이러한 예에서, 하이브리드 패킷(1400)은, 대역폭의 하위 부분(lower portion) 상에는 IEEE 802.11ac-호환가능한 패킷을 포함할 수 있으며 그리고 대역폭의 상위 부분(higher portion) 상에는 고효율 패킷을 포함할 수 있다. 하이브리드 패킷(1400)은 또한, 하위 부분에 IEEE 802.11a 또는 IEEE 802.11n-호환가능한 패킷을 포함할 수 있다. 중요하게는, 하위 부분이 어떤 타입의 패킷인지에 상관없이, L-SIG(1415)는, 패킷이 하이브리드 패킷임을 고효율 디바이스들에게 시그널링하고, 그에 따라 다른 주파수에서 HE-SIG(1425)를 찾도록 하기에 충분한 시그널링 정보를 포함하도록 구성될 수 있다.

[00113] In the L- SIG (1415), if 1- bit code is received , high efficiency devices are to find the HE- S IG (1425) and it is configured to confirm in the bandwid th channel with bandwidth part it is higher it is higher o f the bandwidth allocated in AP if wants to tell. For exa mple, in the hybrid packet (1400), if the L- SIG (1415) having 1- bit code in the orthogonal direction is receive d , high efficiency devices are configured to confirm in 20 MHz channels separated from the channel delivering data to legacy devices about the HE-SIGs which can b e transmitted in dissimilar frequency bands like the HE-SIG (1425) with the legacy packet. For example, in the illustrative hybrid packet (1400), it is illustrated that th e HE- SIG (1425) is transmitted to the simultaneously with the VHT-SIG- A (1420). In such example, while in cluding the packet which is compatible the IEEE 802.11 ac- on the sub-part (lower portion) of the bandwidth t he hybrid packet (1400) may include the high efficienc y packet on and, the upper part (higher portion) of the bandwidth. The hybrid packet (1400) may include the I EEE 802.11a or the packet which is compatible the IEE E 802.11n- in moreover, the sub-part. The important s ub-part is the packet of any kind of type the L- SIG (1 415) signals to high efficiency devices that the packet is the hybrid packet and the signaling information for fi nding the HE- SIG (1425) is configured to be included i n the frequency different according to that.

[00114] 몇몇 양상들에서, HE-SIG(1425)는 이전에 논의된 이전의 고효율 신호 필드들 중 임의의 것과 유사할 수 있다. 몇몇 양상들에서, 고효율 패킷들과 하이브리드 패킷들 모두를 송신하는 AP는, 패킷이 고효율 패킷임을 나타내기 위해, Q-레일에서 1-비트 신호를 이용하기 보다는, HE-SIG(1425) 내에 회전된 BPSK 성상도(QBPSK) 심볼을 갖는 심볼을 이용할 수 있는데, 이는, 패킷이 하이브리드 패킷(1400)과 같은 하이브리드 패킷임을 시그널링하기 위해 Q-레일 상에 1-비트 신호를 이용하는 것이 대신 이용될 수 있기 때문이다. 예를 들어, HE-SIG(1425)는, 이전에 논의된 바와 같이, 이를 테면 그룹 ID를 이용함으로써, 어떤 디바이스 또는 디바이스들이 패킷 내의 정보를 수신할 수 있는지를 고효율 디바이스들에게 나타내는 데에 이용될 수 있다. 따라서, 고효율 디바이스들은 L-STF(1405), L-LTF(1410), 및 L-SIG(1415)를 수신 및 디코딩하도록 구성될 수 있다. L-SIG(1415)가 1-비트 코드를 포함하는 경우, 고효율 디바이스들은, 하이브리드 패킷의 고효율 부분이 그 특정 디바이스에 대한 정보를 포함하는지를 결정하기 위해, 보다 높은 주파수 대역에 있는 HE-SIG(1425)를 로케이팅하고 디코딩하도록 구성될 수 있다.

[00114] In some modes, it can be similar to the arbitrary among the previous high efficiency signal field s in which the HE- SIG (1425) is previously discussed. I n some modes, in order that high efficiency packet and APs transmitting a message both hybrid packets show t hat the packet is the high efficiency packet rather tha n 1- bit signal is used in the Q- rail the symbol having t he rotated BPSK constellation (QBPSK) symbol within th e HE- SIG (1425) can be taken advantage of. The sym bol be used that this uses 1- bit signal on the Q- rail s o that it signal that the packet is the hybrid packet like the hybrid packet (1400). For example, any kind of devi ce or the devices the HE- SIG (1425) is previously disc ussed may be used in shows to high efficiency devices whether it can receive the information within the packe t or not. Therefore, high efficiency devices are configur ed to receive and is configured to decode the L- STF (1405), and the L- LTF (1410) and L- SIG (1415). In or der that it determines the case , and high efficiency de vices where the L- SIG (1415) includes 1- bit code wh ether the high efficiency part of the hybrid packet inclu des the information about the specific device the HE-SIG (1425) which is in the higher frequency band is con figured to be located and it is configured to decode.

[00115] 몇몇 양상들에서, 레거시 패킷은, 도시된 바와 같이, 대역폭의 20 MHz 만을 차지할 수 있다. 하지만, 패킷(1400)의 레거시 부분은 또한, 상이한 양의 대역폭을 또한 차지할 수 있다. 예를 들어, 하이브리드 패킷의 레거시 부분은 40 MHz,

[00115] In some modes, as shown in the figure, the legacy packet can occupy only 20 MHz of the bandwidt h. However, the bandwidth in which the legacy part of the packet (1400) is moreover different of the amount

60 MHz, 80 MHz 또는 다른 크기의 레거시 패킷을 포함할 수 있는 한편, 하이브리드 패킷(1400)의 고효율 부분은 이용가능한 대역폭의 나머지를 이용할 수 있다. 몇몇 양상들에서, 20 MHz 이외의 크기들의 채널들이 또한 이용될 수 있다. 예를 들어, 채널들은 5, 10, 15, 40 MHz, 또는 다른 크기들일 수 있다. 몇몇 양상들에서, 레거시 VHT-SIG-A(1420) 다음에, 레거시 패킷(1430)이 1차 채널을 통해 레거시 디바이스에 송신될 수 있다. 몇몇 양상들에서, 레거시 패킷(1430)은 적어도 1차 채널을 포함할 수 있으며, 부가적인 채널들을 또한 포함할 수 있다. 예를 들어, 이러한 레거시 패킷(1430)은, IEEE 802.11a, 802.11n, 또는 802.11ac 디바이스들과 호환가능할 수 있다. 몇몇 양상들에서, 하나 이상의 HE-SIG들(1425) 다음에, 고효율 패킷(1435)이, AP에 대해 이용가능한 대역폭의 적어도 일부를 이용하여, 하나 이상의 고효율 디바이스들에게 송신될 수 있다. 몇몇 양상들에서, 레거시 패킷은 다수의 레거시 디바이스들에게 전송될 수 있다. 예를 들어, 하이브리드 패킷은, 2개 이상의 802.11ac-호환가능한 STA들에 전송되는 MU-MIMO 802.11ac 패킷을 포함할 수 있다.

can be moreover occupied. For example, the legacy part of the hybrid packet may include 40 MHz, 60 MHz, and the legacy packet of 80 MHz or the dissimilar size. The rest of the bandwidth in which the high efficiency part of the hybrid packet (1400) is available can be used. In some modes, the channels of the sizes except 20 MHz can be moreover used. For example, it has channels with 5, 10, 15, 40 MHz or the size farm work number dissimilar. In some modes, next the legacy packet (1430) can be transmitted to the legacy device through the first channel with the legacy VHT-SIG- A (1420). In some modes, the legacy packet (1430) can include at least first channel and subchannels are include might moreover. For example, it can be compatible with the IEEE 802.11a, and 802.11n or 802.11ac devices. In some modes, next the high efficiency packet (1435) can be transmitted to at least one HE-SIG (1425) using at least a part of the bandwidth which is available about AP to at least one high efficiency devices. In some modes, the legacy packet can be transmitted to multiple legacy devices. For example, the hybrid packet may include the MU-MIMO 802.11ac packet transmitted in STAs which are compatible 802.11ac- more than 2.

[00116] 도 15는 하이브리드 패킷을 송신하는 예시적인 방법(1500)을 도시한다. 이 방법은, 이를 테면 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[00116] Figure 15 shows the illustrative method (1500) transmitting the hybrid packet. This method can be performed with the wireless device like AP if wants to tell.

[00117] 블록(1505)에서, AP는 대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들에 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 갖는다. 몇몇 양상들에서, 하나 이상의 제 1 디바이스들은 레거시 디바이스들일 수 있다. 몇몇 양상들에서, 대역폭의 제 1 부분은 1차 채널일 수 있다. 몇몇 양상들에서, 제 1 디바이스에 송신하기 위한 수단은 송신기일 수 있다.

[00117] In the block (1505), the first part of the bandwidth as to the AP, transmits in at least one first devices and at least one first devices have the first set of the capabilities. In some modes, it has at least one first devices with the legacy device farm work number. In some modes, the first part of the bandwidth can be the first channel. In some modes, the means for transmitting in the first device can be the transmitter.

[00118] 블록(1510)에서, AP는 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들에 동시에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 송신은, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들이 전송된 주파수 대역을 로케이팅하기 위해, 능력들의 제 2 세트를 갖는 디바이스들에 대한 표시를 포함하고, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 어떠한 실질적인 영향도 미치지 않도록 전송된다. 몇몇 양상들에서, 하나 이상의 제 2 디바이스들에 송신하기 위한 수단은 송신기일 수 있다. 몇몇 양상들에서, 프리앰블은 레거시 프리앰블일 수 있고, 표시는 레거시 프리앰블 내의 L-SIG 내의 1-비트 코드일 수 있다. 몇몇 양상들에서, 표시는, 1차 채널에서, 또는 1차 채널 및 하나 이상의 다른 채널들에서, 또는 다른 채널들에서, L-SIG 내에 포함될 수 있다.

[00118] AP in the block (1510) is transmitted so that the substantial influence does not reach the preamble decoding of the devices which has the display, is the first set of the capability the display about the devices is included having the second set of the capabilities the frequency band in which symbols including the set of the transmission parameters about the devices are transmitted is located that have the transmission, is the second set of the capability at least one second devices have the second set of the capabilities it simultaneously transmits a message to at least one second devices in the second part of the bandwidth. In some modes, the means for transmitting in at least one second devices can be the transmitter. In some modes, the preamble can be the legacy preamble and the display can be 1- bit code within the L-SIG within the legacy free amble. In some modes, or or in the first channel as to the display, can be included in the first channel and dissimilar channels in dissimilar channels within the L-SIG.

[00119] 도 16은 하이브리드 패킷을 수신하는 예시적인 방법을 나타낸다. 일부 양상들에서, 이 방법은 고효율 무선 통신 디바이스와 같은 STA에 의해 사용될 수 있다.

[00119] Figure 16 shows the illustrative method for receiving the hybrid packet. In some modes, this method can be used by STA like the high efficiency wireless communication device.

[00120] 블록(1605)에서, STA는 1차 채널에서 레거시 프리앰블을 수신한다. 일부 양상들에서, 레거시 프리앰블을 수신하

[00120] In the block (1605), STA receives the legacy free amble by the first channel. In some modes, the me

기 위한 수단은 수신기일 수 있다.

ans for receiving the legacy free amble can be the rece iver.

[00121] 블록(1610)에서, STA는 레거시 프리앰블이 하나 이상의 넌-1차 채널들에서 고효율 신호 필드를 로케이팅하도록 고효율 디바이스들에 통지하기에 충분한 정보를 포함하는지를 결정한다. 일부 양상들에서, 결정하기 위한 수단은 프로세서 또는 수신기일 수 있다.

[00121] In the block (1610), it determines whether the information which it is sufficient to notify in high efficie ncy devices is contained so that STA locates the high efficiency signal field in first channels or not the legacy free amble hangs out to air. In some modes, the means for determining can be the processor or the receiver.

[00122] 블록(1615)에서, STA는 하나 이상의 넌-1차 채널들 중 적어도 하나에서 고효율 신호 필드를 수신한다. 일부 양상들에서, 고효율 신호 필드를 수신하기 위한 수단은 수신기일 수 있다. 일부 양상들에서, STA는 하나 이상의 넌-1차 채널들 중 적어도 하나를 통해 데이터를 추가로 수신할 수 있다. 일부 양상들에서, 데이터를 수신하기 위한 수단은 수신기일 수 있다.

[00122] In the block (1615), the high efficiency signal field is received by at least one among first channels S TA hangs out to air. In some modes, the means for rec eiving the high efficiency signal field can be the receive r. In some modes, data can be additionally received am ong first channels through at least one STA hangs out to air. In some modes, the means for receiving data ca n be the receiver.

[00123] 고효율 신호 필드의 지연 확산 보호 및 잠재적 구조들

[00123] The delay spread protection and potential structures of the high efficiency signal field.

[00124] 일부 양상들에서, 옥외 또는 다른 무선 네트워크들은 1㎲를 초과하는 것들과 같은 상대적으로 높은 지연 확산들을 갖는 채널들을 가질 수 있다. 예를 들어, 피코/매크로 셀 타워 액세스 포인트와 같은 높은 고도의 액세스 포인트는 높은 지연 확산들을 가질 수 있다. 802.11a/g/n/ac에 따르는 것들과 같은 다양한 무선 시스템들은 단지 800ns의 사이클릭 프리픽스(CP) 길이를 사용한다. 이 길이의 거의 절반이 송신 및 수신 필터들에 의해 소비될 수 있다. 이러한 비교적 짧은 CP 길이 및 송신 및 수신 필터들로부터의 오버헤드 때문에, 이러한 802.11a/g/n/ac 네트워크들은 높은 지연 확산을 갖는 옥외 전개에 적당하지 않을 수도 있다.

[00124] In some modes, the dissimilar outdoor or wireless networks can have channels which exceed 1㎲ have the relatively high delay spreads like field. For exa mple, it can have delay spreads in which the high mark ed access point like the cell tower access point is high to the pico / ***. It follows 802.11a / g / n / ac the v arious wireless system like fields only use the cyclic pre fix (CP) length of 800ns. Half can be nearly consumed by *** filters of this length. It is not appropriate in the outdoor development having the delay spread in which such 802.11a / g / n / ac networks are therefore high with the overhead from the CP length and *** filter ar e short with such relative.

[00125] 본 개시의 양상들에 따르면, 이러한 레거시 시스템들과 하위 호환성이 있고 800ns보다 더 긴 사이클릭 프리픽스들을 지원하는 패킷 포맷(PHY 파형)이 제공되어, 옥외 전개들에서 2.4 및 5㎓ WiFi 시스템들의 사용을 가능하게 할 수도 있다.

[00125] According to the modes of the disclosure, the packet format (PHY waveform) having such legacy syst ems and downward compatibility and supports cyclic pr efixes which are longer with 800ns is provided and it is able to make the use of 2.4 and 5㎓ WiFi systems possi ble in outdoor developments.

[00126] 예를 들어, 정보의 하나 이상의 비트들이 L-STF, L-LTF, L-SIG 중 하나 이상에, 또는 HE-SIG와 같은 패킷 프리앰블의 다른 부분에 임베드될 수 있다. 이러한 정보의 하나 이상의 비트들은 위에서와 같이 이들을 디코딩하도록 구성된 디바이스들에 대해 포함될 수 있지만, 레거시(예를 들어, 802 11a/g/n/ac) 수신기들에 의한 디코딩에 영향을 주지 않을 수도 있다. 이러한 비트들은 옥외 세팅, 또는 잠재적으로 높은 지연 확산을 갖는 다른 세팅에서 이러한 패킷의 사용을 가능하게 하기 위해 지연 확산 보호를 포함하는 패킷의 표시를 포함할 수도 있다.

[00126] For example, in at least one bits of the information is the L-STF, the L-LTF, and one or greater among the L-SIG, it or can be embedded in the dissimil ar part of the packet preamble like the HE-SIG. It can be included about devices in which as described above at least one bit of such information are configured to d ecode these. However it does not affect the decoding by legacy (for example, 802 11a / g / n / ac) receivers. The display of the packet in which such bits include th e delay spread protection in the dissimilar setting havin g the outdoor setting or the potentially high delay spre ad in order to make the use of such packet possible, c an be included.

[00127] 일부 양상들에서, 지연 확산 보호 또는 허용 오차를 제공하는 데 다수의 방법들이 사용될 수도 있다. 예를 들어, 심볼 지속기간을 증가(예를 들어, 동일한 샘플 레이트를 유지하면서 FFT 길이 증가 또는 샘플 레이트를 감소시키도록 다운클

[00127] In some modes, multiple methodses can be used to provide the delay spread protection or the allo wable error. For example, the different transmission par ameters can be used to make the symbol duration perio

록킹)시키는 데 서로 다른 송신 파라미터들이 사용될 수 있다. 심볼 지속기간을 예컨대, 2x 또는 4x로 증가시키는 것은 더 높은 지연 확산들에 대한 허용 오차를 증가시킬 수 있다.

d with the increase (the down clock king while the same sample rate is maintained the FFT length increment or the sample rate is reduced for example). The allowable error about the much higher delay spreads can be increased to increase the symbol duration period to for example, 2x or 4x.

[00128] 일부 양상들에서, 증가된 심볼 지속기간은 L-SIG 또는 HE-SIG의 필드에서 시그널링될 수 있다. 일부 양상들에서, 네트워크 상의 다른 패킷들은 증가된 심볼 지속기간에 대한 시그널링을 포함하는 것이 아니라, 그보다는 종래의 또는 #34# 정규의#34# 심볼 지속기간을 갖는 패킷들일 수도 있다. 증가된 심볼 지속기간은 일반적으로 증가된 FFT 크기 및 그에 따라 주파수 에러에 대한 증가된 감도 및 증가된 PAPR을 의미하기 때문에 #34#정규의#34# 심볼 지속기간을 확보하는 것은 어떤 경우들에는 바람직할 수도 있다. 또한, 네트워크 내의 모든 각각의 디바이스가 이러한 증가된 지연 확산 허용 오차를 필요로 하는 것은 아닐 것이다. 따라서 어떤 경우들에는, 증가된 FFT 크기가 성능을 손상시킬 수 있고, 따라서 일부 패킷들이 종래의 심볼 지속기간을 사용하는 것이 바람직할 수도 있다.

[00128] In some modes, the increased symbol duration period can be signaled from the field of the L-SIG or the HE-SIG. In some modes, the signaling about the symbol duration period in which the dissimilar packet on the networks are increased is not included. But it or can be the packets having the symbol duration period with 34 of the " canonical than that. It can do in any kind of cases to secure the symbol duration period with 34 because the increased sensitivity and increased PAPR about the frequency error are meant according to the FFT size and that in which generally the increased symbol duration period is increased. Moreover, all each devices within the network does not require the increased such delay spread allowable error. Therefore, in any kind of cases, the increased FFT size can injure the performance and partial packets can do to use the conventional symbol duration period with desirable.

[00129] 따라서 일부 양상들에서, 모든 패킷들이 L-SIG 또는 HE-SIG 필드 뒤에 증가된 심볼 지속기간을 포함할 수도 있다. 다른 양상들에서는, L-SIG 또는 HE-SIG에서 증가된 심볼 지속기간을 시그널링하는 정보를 포함하는 패킷들만이 증가된 심볼 지속기간을 포함할 수도 있다. 일부 양상들에서, 증가된 심볼 지속기간에 대한 시그널링은 HE-SIG, 그리고 L-SIG, VHT-SIG-A 또는 패킷 내의 다른 필드 내에 포함될 수도 있다. 일부 양상들에서, 이 시그널링은 예를 들어, L-SIG 또는 HE-SIG와 같은 SIG 필드의 심볼에서 Q-BPSK 회전에 의해 전달될 수도 있다. 일부 양상들에서, 이 시그널링은 패킷의 필드의 허수축과 같은 직교 레일에서 정보를 숨김으로써 전달될 수도 있다.

[00129] Therefore, in some modes, all packets can include the symbol duration period increased after the L-SIG or the HE-SIG field. In dissimilar modes, the symbol duration period in which it is increased only packets including the information signaling the L-SIG or the symbol duration period increased in the HE-SIG can be included. In some modes, the increased signaling about the symbol duration period can be included within the HE-SIG and L-SIG, and the dissimilar field within the VHT-SIG-A or the packet. In some modes, this signaling can be delivered to for example, the symbol of the SIG field like the L-SIG or the HE-SIG by the Q-BPSK rotation. In some modes, this signaling can be the information delivered to the orthogonal rail like the imaginary number axis of the field of the packet as the hiding.

[00130] 일부 양상들에서, 심볼 지속기간 증가는 업링크 또는 다운링크 패킷들 중 어느 하나 또는 둘 모두에 사용될 수도 있다. 업링크 패킷의 경우, AP는 선행하는 다운링크 패킷에서, 업링크 패킷이 증가된 심볼 지속기간을 사용하여 송신될 수 있음을 시그널링할 수 있다. 예를 들어, 업링크 OFDMA 패킷에서, AP는 더 긴 심볼 지속기간들을 사용하도록 사용자에게 통지하는 톤 할당 메시지를 전송할 수도 있다. 그 경우, 업링크 패킷 자체는 특정 심볼 지속기간을 나타내는 표시를 전달할 필요가 없을 수도 있다. 일부 양상들에서, AP로부터 STA로의 신호는 달리 언급되지 않는 한, 모든 향후의 업링크 패킷들에서 특정 심볼 지속기간을 사용하도록 STA에 통보할 수 있다.

[00130] It can be used for any one of symbol duration period increase is the up-link or the downlink packets in some modes or the both. In case of the uplink packet, it can signal being transmitted in the downlink packet in which AP is ahead using the symbol duration period in which the uplink packet is increased. For example, in the up-link OFDMA packet, in order to use the longer symbol duration periods AP can transmit the tone assignment message notified user. The display in which the case , and the uplink packet itself show the specific symbol duration period does not have to be conveyed. In some modes, the signal to STA is not differently mentioned from AP. It can notify to STA in order to use the specific symbol duration period in the uplink packets of all afterwards.

[00131] 일부 양상들에서, 이러한 지연 확산 보호는 앞서 설명한 것들과 같은 고효율 패킷들에 포함될 수도 있다. 본 명세서에서 제시된 프리앰블 포맷들은 레거시 디바이스들이 패킷이 802.11n, 802.11a 패킷인지 아니면 802.ac 패킷인지를 검출할 수 있게 하면서 지연 확산 보호가 패킷들에 포함될 수 있는 방식을 제공한다.

[00131] In some modes, it can be included in high efficiency packets like the things which such delay spread protection before illustrates. Otherwise legacy devices detect whether the packet is 802.11n, 802.11a packet or not whether it is 802 ac. packet or not preamble formats presented at this specification provide the mode in which the delay spread protection can be included in packets.

[00132] 본 명세서에서 제시된 프리앰블 포맷들은 IEEE 802.11ac(혼합 모드 프리앰블) 패킷에서와 같이 L-SIG-기반 연기를 확보할 수 있다. 802.11 a/an/ac 스테이션들에 의해 디코딩 가능한 프리앰블의 레거시 선택을 하는 것은 동일한 송신에서 레거시 및 HE 디바이스들을 혼합하는 것을 가능하게 할 수 있다. 본 명세서에서 제공된 프리앰블 포맷들은 HE SIG에 대한 보호를 제공할 수 있으며, 이는 강력한 성능의 달성에 도움이 될 수 있다. 예를 들어, 이러한 프리앰블 포맷들은 비교적 엄중한 표준 테스트 시나리오들에서 SIG 에러율을 1% 또는 그 미만으로 감소시키는 데 도움이 될 수 있다.

[00132] Preamble formats presented at this specification can secure the L-SIG- base smoke the IEEE 802.11 ac (mixed mode preamble) packet. In the transmission similar to choose with 802.11 a / an / ac stations can be decoded, it is able to make possible mixing the legacy and HE devices. Preamble formats provided from this specification can provide the protection about the HE SIG and it can be helpful to the achievement of the performance in which this is powerful. For example, the SIG error rate is reduced in standard test scenarioes in which relatively such preamble formats are serious to 1% or less than the but it can be helpful.

[00133] 도 17은 본 개시물의 양상들에 따른, 하나의 예시적인 HE 프리앰블 포맷(preamble format)을 갖는 패킷(packet)을 예시한다. 예시적인 HE 프리앰블 포맷은 VHT 프리앰블 포맷과 비교된다. 예시된 바와 같이, HE 프리앰블 포맷은 제 1 타입의 디바이스(예를 들면, 802.11a/ac/n 디바이스들)에 의해 디코딩가능한(decodable) 하나 이상의 신호(SIG) 필드들 및 제 2 타입의 디바이스들(예를 들면, HE 디바이스들)에 의해 디코딩가능한 하나 이상의 SIG 필드들(HE-SIG1)을 포함할 수 있다. 예시된 바와 같이, 802.111/ac/n 디바이스들은 L-SIG 에서 지속기간 필드(duration field)에 기초하여 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다. 예시된 바와 같이, 반복되는 HE-SIG 필드 이후, 패킷이 VHT 패킷인 경우를 디바이스가 이미 알고 있을 수 있으며, 그에 따라 VHT-STF 이득 설정에 문제가 없을 수 있다.

[00133] Fig. 17 exemplifies the packet having one illustrative HE preamble format according to the modes of the disclosure. The illustrative HE preamble format is compared with the VHT preamble format. The HE preamble format it is exemplified comprises at least one signal (SIG) fields canning decode with the device (for example, 802.11a / ac / n devices) of the first type (decodable) and at least one SIG field (HE-SIG1) canning decode with the device (for example, HE devices) of the second type. As shown in it is exemplified 802.111 / ac / n devices can play the role in the L-SIG based on the duration field. The repeated high efficiency SIG (HE-SIG) field can be connected after the L-SIG. As shown in it is exemplified then the device already knows the case in which the packet is the VHT packet with the HE-SIG field and repeated there can be no problem according to that in the VHT-STF gain setting.

[00134] 도 17에 도시된 예시적인 포맷에서, HE-SIG1 필드들은 반복되고 그리고 HE 디바이스들에 대해 HE-SIG1에 대한 보호를 제공하는 정규의 가드 인터벌(normal guard interval)(GI)에 의해 선행될 수 있다. 반복되는 HE-SIG1으로 인하여, 이러한 패킷은 낮은 신호-대-잡음비 동작점(lower signal-to-noise ratio operating point)을 가질 수 있으며, 그에 따라 심볼-간-간섭(inter-symbol-interference; ISI)으로부터 보다 강력한 보호들을 제공할 수 있다. 몇몇 양상들에서, L-SIG는, L-SIG가 영향을 받지 않을 수 있는 이후에, 2개의 심볼들에 대한 Q-BPSK 체크들에 기초한 패킷 타입 검출(packet type detection)로서 6Mbps로 송신할 수 있다.

[00134] In the illustrative format illustrated in Figure 17, it can be preceded with the normal guard interval (normal guard interval) (GI) in which HE-SIG1 fields are repeated and providing the protection about the HE-SIG1 concerning and, HE devices. It can have the signal-to-noise ratio operating point (lower signal-to-noise ratio operating point) in which such packet is low due to the repeated HE-SIG1 and protections which are powerful than the symbol - liver - interference (inter-symbol-interference: ISI) can be provided according to that. In some modes, after as to the L-SIG, the L-SIG is not affected it can transmit a message as the packet type detection based on Q-BPSK checks toward the symbols of 2 to 6Mbps.

[00135] 전술된 바와 같이, HE 디바이스들에 HE 패킷을 시그널링하기 위해) 다양한 기술들이 이용될 수 있다. 예를 들면, HE 패킷은 HE-SIG1에서의 CRC 체크에 기초하여, 또는 HE-SIG1의 반복에 기초하여, L-SIG에 직교 레일 표시(orthogonal rail indication)를 배치함으로써 시그널링될 수 있다.

[00135] As shown in it is aforementioned in order to signal the HE packet in HE devices, various technologies can be used. For example, the HE packet can be signaled to or based on the CRC check at the HE-SIG1 by arranging the orthogonal rail display (orthogonal rail indication) to the L-SIG based on the repetition of the HE-SIG1.

[00136] HE-SIG2에 대한 지연 확산 보호(delay spread protection)는 다양한 형태들을 취할 수 있다. 예를 들면, HE-SIG2는 부가적인 지연 확산 보호를 제공하기 위해 (20MHz에서) 128 톤들에 걸쳐서 송신될 수 있다. 이는 1.6 ㎲의 가드

[00136] The delay spread protection about the HE-SIG2 can take various typeses. For example, it can be transmitted through 128 tones so that the HE-SIG2 provide the additional delay spread protection (in 20MHz).

인터벌을 초래할 수 있지만, 종래의 개수의 톤들을 포함할, L-LTF에 기초하여 계산된 채널 추정들의 보간(interpolation)을 요구할 수 있다. 다른 예로서, HE-SIG2는 동일한 심볼 지속기간을 가질 수 있지만, 1.6 ㎲ 사이클릭 프리픽스(cyclic prefix)로 전송될 수 있다. 이는 25%의 종래의 값보다 더 사이클릭 프리픽스 오버헤드(cyclic prefix overhead)로 이어질 수 있지만, 보간을 요구하지 않을 수 있다. 일 양상에서, HE-SIG2는 또한, 20 MHz 마다 반복하기보다는, 전체 대역폭에 걸쳐서 전송될 수 있다. 이는, 전체 대역폭을 표시하기 위해, HE-SIG1에 대역폭 비트들이 배치되는 것을 요구할 수 있다.

The interpolation of the channel estimations of being c alculated based on the L-LTF of including the tones of the conventional number this can cause the guard inter val of 1.6 ㎲. However can be demanded. By way of an other example, it can have the symbol duration period i n which the HE-SIG2 is identical. However it can be tra nsmitted to 1.6 ㎲ cyclic prefix. This can be more conn ected to the cyclic prefix overhead than the conventio nal value of 25%. However the interpolation is not dem anded. In one aspect, rather than the HE-SIG2 repeats at moreover, 20 MHz it can be transmitted through the end to end bandwidth. In order that this indicates the end to end bandwidth it can require that bandwidth bit s are arranged in the HE-SIG1.

[00137] 도 18은 본 개시물의 양상들에 따른, 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다. 도 17에서와 같이, 예시적인 HE 프리앰블 포맷은 VHT 프리앰블 포맷과 비교된다. 이전과 같이, IEEE 802.11 a/ac/n 디바이스들은 L-SIG에서 지속기간 필드에 기초하여 패킷을 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다. 도 18에 도시된 예시적인 포맷에서, HE-SIG1 필드들은 반복될 수 있지만, 제 1 HE-SIG1 필드는 정규의 가드 인터벌(normal guard interval)에 의해 선행될 수 있는 반면, 제 2 HE-SIG1은 정규의 가드 인터벌에 선행한다.

[00137] Fig. 18 exemplifies the packet having the dissimilar and illustrative HE preamble format according to the modes of the disclosure. As shown in Figure 17, the illustrative HE preamble format is compared with th e VHT preamble format. In IEEE 802.11 a / ac / n devic es like the previous, is the L-SIG, the packet can be po stponed based on the duration field. The repeated high efficiency SIG (HE-SIG) field can be connected after th e L-SIG. In the illustrative format illustrated in Figure 1 8, HE-SIG1 fields can be repeated. However whereas t he first HE-SIG1 field can be preceded with the normal guard interval the second HE-SIG1 is ahead of the nor mal guard interval.

[00138] HE-SIG1의 이러한 반복은, 제 1 HE-SIG1 이전 및 제 2 HE-SIG1 이후에 배치되는 가드 인터벌과 함께, HE 디바이스들에 대한 보호를 제공할 수 있다. HE-SIG1 섹션의 중간 부분이 비교적 큰 CP를 갖는 HE-SIG1 심볼로서 나타날 수 있는 점이 주목될 수 있다. 이러한 양상에서, L-SIG 이후의 제 1 심볼에 대한 Q-BPSK 체크가 영향을 받지 않을 수 있다. 그러나, 제 2 HE-SIG1 이후의 가드 인터벌로 인해, 제 2 심볼에 대한 Q-BPSK 체크가 임의의 결과들을 제공할 수 있다. 그러나, 이러한 임의의 결과들은 VHT 디바이스들에 부정적인 영향을 미칠 수 없다. 예를 들면, VHT 디바이스들은 패킷을 802.11ac 패킷으로서 분류할 수 있지만, 이 시점에서 디바이스들은 VHT-SIG CRC 체크를 수행하려고 시도할 수 있으며, 이는 실패할 것이다. 따라서, VHT 디바이스들은, L-SIG 이후의 제 2 심볼에 대한 Q-BPSK 체크의 임의의 결과들에도 불구하고, 이러한 패킷을 여전히 연기할 것이다.

[00138] Such repetition of the HE-SIG1 can provide the protection about HE devices with the guard interva l arranged after the first HE-SIG1 previous and the sec ond HE-SIG1. It can be watched the middle part of the HE-SIG1 section can show up as the HE-SIG1 symbol h aving the relatively large CP that. In such mode, the Q-BPSK check toward the first symbol of the L-SIG aft er is not affected. But the Q-BPSK check about the se cond symbol can provide arbitrary results concerning d ue to the guard interval of the second HE-SIG1 after. B ut such arbitrary results cannot reach the negative eff ect on VHT devices. For example, VHT devices can cla ssify the packet as 802.11ac packet. However at this moment, it can attempt so that devices perform the V HT-SIG CRC check and this will fail. Therefore, VHT dev ices still will postpone such packet in spite of arbitrary results of the Q-BPSK check about the second symbol of the L-SIG after.

[00139] 이러한 VHT 디바이스들(IEEE의 802.11ac와 호환가능한 것)과 같은 레거시 디바이스들에 대한 자동-검출 프로세스는, 그러한 디바이스들이 도 18에서의 패킷을 연기하게 할 것이기 때문에, 이러한 패킷들은 6 Mbps를 여전히 전달할 수 있다. 도 17의 패킷에서와 같이, 전술된 다수의 기술들은, 패킷이 HE 패킷인 것을 HE 디바이스들에 시그널링하는데 이용될 수 있다. 마찬가지로, HE 디바이스들은, HE-SIG2에 포함된 필드와 같이, 다수의 방식들로 패킷의 지연 확산 보호에 관한 정보를 제공할 수 있다.

[00139] As to the automatic - detection process about the legacy devices like of IEEE), that devices postpone the packet in fig. 18. Therefore the still can deliver 6 M bps to such packets. The multiple technologies aforem entioned the packet of fig. 17 is used when it signals in HE devices the packet is the HE packet. Similarly, HE d evices provides the information about the delay spread protection of the multiple modes the packet, such as t he field included in the HE-SIG2.

[00140] 도 19는 본 개시물의 양상들에 따른, 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다. 이전과 같이, 예시적인 HE 프리앰블 포맷은 802.11ac VHT 프리앰블 포맷과 유사하다. 예시된 바와 같이, 802.11a/ac/n 디바이스들은 L-SI

[00140] Fig. 19 exemplifies the packet having the dissimilar and illustrative HE preamble format according to the modes of the disclosure. The illustrative HE prea mble format is similar to 802.11ac VHT preamble format

G에서 지속기간 필드에 기초하여 패킷을 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다.

like the previous. As shown in it is exemplified 802.11 a / ac / n devices can play the role of the packet in the L-SIG based on the duration field. The repeated high efficiency SIG (HE-SIG) field can be connected after the L-SIG.

[00141] 도 19에 도시된 예시적인 포맷에서, DGI(double guard interval)가 반복되는 HE-SIG1 필드들에 앞설 수 있다. 그러한 이중 가드 인터벌의 사용은 L-SIG 후에 제 1 심볼에 대한 Q-BPSK 체크의 랜덤 결과를 발생시킬 수 있다. 따라서, 일부 레거시 디바이스들은, L-SIG가 6 Mbps의 레이트를 시그널링하면 이러한 패킷을 연기하지 않을 수 있다. 따라서, 그러한 패킷 내의 L-SIG는, 모든 IEEE 802.11a/ac/n 디바이스들이 패킷을 연기하는 것을 보장하기 위해, 6 Mbps 이외의 레이트를 시그널링할 필요가 있을 수 있다. 예를 들면, L-SIG는 9 Mbps의 레이트를 시그널링할 수 있다. 앞서 논의된 기술들과 유사한 기술들은, 패킷이 HE 패킷이라는 것을 시그널링하는데 사용될 수 있고, 패킷이 지연 확산 보호를 포함하는지를 시그널링하는데 사용될 수 있다.

[00141] The use of the guard interval among that this it can precede in HE-SIG1 fields where the DGI (double guard interval) is repeated in the illustrative format illustrated in Figure 19 is used when in order that the random result of the Q-BPSK check about the first symbol can be generated after the L-SIG if the L-SIG signals the rate of 6 Mbps, some legacy devices does not postpone such packet therefore therefore the L-SIG within that packet guarantees that all IEEE 802.11a / ac / n devices postpone the packet the rate except 6 Mbps need to be signaled for example, the L-SIG can signal the rate of 9 Mbps the before discussed technology and the similar techniques can be used to signal and the packet is the HE packet it signals whether the packet includes the delay spread protection.

[00142] 도 17-19에 도시된 것들과 같이, 프리앰블 포맷들에 대한 다양한 최적화가 제공될 수 있다. 예를 들면, 도 18 및 도 19에 도시된 예시적인 포맷들에 대해, 오버헤드를 절약하기 위해, 제 2 HE-SIG1 심볼을 절단하고 다음 심볼을 조기에 시작하는 것이 가능할 수 있다. 게다가, HE-LTF들 후에 SIG-B를 갖는 약간의 이점이 존재할 수 있고, 이것은 MU-MIMO에 대해 사용자 당 비트들을 제공할 수 있다.

[00142] The various optimization about preamble formats can be provided like the things illustrated in Figure 17-19. For example, in order that the overhead is saved about illustrative formats shown in figures 18 and 19 it can be possible to cut the second HE-SIG1 symbol and start the next symbol at its early stage. Moreover, the some advantage having the SIG-B after HE-LTFs can exist and this can provide the bits per the user concerning the MU-MIMO.

[00143] 도 20은 HE-SIG 1 필드에 대한 예시적인 비트 할당을 예시한다. 예시된 바와 같이, BW 표시를 위한 2-3 비트들, 길이 표시를 위한 8-비트, 더 긴 심볼들이 사용되는 것을 표시하기 위한 비트, 2-3 예비 비트들, CRC를 위한 4 비트들, 및 6 테일 비트들이 존재할 수 있다. 더 긴 심볼들 ON 비트가 HE-SIG1에 제공되면, 이것은 다음 중 어느 하나: HE-SIG2가 지연 확산 보호를 갖는다는 것 또는 HE-SIG2가 증가된 FFT 크기를 사용한 후의 모든 것 중 어느 하나를 시그널링하는데 사용될 수 있다. 위의 HE- SIG 포맷들 — HE-SIG는 HE-SIG1 및 HE-SIG2로 구성됨 — 은 지연 확산 보호를 허용할 수 있고, OFDMA 패킷들과 같이 다중 액세스를 허용하는 패킷들에 사용될 수 있다.

[00143] Fig. 20 exemplifies the illustrative bit allocation about the HE-SIG 1 field. As shown in it is exemplified 8- bit for 2-3 bits for the BW display the length mark, the bit for indicating that the longer symbols is used, and four bitses for 2-3 reserved bits CRC and 6 tail bits can exist. The longer symbol on-bit is any one of this is the next it is provided to the HE-SIG1: it can be used to signal any one of alls of the use the FFT size in which or the HE-SIG2 is increased that the HE-SIG2 has the delay spread protection. The HE- SIG format — HE-SIG consists of the HE-SIG1 and HE-SIG2 the delay spread protection can be given a permission of and it can be used for packets allowing the multiple-access like OFDMA packets.

[00144] 레거시 프리앰블을 갖는 업링크 패킷

[00144] The uplink packet having the legacy free amble.

[00145] 도 21은, 하위-호환 가능 다중 액세스 무선 통신들을 가능하게 하는데 사용될 수 있는 업링크 물리 계층 패킷(2100)의 예시적인 구조를 예시한다. 통상적으로, 업링크 패킷에서, 레거시 프리앰블이 필요하지 않을 수 있는데, 왜냐하면 NAV가 AP의 초기 다운링크 메시지에 의해 설정되기 때문이다. AP의 초기 다운링크 메시지는 네트워크 상의 레거시 디바이스들로

[00145] Fig. 21 exemplified the structure of being illustrative of the up-link physical layer packet (2100) which could be used to make low rank - compatible multiple-access wireless communications possible the legacy free amble was not necessary in the uplink packet. In case NAV was due to be set up by the initial downlin

하여금 업링크 패킷을 연기하게 할 수 있다. 그러나, 일부 무선 디바이스들은 AP로 송신하는 STA들의 범위 내에 있지만 AP의 범위 외부에 있을 수 있다. 따라서, 이러한 디바이스들은, 자신들이 레거시 디바이스들인 경우에, 자신들이 AP의 초기 다운링크 메시지를 수신하지 않았을 때, AP에 대해 연기하지 않을 수 있다. 이러한 디바이스들은 또한 도 12에서의 것들과 같은 업링크 패킷을 연기하지 않을 수 있는데, 왜냐하면 그러한 패킷들이 레거시 디바이스들이 인식할 수 있는 레거시 프리앰블을 갖지 않기 때문이다. 따라서, 그러한 디바이스의 송신은 업링크 패킷과 간섭할 수 있고, 따라서 레거시 디바이스들로 하여금 패킷을 연기하게 하기에 충분한 레거시 프리앰블을 포함하는 업링크 패킷을 송신하는 것이 바람직할 수 있다. 이러한 업링크 패킷들은 다수의 가능한 형태들을 취할 수 있다. 업링크 패킷(2100)은 레거시 프리앰블을 포함하는 예시적인 업링크 패킷이다. 패킷(2100)이 패킷의 각각의 부분에 대한 시간들을 포함하지만, 이러한 시간들은 단지 예시적이라는 것을 유의하라. 패킷(2100)의 각각의 부분은 표시된 것보다 더 길거나 더 짧을 수 있다. 일부 양상들에서, 레거시 디바이스들이 프리앰블의 레거시 부분을 디코딩하고 패킷(2100)을 연기하도록 허용하기 위해, L-STF, L-LTF 및 L-SIG와 같은 프리앰블의 레거시 부분들이 나열된 시간들인 것이 유리할 수 있다.

k message of AP the initial downlink message of AP postponed the uplink packet to the legacy devices on the network it was in the range of STAs which some wireless devices transmitted a message to AP but the range could have outside the range of AP but therefore the Because such devices were oneself legacy devices when it did not receive the initial downlink message of oneself AP it does not postpone about AP such devices does not postpone moreover, the uplink packet like the things in fig. 12. That packets have the legacy free amble which legacy devices can recognize therefore the transmission of that device can interfere with the uplink packet. Therefore, such uplink packets it can do with desirable to transmit the uplink packet including the legacy free amble postponing the packet to legacy devices comprises the packet (2100) is the times about each part of the packet multiple possible forms can be taken it is the illustrative uplink packet in which the uplink packet (2100) includes the legacy free amble. And it takes care about such times are only illustrative. It is longer than each part of the packet (2100) is indicated or it can be shorter. In some modes, in order that it allows so that legacy devices decode the legacy part of the preamble and the packet (2100) is postponed it can be advantageous times when the L-STF, and legacy parts of the preamble such as the L-LTF and L-SIG are enumerated.

[00146] 따라서, 패킷(2100)은, 그러한 레거시 디바이스들이 인식할 수 있는 레거시 프리앰블을 제공함으로써, 업링크 패킷을 연기하도록 그러한 레거시 디바이스들에 통지하는데 사용될 수 있다. 이러한 레거시 프리앰블은 L-STF, L-LTF 및 L-SIG를 포함할 수 있다. 패킷(830)에서와 같이, 송신 디바이스들 각각은 자신들의 할당된 대역폭 상에서 그 자신들의 프리앰블을 송신하도록 구성될 수 있다. 이러한 레거시 프리앰블들은, AP의 초기 다운링크 메시지를 청취하지 않은 노드들로부터 업링크 통신들을 보호할 수 있다.

[00146] Therefore, the packet (2100) is used when the legacy free amble which that legacy devices can recognize is provided. In that way it notifies in that legacy devices in order to postpone the uplink packet. Such legacy free amble comprises the L-STF, and the L-LTF and the L-SIG. Each packet (830), the sending device is configured to transmit the preamble of the oneselves on the allocated bandwidth of the oneselves. Such legacy free ambles can protect up-link communications from nodes which does not listen to the initial downlink message of AP.

[00147] 패킷(830)에서와 같이, 다수의 디바이스들 각각, 여기서 N 개의 디바이스들은 자신들의 할당된 대역폭으로 동시에 송신할 수 있다. 레거시 프리앰블 다음에, 각각의 디바이스는 자신의 할당된 톤들 상에서 고효율 프리앰블을 송신할 수 있다. 예를 들면, 각각의 디바이스는 그 자신의 할당된 톤들 상에서 HE-SIG를 송신할 수 있다. 이러한 HE-SIG 다음에, 이후 각각의 디바이스는 HE-STF를 송신할 수 있고, 하나 이상의 HE-LTF들을 송신할 수 있다. 예를 들면, 각각의 디바이스는 단일 HE-STF를 송신할 수 있지만, 그 디바이스에 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들을 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는 가장 높은 수의 공간 스트림들을 갖는 디바이스에 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들을 송신할 수 있다. 공간 스트림들의 이러한 할당은, 예를 들면, AP의 초기 다운링크 메시지에서 이루어질 수 있다. 각각의 디바이스가 동일한 수의 HE-LTF들을 전송하면, 이것은 PAPR(peak-to-average-power ratio)을 감소시킬 수 있다. 그러한 PAPR의 감소가 요구될 수 있다. 추가로, 각각의 디바이스가 동일한 수의 HE-LTF들을 송신하면, 이것은 AP에 대해 수신된 업링크 패킷을 프로세싱하는 것을 더 용이하게 할 수 있다. 예를 들면, 상이한 수의 HE-LTF들이 각각의 디바이스에 의해 전송되면, AP는, 다른 디바이스로부터 데이터를 수신하면서, 하나의 디바이스에 대한 프리앰블을 수신할 수 있다. 이것은 AP에 대해 패킷을 디코딩하는 것을 더 복잡하게 할 수 있다. 따라서, 각각의 디바이스들에 대해 동일한 수의 HE-L

[00147] Here the device of Ns simultaneously can transmit a message the packet (830) to the allocated bandwidth of the oneselves with multiple devices. Next each device can transmit the high efficiency preamble on its own allocated tones with the legacy free amble. For example, each device can transmit the HE-SIG on its own allocated tones. Next then each device can transmit the HE-STF with such HE-SIG and at least one HE-LTFs can be transmitted. For example, the HE-LTFs corresponding to the number of space streams which each device can transmit the single HE-STF and however are allocated in the device of the number can be transmitted. In some modes, each device can transmit the HE-LTFs corresponding to the number of space streams allocated in the device having space streams of the highest number of the number. Such allocation of the space streams can be made in the initial downlink message of AP. If the HE-LTFs in which each device is identical of the number are transmitted , this can reduce the PAPR (peak-to-average-power ratio). The reduction of that PAPR can be requested. Additionally, if the HE-LTFs in which each device is identical of the number are transmitted , it more can facilitate processing the uplink packet in which this is received about AP. For example, if the different HE-LTFs of the number are transmitted wi

TF들을 사용하는 것이 선호될 수 있다. 예를 들면, 송신 디바이스들 각각은 임의의 디바이스가 수신하는 공간 스트림들의 최대수를 결정하고, 그 수에 대응하는 수의 HE-LTF들을 송신하도록 구성될 수 있다.

th each device , while AP receives data from the dissimilar device the preamble about one device can be received. It more makes complicated that this decodes the packet about AP. Therefore, it can be preferred to use the HE-LTFs which are identical about each devices of the number. For example, the maximum number of the space streams which the sending device the arbitrary device receives is determined and the HE-LTFs corresponding to the number of the number are configured to be transmitted.

[00148] 몇몇 양상들에서, 이러한 패킷의 L-STF는 대략 200ns까지 정도의 작은 사이클릭 시프트들을 포함할 수 있다. 큰 사이클릭 시프트들은 교차-상관에 기초하여 검출 알고리즘을 이용할 수 있는 레거시 디바이스들에 있어 이러한 L-STF들을 발행하게 할 수 있다. 이러한 패킷(2100)의 HE-STF는 대략 800ns 정도의 더 큰 사이클릭 시프트들을 포함할 수 있다. 이는 업링크 패킷(2100)을 수신하는 AP에서 보다 정확한 이득 세팅들을 허용할 수 있다.

[00148] In some modes, the L-STF of such packet may include the small cyclic shifts of the extent to approximately, 200ns. Such L-STFs are published as to legacy devices in which big cyclic shifts can use the sensing algorithm based on the cross correlation. The HE-STF of such packet (2100) may include about approximately, the greater cyclic shifts of 800ns. This can allow more correct gain settings in AP receiving the uplink packet (2100).

[00149] 도 22는 하위-호환 가능한 다중 액세스 무선 통신들을 가능케 하는데 이용될 수 있는 업링크 물리 계층 패킷(2200)의 다른 예시적인 구조를 예시한다. 이 패킷(2200)은 패킷(2100)과 유사할 수 있지만, 이 패킷(2200)에서, 송신 디바이스들 각각은 HE-STF를 송신하지 않을 수 있다. 대신, 송신 디바이스들 각각은 예컨대, 대략 800nm 정도의 더 큰 사이클릭 시프트들을 갖는 L-STF를 송신할 수 있다. 이는 교차-상관 패킷 검출기들을 갖는 레거시 디바이스들에 영향을 줄 수 있지만, 이는 패킷이 더 짧게 되도록 허용할 수 있는데, 그 이유는 이것이 송신 디바이스들로 하여금 HE-STF를 송신하지 않도록 허용할 수 있기 때문이다. 패킷(2200)이 패킷의 각각의 부분에 대한 시간들을 포함하지만, 이들 시간들은 단지 예시적이며, 패킷의 각각의 부분은 표시된 것보다 더 길거나 짧게 될 수 있다. 몇몇 양상들에서, 이것은 레거시 디바이스들이 프리앰블의 레거시 부분을 디코딩하고 패킷(2200)을 연기하도록 허용하기 위해 나열된 시간들에 대한 L-STF, L-LTF, 및 L-SIG와 같은 프리앰블의 레거시 부분들에 대해 유익할 수 있다.

[00149] The structure of being illustrative of being different of the up-link physical layer packet (2200) which can be used to make multiple-access wireless communications which are compatible low rank - fig. 22 possible is exemplified. This packet (2200) can be similar to the packet (2100). However this packet (2200) the sending device does not transmit the HE-STF. Instead of, the L-STF can be transmitted the sending device has about for example, approximately, the greater cyclic shifts of 800nm. This can affect legacy devices having cross correlation packet detections. However it can allow so that as to the this, the packet is shorter. Reason for the allow so that this does not transmit the HE-STF to sending devices. The packet (2200) includes the times toward each part of the packet. However these times are only illustrative and it is longer than each part of the packet is indicated or it is short. In some modes, it can be profitable about the L-STF about the times which are enumerated in order to allow so that legacy devices decode the legacy part of the preamble and this postpones the packet (2200), and legacy parts of the preamble such as the L-LTF and L-SIG.

[00150] 패킷(2200)에서, 각각의 디바이스는 그 디바이스에 할당된 공간적 스트림들의 수에 대응하는 다수의 HE-LTF들을 송신할 수 있다. 몇몇 양상들에서, 각각의 디바이스는 대신, 가장 높은 수의 공간적 스트림들에 할당되는 디바이스에 할당되는 공간적 스트림들의 수에 대응하는 다수의 HE-LTF들을 송신할 수 있다. 위에서 논의된 바와 같이, 이러한 접근법은 PAPR을 감소시킬 수 있다.

[00150] Multiple HE-LTFs corresponding to the number of spatial streams in which each device is allocated in the packet (2200) in the device can be transmitted. In some modes, each device can transmit multiple HE-LTFs corresponding to the number of spatial streams allocated in the device allocated in spatial streams of the highest number. As shown in it is discussed before the upper part such approach can reduce PAPR.

[00151] 몇몇 양상들에서, 더 긴 심볼 지속기간은 지연 확산 보호 및 타이밍 오프셋으로부터의 보호를 제공할 수 있다. 예를 들어, 업링크 패킷을 송신하는 디바이스들은 동시에 패킷을 송신하기 시작하는 것이 아니라 대신 약간 상이한 시간들에 시작할 수 있다. 더 긴 심볼 지속기간은 또한 이러한 인스턴스들에서 패킷을 해석하는데 있어 AP를 도울 수 있다. 몇몇 양상들에

[00151] In some modes, the longer symbol duration period can provide protection from the delay spread protection and timing offset. For example, devices transmitting the uplink packet simultaneously not,begin to transmit the packet but it can begin at instead ofa little bit different times. It has with number in which such in

서, 디바이스들은 AP의 다운링크 트리거 메시지의 신호에 기초하여 더 긴 심볼 지속기간으로 송신하도록 구성될 수 있다. 몇몇 양상들에서, 패킷(830)과 같은 그린-필드 패킷에 대해, 전체 파형은, 레거시 호환성에 대한 필요가 없기 때문에 더 긴 심볼 지속기간에서 송신될 수 있다. 패킷(2100 또는 2200)과 같은 레거시 프리앰블을 포함하는 업링크 패킷에서, 레거시 프리앰블은 종래의 심볼 지속기간으로 송신될 수 있다. 몇몇 양상들에서, 레거시 프리앰블 이후의 부분은 더 긴 심볼 지속기간으로 송신될 수 있다. 몇몇 양상들에서, 더 긴 심볼 지속기간은 더 작은 대역폭의 기존의 IEEE 802.11 톤 플랜을 이용함으로써 달성될 수 있다. 예를 들어, 더 작은 서브-캐리어 간격이 이용될 수 있으며, 이는 다운-클로킹으로서 지칭될 수 있다. 예를 들어, 대역폭의 5MHz 부분은 64-비트 FFT 802.11a/n/ac 톤 플랜을 이용할 수 있는 반면에, 20MHz는 종래식으로 이용될 수 있다. 따라서, 각각의 톤은 이러한 구성에서 통상적인 IEEE 802.11 a/n/ac 패킷보다 4배 더 길 수 있다. 다른 지속기간들이 또한 이용될 수 있다. 예를 들어, 통상적인 IEEE 802.11 a/n/ac 패킷에 있는 한, 2배인 톤들을 이용하는 것이 바람직할 수 있다.

stances as to the longer symbol duration period, are to interpret the packet and which helps AP. In some modes, devices are configured to transmit a message based on the signal of the down-link trigger message of AP to the longer symbol duration period. In some modes, the whole wavy pattern can be transmitted in the longer symbol duration period about the green - field packet like the packet (830) because there is no need about the legacy compatibility. In the uplink packet including the legacy free amble like the packet (2100 or 2200), the legacy free amble can be transmitted to the conventional symbol duration period. In some modes, the part of the legacy free amble after can be transmitted to the longer symbol duration period. In some modes, the is smaller bandwidth can be achieved since the longer symbol duration period uses the existing IEEE 802.11 tone plan of the bandwidth which. For example, it can take advantage of the sub-carrier gap which is smaller and this can be called as the down - clocking. For example, whereas 5MHz part of the bandwidth can use 64- bit FFT 802.11a / n / ac tone plan 20MHz can be used as the conventional type. Therefore, it can be each tone longer from such configuration than the normal IEEE 802.11 a / n / ac packet with the quadruple. Dissimilar durations can be moreover used. For example, it is in the normal IEEE 802.11 a / n / ac packet. It can do with desirable to take advantage of 2 vane tones.

[00152] 도 23은 패킷을 수신하는 예시적인 방법(2300)을 예시한다. 이 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[00152] Fig. 23 exemplifies the illustrative method (2300) receiving the packet. This method can be performed with the wireless device like AP.

[00153] 블록(2305)에서, AP는 대역폭의 제 1 섹션의 제 1 부분을 수신하고, 제 1 부분은 제 1 무선 디바이스에 의해 송신되고, 제 1 부분은 제 1 프리앰블의 고효율 섹션 및 패킷을 언기하도록 레거시 디바이스들에 통지하기에 충분한 정보를 포함하는 제 1 프리앰블의 레거시 섹션을 포함한다. 몇몇 양상들에서, 수신하기 위한 수단은 수신기일 수 있다.

[00153] In the block (2305), AP includes the first part is the high efficiency section of the first preamble the first part is transmitted with the first wireless device the first part of the first section of the bandwidth is received and the legacy section of the first preamble which contains the information which is sufficient to notify in legacy devices in order to postpone the packet. In some modes, the means for receiving can be the receiver.

[00154] 블록(2310)에서, AP는 대역폭의 제 2 섹션에서 제 2 부분을 동시에 수신하고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되며, 제 2 부분은 제 2 프리앰블의 제 2 고효율 섹션 및 패킷을 언기하도록 레거시 디바이스에 통지하기에 충분한 정보를 포함하는 제 2 프리앰블의 레거시 섹션을 포함한다. 몇몇 양상들에서, 동시에 수신하기 위한 수단은 수신기일 수 있다. 몇몇 양상들에서, 제 1 무선 디바이스 및/또는 제 2 무선 디바이스는 다수의 공간적 스트림들을 통해 송신할 수 있다. 몇몇 양상들에서, 제 1 및 제 2 무선 디바이스들에 의해 송신된 프리앰블의 고효율 부분은 다수의 긴 트레이닝 필드를 포함할 수 있다. 몇몇 양상들에서, 더 긴 트레이닝 필드들의 수는 임의의 무선 디바이스에 할당된 최고 수의 공간적 스트림들 또는 그 특정한 디바이스에 할당된 공간적 스트림들의 수에 기초할 수 있다.

[00154] In the block (2310), AP includes the second part is the second high efficiency section of the second preamble the second part is transmitted with the second radio device the second part is simultaneously received by the second section of the bandwidth and the legacy section of the second preamble which contains the information which is sufficient to notify in the legacy device in order to postpone the packet. In some modes, the means for simultaneously receiving can be the receiver. In some modes, the first wireless device and/or the second radio device can transmit a message through multiple spatial streams. In some modes, the high efficiency part of the preamble transmitted with first and second wireless devices may include the multiple long training fields. In some modes, it can be based on the number of spatial streams allocated in spatial streams in which the number is allocated in the arbitrary wireless device or the specific device of the maximum number of the longer training fields.

[00155] 몇몇 양상들에서, 업링크 OFDMA 패킷이 MU-MIMO(uplink multi-user multiple input and multiple-output) 패킷의 것을 보다 근접하게 모방하는 구조를 갖는 것이 바람직할 수 있다. 예를 들어, 도 21의 패킷(2100)과 같은 다

[00155] In some modes, it can do that the up-link OFDMA packet has the structure of imitating of MU- MIMO (uplink multi-user multiple input and multiple-output) packet more closely. For example, a plurality of prec

수의 선행 패킷들은 하나 이상의 HE-LTF들 이전에 HE-SIG를 포함할 수 있다. 유사하게, 도 12의 패킷(830)에서, 송신 디바이스들 각각은 단일 HE-LTF에 이어, HE-SIG에 이어, 잔여 수의 HE-LTF들을 송신한다. 그러나 업링크 MU-MIMO 패킷과 보다 유사한 구조를 갖는 업링크 패킷을 갖기 위해, 패킷에서 모든 HE-LTF들 이후에 HE-SIG가 후속하는 패킷을 갖는 것이 바람직할 수 있다.

edence packets such as the packet (2100) of fig. 21 previously may include the HE-SIG at least one HE-LTFs. Similarly, in the packet (830) of fig. 12, the sending device transmits the HE-LTFs of the residual water following the single HE-LTF following the HE-SIG. But in order that it has the uplink packet having the structure of being more similar to the up-link MU-MIMO packet it can do with desirable that the HE-SIG has the subsequent packet at the packet after all HE-LTFs.

[00156] 그에 따라, 설명된 패킷들 중 임의의 패킷에서, HE-LTF들 모두 다음에 HE-SIG를 송신하는 것이 가능할 수 있다. 일부 양상들에서, HE-SIG가 HE-LTF들 모두 이후에 따라올 경우, 업링크 패킷에서 각각의 송신 디바이스에 의해 사용되는 다수의 공간 스트림들을 시그널링하는 다른 방법을 찾는 것이 바람직할 수 있다. 예를 들어, 앞에서 설명된 패킷들 중 일부에서, 송신 디바이스로부터의 제 1 HE-LTF는, AP로 하여금 그 송신 디바이스로부터 HE-SIG를 디코딩하기에 충분한 정보를 포함할 수 있다. 앞에서 설명된 패킷들 중 일부에서, 송신 디바이스로부터 HE-SIG는 패킷 내 그 디바이스에 의해 사용되는 공간 스트림들의 수에 관한 정보를 포함할 수 있고, 따라서, 일부 양상들에서, HE-SIG는 그 송신 디바이스에 의해 송신될 HE-LTF들의 수를 나타낼 수 있다. 그러나, HE-SIG가 각각의 HE-LTF 다음에 송신되는 경우, 이것과는 상이한 방식으로 송신 디바이스에 의해 사용되는 공간 스트림들의 수를 나타내는 것이 바람직할 수 있다. 예를 들어, 송신 디바이스에 의해 사용되는 공간 스트림들의 수는 AP로부터의 다운링크 메시지에 표시될 수 있다. 예를 들어, 업링크 OFDMA 패킷은 AP로부터의 다운링크 패킷에 응답하여 전송될 수 있는데, 이는 어느 디바이스들이 업링크 OFDMA 패킷을 송신하는지를 나타낸다. 그에 따라, 이 다운링크 패킷은 또한 다수의 공간 스트림들을 각각의 디바이스로 할당할 수 있다.

[00156] Thus, in the arbitrary packet among the explained packet, it can be altogether possible in the next with HE-LTF to transmit the HE-SIG. In some modes, thereafter when the HE-SIG altogether follows with HE-LTF it can do to find out the dissimilar method for signaling multiple space streams used in the uplink packet with each sending device. For example, in the part among the packet explained in front of, the information in which the first HE-LTF from the sending device is sufficient to decode the HE-SIG from the sending device to AP is include might. The number of HE-LTFs in which may include the information and the HE-SIG is transmitted in some modes with the sending device about the number of space streams in which the HE-SIG is used by the packet nag device in the part among packets explained in front of from the sending device can be shown. But it can do with desirable to show the number of space streams used by the sending device as the case where the HE-SIG is transmitted to each HE-LTF next, and this and the different mode. For example, the number of space streams used by the sending device can be indicated on the downlink message from AP. For example, the up-link OFDMA packet can be transmitted in response to the downlink packet from AP. This shows whether a devices transmit the up-link OFDMA packet. Thus, this downlink packet can assign moreover, the multiple space streams to each device.

[00157] 도 24는 각각의 HE-LTF 이후에 HE-SIG가 송신되는 예시적인 업링크 패킷 구조이다. 업링크 OFDMA 패킷(2400)에서, 송신 디바이스들 각각은 상술된 다른 패킷들에서와 같이, HE-STF(2410)을 송신할 수 있다. HE-STF(2410) 다음에, 송신 디바이스들 각각은 다수의 HE-LTF들(2420)을 송신할 수 있다. 송신 디바이스들 각각은, 그 송신 디바이스에 의해 사용되는 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신할 수 있다. 예를 들어, 송신 디바이스가 2개의 공간 스트림들을 이용하여 송신하고 있는 경우, 그 디바이스는 2개의 HE-LTF들(2420)을 송신할 수 있다. 그의 HE-LTF들(2420) 모두를 송신한 후, 각각의 송신 디바이스는 그 후 HE-SIG(2430)를 송신한다. 이 HE-SIG(2430)는 상술된 것과 유사한 정보를 포함할 수 있다.

[00157] Figure 24 is an illustrative uplink packet structure the HE-SIG being transmitted after each HE-LTF. In the up-link OFDMA packet (2400), the HE- STF (2410) in which the sending device is above mentioned can be transmitted. Next the sending device can transmit multiple HE-LTFs (2420) with the HE- STF (2410). The HE-LTF (2420) corresponding to the number of space streams which the sending device is used by the sending device of the number can be transmitted. For example, the case , and the device where the sending device transmits a message using the space streams of 2 can transmit the HE-LTF (2420) of 2. Thereafter each sending device transmits the HE- SIG (2430) both its HE-LTF (2420) after doing the transmission. This HE- SIG (2430) comprises and the information which is similar.

[00158] 예시된 바와 같이, 패킷(2400)에서, 각각의 송신 디바이스는 그 디바이스에 의해 사용되는 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신한다. 상술된 바와 같이, 다른 양상들에서, 디바이스에 의해 사용되는 다수의 공간 스트림들은 그 디바이스에 의해 전송된 HE-SIG에 표시될 수 있다. 그러나, 패킷(2400)에서, AP가 송신 디바이스가 송신할

[00158] The HE-LTF (2420) corresponding to the number of space streams in which as shown in it is exemplified each sending device is used by the device in the packet (2400) of the number is transmitted. As shown in it is above mentioned multiple space streams used by the device in dissimilar modes can be indicated on

수 있는 HE-LTF들(2420)의 수를 예상하기에는 이 표시가 너무 늦게 도달할 수 있기 때문에, 다수의 공간 스트림들이 HE-SIG(2430)에 포함되지 않을 수 있다. 따라서, AP가 주어진 이벤트로부터 공간 스트림들의 수를 결정하는 다른 방법들이 사용될 수 있다. 예를 들어, AP로부터의 다운링크 메시지, 이를 테면, 업링크 OFDMA 패킷(2400)을 트리거링하는 메시지가 다수의 공간 스트림들을 각각의 송신 디바이스로 할당할 수 있다. AP로부터의 예시적인 다운링크 메시지가 도 26에 도시되며, 이 메시지는, 각각의 송신 디바이스가 사용할 수 있는 공간 스트림들의 수가 얼마나 되는지에 관한 정보를 포함한다. 일부 양상들에서, 각각의 송신 디바이스에 의해 사용된 공간 스트림들의 수가 마찬가지로 다른 방식으로 결정될 수 있다. 예를 들어, 각각의 송신 디바이스에 대한 공간 스트림들의 수가 주기적인 다운링크 메시지로, 이를 테면, 비콘으로 전달될 수 있다. 일부 양상들에서, AP는 수신된 패킷(2400)에 기초하여 다수의 공간 스트림들을 결정하도록 구성될 수 있다. 예를 들어, AP는, 예를 들어, 착신하는 패킷(2400)을 분석하고 HE-LTF들(2420)의 종료와 HE-SIG(2430)의 시작을 검출함으로써 얼마나 많은 수의 공간 스트림들이 송신될 수 있는지에 관한 사전 지식없이도 각각의 송신 디바이스에 의해 송신되는 HE-LTF들(2420)의 수를 결정하도록 구성될 수 있다. 다른 방법들 또한, AP로 하여금 다수의 공간 스트림들을 결정하고, 따라서, 패킷(2400)의 각각의 디바이스에 의해 송신되는 HE-LTF들(2420)의 수를 결정할 수 있게 하는 다른 방법들이 사용될 수 있다. 각각의 송신 디바이스로부터 HE-SIG(2430) 다음에, 그 디바이스는 이것이 패킷(2400)에서 송신하기 원하는 데이터(2440)를 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는 패킷(2400)에서 동일한 수의 HE-LTF들(2420)을 송신할 수 있다. 예를 들어, 각각의 송신 디바이스는, 공간 스트림들 중 가장 큰 수가 할당되는 디바이스로 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신할 수 있다.

the HE-SIG. Transmitted with the device. But this display so slower can reach to anticipate the number of HE-LTFs (2420) which the sending device of AP can transmit a message in the packet (2400). Therefore multiple space streams are not included in the HE- SIG (2430). Therefore, the dissimilar methods determining the number of the space stream from the event in which AP is given can be used. For example, it tells with the downlink message from AP. The message triggering the up-link OFDMA packet (2400) can assign multiple space streams to each sending device. The information which relates if the number of space streams which the downlink message from AP is illustrated in 26 and illustrative this message each sending device can use how many is contained. The number of space streams used by each sending device in some modes can be determined as the mode different from the likeness. For example, it reaches through the downlink message in which the number of the space streams about each sending device is periodic. It can be delivered to the beacon. In some modes, multiple space streams are configured to be determined based on the packet (2400) in which AP is received. For example, as to AP, by analyzing the packet (2400) incoming and detecting the termination of the HE-LTF (2420) and beginning of the HE- SIG (2430) the how many space streams is configured to determine the number of HE-LTF (2420) transmitted without the priori Knowledge which relates about being transmitted with each sending device for example. The dissimilar methods determining the number of HE-LTFs (2420) which determines and the therefore is transmitted with each device of the packet (2400) can be multiple space streams used to the dissimilar methods, moreover, AP. Next the device can transmit the data (2440) which desires that this transmits a message in the packet (2400) from each sending device with the HE- SIG (2430). In some modes, the packet (2400) each device can transmit the same HE-LTF (2420) of the number. For example, the HE-LTF (2420) corresponding to the number of space streams in which each sending device is allocated to device in which *** is most allocated among space streams of the number can be transmitted.

[00159] 도 25는, HE-SIG가 각각의 HE-LTF 이후 송신되는 다른 예시적인 업링크 패킷 구조이다. 패킷(2500)은, 각각의 송신 디바이스가 패킷의 고효율 부분을 송신하기 전에 레거시 프리앰블을 송신하는 혼합 모드 패킷에 대응할 수 있다. 패킷(2500)에서, 각각의 디바이스는 먼저 L-STF(2502), 및 L-LTF(2504), 및 L-SIG(2506)를 포함하는 레거시 프리앰블을 송신한다. 패킷(2500)의 이러한 부분들은 상술된 바와 같이 송신될 수 있다.

[00159] Figure 25 is a dissimilar and illustrative uplink packet structure then the HE-SIG being transmitted to each HE-LTF. The packet (2500) can correspond to the mixed mode packet which transmits the legacy free amble before each sending device transmits the high efficiency part of the packet. In the packet (2500), each device transmits the legacy free amble including the L-STF (2502), the L- LTF (2504) and L- SIG (2506) in advance. It can be transmitted as such part of the packet (2500)s been above mentioned.

[00160] 레거시 프리앰블에 따르면, 패킷(2500)은 패킷(2400)과 유사하다. 송신 디바이스들 각각은 HE-STF(2510), 그에 후속하는 다수의 HE-LTF들(2520), 그에 후속하는 HE-SIG(2530), 그에 후속하여 송신 디바이스가 AP에 송신하기를 원하는 데이터(2540)를 송신할 수도 있다. 패킷의 이들 부분들 각각은 상술된 방법들과 유사한 방법들로 송신될 수도 있다. 각각의 디바이스에 의해 송신된 HE-LTF들(2520)의 수는, 각각의 디바이스가 송신하고 있는 공간 스트림들의 수에 적어도 부분적으로 기초할 수도 있다. 예를 들어, 2개의 공간 스트림들 상에서 송신하고 있는 디바이스는 2개의 HE-LTF들(2520)을 송신할 수도 있다.

[00160] According to the legacy free amble, the packet (2500) is similar to the packet (2400). The sending device can transmit data (2540) which desires that the sending device transmits the subsequently to AP to the subsequent HE- SIG (2530), and that in the HE- STF (2510), and that in the HE-LTF (2520) of the subsequent multiple, and that. It can be transmitted to the methods which is similar to the methods in which these part of the packets are above mentioned. The number of HE-LTF (2520) transmitted with each devices can be based on the number of space streams which each device transmits a message at least partially. For exampl

e, the device transmitting a message on 2 space streams can transmit the HE-LTF (2520) of 2.

[00161] 몇몇 양상들에서, 패킷(2500)에서 각각의 디바이스는 동일한 수의 HE-LTF들(2520)을 송신할 수도 있다. 예를 들어, 송신 디바이스들 각각은, 송신 디바이스들 중 임의의 디바이스에 의해 송신되는 가장 높은 수의 공간 스트림들에 대응하는 다수의 HE-LTF들(2520)을 송신할 수도 있다. 따라서, 패킷(2500)에서, 송신 디바이스들 각각은, 얼마나 많은 HE-LTF들(2520)이 패킷에서 송신될지의 정보를 가져야 한다. 이전과 같이, 송신 디바이스들 각각이 동일한 수의 HE-LTF들(2520)을 송신하게 하는 것은, 이것이 패킷의 PAPR을 감소시킬 수도 있으므로 유익할 수도 있다. PAPR에서의 그러한 감소는 상술된 바와 같이, AP가 패킷(2500)을 수신하기 위한 이점들을 초래할 수도 있다. 패킷(2500)에서 각각의 송신 디바이스가 동일한 수의 HE-LTF들(2520)을 송신하면, 이들 디바이스들 각각은 얼마나 많은 HE-LTF들(2520)이 송신될지를 인식해야 한다. 이것은 다수의 방식들로 달성될 수도 있다. 예를 들어, AP는 다운링크 트리거 메시지를 송신 디바이스들에 전송할 수도 있다. 이러한 트리거 메시지는, 어느 디바이스들이 업링크 패킷에서 송신할 수도 있는지, 각각의 디바이스에 할당된 대역폭, 및 각각의 디바이스에 할당된 공간 스트림들의 수와 같은 정보를 포함할 수도 있다. 이러한 트리거 메시지는 또한, 얼마나 많은 HE-LTF들(2520)이 업링크 패킷(2500)에 포함되는지를 송신 디바이스들에 표시할 수도 있다. 예를 들어, 다운링크 메시지는, 각각의 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지를 송신 디바이스들에 표시할 수도 있다. 각각의 송신 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지에 대한 정보를 포함하는 AP로부터의 예시적인 다운링크 트리거 메시지가 도 26에 도시된다. 유사하게, 각각의 디바이스에 할당된 공간 스트림들의 수가 고정될 수도 있다. 예를 들어, 네트워크가 구성될 수도 있으며, 여기서, 각각의 디바이스는 2개의 공간 스트림들만을 사용할 수도 있다. 유사하게, 각각의 디바이스에 할당된 공간 스트림들의 수는, AP로부터 주기적으로 송신되는 비콘 메시지에서와 같이 메시지에서 운반될 수도 있다. 따라서, 송신 디바이스들은, 대부분의 공간 스트림들에 할당된 디바이스에 할당되는 공간 스트림들의 수에 대응하는 다수의 HE-LTF들(2520)을 송신할 수도 있다. 몇몇 양상들에서, 다른 방법들이 또한, 각각의 송신 디바이스에 의해 송신된 HE-LTF들(2520)의 수를 조정하기 위해 사용될 수도 있다.

[00161] In some modes, the HE-LTF (2520) in which each device is identical in the packet (2500) of the number can be transmitted. For example, the sending device can transmit multiple HE-LTFs (2520) corresponding to the space streams of the highest number transmitted among sending devices with the arbitrary device. Therefore, in the packet (2500), the sending device has to have the information of the paper in which the how many many HE-LTF (2520) is transmitted in the packet. Since this can reduce PAPR of the packet this can be profitable to transmit the HE-LTF (2520) in which the sending device is identical of the number like the previous. As shown in such reduction at PAPR is above mentioned advantages in which AP receives the packet (2500) can be caused. In the packet (2500), if the HE-LTF (2520) in which each sending device is identical of the number is transmitted the HE-LTF (2520) in which these devices are many is transmitted it has to recognize. This can be achieved by multiple modes. For example, AP can transmit the down-link trigger message in sending devices. Such trigger message includes the information, such as the number of the bandwidth which is allocated in each device a devices can transmit a message in the uplink packet and the space streams allocated in each device. It can indicate in sending devices whether the HE-LTF (2520) in which such trigger message is moreover many is included in the uplink packet (2500) or not. For example, the downlink message can indicate in sending devices whether it can use space streams in which each device is many or not. The down-link trigger message from AP including the information to use space streams in which each sending device is many is illustrated in 26 illustrative. Similarly, the number of space streams allocated in each device can be fixed. For example, the network can be formed and here each device can use the space stream bay of 2. Similarly, the number of space streams allocated in each device can be carried the Beacon message periodically transmitted from AP in the message. Therefore, sending devices can transmit multiple HE-LTFs (2520) corresponding to the number of space streams allocated in the allocated device to the most of space streams. It can be used the number of HE-LTF (2520) in which the dissimilar methods is transmitted in some modes with moreover, each sending device are controlled.

[00162] 각각의 송신 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지에 대한 정보를 포함하는 AP로부터의 예시적인 다운링크 메시지(2600)가 도 26에 도시된다. 이러한 메시지(2600)는 트리거 메시지 정보(2605)를 포함할 수도 있다. 예를 들어, 이러한 정보(2605)는, 업링크 메시지가 전송될 수도 있는 때에 대한 타이밍 정보를 포함할 수도 있다. 이러한 정보(2605)는, 송신 디바이스들이 트리거 메시지의 수신을 확인해야 하는지에 대한 정보를 더 포함할 수도 있다. 이러한 정보(2605)에 후속하여, 다운링크 메시지(2600)는 디바이스 1의 식별(2610)을 포함할 수도 있다. 이러한 식별(2610)은, 예를 들어, 디바이스 1에 할당되고 디바이스 1을 식별하는 고유한 넘버 또는 값일 수도 있다. 다운링크 메시지(2600)는 또한, 디바이스 1에 할당된 다수의 스트림들(2615)을 포함할 수도 있다. 예를 들어, 디바이스 1은 2개의 공간 스트림들을 할당받을 수도 있다. 다운링크 메시지는 또한, 디바이스 2의 식별(26

[00162] The illustrative downlink message (2600) from AP including the information to use space streams in which each sending device is many is illustrated in fig. 26. Such message (2600) can include the trigger message information (2605). For example, such information (2605) can include the timing information which it confronts when the up-link message can be transmitted. Such information (2605) further can include the information whether sending devices have to confirm the reception of the trigger message. Subsequently the downlink message (2600) can include the identification (2610) of the device 1 in such information (2605). Such identification (2610) for example can be the number or the value which is allocated in the device 1 and which distinguishes the device 1 and is inherent. Multiple streams (2615) in which the downlink message (2600) is allocated in

20), 디바이스 2에 대한 공간 스트림들(2625)의 수, 디바이스 3의 식별(2630), 및 디바이스 3에 대한 공간 스트림들(2635)의 수를 포함할 수도 있다. 몇몇 양상들에서, 다른 수들의 디바이스들은 또한, 다운링크 메시지(2600)에서 식별될 수도 있다. 예를 들어, 2, 3, 4, 5, 6 또는 더 많은 디바이스들이 다운링크 메시지(2600)에서 식별될 수도 있다. 이러한 다운링크 메시지(2600)가 단지 예시적임을 유의한다. 다른 정보가 또한 다운링크 트리거 메시지에 포함될 수도 있으며, 다운링크 메시지(2600)에서 예시한 것과는 상이한 순서 또는 넘버로 포함할 수도 있다.

moreover, the device 1 can be included. For example, the device 1 can be allocated the space streams of 2. The downlink message comprises moreover, the identification (2620) of the device 2, the number of device 2 the space streams (2625), and the identification (2630) of the device 3, and the number of device 3 the space streams (2635). In some modes, the dissimilar device of the numbers can be discriminated in moreover, the downlink message (2600). For example, 2, 3, 4, 5, 6 or more devices can be discriminated in the downlink message (2600). It notes that such downlink message (2600) is only illustrative. The other information can be included in moreover, the down-link trigger message and it can include in exemplified in the downlink message (2600) and order or the different number.

[00163] 몇몇 양상들에서, 업링크 OFDMA 패킷에서 송신된 LTF들을 UL MU-MIMO 패킷에서 송신된 것들과 조화시키는 것이 유익할 수도 있다. 예를 들어, UL MU-MIMO 패킷에서, 각각의 송신 디바이스는 모든 톤들에 걸쳐 메시지들을 송신할 수도 있다. 따라서, UL MU-MIMO 패킷 내의 LTF들은, AP와 같은 수신 STA가 각각의 톤 상에서 각각의 송신 STA로부터의 송신들을 인식하게 하는데 충분한 정보를 포함할 필요가 있을 수도 있다. 그러한 LTF 포맷들은 UL MU-MIMO 패킷 및 UL OFDMA 패킷 둘 모두에서 사용될 수도 있다.

[00163] In some modes, it can be profitable to harmonize LTFs transmitted in the up-link OFDMA packet with the things transmitted in the UL MU-MIMO packet. For example, in the UL MU-MIMO packet, each sending device can transmit messages through all tones. Therefore, LTFs within the UL MU-MIMO packet includes enough information in which the reception STA recognizes the transmission from each transmission STA on each tone but, such as AP. Such LTF formats may be used in the UL MU-MIMO packet and the UL OFDMA packet both.

[00164] 예를 들어, LTF들에 대해 사용될 수 있는 하나의 포맷은, UL MU-MIMO 패킷에서든 또는 UL OFDMA 패킷에서든, P-매트릭스 기반 LTF들을 송신하기 위한 것이다. 이 접근에서는, LTF들은 송신 STA들 각각에 의해 각각의 톤 상에서 송신될 수 있다. 각각의 디바이스로부터의 LTF들은, 그들이 서로 직교하는 방식으로 송신될 수 있다. 송신되는 LTF들의 수는 디바이스들 전부에 할당되는 공간 스트림들의 수에 대응할 수 있다. 예를 들어, 두 개의 디바이스들이 하나의 스트림 상에서 각각 송신한다면, 두 개의 LTF들이 전송될 수 있다. 몇몇 양상들에서는, 제 1 LTF에서, 주어진 톤의 값은 H1+H2와 동일할 수 있는데, 여기서 H1은 제 1 디바이스로부터의 신호이고, H2는 제2 디바이스로부터의 신호이다. 다음 차례의 LTF에서, 주어진 톤의 값은 H1-H2와 동일할 수 있다. 이에 따라, 이러한 직교성 때문에, 수신 디바이스는 각각의 톤 상에서 두 개의 송신 디바이스들 각각의 송신을 식별할 수 있다. LTF들에 대한 이러한 포맷은, 예컨대, 이전 IEEE 802.11 포맷들에서 사용되었다. 그러나, P 매트릭스 기반 LTF들에 대한 하나의 잠재적인 문제점은, 송신 디바이스들 중 둘 이상이 서로에 대하여 높은 주파수 오프셋을 갖는다면 이 P 매트릭스 기반 LTF들은 효과적이지 않을 수 있다는 점이다. 그 상황에서는, LTF들의 직교성이 손실될 수 있고, 이에 따라, 패킷을 적절하게 디코딩하는 수신 디바이스의 능력이 손상될 수 있다. 이에 따라, 몇몇 양상들에서는, UL MU-MIMO 패킷 및 UL OFDMA 패킷에 대해 상이한 LTF 포맷을 사용하는 것이 원해질 수 있다.

[00164] For example, in the UL MU-MIMO packet, or one format which can be used about LTFs is to transmit P- matrix base LTFs in the UL OFDMA packet. In this access, LTFs can be transmitted with the transmission STA on each tone. As to LTF from each device, they can be transmitted to the mode which is each other orthogonal. The number of transmitted LTFs can correspond to the number of space streams allocated in the device whole. For example, if two devices transmits a message on one stream two LTFs can be transmitted. In some modes, the given value of the tone can be identical with the H1+H2 in the first LTF. The here the H1 is the signal from the first device and the H2 is the signal from the second device. In LTF of the next turn, the given value of the tone can be identical with the H1-H2. Accordingly, the receiver device therefore can distinguish two sending device each transmissions on each tone with such orthogonally. Such format about LTFs may be used in for example, previous IEEE 802.11 formats. But if one potential problem about P matrix base LTFs have the frequency offset high over two among sending devices these P matrix base LTFs are not effective. In the situation, the orthogonally of LTFs can be lost and the capability of the receiver device which the accordingly appropriately decodes the packet can be injured. Accordingly, in some modes, it desires about the UL MU-MIMO packet and UL OFDMA packet to use the different LTF format.

[00165] UL MU-MIMO 패킷 및 UL OFDMA 패킷에 대한 다른 가능한 상이한 LTF 포맷은, 톤-인터리빙된 또는 서브-대역 인터리빙된 LTF를 사용하기 위한 것이다. 앞에서와 같이, 송신되는 LTF들의 수는 송신 디바이스들 전부에 의해 전송되는 공간 스트림들의 총 수에 대응할 수 있다. 이러한 LTF 포맷들은, 업링크 패킷을 송신하는 다양한 디바이스들 사이에서 커다란

[00165] The dissimilar possible and different LTF format for the UL OFDMA packet and UL MU-MIMO packet is to use LTF which the sub-band which tone - is interleaved is interleaved. It can correspond to the total count of the space streams in which the number of LTFs transmitted front is transmitted with the sending device wh

주파수 오프셋이 존재할 때 특히 유용할 수 있다. 이들 LTF 포맷들은 UL MU-MIMO 패킷에서 사용될 수 있다. UL OFDMA 패킷을 UL MU-MIMO 패킷과 조화시키기 위하여, 이들 LTF 포맷들은 또한 UL OFDMA 패킷에서 사용될 수 있다.

ole. As to such LTF formats, when the big frequency offset exists between various devices transmitting the up link packet, it can be especially useful. These LTF formats may be used in the UL MU-MIMO packet. These LTF formats the UL OFDMA packet is harmonized with the UL MU-MIMO packet may be used in moreover, the UL OFDMA packet.

[00166] 도 27은 UL OFDMA 패킷에서 사용될 수 있는 톤-인터리빙된 LTF의 예시(2700)이다. 예를 들어, 이들 LTF들은 앞서 설명된 UL OFDMA 패킷들 중 임의의 패킷에서 사용될 수 있다. 예를 들어, 이 패킷에서는, 네 개의 공간 스트림들이 존재한다. 이들 공간 스트림들은, 예컨대, 공간 스트림 1-4로서 넘버링될 수 있다. 각각의 공간 스트림이 별개의 디바이스에 의해 송신될 수 있거나, 또는 하나의 디바이스가 공간 스트림들 중 둘 이상을 송신할 수 있다. 이에 따라, 네 개의 공간 스트림들이 UL OFDMA 패킷에 대응할 수 있고, 이 UL OFDMA 패킷은 두 개, 세 개, 또는 네 개의 디바이스들에 의해 송신되고 있다. 네 개의 공간 스트림들이 존재하기 때문에, 네 개의 LTF들은 LTF1 2705, LTF2 2710, LTF3 2715, 및 LTF4 2720으로 라벨링되어 전송될 수 있다. 각각의 LTF는 다수의 톤들을 포함할 수 있고, 이 다수의 톤들은 여기서 1 내지 8로 넘버링된다. 임의의 수의 톤들이 LTF에 포함될 수 있는데, 이 수는 UL OFDMA 패킷의 데이터 부분에 포함되는 톤들의 수에 대응한다. 이러한 톤-인터리빙된 LTF에서는, LTF1 2705 동안, 제 1 스트림이 톤들 1, 5, 9 등에서 송신할 수 있다. 몇몇 양상들에서, 그러한 톤들 사이의 간격(즉, 1과 5 사이의 간격)은 공간 스트림들의 수에 기초한다. 예를 들어, 예시(2700)에서는, 네 개의 공간 스트림들이 존재하고, 그래서 톤들(각각의 스트림이 이 톤들 상에서 송신함) 사이의 간격이 또한 4이다. LTF1 2705 동안, 제 2 스트림이 톤들 2, 6, 10 등에서 송신할 수 있는 동시에, 제 3 공간 스트림이 톤들 3, 7, 11 등에서 송신할 수 있고 제 4 공간 스트림이 톤들 4, 8, 12 등에서 송신할 수 있다. 다음 차례의 LTF, LTF2 2710에서는, 각각의 공간 스트림이 이전 LTF보다 1 톤만큼 더 높은 톤들 상에서 송신할 수 있다. 예를 들어, LTF1 2705에서는, 스트림 1이 톤들 1 및 5 상에서 송신하는 반면에, LTF2 2710에서는, 스트림 1이 톤들 2 및 5 상에서 송신한다. 이에 따라, 공간 스트림들의 수와 동일한 수의 LTF들 이후, 각각의 공간 스트림은 각각의 톤 상에서 송신했을 수 있다. 이러한 톤-인터리빙된 LTF를 사용하여, 공간 스트림들이 동일한 주파수로 동시에 송신하지 않기 때문에, 교차-스트림 누출(cross-stream leakage)은 오프셋 때문에 쟁점이 아닐 수 있다. 예를 들어, 오프셋은 수 kHz일 수 있다. 몇몇 양상들에서는, 스트림마다 주파수 오프셋을 추정하기 위하여, 최종 LTF 이후 LTF1 2725를 다시 반복하는 것이 유리할 수 있다. 예를 들어, LTF1 2705는 LTF1 2725와 동일할 수 있다. 그러나, 이들 두 개의 LTF들은 비교될 수 있다.

[00166] Figure 27 is an example (2700) of LTF which tone - is interleaved being used in the UL OFDMA packet. For example, these LTFs may be used in the arbitrary packet among before explained UL OFDMA packets. For example, in this packet, four space streams exists. These space streams for example can be numbered as the space stream 1-4. Each space stream can be transmitted with the separate device or or one device can transmit two or greater among space streams. Accordingly, four space streams can correspond to the UL OFDMA packet and this UL OFDMA packet is transmitted with two, and the force or four devices. Four space streams exists. Therefore four LTFs is labeled to the LTF1 2705, the LTF2 2710, and the LTF3 2715 and LTF4 2720 and it can be transmitted. Each LTF may include the multiple tones and the tone of this multiples are numbered from the here to 1 through 8. It corresponds to the number of tones in which the tones of the arbitrary number can be included in LTF and the water utility is included in the data part of the UL OFDMA packet. In LTF which such tone - is interleaved, the first stream can transmit a message for the LTF1 2705 in the tone 1, 5, 9 etc. It is based on the number of gap (in other words, the gap between 1 and 5) between that tones is the space stream in some modes. For example, in the example (2700), four space streams exists and so the gap between the tone (each stream transmits a message on Eatons) is the moreover 4. The second stream can transmit a message for the LTF1 2705 in the tone 2, 6, 10 etc. Simultaneously the third space stream can transmit a message in the tone 3, 7, 11 etc. and the fourth space stream can transmit a message in the tone 4, 8, 12 etc. In LTF of the next turn, and the LTF2 2710, each space stream can transmit a message than the previous LTF as 1 tone on much higher tones. For example, in the LTF1 2705, whereas the stream 1 transmits a message with the tone 1 on 5 the stream 1 transmits a message in the LTF2 2710 with the tone 2 on 5. Accordingly, then each space stream could transmit a message on each tone with LTF of the number as the number of space streams. Space streams simultaneously does not transmit a message using LTF which such tone - is interleaved to the same frequency. Therefore the intersection - stream leak (cross-stream leakage) can be therefore not offset the issue. For example, the offset can be the number kHz. In some modes, in order that the frequency offset is estimated at the stream it can be advantageous then to again repeat the LTF1 2725 with the final LTF. For example, the LTF1 2705 can be identical with the LTF1 2725. But LTF of these twoes can be compared.

[00167] 도 28은 UL OFDMA 패킷에서 사용될 수 있는 서브-대역 인터리빙된 LTF의 예시(2800)이다. 예를 들어, 이들 LTF들은 앞서 설명된 UL OFDMA 패킷들 중 임의의 패킷에서 사용될 수 있다. UL OFDMA 패킷은 다수의 공간 스트림들을 포

[00167] Figure 28 is an example (2800) of LTF which the sub-band is interleaved being used in the UL OFDMA packet. For example, these LTFs may be used in the arbitrary packet among before explained UL OFDMA pac

함할 수 있고, 다수의 톤들 상에서 송신될 수 있다. 예를 들어, 예시(2800)는 네 개의 공간 스트림들을 포함한다. 네 개의 공간 스트림들이 존재하기 때문에, 1개 내지 NSC개의 톤들(여기서, NSC는 가드 톤들 및 DC 톤들을 제외한 서브캐리어들의 총 수임)은 네 개의 서브-대역들로 분할된다. 예를 들어, 64개 톤들이 존재한다면, 톤들 1-16이 서브-대역 1일 수 있고, 톤들 17-32가 서브-대역 2일 수 있으며, 톤들 33-48이 서브-대역 3일 수 있고, 그리고 톤들 49-64가 서브-대역 4일 수 있다. 몇몇 양상들에서, 각각의 서브-대역의 톤들의 수는 동일할 수 있거나 또는 대략 동일할 수 있다. 네 개의 LTF들 각각에서, 네 개의 공간 스트림들 각각은 자신의 할당된 서브-대역의 톤들 상에서 송신할 수 있다. 예를 들어, LTF1 2805에서는, 서브-대역 1이 공간 스트림 1에 할당될 수 있고, 서브-대역 2가 공간 스트림 2에 할당될 수 있는 식이다. 후속하는 LTF2 2810에서는, 서브-대역들 각각이 공간 스트림들의 상이한 공간 스트림에 할당될 수 있다. 이에 따라, 네 개의 LTF들 이후, 네 개의 공간 스트림들 각각은 네 개의 서브-대역들 중 각각의 서브-대역 상에서 한 번 송신했을 수 있다.

kets. The UL OFDMA packet may include the multiple space streams and it can be transmitted on multiple tones. For example, the example (2800) includes four space streams. Four space streams exists. Therefore tone (here, NSC is the total acceptance of an appointment of the subcarrier except for guard tons and DC tones) of 1 to NSC are divided to four sub-bands. For example, if 64 tones exist the tone 1-16 can be the sub-band 1 and the tone 17-32 can be the sub-band 2 and the tone 33-48 can be the sub-band 3 and and, the tone 49-64 can be the sub-band 4. The number of the tones of each sub-band in some modes can be identical or it can be approximately identical. In four LTFs, it can transmit a message on the tones of its own allocated sub-band with four space streams. For example, in the LTF1 2805, the sub-band 1 can be allocated in the space stream 1 and it is the method in which the sub-band 2 can be allocated in the space stream 2. In the subsequent LTF2 2810, the sub-band can be allocated in the different space stream of the space streams. Accordingly, then four space streams could transmit a message among four sub-bands on each sub-band with four LTFs.

[00168] 도면(2700) 및 도면(2800)에 예시된 LTF 구조들은 다수의 이점들을 가질 수 있다. 예를 들어, 이러한 구조는 업링크 클라이언트들 사이에 큰 주파수 오프셋이 존재할 때 더 양호한 성능을 제공할 수 있다. 추가로, 이러한 LTF 구조들은 AP가 톤들 각각 상에서 공간 스트림들 각각에서 송신들을 수신하게 할 것이다. 이것은, 예를 들어, 특정 톤들로부터 특정 다른 톤들로의 스위칭이 요구되었을 경우, 공간 스트림이 특정 톤들로부터 특정 다른 톤들로 스위칭하게 할 수 있다. 추가로, 이것은 AP가 각각의 톤 상에서 주어진 디바이스의 주어진 공간 스트림의 신호 강도를 결정하게 할 수 있다. 이것은 이후 패킷에서, AP가 디바이스가 어떤 톤들 상에서 최적의 신호를 갖는지에 기초하여 톤들을 디바이스에 할당하게 할 수 있다. 예를 들어, AP가 톤들을 다양한 디바이스들에 할당하는 경우, AP는 다른 톤들 상의 일부 톤들 상에서 더 낮은 신호-대-잡음 비 및 더 강한 신호를 가짐을 관측할 수 있다. 따라서, AP는 이후 패킷에서 그러한 더 강한 톤들을 그 디바이스에 할당할 수 있다. 도 29는 UL OFDMA 패킷에서 송신될 수 있는 패킷의 예시적 LTF 부분(2900)이다. 예를 들어, 위에서 설명된 바와 같이, 특정 UL OFDMA 패킷들에서, 패킷의 SIG 부분에서 톤들을 할당하기보다는, 톤들은 어떤 다른 곳에 할당될 수 있다. 예를 들어, 위에서 설명된 바와 같이, 특정 UL OFDMA 패킷들은 AP로부터 송신 디바이스들로 시그널링 메시지에서의 톤들을 할당할 수 있고, 송신 디바이스들은 특정 톤들을 특정 디바이스들에 할당할 수 있다. 따라서, 이전 UL 패킷들에서 SIG는 MCS, 코딩 비트들 및 톤 할당 정보를 포함할 수 있지만, 일부 양상들에서는, 톤 할당 정보가 SIG 필드에 포함될 필요가 없다. 따라서, SIG 필드는 단지, 함께 정보의 6-7 비트들을 포함하는 MCS 및 코딩 비트들, 및 6 비트들일 수 있는 BCC(binary convolutional coding) 테일 비트들을 포함할 수 있다. 따라서, 송신하는 이러한 SIG 필드가 또한 오버헤드로서 CRC 정보의 6 비트들을 포함할 때, 단지 정보의 6-7 비트들만을 포함하는 SIG 필드를 송신하는 것이 비효율적일 수 있다. 추가로, 포함하는 이러한 CRC 정보가 이러한 경우 충분한 이익들을 갖는지 여부가 전혀 명백하지 않다. 따라서, MCS 정보(2910) 및 코딩 비트들(2915)을 포함하는 패킷의 LTF 부분(2900)을 전송하는 것이 요구될 수 있다. 패킷의 LTF 부분에 이러한 정보를 포함시킴으로써, 패킷은 SIG 필드를 포함할 필요가 전혀 없을 수 있다.

[00168] The drawing (2700) and LTF structures exemplified in the drawing (2800) can have multiple advantages. For example, when the frequency offset large between up-link clients exists such structure can provide the performance which is better. Additionally, in each in such LTF structures, AP tone phase, transmissions are received by the space stream. When the switching to the tone which specific varied was required from specified tones for example the space stream switches with tones which specific vary from specified tones. Additionally, as to the this, AP determines the signal strength of the given space stream of the given device on each tone. In the this, then, the packet, AP is based if the device has the optimal signal on any kind of tones and tones are assigned to the device. For example, AP can observe tones in various devices in case the allocation that AP has the signal-to-noise ratio and the lower stronger signal on part tones on the dissimilar tones. Therefore, then AP can assign the stronger tones to the device in the packet. Figure 29 is a foreshadowing LTF part (2900) of the packet being transmitted in the UL OFDMA packet. For example, in as described in detail in the upper part, specific UL OFDMA packets, rather than tones are assigned in the SIG part of the packet tones can be allocated in the dissimilar place. For example, as described in detail in the upper part, specific UL OFDMA packets can assign the tones at the signalling message to sending devices from AP and sending devices can assign specified tones to specific devices. Therefore, in previous UL packets, SIG may include MCS, and the coding bits and tone assignment information. However the tone assignment information does not have to be included in the SIG field in some modes. Therefore, the SIG field comprises MCS which cuts off a finger sin and together includes 6-7 bits of the information and the coding bits and BCC (binary convolutional coding) tail bits having with 6 bit farm work number. Therefore, when such SIG field transmitted a message includes 6 bits of the CRC information as moreover, the overhead it can be inefficient to transmit the SIG field which only includes only 6-7 bits of the information. Additionally, it has benefits in which in this case, such CRC information including is sufficient it is not clear at all. Therefore, it can be re

quired to transmit the LTF part (2900) of the packet in cluding the MCS information (2910) and coding bit (291 5). Such information is included in the LTF part of the packet. In that way there can be no need that the pac ket includes the SIG field.

[00169] 이러한 정보는 다수의 방식들에서 패킷의 LTF 부분(2900)에 포함될 수 있다. 예를 들어, 넌-코히런트 복조를 이용할 수 있는 시그널링 메커니즘들이 이용될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 LTF의 톤들 중 일부 또는 그 전부에 걸쳐 낮은-강도 코드에 포함될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 단일 LTF에서, 이를테면, LTF1(2825) 또는 또 다른 LTF에서 송신될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 다수의 LTF들 각각에 걸쳐 분할될 수 있다. 예를 들어, MCS 정보(2910) 및 코딩 비트들(2915) 중 하나 또는 둘 이상의 비트들은 LTF들 중 둘 또는 셋 이상에 포함될 수 있다. 따라서, 일부 양상들에서, 명시적 SIG 필드가 UL OFDMA 패킷 내에 필요할 수 있는데, 그 이유는 이 정보가 패킷의 LTF들 내에 포함될 수 있기 때문이다.

[00169] In such information is the multiple modes, it can be included in the LTF part (2900) of the packet. F or example, signaling mechanisms using the non-cohere nt demodulation can be used. A part of the MCS inform ation (2910) and coding bit (2915) is the tones of LTF i n some modes. And or day steel can be included in the code through the whole. In some modes, the MCS infor mation (2910) and coding bit (2915) arrive the single L TF. It can be transmitted in the LTF 1 (2825) or anoth er LTF. In some modes, the MCS information (2910) an d coding bit (2915) can be divided through multiple LTF s. For example, one or two or more bits can be include d in two or the set or greater among the MCS informati on (2910) and coding bit (2915) among LTFs. Therefor e, in some modes, the explicit SIG field can need within the UL OFDMA packet. This information reason for the be included within LTFs of the packet.

[00170] 전형적으로, UL MU-MIMO 패킷에서, 사용자당 SIG 필드는 그 패킷에 대한 LTF들 각각이 송신된 이후에 포함될 수 있다. 예를 들어, 이러한 포맷은 패킷(2400)의 포맷과 유사할 수 있다. 그러나, UL OFDMA 패킷에서, HE-SIG는 패킷(2100)에 예시된 바와 같이, 패킷의 STF들 또는 LTF들 이전에 포함될 수 있다. 일부 양상들에서, UL MU-MIMO 패킷을 UL OFDMA 패킷과 조화(harmonize)시키기 위해, 둘 모두의 위치들에서 SIG 필드를 갖는 패킷을 송신하는 것이 요구될 수 있다. 예를 들어, HE-STF 이전에, 공통 SIG 필드를 포함하고, 또한 모든 HE-LTF들 이후에 사용자당 SIG 필드를 포함하는 패킷이 송신될 수 있다.

[00170] Typically, in the UL MU-MIMO packet, the SIG field per the user can be included after LTF about the packet is transmitted. For example, such format can be similar to the format of the packet (2400). But in the U L OFDMA packet, as shown in the HE-SIG is exemplified in the packet (2100) it can be previously included with STF or LTF of the packet. In some modes, in order that the UL MU-MIMO packet is made with the UL OFDMA p acket and harmonization (harmonize) it can be required to transmit the packet having the SIG field at the posit ions of the both. For example, the common SIG field is previously included with HE-STF and the packet includi ng the SIG field per the user after moreover, all HE-LTF s can be transmitted.

[00171] 도 30은 HE-STF 이전에 공통 SIG 필드를 그리고 모든 HE-LTF들 이후에 사용자당 SIG 필드를 갖는 패킷(3000)의 예시이다. 패킷(3000)에서, 패킷은 레거시 프리앰블을 포함하고, 레거시 쇼트 트레이닝 필드(3005), 레거시 롱 트레이닝 필드(3010) 및 레거시 SIG 필드(3015)를 포함하는 것으로 도시된다. 그러나, 이러한 패킷은 또한 이러한 레거시 프리앰블없이 송신될 수 있다. 레거시 프리앰블 이후, 이러한 프리앰블이 포함되는 경우, 패킷(3000)은 공통 SIG(3020)를 포함한다. 일부 양상들에서, 이러한 공통 SIG(3020)는 이전 UL OFDMA 패킷들 내의 이러한 SIG 필드에 포함되는 정보와 유사한 정보를 포함할 수 있다. 예를 들어, 공통 SIG는 OFDMA 패킷에 포함되는 공간 스트림들의 수를 전달할 수 있다. 예를 들어, UL OFDMA 패킷에서 각각의 송신하는 디바이스는 공통 SIG(3020)의 톤들의 부분을 파퓰러링(popular)할 수 있다. 공통 SIG(3020) 이후, HE-STF(3025) 및 HE-LTF들(3030)이 송신된다. 이러한 필드들은 위의 개시들에 따라 송신될 수 있다. 예를 들어, HE-LTF들(3030)은 도 27 및 28에 예시된 LFT 포맷들에 기초할 수 있다. 임의의 수의 HE-LTF들(3030)이 송신될 수 있다. 예를 들어, 송신되는 HE-LTF들(303)의 수는 패킷(3000)의 일부인 공간 스트림들의 수의 합에 적어도 부분적으

[00171] Figure 30 is an example of the packet (3000) previously having the SIG field per the user the commo n SIG field after and, all HE-LTFs with HE-STF. In the p acket (3000), the packet includes the legacy free ambl e and with the legacy short training field (3005), and t he legacy long training field (3010) and legacy SIG field (3015) are included it is illustrated. But such packet ca n be transmitted without such legacy free amble. The case then where such preamble is included with the leg acy free amble, and the packet (3000) is the common SIG (3020) are included. Such common SIG (3020) in s ome modes comprises the information included in such SIG field within previous UL OFDMA packets and the inf ormation which is similar. For example, the number of s pace streams in which the common SIG is included in t he OFDMA packet can be delivered. For example, in the UL OFDMA packet, the device transmitting a message c an do the part of the tones of the common SIG (3020) with the wave fuller ring (popular). Then the HE- STF (3025) and HE-LTF (3030) are transmitted to the com mon SIG (3020). Such fields can be transmitted accordi

로 기초할 수 있다. HE-LTF들(303) 이후, 제 2 SIG 필드가 송신될 수 있다. 이러한 사용자당 SIG(3035)는 UL OFDMA 패킷을 송신하는 디바이스들 각각에 의해 송신될 수 있다. 사용자당 SIG 필드(3035)의 포맷은 UL MU-MIMO 패킷 내의 SIG 필드의 포맷에 기초할 수 있다. 사용자당 SIG 필드(3035) 이후, 데이터(3040)가 송신될 수 있다. 따라서, 패킷(3000)은 다른 UL OFDMA 패킷들 내의 공통 SIG(3020) 및 다른 UL MU-MIMO 패킷들 내의 사용자당 SIG 필드(3035) 둘 모두를 포함할 수 있다. 둘 모두의 SIG 필드들이 패킷(3000)에 포함되기 때문에, 이러한 패킷 포맷은 UL OFDMA 및 UL MU-MIMO 둘 모두에서 재이용될 수 있다.

ng to the initiations. For example, it can be based on LFT formats in which the HE-LTF (3030) is exemplified in 27 and 28. The HE-LTF (3030) of the arbitrary number can be transmitted. For example, the number of transmitted HE-LTFs (303) can be based on the sum total of the number of space streams which are the part of the packet (3000) at least partially. Then the second SIG field can be transmitted to the HE-LTF (303). It can be transmitted with the device in which the SIG (3035) per such user transmits the UL OFDMA packet. The format of the SIG field (3035) per the user can be based on the format of the SIG field within the UL MU-MIMO packet. Then data (3040) can be transmitted to the SIG field (3035) per the user. Therefore, may include both the SIG field (3035) two per the user within UL MU-MIMO packets different from the common SIG (3020) within UL OFDMA packets in which the packet (3000) is different. SIG fields of both are included in the packet (3000). Therefore such packet format can be re-used in the UL OFDMA and the UL MU-MIMO both.

[00172] 도 31은 단일 송신으로 하나 이상의 디바이스들에 송신하는 예시적인 방법(3100)을 예시한다. 이러한 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[00172] Fig. 31 exemplifies the illustrative method (3100) transmitted to at least one devices to the single transmission. Such method can be performed with the wireless device like AP.

[00173] 블록(3105)에서, AP는 제 1 포맷에 따라 프리앰블의 제 1 섹션을 송신하고, 프리앰블의 제 1 섹션은, 송신을 얻기하도록, 제 1 포맷과 호환가능한 디바이스들에게 통지하기에 충분한 정보를 포함한다. 예컨대, 제 1 포맷은 기존의 IEEE 802.11 표준들 중 하나 이상에 의해 정의된 포맷과 같은 기존의 포맷일 수 있다. 몇몇 양상들에서, 제 1 포맷은 레거시 포맷이라고 지칭될 수 있다. 몇몇 양상들에서, 프리앰블의 제 1 섹션은, 제 2 포맷과 호환가능한 및/또는 능력들의 제 2 세트를 갖는 디바이스들에게, 프리앰블의 다른 섹션이 그들 디바이스들에 송신될 수 있는 것을 경보하기에 충분한 정보를 포함할 수 있다. 몇몇 양상들에서, 제 1 섹션을 송신하기 위한 수단은 송신기를 포함할 수 있다.

[00173] In the block (3105), AP includes the first format the first section of the preamble postpones the transmission the first section of the preamble is transmitted according to the first format and the information which it is sufficient to notify to compatible devices. For example, it can be the existing format in which the first format is defined by at least one of existing IEEE 802.11 standards like the format. In some modes, the first format can be called as the legacy format. The first section of the preamble in some modes comprises the second format and the information which is sufficient to alarm to the compatible / or the devices having the second set of the capabilities that the dissimilar section of the preamble can be transmitted in it devices. In some modes, the means for transmitting first section may include the transmitter.

[00174] 블록(3110)에서, AP는 제 2 포맷에 따라 프리앰블의 제 2 섹션을 송신하고, 프리앰블의 제 2 섹션은 톤 할당 정보를 포함하고, 톤 할당 정보는 2개 이상의 무선 통신 디바이스들을 식별한다. 예컨대, 프리앰블의 제 2 섹션은 고효율 프리앰블을 포함할 수 있고, 제 2 포맷은 제 1 포맷보다 더 새로운 IEEE 802.11 포맷을 포함할 수 있다. 몇몇 양상들에서, AP의 제 2 섹션은 2개 이상의 무선 통신 디바이스들을 식별할 수 있고, 그들 디바이스들 각각에게, 송신의 대역폭의 하나 이상의 서브-대역들을 할당할 수 있다. 몇몇 양상들에서, 제 2 섹션을 송신하기 위한 수단은 송신기를 포함할 수 있다.

[00174] In the block (3110), AP transmits the second section of the preamble according to the second format and the second section of the preamble includes the tone assignment information and the tone assignment information distinguishes the wireless communication device more than 2. For example, the second section of the preamble may include the high efficiency preamble and the second format may include the IEEE 802.11 format which is more new than the first format. In some modes, the second section of AP can distinguish the wireless communication device more than 2 and at least one sub-bands of the bandwidth of the transmission can be assigned to it device. In some modes, the means for transmitting the second section may include the transmitter.

[00175] 블록(3115)에서, AP는 2개 이상의 무선 통신 디바이스들에 동시에 데이터를 송신하고, 데이터는 2개 이상의 서브-대역들 상에 포함된다. 몇몇 양상들에서, 서브-대역들 각각은, 송신의 대역폭의 개별적이고 별개인 중첩하지 않는 부분들

[00175] In the block (3115), the simultaneously AP transmits data to the wireless communication device more than 2 and data are included on the sub-band more than 2. In some modes, can be indivisual of the bandwi

상에서 송신될 수 있다. 예컨대, 각각의 서브-대역은 송신의 대역폭의 특정한 부분에 대응할 수 있고, 각각의 무선 통신 디바이스는, 서브-대역들 중 하나 이상 상에서 데이터를 수신하도록 할당될 수 있다. 따라서, AP는, 송신의 대역폭의 상이한 서브-대역들에서, 2개 이상의 상이한 무선 통신 디바이스들로 상이한 데이터를 동시에 송신할 수 있다. 몇몇 양상들에서, 데이터를 송신하기 위한 수단은 송신기를 포함할 수 있다.

dth of the transmission and it can be transmitted to th e sub-band on parts which are the discrete and does n ot overlap. For example, each sub-band can correspon d to the specific part of the bandwidth of the transmis sion and each wireless communication device can be all ocated among sub-bands in order to receive data by th e phase over one. Therefore, in the different sub-band s of the bandwidth of the transmission, AP simultaneou sly can transmit different data to the different wireless communication device more than 2. In some modes, th e means for transmitting data may include the transmit ter.

[00176] 도 32는, 능력들의 제 1 세트를 갖는 하나 이상의 제 1 디바이스들로 송신하고, 동시에, 능력들의 제 2 세트를 갖는 하나 이상의 제 2 디바이스들로 송신하는 예시적인 방법(3200)을 예시한다. 이러한 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[00176] Fig. 32 transmits a message to at least one first devices having the first set of the capabilities and it exemplifies the illustrative method (3200) transmitted a message to at least one second devices having the s econd set of the capabilities. Such method can be perf ormed with the wireless device like AP.

[00177] 블록(3205)에서, AP는 대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들로 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 갖는다. 몇몇 양상들에서, 이러한 송신은 1차 채널 상에서 발생할 수 있고, 또한, 주어진 대역폭의 하나 이상의 2차 채널들 상에서 발생할 수 있다. 몇몇 양상들에서, 능력들의 제 1 세트를 갖는 디바이스들은, 특정한 IEEE 802.11 표준들과 호환가능한 디바이스들을 포함할 수 있다.

[00177] In the block (3205), the first part of the bandwidth as to the AP, transmits to at least one first devices and at least one first devices have the first se t of the capabilities. In some modes, such transmission can be generated on the first channel and it can be ge nerated on at least one secondary channels of the mor eover given bandwidth. Devices having the first set of the capabilities at some modes comprises the specific I EEE 802.11 standards and compatible devices.

[00178] 블록(3210)에서, AP는 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들로 동시에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 여기에서, 송신은, 능력들의 제 2 세트를 갖는 디바이스들이, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들에 대한 대역폭에서의 주파수 대역을 로케이팅하기 위한 표시를 포함하는 프리앰블을 포함하고, 여기에서, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 실질적으로 영향을 미치지 않도록 전송된다. 예컨대, 표시는 프리앰블의 부분의 허수 축 상에 있는 1-비트 코드일 수 있다. 이러한 표시는 낮은 전력으로 전송될 수 있고, 그에 따라, 그러한 표시는, 능력들의 제 1 세트를 갖는 디바이스들에 의한 프리앰블의 수신과 간섭하지 않을 수 있다. 몇몇 양상들에서, 능력들의 제 2 세트는 능력들의 제 1 세트보다 더 새롭고 더 진보될 수 있다. 예컨대, 능력들의 제 1 세트는 #34#레거시#34# 포맷에 대응할 수 있는 한편, 능력들의 제 2 세트는 #34#고효율#34# 포맷에 대응할 수 있다. 몇몇 양상들에서, 능력들의 제 2 세트를 갖는 디바이스들은 송신에서 표시를 발견하도록 구성될 수 있고, 표시가 발견되는 경우에, 대역폭의 제 2 부분에 포함된 송신의 부분을 로케이팅 및 수신하도록 구성될 수 있다. 몇몇 양상들에서, 대역폭의 제 2 부분에서의 송신은 위에서 설명된 다양한 타입들의 고효율 패킷들에 대응할 수 있다.

[00178] In the block (3210), AP simultaneously transmits a message in the second part of the bandwid th to at least one second devices and at least one sec ond devices have the second set of the capabilities an d the here the transmission includes the preamble inclu ding the display for locating the frequency band at the bandwidth about the symbols in which devices having t he second set of the capabilities include the set of the transmission parameters about the devices having the second set of the capabilities and the preamble is trans mitted in order not to substantially affect the preamble decoding of the devices in which here the display has t he first set of the capabilities. For example, the display can be 1- bit code having on the imaginary number axis of the part of the preamble. It can be transmitted to t he electricity that such display is low and it does not in terfere with the reception of the preamble by the devic es in which that display thus has the first set of the ca pabilities. In some modes, it can be more new than the first set of the capabilities and the second set of the c apabilities can be progressed at more. For example, the first set of the capabilities can correspond to the " lega cy " format. The second set of the capabilities can corr espond to the " high efficiency " format. In some mode s, devices having the second set of the capabilities are configured to discover the display in the transmission a nd in case the display is discovered the part of the tra nsmission included in the second part of the bandwidth is configured to be located and it is configured to recei ve. In some modes, the transmission at the second par t of the bandwidth can correspond to the various type s of high efficiency packets explained in the upper par t.

[00179] 몇몇 양상들에서, 표시는 프리앰블에 1-비트 코드로

[00179] In some modes, the display can be included in

서 포함될 수 있다. 몇몇 양상들에서, 프리앰블은 송신의 대역폭에 걸쳐 이중으로 송신될 수 있다. 몇몇 양상들에서, 표시는 이러한 프리앰블의 특정한 부분들에 포함될 수 있다. 예컨대, 표시는, 능력들의 제 2 세트를 갖는 디바이스들로의 송신들을 포함할 대역폭의 부분들에서 송신되는 프리앰블의 카피들에 포함될 수 있다. 몇몇 양상들에서, 하나 이상의 제 1 디바이스들로 송신하기 위한 수단, 및 하나 이상의 제 2 디바이스들로 동시에 송신하기 위한 수단은 송신기를 포함할 수 있다.

the preamble as 1- bit code. In some modes, the prea mble can be transmitted to the dually through the band width of the transmission. In some modes, the display can be included in the specific parts of such preamble. For example, the display can be included in the copies of the preamble transmitted in the parts of the bandwi dth including the transmission to the device having the second set of the capabilities. In some modes, the mea ns for transmitting to at least one first devices and the means for simultaneously transmitting to at least one s econd devices may include the transmitter.

[00180] 도 33은 제 1 세트의 성능들을 가진 디바이스들 및 제 2 세트의 성능들을 가진 디바이스들 양쪽 모두와 호환가능한 송신을 수신하는 예시적인 방법(3300)을 예시한다. 이 방법은 제 2 세트의 성능들을 가진 STA와 같은 무선 디바이스에 의해 수행될 수 있다.

[00180] The illustrative method (3300) receiving the device both having the performances of the second set and the devices in which fig. 33 has the performances of the first set and the compatible transmission is exem plified. This method can be performed by the wireless d evice like STA having the performances of the second set.

[00181] 블록(3305)에서, STA는 대역폭의 제 1 부분에서 프리앰블을 수신하고, 프리앰블은 제 1 세트의 성능들을 가진 디바이스들과 호환가능한 포맷으로 송신된다. 일부 양상들에서, 대역폭의 제 1 부분은 1차 채널을 포함할 수 있고 선택적으로는 하나 또는 둘 이상의 2차 채널들을 포함할 수 있다. 일부 양상들에서, 제 1 세트의 성능들은 IEEE 802.11a 또는 802.11ac와 같은 IEEE 802.11 표준을 포함할 수 있다. 일부 양상들에서, 프리앰블을 수신하기 위한 수단은 수신기를 포함할 수 있다.

[00181] In the block (3305), STA receives the preamble by the first part of the bandwidth and the pre amble is transmitted to the devices having the perform ances of the first set and the compatible format. In so me modes, the first part of the bandwidth may include the first channel and one or two or more secondary ch annels is include might selectively. In some modes, the performances of the first set may include the IEEE 80 2.11 standard such as the IEEE 802.11a and 802.11ac. In some modes, the means for receiving the preamble may include the receiver.

[00182] 블록(3310)에서, STA는 신호 필드를 대역폭의 제 2 부분에 로케이팅하도록 제 2 세트의 성능들을 가진 디바이스들에 통지하기에 충분한 정보를 프리앰블이 포함하고 있는지를 결정하며, 대역폭의 제 2 부분은 대역폭의 제 1 부분과 중첩하지 않는다. 예를 들어, 앞서 나타낸 바와 같이, 프리앰블은 프리앰블의 적어도 일부분의 허수 축 상에 1-비트 코드와 같은 표시를 포함할 수 있다. 따라서, STA는 이러한 정보가 주어진 프리앰블에 존재하는지의 여부를 결정하도록 구성될 수 있다. 일부 양상들에서, 대역폭의 제 2 부분은 하나 또는 둘 이상의 2차 채널들을 포함할 수 있다. 일부 양상들에서, 프리앰블이 정보를 포함하는지를 결정하기 위한 수단은 프로세서 또는 수신기를 포함할 수 있다.

[00182] In the block (3310), it determines whether the preamble includes the information which it is sufficient to notify in devices which have the performances of th e second set so that STA locates the signal field in the second part of the bandwidth and the second part of t he bandwidth does not overlap with the first part of th e bandwidth. For example, the preamble before as sho wn in the figure may include the display like 1- bit code on the imaginary number axis of at least one part of th e preamble. Therefore, acceptance and rejection are c onfigured to be decided STA exists in the preamble in which such information is given. In some modes, the se cond part of the bandwidth may include one or two or more secondary channels. The preamble in some modes may include the means for determining whether it cont ains the information or not is the processor or the recei ver.

[00183] 블록(3315)에서, STA는 대역폭의 제 2 부분에서 신호 필드를 수신한다. 예를 들어, 표시는 대역폭의 제 2 부분에 로케이팅하기에 그리고 신호 필드가 대역폭의 제 2 부분에서 송신될 것임을 알게 하기에 충분한 정보를 STA에 제공할 수 있다. 따라서, STA는 대역폭의 이러한 부분에서 신호 필드를 수신하도록 구성될 수 있다. 일부 양상들에서, 신호 필드는, 대역폭의 제 2 부분에서 제 2 세트의 성능들을 가진 디바이스들에 송신되는 #34#고효율#34# 프리앰블과 같은 프리앰블의 전부 또는 일부일 수 있다. 일부 양상들에서, 이는, 제 2 세트의 성능들을 가진 디바이스들이, 대역폭의 제 1 부분 상에서 제 1 세트의 성능들을 가진 디바이스들의 수신을 방해함이 없이, 대역폭의 부분들 상에서 AP 또는 다른 디바이스로부터 정보를 수신하도록 허용할 수 있다. 따라서, 앞서 논의된 바와 같이, 이는 더 많은 시간에 대역폭을 더 최대한 사용하는 것을 허용할

[00183] In the block (3315), STA receives the signal field by the second part of the bandwidth. For exampl e, the information in which the display knows because of locating in the second part of the bandwidth being t he thing in which and, the signal field is transmitted in the second part of the bandwidth can be provided to S TA. Therefore, in STA is such part of the bandwidth, th e signal field is configured to be received. In some mod es, or it all can be the part of the preamble like the " hi gh efficiency " preamble in which the signal field is tran smitted to devices having the performances of the sec ond set in the second part of the bandwidth. In some modes, the reception of the devices in which devices i n which this has the performances of the second set h ave the performances of the first set on the first part

수 있기 때문에, 이는 AP 또는 다른 디바이스에 이용가능한 대역폭의 더 효율적인 사용을 허용할 수 있다. 일부 양상들에서, 신호 필드를 수신하기 위한 수단은 수신기를 포함할 수 있다.

of the bandwidth is obstructed. In order to receive the information from AP or the dissimilar device it can allow on the parts of the bandwidth. Therefore, as shown in i t is before discussed it can allow that this more more t o the utmost uses the bandwidth in many hours. There fore this can allow the efficient use of the bandwidth w hich is available in AP or the dissimilar device. In some modes, the means for receiving the signal field may incl ude the receiver.

[00184] 도 34는 송신을 수신하는 예시적인 방법(3300)을 예시하며, 여기서, 송신의 부분들은 상이한 무선 디바이스들에 의해 송신된다. 방법은 AP와 같은 무선 디바이스에 의해 수행될 수 있다.

[00184] Fig. 34 exemplifies the illustrative method (3300) receiving the transmission and it is transmitted with wireless devices in which here the part of the tran smissions are different. The method can be performed by the wireless device like AP.

[00185] 블록(3405)에서, AP는 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하고, 제 1 부분은 제 1 무선 디바이스에 의해 송신되고 제 1 프리앰블 및 제 1 데이터 섹션을 포함한다. 일부 양상들에서, AP는 사전에 메시지를 제 1 무선 디바이스에 전송하여, 제 1 무선 디바이스가 AP에 송신할 수 있는 시간 및 대역폭을 제 1 무선 디바이스에 통지할 수 있다.

[00185] In the block (3405), AP includes the first preamble the first part is transmitted with the first wire less device the first part of the transmission is received by the first section of the bandwidth and the first data section. In some modes, AP transmits the message in t he first wireless device in advance and time and the ba ndwidth which the first wireless device can transmit to AP can be notified of in the first wireless device.

[00186] 블록(3410)에서, AP는 동시에, 대역폭의 제 2 섹션에서 송신의 제 2 부분을 수신하며, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 프리앰블 및 제 2 데이터 섹션을 포함한다. 일부 양상들에서, 제 1 프리앰블 및 제 2 프리앰블은 트레이닝 필드들을 각각 포함할 수 있다. 일부 양상들에서, 각각의 프리앰블이 포함하는 트레이닝 필드들의 수는 특정 디바이스에 할당된 공간 스트림들의 수에 기초할 수 있다. 예를 들어, 3개의 공간 스트림들이 할당된 디바이스는 하나의 짧은 트레이닝 필드를 송신하고 3개의 긴 트레이닝 필드들을 송신할 수 있다. 유사하게, 하나의 공간 스트림이 할당된 디바이스는 하나의 짧은 트레이닝 필드 및 하나의 긴 트레이닝 필드를 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는, 얼마나 많은 공간 스트림들이 그 특정 디바이스에 할당되었는지에 기초하여 다수의 트레이닝 필드들을 송신할 수 있다. 일부 양상들에서, 각각의 디바이스가 동일한 수의 공간 스트림들을 송신하는 것이 유리할 수 있다. 예를 들어, 각각의 디바이스가 동일한 수의 공간 스트림들을 송신하는 경우, 이는 결합된 송신의 PAPR(peak-to-average power ratio)을 감소시킬 수 있으며, 이는 유리할 수 있다. 일부 양상들에서, 제 1 및 제 2 무선 디바이스들로부터의 송신들은 AP로부터의 메시지에 의해 트리거링될 수 있다. 이러한 메시지는 또한, 디바이스가 얼마나 많은 공간 스트림들을 송신할 수 있는지를 각각의 디바이스에 표시할 수 있고, 각각의 디바이스가 송신해야 하는 트레이닝 필드들의 수를 표시할 수 있다.

[00186] In the block (3410), AP includes the second section of the bandwidth is the first section of the ban dwidth the second part of the transmission is simultane ously received by the second section of the bandwidth and the second part is the second preamble and the se cond data section the second part is transmitted with the second radio device it does not overlap. In some m odes, the first preamble and the second preamble can i nclude training fields. The number of training fields whic h each preamble includes in some modes can be based on the number of space streams allocated in specific d evice. For example, device in which 3 space streams is allocated can transmit one short training field and long training fields of 3 can be transmitted. Similarly, device in which one space stream is allocated can transmit on e short training field and one long training field. In som e modes, it is based if space streams in which each de vice was many were allocated in the specific device an d multiple training fields can be transmitted. In some m odes, it can be advantageous to transmit the space str eams in which each device is identical of the number. F or example, the space streams in which each device is identical of the number the PAPR (peak-to-average po wer ratio) of the transmission in which this is combined can be reduced in case the transmission and this can b e advantageous. In some modes, the transmission from first and second wireless devices can be triggered with the message from AP. The number of training fields whi ch it can indicate in each device whether such messag e can transmit space streams in which moreover, the d evice is many and each device has to transmit a messa ge can be indicated.

[00187] 도 35는 무선 통신 시스템(100) 내에 채용될 수 있는 무선 디바이스(3502)에서 활용될 수 있는 다양한 컴포넌트들을 도시한다. 무선 디바이스(3502)는 본원에 설명된 다양한 방법들을 구현하도록 구성될 수 있는 디바이스의 일례이다. 예

[00187] Figure 35 shows various components which can be used in the wireless device (3502) which can b e employed within the radio communication system (10 0). It is an example of the device which is configured t

를 들어, 무선 디바이스(3502)는 도 10의 AP(104) 또는 STA들(106) 중 하나를 포함할 수 있다. 일부 양상들에서, 무선 디바이스(3502)는 앞서 설명된 패킷들을 수신하도록 구성된 무선 디바이스를 포함할 수 있다.

o take various methods in which the wireless device (3502) is explained in the present application. For example, the wireless device (3502) may include one among the AP (104) of fig. 10 or the STA (106). In some modes, the wireless device which is configured to receive packets in which the wireless device (3502) is before explained is include might.

[00188] 무선 디바이스(3502)는 무선 디바이스(3502)의 동작을 제어하는 프로세서(3504)를 포함할 수 있다. 프로세서(3504)는 또한 중앙 프로세싱 유닛(CPU)으로 지칭될 수 있다. ROM(read-only memory) 및 RAM(random access memory) 둘 모두를 포함하는 메모리(3506)는 프로세서(3504)에 명령들 및 데이터를 제공한다. 메모리(3506)의 일부는 또한, NVRAM(non-volatile random access memory)를 포함할 수 있다. 프로세서(3504)는 통상적으로, 메모리(3506) 내에 저장된 프로그램 명령들에 기초하여 논리 및 산술 연산들을 수행한다. 메모리(3506) 내의 명령들은 본원에 설명된 방법들을 구현하도록 실행가능할 수 있다. 예를 들어, 메모리(3506)는 고효율 디바이스로부터 무선 디바이스(3502)가 송신들을 수신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 메모리(3506)는, 제 1 세트의 성능들을 갖춘 디바이스에 대한 프리앰블 및 제 2 세트의 성능들을 갖춘 디바이스에 대한 제 2 프리앰블을 포함하는 패킷들을 무선 디바이스(3502)가 수신하게 하도록 허용하기에 충분한 명령들을 포함할 수 있다. 일부 양상들에서, 무선 디바이스(3502)는 방법(3300) 및/또는 방법(3400)에 설명되는 바와 같은 패킷들을 무선 디바이스(3502)로 하여금 수신하도록 허용하기에 충분한 명령들을 포함할 수 있는 프레임 수신 회로(3521)를 포함할 수 있다. 방법(3300)에 설명된 바와 같이, 프레임 수신 회로(3521)는, 디바이스로 하여금, 제 1 부분의 대역폭에 프리앰블을 수신하고, 표시가 존재하는지 결정하고, 그리고 제 2 부분의 대역폭에 신호 필드를 수신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 일부 양상들에서, 방법(3400)에 설명된 바와 같이, 프레임 수신 회로(3521)는, 디바이스로 하여금, 제 1 섹션의 대역폭에 제 1 부분의 송신을 수신하고, 그리고 동시에 제 2 섹션의 대역폭에 제 2 부분의 송신을 수신하도록 허용하기에 충분한 명령들을 포함할 수 있다.

[00188] The processor (3504) in which the wireless device (3502) controls the operation of the wireless device (3502) is include might. The processor (3504) can be called moreover, the central processing unit (CPU). The ROM (read-only memory) and the memory (3506) of including both the RAM (random access memory) two provide the commands and data to the processor (3504). The part of the memory (3506) may include moreover, the NVRAM (non-volatile random access memory). The processor (3504) performs logic and arithmetic operations based on program instructions which generally are stored within the memory (3506). In order to implement the methods in which the command within the memory (3506)s are explained in the present application it can be executable. For example, the memory (3506) is the wireless device (3502) from the high efficiency device may include commands which it is sufficient to allow in order to receive transmissions. For example, the memory (3506) comprises the preamble about the device having the performances of the first set and commands which it is sufficient to allow so that the wireless device (3502) receives packets including the second preamble about the device having the performances of the second set. In some modes, the frame receiving circuit (3521) maying include commands which are sufficient to allow so that the wireless device (3502) receives the method (3300) and/or the packets like being explained in the method (3400) to the wireless device (3502) is include might. As described in the method (3300), the display the frame receiving circuit (3521) receives the preamble to device in the bandwidth of the first part may include commands which whether it exists or not determine and it is sufficient to allow in order to receive the signal field in and, the bandwidth of the second part. As described in the method (3400) in some modes, the frame receiving circuit (3521) receives the transmission of the first part to device in the bandwidth of the first section and it may include commands which it is sufficient to allow in order to simultaneously receive the transmission of the second part in the bandwidth of the second section.

[00189] 프로세서(3504)는 하나 또는 그 초과의 프로세서들로 구현된 프로세싱 시스템의 컴포넌트를 포함할 수 있거나 또는 그 컴포넌트일 수 있다. 하나 또는 그 초과의 프로세서들은, 범용 마이크로프로세서들, 마이크로컨트롤러들, DSP(digital signal processor)들, FPGA(field programmable gate array)들, PLD(programmable logic device)들, 컨트롤러들, 상태 머신들, 게이티드 로직, 이산 하드웨어 컴포넌트들, 전용 하드웨어 유한 상태 머신들, 또는 계산들 또는 다른 정보 조작들을 수행할 수 있는 임의의 다른 적합한 엔티티들의 임의의 조합으로 구현될 수 있다.

[00189] The component of the processing system in which the processor (3504) is implemented as the processor greater than one or that is include might or it can be the component. The processor greater than one or that can be implemented as the arbitrary combination of dissimilar and suitable entities performing the universal microprocessors, microcontrollers, DSP (digital signal processor), FPGA (field programmable gate array), PLD (programmable logic device), controllers, state machines, gated logic, discrete hardware components, special-purpose hardware finite state machines, the calculations, or the dissimilar information constructions.

[00190] 프로세싱 시스템은 또한 소프트웨어를 저장하기 위한 머신-판독가능 매체를 포함할 수 있다. 소프트웨어는, 소프트

[00190] The machine - readable medium in which the processing system stores moreover, software is include

웨어, 펌웨어, 미들웨어, 마이크로코드, 하드웨어 디스크립션 언어 또는 다른 것들 중 어느 것으로 지칭되든, 임의의 타입의 명령들을 의미하는 것으로 광범위하게 해석될 것이다. 명령들은 (예를 들어, 소스 코드 포맷, 이진 코드 포맷, 실행가능 코드 포맷, 또는 임의의 다른 적합한 코드 포맷 형태의) 코드를 포함할 수 있다. 명령들은, 하나 또는 그 초과의 프로세서들에 의해 실행될 때, 프로세싱 시스템으로 하여금 본원에 설명된 다양한 기능들을 수행하게 한다.

might. Software is called anything among the software, firmware, middleware, micro code, hardware description language or the dissimilar things or with it means the commands of the arbitrary type it will be extensively interpreted. Commands may include (of for example, the source code format, the electronic magazine code format, and the executable code format or the dissimilar and suitable code format form) code. When commands are carried out by the processor greater than one or that it allows to perform various functions which are explained to the processing system in the present application.

[00191] 무선 디바이스(3502)는 또한, 무선 디바이스(3502)와 원격 위치 사이에서 데이터의 송신 및 수신을 허용하기 위해 송신기(3510) 및 수신기(3512)를 포함할 수 있는 하우징(3508)을 포함할 수 있다. 송신기(3510) 및 수신기(3512)는 트랜시버(3514)로 조합될 수 있다. 안테나(3516)는 하우징(3508)에 부착될 수 있고 그리고 트랜시버(3514)에 전기적으로 커플링될 수 있다. 무선 디바이스(3502)는 또한, 다수의 송신기들, 다수의 수신기들, 다수의 트랜시버들, 및/또는 다수의 안테나들을 포함할 수 있다(미도시).

[00191] The wireless device (3502) comprises moreover, the wireless device (3502) and the housing (3508) which may include the transmitter (3510) and receiver (3512) in order to allow *** of data between the remote position. The transmitter (3510) and receiver (3512) can be combined to the transceiver (3514). The antenna (3516) can be adhered to the housing (3508) and the electrically can be coupled in and, the transceiver (3514). The wireless device (3502) may include the multiple antennae (the not illustrated).

[00192] 무선 디바이스(3502)는 또한 트랜시버(3514)에 의해 수신된 신호들의 레벨을 검출하고 계량화하기 위한 노력으로 이용될 수 있는 신호 검출기(3518)를 포함할 수 있다. 신호 검출기(3518)는, 전체 에너지로서의 이러한 신호들, 심볼당 서브캐리어당 에너지, 전력 스펙트럼 밀도 및 다른 신호들을 검출할 수 있다. 무선 디바이스(3502)는 또한, 신호들을 프로세싱하는데 이용하기 위한 디지털 신호 프로세서(DSP)(3520)를 포함할 수 있다. DSP(3520)는 송신을 위한 데이터 유닛을 생성하도록 구성될 수 있다. 일부 양상들에서, 데이터 유닛은 PPDU(physical layer data unit)를 포함할 수 있다. 일부 양상들에서, PPDU는 패킷으로 지칭된다.

[00192] The signal detector (3518) which can be used as the effort of the wireless device (3502) detecting the level of the received signals with moreover, the transceiver (3514) and quantizing is include might. The signal detector (3518) can detect signals different from such signals as the total energy the Sim BolDang per sub carrier energy, and the power spectrum density. The digital signal processor (DSP) (3520) for using to the wireless device (3502) process moreover, signals is include might. The DSP (3520) is configured to produce the data unit for the transmission. In some modes, the data unit may include the PPDU (physical layer data unit). In some modes, PPDU is called the packet.

[00193] 무선 디바이스(3502)는 일부 양상들에서 사용자 인터페이스(3522)를 더 포함할 수 있다. 사용자 인터페이스(3522)는 키패드, 마이크로폰, 스피커, 및/또는 디스플레이를 포함할 수 있다. 사용자 인터페이스(3522)는, 무선 디바이스(3502)의 사용자에게 정보를 전달하고 그리고/또는 사용자로부터 입력을 수신하는 임의의 엘리먼트 또는 컴포넌트를 포함할 수 있다.

[00193] In the wireless device (3502) is part modes, the user interface (3522) is further include might. The user interface (3522) may include the display. The user interface (3522) may include the arbitrary element or the component instructing the user of the wireless device (3502) in the information and receives the input from the user.

[00194] 무선 디바이스(3502)의 다양한 컴포넌트들은 버스 시스템(3526)에 의해 함께 커플링될 수 있다. 버스 시스템(3526)은, 데이터 버스뿐만 아니라, 예를 들어, 전력 버스, 제어 신호 버스, 및 데이터 버스에 부가하여 상태 신호 버스를 포함할 수 있다. 당업자들은, 무선 디바이스(3502)의 컴포넌트들이 함께 커플링될 수 있거나 또는 몇몇 다른 메커니즘을 이용하여 서로에게 입력들을 수락하거나 또는 제공할 수 있다는 점을 인식할 것이다.

[00194] The various component of the wireless device (3502)s can be coupled in the together with the bus system (3526). The bus system (3526) comprises data bus, for example, the power bus, and the control signal bus and the status signal bus in addition to data bus. The components of the wireless device (3502) can be coupled in the together or it accepts inputs using the dissimilar mechanism or or it will recognize the point that person skilled in the arts can provide.

[00195] 다수의 별개의 컴포넌트들이 도 35에 예시되지만, 컴포넌트들 중 하나 이상은 결합되거나 공통 구현될 수 있다. 예를 들어, 프로세서(3504)는, 프로세서(3504)에 대해 앞서 설명된 기능을 구현할 뿐만 아니라, 신호 검출기(3518) 및/또는

[00195] Multiple separate components are exemplified in fig. 35. However one or greater is combined among components or it can be realized with common. For example, the processor (3504) realizes the function before

DSP(3520)에 대해 앞서 설명된 기능을 구현하기 위해 이용될 수 있다. 추가로, 도 35에 예시된 컴포넌트들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 게다가, 프로세서(3504)는, 아래에서 설명되는 임의의 컴포넌트들, 모듈들, 회로들 등을 구현하기 위해 이용될 수 있거나, 이들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 본 명세서에서 사용되는 바와 같이, 용어 #34#결정#34#은 광범위한 동작들을 포함한다. 예를 들어, #34#결정#34#은 계산, 컴퓨팅, 프로세싱, 유도, 검사, 검색(예를 들어, 표, 데이터베이스 또는 다른 데이터 구조에서의 검색), 확인 등을 포함할 수 있다. 또한, #34#결정#34#은 수신(예를 들어, 정보 수신), 액세스(예를 들어, 메모리 내의 데이터에 액세스) 등을 포함할 수 있다. 또한, #34#결정#34#은 해결, 선택, 선정, 설정 등을 포함할 수 있다. 추가로, 본 명세서에서 사용되는 바와 같이, #34#채널 폭#34#은 특정한 양상들에서 대역폭으로 또한 지칭될 수 있거나 이를 포함할 수 있다.

explained about the processor (3504). In addition in order to realize the function before explained about the signal detector (3518) and/or the DSP (3520) the function can be used. Additionally, the component exemplified in fig. 35 can be implemented using multiple separate elements. Moreover, the processor (3504) can be used it implements arbitrary components illustrated below the module the circuit etc. or each of them can be implemented using multiple separate elements. As shown in it is used in this specification operations in which the term " Decision " is of very wide range are included. For example, the " Decision " may include the calculation, the computing, the processing, the induction, the inspection, search (for example, table, and the search at the database or data construct of being different), the identifier light. Moreover, the " Decision " may include the reception, the access (for example, the access in data of in memory) etc. Moreover, the " Decision " may include the resolution, the selection, the selection, the establishment etc. Additionally, as shown in it is used in this specification the " channel width " can be moreover called the bandwidth in the specific modes or it can include the same.

[0196] 본 명세서에서 사용되는 바와 같이, 항목들의 리스트 #34#중 적어도 하나#34#로 지칭되는 구문은 단일 멤버들을 포함하여 그 항목들의 임의의 조합을 지칭한다. 예를 들어, #34#a, b 또는 c 중 적어도 하나#34#는 a, b, c, a-b, a-c, b-c, 및 a-b-c를 커버하는 것으로 의도된다.

[0196] As shown in it is used in this specification the syntax called at least one " in the list " of the items names the arbitrary combination of the items including singleness members. For example, at least one " covers the A, B, C, A-b, A-c, B-c and a-b-c and it is intended among the "a, and the b or the c.

[0197] 전술한 방법들의 다양한 동작들은, 다양한 하드웨어 및/또는 소프트웨어 컴포넌트(들), 회로들 및/또는 모듈(들)과 같은, 동작들을 수행할 수 있는 임의의 적절한 수단에 의해 수행될 수 있다. 일반적으로, 도면들에 도시된 임의의 동작들은 그 동작들을 수행할 수 있는 대응하는 기능 수단에 의해 수행될 수 있다.

[0197] The various operations of the above-described methods can be performed by the proper means of performing hardware and/or the various software component (***), and the operation like the circuits and/or the module (***). Generally, it can be performed by the means-plus-function of corresponding to which arbitrary operations shown in drawings can perform the operations.

[0198] 본 개시와 관련하여 설명되는 다양한 예시적인 논리 블록들, 모듈들, 및 회로들은 범용 프로세서, 디지털 신호 프로세서(DSP), 주문형 집적회로(ASIC), 필드 프로그래머블 게이트 어레이(FPGA) 또는 다른 프로그래머블 로직 디바이스(PLD), 이산 게이트 또는 트랜지스터 로직, 이산 하드웨어 컴포넌트들 또는 본 명세서에 설명된 기능들을 수행하도록 설계된 이들의 임의의 조합으로 구현 또는 수행될 수 있다. 범용 프로세서는 마이크로 프로세서일 수 있지만, 대안적으로, 프로세서는 상용 프로세서, 제어기, 마이크로제어기, 또는 상태 머신일 수 있다. 또한 프로세서는 컴퓨팅 디바이스들의 조합, 예를 들어 DSP 및 마이크로프로세서의 조합, 복수의 마이크로프로세서들, DSP 코어와 결합된 하나 이상의 마이크로프로세서들, 또는 임의의 다른 이러한 구성으로서 구현될 수 있다.

[0198] It can be performed to the various and illustrative logic block which is explained in connection with the disclosure the module and their arbitrary combination in which circuits are designed in order to perform functions explained in the universal processor, digital signal processor (DSP), application specific integrated circuit (ASIC), field programmable gate array (FPGA) or the dissimilar programmable logic device (PLD), the discrete gate or the transistor logic, and discrete hardware components or this specification, as the implementation. The universal processor can be the microprocessor. However the alternatively the processor can be the commercial processor, the controller, and the microcontroller or the state machine. Moreover, the processor can be implemented as at least one microprocessors combining with the combination of the computing devices for example the combination of the microprocessor and DSP, the multiple microprocessors, and the DSP core or the dissimilar such configuration.

[0199] 하나 이상의 양상들에서, 설명된 기능들은 하드웨어, 소프트웨어, 펌웨어 또는 이들의 임의의 조합으로 구현될 수 있다. 소프트웨어로 구현되는 경우, 상기 기능들은 컴퓨터 판독가능 매체 상에 하나 이상의 명령들 또는 코드로서 저장되거나 이를 통해 송신될 수 있다. 컴퓨터 판독가능 매체는, 일 장소로

[0199] In at least one modes, explained functions can be implemented as hardware, software, and firmware or their arbitrary combination. The case , and functions of being implemented as software are stored on the computer readable medium as at least one commands or the

부터 다른 장소로 컴퓨터 프로그램의 전송을 용이하게 하는 임의의 매체를 포함하는 통신 매체 및 컴퓨터 저장 매체 모두를 포함한다. 저장 매체는 컴퓨터에 의해 액세스될 수 있는 임의의 가용한 매체일 수 있다. 예를 들어, 이러한 컴퓨터 판독가능 매체는 RAM, ROM, EEPROM, CD-ROM 또는 다른 광학 디스크 저장소, 자기 디스크 저장 또는 다른 자기 저장 디바이스들, 또는 명령들 또는 데이터 구조들의 형태로 요구되는 프로그램 코드를 저장 또는 반송하는데 사용될 수 있고, 컴퓨터에 의해 액세스될 수 있는 임의의 다른 매체를 포함하지만, 이들로 제한되는 것은 아니다. 또한, 임의의 연결 수단(connection)이 컴퓨터 판독가능 매체로 적절히 지칭된다. 예를 들어, 소프트웨어가 웹사이트, 서버, 또는 다른 원격 소스로부터 동축 케이블, 광섬유 케이블, 연선(twisted pair), 디지털 가입자 라인(DSL), 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들을 이용하여 송신되는 경우, 동축 케이블, 광섬유 케이블, 연선, DSL, 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들이 이러한 매체의 정의에 포함된다. 여기서 사용되는 디스크(disk) 및 디스크(disc)는 컴팩트 디스크(disc(CD)), 레이저 디스크(disc), 광 디스크(disc), 디지털 다기능 디스크(disc)(DVD), 플로피 디스크(disk), 및 블루-레이 디스크(disc)를 포함하며, 여기서 디스크(disk)들은 데이터를 보통 자기적으로 재생하지만, 디스크(disc)들은 레이저들을 이용하여 광학적으로 데이터를 재생한다. 따라서, 몇몇 양상들에서, 컴퓨터 판독가능 매체는 비일시적(non-transitory) 컴퓨터 판독가능 매체(예를 들어, 유형의(tangible) 매체)를 포함할 수 있다. 또한, 다른 양상들에서, 컴퓨터 판독가능 매체는 일시적 컴퓨터 판독가능 매체(예를 들어, 신호)를 포함할 수 있다. 상기한 것들의 조합들 또한 컴퓨터 판독가능 매체의 범위 내에 포함되어야 한다.

code or the code can be transmitted. The computer readable medium includes both the communication medium and the computer storage medium including the arbitrary media facilitating the transmission of the computer program to the place different from the task place. It can be the media in which the storage medium can be accessed with the computer and which is available. For example, such computer readable medium comprises the dissimilar media which can be accessed with the computer it can be used it returns it stores the RAM, ROM, EEPROM, the CD-ROM or the dissimilar optical disk repository, and the magnetic disk storage or dissimilar magnetism storage devices or the commands or the program code required in the form of data constructs. And it is not limited within these. Moreover, the arbitrary connecting means (connection) is appropriately called the computer readable medium. For example, the case, the coaxial cable, the optical fiber cable, the twisted wire, DSL or the infrared ray in which software is transmitted from the website, and the server or the dissimilar remote source using the coaxial cable, the optical fiber cable, the twisted wire (twisted pair), the digital subscriber line (DSL) or the infrared ray, and the wireless technologies like radio and microwave, and the wireless technologies like radio and microwave are implied in the definition of such media. Here, the used disc (disk) and the disc include the compact disc (disc(CD)), the laser disc, the optical disc, the DVD (disc) (DVD), the floppy disk and blue-ray disk (disc) and here disc (disk) reproduce data as the ordinary china. However disc optically reproduce data using lasers. Therefore, in some modes, the computer readable medium may include the nontemporary (non-transitory) computer readable medium (for example, the media of the type (tangible)). Moreover, in dissimilar modes, the computer readable medium may include the temporary computer readable medium (for example, the signal). It has to be included within the combinations of the above-described things moreover the range of the computer readable medium.

[0200] 본 명세서에 개시된 방법들은 설명된 방법을 달성하기 위한 하나 이상의 단계들 또는 동작들을 포함한다. 방법 단계들 및/또는 동작들은 청구항들의 범위를 벗어나지 않고 서로 교환될 수 있다. 즉, 단계들 또는 동작들의 특정한 순서가 규정되지 않으면, 특정 단계들 및/또는 동작들의 순서 및/또는 이용은 청구항들의 범위를 벗어나지 않고 변형될 수 있다.

[0200] At least one steps or the operations for achieving the method in which the disclosed methods is explained in this specification are included. The method step and/or the operations can not deviate from the range of claims and it can be exchanged. That is, if the specific order of the steps or the operations is not prescribed , the order of the specific step and/or the operation and/or the usages can not deviate from the range of claims and it can be transformed into.

[0201] 설명된 기능들은 하드웨어, 소프트웨어, 펌웨어 또는 이들의 임의의 조합으로 구현될 수 있다. 소프트웨어로 구현되면, 기능들은 컴퓨터 판독가능 매체 상에 하나 이상의 명령들로서 저장될 수 있다. 저장 매체는 컴퓨터에 의해 액세스될 수 있는 임의의 가용한 매체일 수 있다. 예를 들어, 이러한 컴퓨터 판독가능 매체는 RAM, ROM, EEPROM, CD-ROM 또는 다른 광학 디스크 저장소, 자기 디스크 저장소 또는 다른 자기 저장 디바이스들, 또는 명령들 또는 데이터 구조들의 형태로 요구되는 프로그램 코드를 저장 또는 반송하는데 사용될 수 있고, 컴퓨터에 의해 액세스될 수 있는 임의의 다른 매체를 포함하지만, 이들로 제한되는 것은 아니다. 여기서 사용되는 디스크(disk) 및 디스크(disc)는 컴팩트 디스크(disc(CD)), 레이저 디스크(disc), 광 디스크(disc), 디지털 다기능 디스크(disc)(DVD), 플로피 디스크(disk), 및 블루-레이? 디스크(disc)를 포함하

[0201] Explained functions can be implemented as hardware, software, and firmware or their arbitrary combination. If it is implemented as software functions can be stored on the computer readable medium as at least one commands. It can be the media in which the storage medium can be accessed with the computer and which is available. For example, such computer readable medium comprises the dissimilar media which can be accessed with the computer it can be used it returns it stores the RAM, ROM, EEPROM, the CD-ROM or the dissimilar optical disk repository, and the magnetic disc reposistory or dissimilar magnetism storage devices or the commands or the program code required in the form of data constructs. And it is not limited within these. Here, the used disc (disk) and disc is the compact disc (disc(C

며, 여기서 디스크(disk)들은 데이터를 보통 자기적으로 재생하지만, 디스크(disc)들은 레이저를 이용하여 광학적으로 데이터를 재생한다.

D)), the laser disc, the optical disc, the DVD (disc) (DVD), the floppy disk and BLU-ray .

[0202] 따라서, 특정한 양상들은 본 명세서에 제시된 동작들을 수행하기 위한 컴퓨터 프로그램 물건을 포함할 수 있다. 예를 들어, 이러한 컴퓨터 프로그램 물건은 명령들이 저장(및/또는 인코딩)된 컴퓨터 판독가능 매체를 포함할 수 있고, 명령들은, 본 명세서에 설명된 동작들을 수행하도록 하나 이상의 프로세서들에 의해 실행될 수 있다. 특정한 양상들의 경우, 컴퓨터 프로그램 물건은 패키징 재료를 포함할 수 있다.

[0202] Therefore, the computer program object for performing operations in which the specific modes is presented in this specification is include might. For example, the computer readable medium in which in such computer program object, commands is the storage (encoding) is include might and it performs operations explained in this specification but commands can be performed with the processors described in the above. In case of the specific modes, the computer program object may include the packaging material.

[0203] 소프트웨어 또는 명령들이 또한 송신 매체를 통해 송신될 수 있다. 예를 들어, 소프트웨어가 웹사이트, 서버, 또는 다른 원격 소스로부터 동축 케이블, 광섬유 케이블, 연선, 디지털 가입자 라인(DSL), 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들을 이용하여 송신되는 경우, 동축 케이블, 광섬유 케이블, 연선, DSL, 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들이 송신 매체의 정의에 포함된다.

[0203] Software or the commands can be transmitted through moreover, the transmission media. For example, the case, coaxial cable, optical fiber cable, twisted wire, DSL or the infrared ray in which software is transmitted from the website, and the server or the dissimilar remote source using the coaxial cable, optical fiber cable, twisted wire, digital subscriber line (DSL) or the infrared ray, and the wireless technologies like radio and micro wave, and the wireless technologies like radio and microwave are implied in the definition of the transmission media.

[0204] 추가로, 본 명세서에 설명된 방법들 및 기술들을 수행하기 위한 모듈들 및/또는 다른 적절한 수단들은 적용가능한 경우 사용자 단말 및/또는 기지국에 의해 획득 및/또는 그렇지 않으면 다운로딩될 수 있음을 인식해야 한다. 예를 들어, 이러한 디바이스는 본 명세서에 설명된 방법들을 수행하기 위한 수단의 전송을 용이하게 하기 위해 서버에 커플링될 수 있다. 대안적으로, 본 명세서에 설명된 다양한 방법들은 저장 수단들(예를 들어, RAM, ROM, 컴팩트 디스크(CD) 또는 플로피 디스크와 같은 물리적 저장 매체 등)을 통해 제공될 수 있어서, 사용자 단말 및/또는 기지국은 저장 수단들을 디바이스에 커플링 또는 제공할 때 다양한 방법들을 획득할 수 있다. 또한, 본 명세서에 설명된 방법들 및 기술들을 디바이스에 제공하기 위한 임의의 다른 적절한 기술이 활용될 수 있다.

[0204] Additionally, in case the dissimilar proper methods and the module and/or the meanses are applicable for performing technologies explained in this specification it has to recognize by the user terminal and/or the base station if it is not so and/or the acquisition being downloaded. For example, such device can be coupled in the server to facilitate the transmission of the means for performing the methods explained in this specification. Alternatively, various methods explained in this specification can be provided through storage means (for example, RAM, ROM, the physical storage medium such as the compact disc (CD) and floppy disk etc) and when storage meanses being coupled on device or providing the user terminal and/or the base station can obtain various methods. Moreover, the methods explained in this specification and the dissimilar proper technology for providing technologies to device can be used.

[0205] 청구항들은 전술한 것과 정확히 같은 구성 및 컴포넌트들에 한정되지 않음을 이해해야 한다. 청구항들의 범위를 벗어나지 않으면서 전술한 방법들 및 장치의 배열, 동작 및 세부사항들에서 다양한 변형들, 변경들 및 변화들이 행해질 수 있다.

[0205] It has to understand with claims describe in the above nots being accurately restricted to the configuration and the same components. The various deformation the change and changes can be performed in the arrangement of the methods which is not out of the range of claims and describes in the above and apparatus thereof, and the operation and detail articles.

[0206] 상기 내용은 본 개시의 양상들에 관한 것이지만, 본 개시의 기본적 범위를 벗어나지 않으면서 본 개시의 다른 양상들 및 추가적 양상들이 고안될 수 있고, 이들의 범위는 후속하는 청구항들에 의해 결정된다.

[0206] The contents mentioned above relates to the modes of the disclosure, but the modes and the dissimilar additive phases of the initiation which is not out of the basic range of the disclosure can be originated and their range is determined with the subsequent claims.

## 도면에 대한 간단한 설명

## Brief explanation of the drawing

[0011] 도 1은 IEEE 802.11 시스템들에 대해 이용가능한 채널들의 채널 할당을 예시한다.

[0011] Fig. 1 exemplifies the channel allocation of the channels which are available about IEEE 802.11 systems.

[0012] 도 2는, IEEE 802.11a/b/g/j/p 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0012] Fig. 2 exemplifies the structure of the physical - layer packet (PPDU frame) which can be used of the IEEE 802.11a / b / g / j / p communication.

[0013] 도 3은, IEEE 802.11n 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0013] Fig. 3 exemplifies the structure of the physical - layer packet (the PPDU frame) which can be used of the IEEE 802.11n communication.

[0014] 도 4는, IEEE 802.11ac 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0014] Fig. 4 exemplifies the structure of the physical - layer packet (the PPDU frame) which can be used of the IEEE 802.11ac communication.

[0015] 도 5는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0015] Fig. 5 exemplifies the structure of being illustrative of the down-link physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0016] 도 6은, STA들을 식별하고, 이러한 STA들에 서브-대역들을 할당하기 위해 이용될 수 있는 신호의 예시적인 예를 예시한다.

[0016] Fig. 6 distinguishes STAs and it shows a sign of the illustrative example of the signal which can be used in order to assign sub-bands to such STAs.

[0017] 도 7은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 2 예시적인 구조를 예시한다.

[0017] Fig. 7 exemplifies the structure of being illustrative the second of the down-link physical - layer packet which can be used in order to make multiple-access wireless communications which are compatible low rank - possible.

[0018] 도 8은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 3 예시적인 구조를 예시한다.

[0018] Fig. 8 exemplifies the structure of being illustrative the third of the down-link physical - layer packet which can be used in order to make multiple-access wireless communications which are compatible low rank - possible.

[0019] 도 9는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 4 예시적인 구조를 예시한다.

[0020] 도 10은, 본 개시의 양상들이 이용될 수 있는 무선 통신 시스템의 예를 예시한다.

[0021] 도 11은, 도 1의 무선 통신 시스템 내에서 이용될 수 있는 예시적인 무선

디바이스의 기능 블록도를 도시한다.

[0022] 도 12는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0023] 도 13은, 둘 이상의 무선 통신 디바이스들에 고효율 패킷을 송신하는 예시적인 방법에 대한 프로세스 흐름도를 예시한다.

[0024] 도 14는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 하이브리드 다운링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0025] 도 15는, 하이브리드 패킷을 송신하는 예시적인 방법을 예시한다.

[0026] 도 16은, 하이브리드 패킷을 수신하는 예시적인 방법을 예시한다.

[0027] 도 17은 하나의 예시적인 HE 프리엠블 포맷을 갖는 패킷을 예시한다.

[0028] 도 18은 다른 예시적인 HE 프리엠블 포맷을 갖는 패킷을 예시한다.

[0029] 도 19는 다른 예시적인 HE 프리엠블 포맷을 갖는 패킷을 예시한다.

[0030] 도 20은 HE-SIG 1 필드에 대한 예시적인 비트 할당을 예시한다.

[0031] 도 21은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0032] 도 22는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 다른 예시적인 구조를 예시한다.

[0033] 도 23은 패킷을 수신하는 예시적인 방법을 예시한다.

[0034] 도 24는 업링크 HE 패킷에 대한 예시적인 업링크 패킷 구조이다.

[0035] 도 25는 업링크 HE 패킷에 대한 예시적인 업링크 패킷 구조이다.

[0036] 도 26은, 각각의 송신 디바이스가 얼마나 많은 공간적 스트림들을 이용할 수 있는지에 대한 정보를 포함하는, AP로부터의 예시적인 다운링크 메시지이다.

[0037] 도 27은, UL OFDMA 패킷에서 이용될 수 있는 톤-인터리빙된 LTF의 예시이다.

[0038] 도 28은, UL OFDMA 패킷에서 이용될 수 있는 서브-대역 인터리빙된 LTF의 예시이다.

[0039] 도 29는, UL OFDMA 패킷에서 송신될 수 있는 패킷의 예시적인 LTF 부분이다.

[0040] 도 30은, HE-STF 이전의 공통 SIG 필드 및 모든 HE-LTF들 이후의 사용자당 SIG 필드를 갖는 패킷의 예시이다.

[0041] 도 31은, 단일 송신에서 하나 이상의 디바이스에 송신하는 예시적인 방법을 예시한다.

[0042] 도 32는, 동시에, 제 1 세트의 능력들을 갖는 하나 이상의 제 1 디바이스들에 송신하고, 제 2 세트의 능력들을 갖는 하나 이상의 제 2 디바이스들에 송신하는 예시적인 방법을 예시한다.

[0043] 도 33은, 제 1 세트의 능력들을 갖는 디바이스들 및 제 2 세트의 능력들을 갖는 디바이스들 둘 모두와 호환가능한 송신을 수신하는 예시적인 방법을 예시한다.

[0044] 도 34는, 송신을 수신하는 예시적인 방법을 예시하고, 여기서 송신의 부분들은 상이한 무선 디바이스들에 의해 송신된다.

[0045] 도 35는, 무선 통신 시스템 내에서 이용될 수 있는 무선 디바이스에서 활용될 수 있는 다양한 컴포넌트들을 예시한다.

[0019] Fig. 9 exemplifies the structure of being illustrative the fourth of the down-link physical - layer packet which can be used in order to make multiple-access wireless communications which are compatible low rank - possible.

[0020] Fig. 10 shows a sign of the example of the radio communication system in which it is able to make use of the modes of the disclosure.

[0021] Figure 11 shows the functional block diagram of the illustrative wireless device which can be used in the radio communication system of fig. 1.

[0022] Fig. 12 exemplifies the structure of being illustrative of the up-link physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0023] Fig. 13 exemplifies the process flow diagram about the illustrative method for transmitting the high efficiency packet to two or more wireless communication devices.

[0024] Fig. 14 exemplifies the structure of being illustrative of the hybrid down-link physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0025] Fig. 15 exemplifies the illustrative method for transmitting the hybrid packet.

[0026] Fig. 16 exemplifies the illustrative method for receiving the hybrid packet.

[0027] Fig. 17 exemplifies the packet having one illustrative HE preamble format.

[0028] Fig. 18 exemplifies the packet having the dissimilar and illustrative HE preamble format.

[0029] Fig. 19 exemplifies the packet having the dissimilar and illustrative HE preamble format.

[0030] Fig. 20 exemplifies the illustrative bit allocation about the HE-SIG 1 field.

[0031] Fig. 21 exemplifies the structure of being illustrative of the up-link physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0032] Fig. 22 exemplifies the structure of being illustrative of being different of the up-link physical - layer packet which can be used it makes multiple-access wireless communications which are compatible low rank - possible.

[0033] Fig. 23 exemplifies the illustrative method for receiving the packet.

[0034] Fig. 24 is the illustrative uplink packet structure about the up-link HE packet.

[0035] Fig. 25 is the illustrative uplink packet structure about the up-link HE packet.

[0036] Figure 26 is an illustrative downlink message including the information to use spatial streams from AP each sending device being many.

[0037] Figure 27 is an example of LTF which tone - is interleaved being used of the UL OFDMA packet.

[0038] Figure 28 is an example of LTF which the sub-band is interleaved being used of the UL OFDMA packet.

[0039] Figure 29 is an illustrative LTF part of the packet being transmitted in the UL OFDMA packet.

[0040] Figure 30 is an example of the packet having the SIG field per the user of the common SIG field of the HE-STF previous and all HE-LTF afters.

[0041] In the single transmission, fig. 31 exemplifies the illustrative method for transmitting to at least one device.

[0042] Fig. 32 transmits to at least one first devices having the capabilities of the first set and it exemplifies the illustrative method for transmitting to at least one second devices having the capabilities of the second set.

[0043] Fig. 33 exemplifies the illustrative method for receiving the device both having the capabilities of the second set and the devices having the capabilities of the first set and the compatible transmission.

[0044] Fig. 34 exemplifies the illustrative method for receiving the trans mission and it is transmitted with wireless devices in which here the part of the transmissions are different.

[0045] Fig. 35 exemplifies various components which can be used in the wireless device which can be used in the radio communication system.

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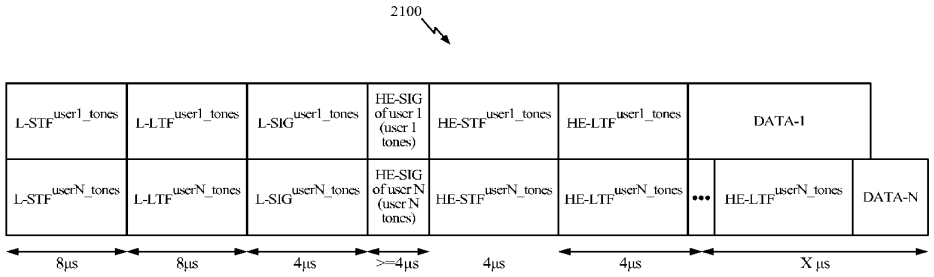
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(54) 발명의 명칭 **다중 액세스 무선 통신에 대한 하위-호환가능한 프리앰블 포맷들을 위한 시스템들 및 방법들**

(57) 요 약

무선 통신을 위한 시스템들, 방법들 및 디바이스들이 본 명세서에 개시된다. 본 개시의 일 양상은 무선 통신 네트워크 상에서 통신하는 방법을 제공한다. 방법은, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법을 제공한다. 방법은, 제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 단계; 제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 단계; 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하는 단계 -제 1 부분은 제 1 데이터 섹션을 포함하여 제 1 무선 디바이스에 의해 송신됨-; 및 대역폭의 제 2 섹션에서 송신의 제 2 부분을 동시에 수신하는 단계를 포함하고, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 데이터 섹션을 포함한다.

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명 세 서

청구범위

**청구항 1**

둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법으로서,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 단계;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 단계;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하는 단계 -상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨-; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하는 단계를 포함하고,

상기 대역폭의 제 2 섹션은 상기 대역폭의 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 2**

제 1 항에 있어서,

상기 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함하고, 상기 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 3**

제 2 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션 및 상기 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 4**

제 2 항에 있어서,

상기 제 1 프리앰블의 제 2 섹션 및 상기 제 2 프리앰블의 제 4 섹션 각각은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 5**

제 4 항에 있어서,

특정 디바이스로부터의 상기 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 상기 특정 무선 디바이스에 할당된 공간적 스트림들의 양에 기초하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 6**

제 4 항에 있어서,

상기 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 가장 많은 공간적 스트림들을 할당받은 무선 디바이스에 할당된 공간적 스트림들의 양에 기초하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 7**

제 1 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션은 상기 제 1 타입의 제 1 트레이닝 필드를 포함하고, 상기 제 1 프리앰블의 제 2 섹션은, 상기 제 1 타입의 제 1 트레이닝 필드보다 큰 사이클릭 시프트들을 포함하는 제 1 타입의 제 2 트레이닝 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 8**

제 1 항에 있어서,

상기 제 1 프리앰블은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드를 포함하고, 상기 제 2 프리앰블은, 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함하고, 상기 제 2 프리앰블의 제 2 타입의 상기 트레이닝 필드들의 수는 상기 제 1 프리앰블의 제 2 타입의 상기 트레이닝 필드들의 수와 동일한, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 9**

제 1 항에 있어서,

상기 제 1 프리앰블은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 10**

제 1 항에 있어서,

상기 제 1 프리앰블은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 제 2 프리앰블은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 제 1 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들은, 상기 제 2 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들에 대해 시간, 주파수에서 또는 코드를 통해 직교하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 11**

제 1 항에 있어서,

상기 제 1 프리앰블은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하고, 상기 송신은, 다수의 톤들 및 다수의 공간적 스트림들 상에서 전송되는 데이터 섹션을 포함하고, 상기 제 2 타입의 하나 이상의 트레이닝 필드들은, 상기 공간적 스트림들 각각이 상기 제 1 섹션 및 상기 대역폭의 제 2 섹션 둘 모두에 걸쳐 있는 주파수 톤들을 통해 공지된 심볼을 송신하도록 전송되는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 12**

제 1 항에 있어서,

상기 제 1 프리앰블 및 상기 제 2 프리앰블 각각은 신호 필드, 그에 후속하는 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 다른 신호 필드를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 13**

제 1 항에 있어서,

상기 제 1 프리앰블 및 상기 제 2 프리앰블 각각은, 상기 제 1 타입의 트레이닝 필드, 그에 후속하는 상기 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 상기 송신의 제 1 부분 및 제 2 부분을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 14**

제 1 항에 있어서,

상기 제 1 프리앰블은 상기 대역폭의 제 1 섹션에서만 전송되는 심볼들을 포함하고, 상기 제 2 프리앰블은 상기 대역폭의 제 2 섹션에서만 전송되는 심볼들을 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 15**

제 14 항에 있어서,

상기 대역폭의 제 1 섹션 및 상기 대역폭의 제 2 섹션 각각은 톤들의 중첩하지 않는 세트를 포함하는, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법.

**청구항 16**

무선 통신을 위한 장치로서,

대역폭을 결친 송신을 수신하도록 구성되는 수신기를 포함하고,

상기 송신을 수신하는 것은,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 것;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 것;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하는 것 －상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨－; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하는 것을 포함하고,

상기 대역폭의 제 2 섹션은 상기 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 무선 통신을 위한 장치.

**청구항 17**

제 16 항에 있어서,

상기 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함하고, 상기 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함하고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함하는, 무선 통신을 위한 장치.

**청구항 18**

제 17 항에 있어서,

상기 제 1 프리앰블의 제 1 섹션 및 상기 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함하는, 무선 통신을 위한 장치.

**청구항 19**

제 16 항에 있어서,

상기 제 1 프리앰블의 제 2 섹션 및 상기 제 2 프리앰블의 제 4 섹션 각각은 상기 제 2 타입의 하나 이상의 트레이닝 필드들을 포함하는, 무선 통신을 위한 장치.

**청구항 20**

무선 통신을 위한 장치로서,

제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하기 위한 수단;

제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하기 위한 수단;

대역폭의 제 1 섹션에서 상기 송신의 제 1 부분을 수신하기 위한 수단 －상기 제 1 부분은 상기 제 1 데이터 섹션을 포함하여 상기 제 1 무선 디바이스에 의해 송신됨－; 및

상기 대역폭의 제 2 섹션에서 상기 송신의 제 2 부분을 동시에 수신하기 위한 수단을 포함하고,

상기 대역폭의 제 2 섹션은 상기 대역폭의 제 1 섹션과 중첩하지 않고, 상기 제 2 부분은 상기 제 2 무선 디바이스에 의해 송신되고, 상기 제 2 부분은 제 2 데이터 섹션을 포함하는, 무선 통신을 위한 장치.

## 발명의 설명

### 기 술 분 야

[0001] [0001] 본 출원은 일반적으로 무선 통신들에 관한 것이고, 더 구체적으로는, 하위-호환가능한 다중 액세스 무선 통신을 가능하게 하는 시스템들, 방법들 및 디바이스들에 관한 것이다. 본 명세서의 특정 양상들은, 특히 IEEE 802.11 무선 통신 표준군의 직교 주파수-분할 다중 액세스(OFDMA) 통신들에 관한 것이다.

### 배 경 기 술

[0002] [0002] 많은 전기통신 시스템들에서, 통신 네트워크들은, 몇몇 상호작용하는 공간적으로 분리된 디바이스들 사이에서 메시지들을 교환하는데 이용된다. 네트워크들은 지리적 범위에 따라 분류될 수 있고, 지리적 범위는, 예를 들어, 대도시 영역, 로컬 영역 또는 개인 영역일 수 있다. 이러한 네트워크들은, 광역 네트워크(WAN), 대도시 영역 네트워크(MAN), 로컬 영역 네트워크(LAN) 또는 개인 영역 네트워크(PAN)로서 각각 지정될 수 있다. 네트워크들은 또한, 다양한 네트워크 노드들 및 디바이스들을 상호접속하는데 이용되는 교환/라우팅 기술(예를 들어, 회선 교환 대 패킷 교환), 송신을 위해 이용되는 물리적 매체의 타입(예를 들어, 유선 대 무선), 및 이용되는 통신 프로토콜들의 세트(예를 들어, 인터넷 프로토콜 세트(suite), SONET(Synchronous Optical Networking), 이더넷 등)에 따라 상이하다.

[0003] [0003] 무선 네트워크들은, 네트워크 엘리먼트들이 이동식이어서 동적 접속 필요성들을 갖는 경우, 또는 네트워크 아키텍처가 고정식보다는 애드혹(ad hoc) 토폴로지로 형성되는 경우 종종 선호된다. 무선 네트워크들은, 라디오, 마이크로파, 적외선, 광학 등의 주파수 대역들에서 전자기파들을 이용하여, 가이드되지 않은 전파 모드로 무형의(intangible) 물리적 매체를 이용한다. 무선 네트워크들은 유리하게는, 고정식 유선 네트워크들에 비해 빠른 필드 전개 및 사용자 이동성을 용이하게 한다.

### 발명의 내용

[0004] [0004] 본 발명의 시스템들, 방법들 및 디바이스들 각각은 몇몇 양상들을 갖고, 이 양상들 중 어떠한 단일 양상도 본 발명의 바람직한 속성들을 단독으로 담당하지 않는다. 후속하는 청구항들에 의해 표현되는 바와 같은 본 발명의 범위를 제한하지 않고, 이제 몇몇 특징들이 간략하게 논의될 것이다. 이 논의를 고려한 후, 그리고 특히, "상세한 설명"으로 명명된 섹션을 읽은 후, 본 발명의 특징들이, 무선 매체의 효율적 이용을 포함하는 이점들을 어떻게 제공하는지를 이해할 것이다.

[0005] [0005] 본 개시의 일 양상은 무선 통신 네트워크 상에서 통신하는 방법을 제공한다. 방법은, 둘 이상의 무선 통신 디바이스들로부터의 송신을 수신하는 방법을 제공한다. 방법은, 제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 단계; 제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 단계; 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하는 단계 －제 1 부분은 제 1 데이터 섹션을 포함하여 제 1 무선 디바이스에 의해 송신됨－; 및 대역폭의 제 2 섹션에서 송신의 제 2 부분을 동시에 수신하는 단계를 포함하고, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 데이터 섹션을 포함한다.

[0006] [0006] 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함할 수 있고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함할 수 있고, 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디

바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함할 수 있고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함할 수 있다. 제 1 프리앰블의 제 1 섹션 및 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함할 수 있다. 제 1 프리앰블의 제 2 섹션 및 제 2 프리앰블의 제 4 섹션 각각은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함할 수 있다. 특정 디바이스로부터의 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 특정 무선 디바이스에 할당된 공간적 스트림들의 양에 기초할 수 있다. 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 가장 많은 공간적 스트림들을 할당받은 무선 디바이스에 할당된 공간적 스트림들의 양에 기초할 수 있다. 제 1 프리앰블의 제 1 섹션은 제 1 타입의 제 1 트레이닝 필드를 포함할 수 있고, 제 1 프리앰블의 제 2 섹션은, 제 1 타입의 제 1 트레이닝 필드보다 큰 사이클릭 시프트들을 포함하는 제 1 타입의 제 2 트레이닝 필드를 포함할 수 있다. 제 1 프리앰블은, 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드를 포함할 수 있고, 제 2 프리앰블은, 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함할 수 있고, 제 2 프리앰블의 제 2 타입의 트레이닝 필드들의 수는 제 1 프리앰블의 제 2 타입의 트레이닝 필드들의 수와 동일할 수 있다. 제 1 프리앰블은, 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 데이터를 포함할 수 있다. 제 1 프리앰블은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함할 수 있고, 제 2 프리앰블은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함할 수 있고, 제 1 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들은, 제 2 프리앰블의 제 2 타입의 하나 이상의 트레이닝 필드들에 대해 시간, 주파수에서 또는 코드를 통해 직교할 수 있다. 제 1 프리앰블은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함할 수 있고, 송신은, 다수의 톤들 및 다수의 공간적 스트림들 상에서 전송되는 데이터 섹션을 포함할 수 있고, 제 2 타입의 하나 이상의 트레이닝 필드들은, 공간적 스트림들 각각이 제 1 섹션 및 대역폭의 제 2 섹션 둘 모두에 걸쳐 있는 주파수 톤들을 통해 공지된 심볼을 송신하도록 전송된다. 제 1 프리앰블 및 제 2 프리앰블 각각은 신호 필드, 그에 후속하는 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 제 2 신호 필드를 포함할 수 있다. 제 1 프리앰블 및 제 2 프리앰블 각각은, 제 1 타입의 트레이닝 필드, 그에 후속하는 제 2 타입의 하나 이상의 트레이닝 필드들, 그에 후속하는 신호 필드, 그에 바로 후속하는 송신의 제 1 부분 및 제 2 부분을 포함할 수 있다. 제 1 프리앰블은 대역폭의 제 1 섹션에서만 전송되는 심볼들을 포함할 수 있고, 제 2 프리앰블은 대역폭의 제 2 섹션에서만 전송되는 심볼들을 포함할 수 있다. 대역폭의 제 1 섹션 및 대역폭의 제 2 섹션 각각은 톤들의 중첩하지 않는 세트를 포함할 수 있다.

[0007] [0007] 본 개시의 일 양상은 무선 통신을 위한 장치를 제공한다. 장치는, 대역폭을 걸친 송신을 수신하도록 구성되는 수신기를 포함한다. 송신을 수신하는 것은, 제 1 무선 디바이스에 의해 송신되는 제 1 프리앰블을 수신하는 것; 제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하는 것; 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하는 것 －제 1 부분은 제 1 데이터 섹션을 포함하여 제 1 무선 디바이스에 의해 송신됨－; 및 대역폭의 제 2 섹션에서 송신의 제 2 부분을 동시에 수신하는 것을 포함하고, 대역폭의 제 2 섹션은 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 데이터 섹션을 포함한다.

[0008] [0008] 제 1 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 1 섹션을 포함할 수 있고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 2 섹션을 더 포함할 수 있고, 제 2 프리앰블은, 능력들의 제 1 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 1 포맷을 이용하여 송신되는 제 3 섹션을 포함할 수 있고, 능력들의 제 2 세트를 갖는 무선 디바이스들에 의해 해석가능한 제 2 포맷을 이용하여 송신되는 제 4 섹션을 더 포함할 수 있다.

[0009] [0009] 제 1 프리앰블의 제 1 섹션 및 제 2 프리앰블의 제 3 섹션 각각은, 자동 이득 제어에 이용되는 제 1 타입의 트레이닝 필드, 정확한 주파수 오프셋 추정, 시간 동기화 및 채널 추정에 이용되는 제 2 타입의 트레이닝 필드, 및 신호 필드를 포함할 수 있다. 제 1 프리앰블의 제 2 섹션 및 제 2 프리앰블의 제 4 섹션 각각은 제 2 타입의 하나 이상의 트레이닝 필드들을 포함할 수 있다. 특정 디바이스로부터의 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 그 특정 무선 디바이스에 할당되는 공간적 스트림들의 양에 기초할 수 있다. 제 2 타입의 하나 이상의 트레이닝 필드들의 양은, 가장 많은 공간적 스트림들을 할당받은 무선 디바이스에 할당된 공간적 스트림들의 양에 기초할 수 있다.

[0010] [0010] 본 개시의 일 양상은 무선 통신을 위한 장치를 제공한다. 장치는, 제 1 무선 디바이스에 의해 송신되는

제 1 프리앰블을 수신하기 위한 수단; 제 2 무선 디바이스에 의해 송신되는 제 2 프리앰블을 수신하기 위한 수단; 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하기 위한 수단 -제 1 부분은 제 1 데이터 섹션을 포함하여 제 1 무선 디바이스에 의해 송신됨-; 및 대역폭의 제 2 섹션에서 송신의 제 2 부분을 동시에 수신하기 위한 수단을 포함하고, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 데이터 섹션을 포함한다.

## 도면의 간단한 설명

[0011] [0011] 도 1은 IEEE 802.11 시스템들에 대해 이용가능한 채널들의 채널 할당을 예시한다.

[0012] 도 2는, IEEE 802.11a/b/g/j/p 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0013] 도 3은, IEEE 802.11n 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0014] 도 4는, IEEE 802.11ac 통신에서 이용될 수 있는 물리-계층 패킷(PPDU 프레임)의 구조를 예시한다.

[0015] 도 5는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0016] 도 6은, STA들을 식별하고, 이러한 STA들에 서브-대역들을 할당하기 위해 이용될 수 있는 신호의 예시적인 예를 예시한다.

[0017] 도 7은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 2 예시적인 구조를 예시한다.

[0018] 도 8은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 3 예시적인 구조를 예시한다.

[0019] 도 9는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 다운링크 물리-계층 패킷의 제 4 예시적인 구조를 예시한다.

[0020] 도 10은, 본 개시의 양상들이 이용될 수 있는 무선 통신 시스템의 예를 예시한다.

[0021] 도 11은, 도 1의 무선 통신 시스템 내에서 이용될 수 있는 예시적인 무선 디바이스의 기능 블록도를 도시한다.

[0022] 도 12는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0023] 도 13은, 둘 이상의 무선 통신 디바이스들에 고효율 패킷을 송신하는 예시적인 방법에 대한 프로세스 흐름도를 예시한다.

[0024] 도 14는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 하이브리드 다운링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0025] 도 15는, 하이브리드 패킷을 송신하는 예시적인 방법을 예시한다.

[0026] 도 16은, 하이브리드 패킷을 수신하는 예시적인 방법을 예시한다.

[0027] 도 17은 하나의 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다.

[0028] 도 18은 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다.

[0029] 도 19는 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다.

[0030] 도 20은 HE-SIG 1 필드에 대한 예시적인 비트 할당을 예시한다.

[0031] 도 21은, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 예시적인 구조를 예시한다.

[0032] 도 22는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷의 다른 예시적인 구조를 예시한다.

[0033] 도 23은 패킷을 수신하는 예시적인 방법을 예시한다.

[0034] 도 24는 업링크 HE 패킷에 대한 예시적인 업링크 패킷 구조이다.

[0035] 도 25는 업링크 HE 패킷에 대한 예시적인 업링크 패킷 구조이다.

[0036] 도 26은, 각각의 송신 디바이스가 얼마나 많은 공간적 스트림들을 이용할 수 있는지에 대한 정보를 포함하는, AP로부터의 예시적인 다운링크 메시지이다.

[0037] 도 27은, UL OFDMA 패킷에서 이용될 수 있는 톤-인터리빙된 LTF의 예시이다.

[0038] 도 28은, UL OFDMA 패킷에서 이용될 수 있는 서브-대역 인터리빙된 LTF의 예시이다.

[0039] 도 29는, UL OFDMA 패킷에서 송신될 수 있는 패킷의 예시적인 LTF 부분이다.

[0040] 도 30은, HE-STF 이전의 공통 SIG 필드 및 모든 HE-LTF들 이후의 사용자당 SIG 필드를 갖는 패킷의 예시이다.

[0041] 도 31은, 단일 송신에서 하나 이상의 디바이스에 송신하는 예시적인 방법을 예시한다.

[0042] 도 32는, 동시에, 제 1 세트의 능력들을 갖는 하나 이상의 제 1 디바이스들에 송신하고, 제 2 세트의 능력들을 갖는 하나 이상의 제 2 디바이스들에 송신하는 예시적인 방법을 예시한다.

[0043] 도 33은, 제 1 세트의 능력들을 갖는 디바이스들 및 제 2 세트의 능력들을 갖는 디바이스들 둘 모두와 호환가능한 송신을 수신하는 예시적인 방법을 예시한다.

[0044] 도 34는, 송신을 수신하는 예시적인 방법을 예시하고, 여기서 송신의 부분들은 상이한 무선 디바이스들에 의해 송신된다.

[0045] 도 35는, 무선 통신 시스템 내에서 이용될 수 있는 무선 디바이스에서 활용될 수 있는 다양한 컴포넌트들을 예시한다.

## 발명을 실시하기 위한 구체적인 내용

[0012] [0046] 이하, 신규한 시스템들, 장치들 및 방법들의 다양한 양상들을 첨부한 도면들을 참조하여 더 상세히 설명한다. 그러나, 본 교시들의 개시는 다수의 다른 형태들로 구현될 수 있고, 본 개시 전체에 제시되는 임의의 특정한 구조 또는 기능에 제한되는 것으로 해석되어서는 안된다. 오히려, 이 양상들은, 본 개시가 철저하고 완전해지도록 제공되고, 본 개시의 범위를 당업자들에게 완전하게 전달할 것이다. 본 명세서의 교시들에 기초하여, 당업자는, 본 개시의 범위가 본 발명의 임의의 다른 양상과 결합되어 구현되든 독립적으로 구현되든, 본 명세서에 개시된 신규한 시스템들, 장치들 및 방법들의 임의의 양상을 커버하도록 의도됨을 인식해야 한다. 예를 들어, 본 명세서에 기술된 양상들 중 임의의 수의 양상들을 이용하여 장치가 구현될 수 있고, 또는 방법이 실시될 수 있다. 또한, 본 발명의 범위는, 본 명세서에 기술된 본 발명의 다양한 양상들에 부가하여 또는 그 이외의 다른 구조, 기능, 또는 구조 및 기능을 이용하여 실시되는 이러한 장치 또는 방법을 커버하도록 의도된다. 본 명세서에 개시된 임의의 양상은 청구항의 하나 이상의 엘리먼트들에 의해 구현될 수 있음을 이해해야 한다.

[0013] [0047] 특정한 양상들이 본 명세서에서 설명되지만, 이 양상들의 많은 변화들 및 치환들은 본 개시의 범위 내에 속한다. 선호되는 양상들의 몇몇 이익들 및 이점들이 언급되지만, 본 개시의 범위는 특정한 이점들, 이용들 또는 목적들로 제한되도록 의도되지 않는다. 오히려, 본 개시의 양상들은, 상이한 무선 기술들, 시스템 구성들, 네트워크들 및 송신 프로토콜들에 광범위하게 적용가능하도록 의도되고, 이들 중 일부는, 선호되는 양상들의 하기 설명 및 도면들에서 예시의 방식으로 예시된다. 상세한 설명 및 도면들은 제한적이기 보다는 본 개시의 단지 예시이고, 본 개시의 범위는 첨부된 청구항들 및 이들의 균등물들에 의해 정의된다.

[0014] [0048] 무선 네트워크 기술들은 다양한 타입들의 무선 로컬 영역 네트워크들(WLAN들)을 포함할 수 있다. WLAN은, 광범위하게 이용된 네트워킹 프로토콜들을 이용하여, 인근의 디바이스들을 서로 상호접속시키는데 이용될 수 있다. 본 명세서에서 설명되는 다양한 양상들은 임의의 통신 표준, 예를 들어, WiFi 또는 더 일반적으로 무선 프로토콜들의 IEEE 802.11 군의 임의의 멤버에 적용될 수 있다. 예를 들어, 본 명세서에서 설명되는 다양한 양상들은, 직교 주파수-분할 다중 액세스(OFDMA) 통신들을 지원하는 802.11 프로토콜과 같은 IEEE 802.11 프로토콜의 일부로서 이용될 수 있다.

[0015] [0049] STA들과 같은 다수의 디바이스들이 AP와 동시에 통신하도록 허용하는 것은 유리할 수 있다. 예를 들어,

이것은, 다수의 STA들이 더 짧은 시간에 AP로부터의 응답을 수신하도록 허용할 수 있고, 더 적은 지연으로 AP로부터 데이터를 수신 및 송신할 수 있도록 허용할 수 있다. 이것은 또한, AP가 더 많은 수의 디바이스들과 전반적으로 통신하도록 허용할 수 있고, 또한 대역폭 이용량을 더 효율적이 되게 할 수 있다. 다중 액세스 통신들을 이용함으로써, AP는, 예를 들어, 80 MHz 대역폭에 걸쳐 한번에 4개의 디바이스들에 OFDM 심볼들을 멀티플렉싱할 수 있고, 여기서 각각의 디바이스는 20 MHz 대역폭을 활용한다. 따라서, 다중 액세스는 몇몇 양상들에서 유리할 수 있는데, 이는, AP가 자신에게 이용가능한 스펙트럼을 더 효율적으로 이용하도록 허용할 수 있기 때문이다.

[0016] [0050] AP와 STA들 사이에서 송신되는 심볼들의 상이한 서브캐리어들(또는 톤들)을 상이한 STA들에 할당함으로써, 802.11 군과 같은 OFDM 시스템에서 이러한 다중 액세스 프로토콜들을 구현하는 것이 제안되었다. 이러한 방식으로, AP는 단일 송신된 OFDM 심볼로 다수의 STA들과 통신할 수 있고, 여기서 심볼의 상이한 톤들이 상이한 STA들에 의해 디코딩 및 프로세싱되어, 다수의 STA들로의 동시 데이터 전송을 허용한다. 이러한 시스템들은 때때로 OFDMA 시스템들로 지칭된다.

[0017] [0051] 이러한 톤 할당 방식은 본 명세서에서 "고효율"(HE) 시스템으로 지칭되고, 이러한 다중 톤 할당 시스템에서 송신되는 데이터 패킷들은 고효율(HE) 패킷들로 지칭될 수 있다. 하위-호환가능한 프리앰블 필드들을 포함하는 이러한 패킷들의 다양한 구조들이 아래에서 상세히 설명된다.

[0018] [0052] 이하, 신규한 시스템들, 장치들 및 방법들의 다양한 양상들을 첨부한 도면들을 참조하여 더 상세히 설명한다. 그러나, 이러한 개시는 다수의 다른 형태들로 구현될 수 있고, 본 개시 전체에 제시되는 임의의 특정한 구조 또는 기능에 제한되는 것으로 해석되어서는 안된다. 오히려, 이 양상들은, 본 개시가 철저하고 완전해지도록 제공되고, 본 개시의 범위를 당업자들에게 완전하게 전달할 것이다. 본 명세서의 교시들에 기초하여, 당업자는, 본 개시의 범위가 본 발명의 임의의 다른 양상과 결합되어 구현되든 독립적으로 구현되든, 본 명세서에 개시된 신규한 시스템들, 장치들 및 방법들의 임의의 양상을 커버하도록 의도됨을 인식해야 한다. 예를 들어, 본 명세서에 기술된 양상들 중 임의의 수의 양상들을 이용하여 장치가 구현될 수 있고, 또는 방법이 실시될 수 있다. 또한, 본 발명의 범위는, 본 명세서에 기술된 본 발명의 다양한 양상들에 부가하여 또는 그 이외의 다른 구조, 기능, 또는 구조 및 기능을 이용하여 실시되는 이러한 장치 또는 방법을 커버하도록 의도된다. 본 명세서에 개시된 임의의 양상은 청구항의 하나 이상의 엘리먼트들에 의해 구현될 수 있음을 이해해야 한다.

[0019] [0053] 특정한 양상들이 본 명세서에서 설명되지만, 이 양상들의 많은 변화들 및 치환들은 본 개시의 범위 내에 속한다. 선호되는 양상들의 몇몇 이익들 및 이점들이 언급되지만, 본 개시의 범위는 특정한 이점들, 이용들 또는 목적들로 제한되도록 의도되지 않는다. 오히려, 본 개시의 양상들은, 상이한 무선 기술들, 시스템 구성들, 네트워크들 및 송신 프로토콜들에 광범위하게 적용가능하도록 의도되고, 이들 중 일부는, 선호되는 양상들의 하기 설명 및 도면들에서 예시의 방식으로 예시된다. 상세한 설명 및 도면들은 제한적이기 보다는 본 개시의 단지 예시이고, 본 개시의 범위는 첨부된 청구항들 및 이들의 균등물들에 의해 정의된다.

[0020] [0054] 대중적인 무선 네트워크 기술들은 다양한 타입들의 무선 로컬 영역 네트워크들(WLAN들)을 포함할 수 있다. WLAN은, 광범위하게 이용된 네트워킹 프로토콜들을 이용하여, 인근의 디바이스들을 서로 상호접속시키는데 이용될 수 있다. 본 명세서에서 설명되는 다양한 양상들은 임의의 통신 표준, 예를 들어, 무선 프로토콜에 적용될 수 있다.

[0021] [0055] 몇몇 양상들에서, 무선 신호들은 802.11 프로토콜에 따라 송신될 수 있다. 몇몇 구현들에서, WLAN은, 무선 네트워크에 액세스하는 컴포넌트들인 다양한 디바이스들을 포함한다. 예를 들어, 2가지 타입들의 디바이스들, 즉 액세스 포인트들(AP들) 및 클라이언트들(또한, 스테이션들 또는 STA들로 지칭됨)이 존재할 수 있다. 일반적으로, AP는 WLAN에 대한 허브 또는 기지국으로 기능하고, STA는 WLAN의 사용자로서 기능할 수 있다. 예를 들어, STA는 랩탑 컴퓨터, 개인 휴대 정보 단말(PDA), 모바일 폰 등일 수 있다. 일례에서, STA는, 인터넷에 대한 또는 다른 광역 네트워크들에 대한 일반적 접속을 획득하기 위해, WiFi 준수(compliant) 무선 링크를 통해 AP에 접속한다. 몇몇 구현들에서, STA는 또한 AP로서 이용될 수 있다.

[0022] [0056] 액세스 포인트(AP)는 또한, 기지국, 무선 액세스 포인트, 액세스 노드 또는 유사한 용어를 포함하거나, 이들로 구현되거나 또는 이들로 공지될 수 있다.

[0023] [0057] 스테이션 "STA"는 또한 액세스 단말("AT"), 가입자국, 가입자 유닛, 모바일 스테이션, 원격국, 원격 단말, 사용자 단말, 사용자 에이전트, 사용자 디바이스, 사용자 장비 또는 몇몇 다른 용어를 포함하거나, 이들로 구현되거나 또는 이들로 공지될 수 있다. 따라서, 본 명세서에 교시된 하나 이상의 양상들은 폰(예를 들어, 셀

룰러 폰 또는 스마트폰), 컴퓨터(예를 들어, 랩탑), 휴대용 통신 디바이스, 헤드셋, 휴대용 컴퓨팅 디바이스(예를 들어, 개인 휴대 정보 단말), 오락 디바이스(예를 들어, 음악 또는 비디오 디바이스 또는 위성 라디오), 게이밍 디바이스 또는 시스템, 글로벌 측위 시스템 디바이스, 또는 무선 매체를 통한 네트워크 통신을 위해 구성되는 임의의 다른 적절한 디바이스에 통합될 수 있다.

[0024] [0058] 앞서 논의된 바와 같이, 본 명세서에서 설명되는 특정 디바이스들은, 예를 들어, 802.11 표준을 구현할 수 있다. 이러한 디바이스들은, STA로 이용되든 또는 AP로 이용되든 또는 다른 디바이스로 이용되든, 스마트 계측을 위해 또는 스마트 그리드 네트워크에서 이용될 수 있다. 이러한 디바이스들은 센서 애플리케이션들을 제공할 수 있거나 홈 오토메이션(home automation)에서 이용될 수 있다. 디바이스들은 그 대신 또는 추가적으로, 예를 들어, 개인 건강관리를 위한 건강관리 상황에서 이용될 수 있다. 디바이스들은 또한, 확장된 범위의 인터넷 접속을 가능하게 하기 위해(예를 들어, 핫스팟들로 이용하기 위해) 또는 머신-투-머신 통신들을 구현하기 위해, 감시를 위해 이용될 수 있다.

[0025] [0059] 도 1은, 802.11 시스템들에 대해 이용가능한 채널들에 대한 채널 할당을 예시한다. 다양한 IEEE 802.11 시스템들은, 5, 10, 20, 40, 80 및 160 MHz 채널들과 같은 다수의 상이한 크기들의 채널들을 지원한다. 예를 들어, 802.11ac 디바이스는 20, 40 및 80 MHz 채널 대역폭 수신 및 송신을 지원할 수 있다. 더 큰 채널은 2개의 인접한 더 작은 채널들을 포함할 수 있다. 예를 들어, 80 MHz 채널은 2개의 인접한 40 MHz 채널들을 포함할 수 있다. 현재 구현된 IEEE 802.11 시스템들에서, 20 MHz 채널은, 서로 312.5 kHz만큼 분리된 64개의 서브캐리어들을 포함한다. 이러한 서브캐리어들 중, 더 작은 수가 데이터를 반송하기 위해 이용될 수 있다. 예를 들어, 20 MHz 채널은 -1 내지 -28 및 1 내지 28로 넘버링된 송신 서브캐리어들, 즉, 56개의 서브캐리어들을 포함할 수 있다. 이러한 캐리어들 중 일부는 또한 파일럿 신호들을 송신하기 위해 이용될 수 있다. 수년간, IEEE 802.11 표준은 몇몇 버전들에 걸쳐 진화해왔다. 구 버전들은 11a/g 및 11n 버전들을 포함한다. 가장 최근에는 802.11ac 버전이 릴리즈되었다.

[0026] [0060] 도 2, 도 3 및 도 4는 몇몇 현재 존재하는 IEEE 802.11 표준들에 대한 데이터 패킷 포맷들을 예시한다. 먼저 도 2를 참조하면, IEEE 802.11a, 11b 및 11g에 대한 패킷 포맷이 예시된다. 이러한 프레임은 숏 트레이닝 필드(22), 롱 트레이닝 필드(24) 및 신호 필드(26)를 포함한다. 트레이닝 필드들은 데이터를 송신하지 않지만, 데이터 필드(28)의 데이터를 디코딩하기 위해 AP와 수신 STA들 사이의 동기화를 허용한다.

[0027] [0061] 신호 필드(26)는, 전달되고 있는 패킷의 성질에 정보를 AP로부터 STA들로 전달한다. IEEE 802.11a/b/g 디바이스들에서, 이러한 신호 필드는 24 비트의 길이를 갖고, 1/2의 코드 레이트 및 BPSK 변조를 이용하여 6 Mb/s 레이트에서 단일 OFDM 심볼로 송신된다. SIG 필드(26)의 정보는, 패킷의 데이터의 변조 방식을 설명하는 4 비트(예를 들어, BPSK, 16QAM, 64QAM 등), 및 패킷 길이에 대한 12 비트를 포함한다. 이 정보는, 패킷이 STA에 의도된 경우 패킷의 데이터를 디코딩하기 위해 그 STA에 의해 이용된다. 패킷이 특정 STA에 의도되지 않은 경우, STA는 SIG 심볼(26)의 길이 필드에서 정의되는 시간 기간 동안 임의의 통신 시도들을 연기할 것이고, 전력을 절감하기 위해, 약 5.5 msec까지의 패킷 기간 동안 수면 모드에 진입할 수 있다.

[0028] [0062] 특징들이 IEEE 802.11에 추가됨에 따라, STA들에 추가적인 정보를 제공하기 위해, 데이터 패킷들의 SIG 필드들의 포맷에 대한 변경들이 개발되었다. 도 3은, IEEE 802.11n 패킷에 대한 패킷 구조를 도시한다. IEEE.802.11 표준에의 11n 추가는 IEEE.802.11 호환가능한 디바이스들에 MIMO 기능을 추가하였다. IEEE 802.11a/b/g 디바이스들 및 IEEE 802.11n 디바이스들 둘 모두를 포함하는 시스템들에 대해 하위-호환성을 제공하기 위해, IEEE 802.11n 시스템들에 대한 데이터 패킷은 또한, L-STF 22, L-LTF 24, 및 L-SIG 26으로 표기된, 이러한 더 앞선 시스템들의 STF, LTF 및 SIG 필드들을 포함하며, 프리픽스 L은 이들이 "레거시" 필드들임을 표기한다. IEEE 802.11n 환경에서 STA들에 필요한 정보를 제공하기 위해, 2개의 추가적인 신호 심볼들(140 및 142)이 IEEE 802.11n 데이터 패킷에 추가되었다. 그러나, SIG 필드 및 L-SIG 필드(26)와는 반대로, 이러한 신호 필드들은 회전된 BPSK 변조(또한 QBPSK 변조로 지칭됨)를 이용하였다. IEEE 802.11a/b/g와 동작하도록 구성된 레거시 디바이스가 이러한 패킷을 수신하는 경우, 디바이스는 L-SIG 필드(26)를 수신하고 이를 정규의 11a/b/g 패킷으로 표기할 것이다. 그러나, 디바이스가 추가적인 비트들을 디코딩하는 것을 계속함에 따라, 비트들은 성공적으로 디코딩되지 않을 것인데, 이는, L-SIG 필드(26) 이후의 데이터 패킷의 포맷은 11a/b/g 패킷의 포맷과는 상이하고, 이러한 프로세스 동안 디바이스에 의해 수행되는 CRC 체크가 실패할 것이기 때문이다. 이것은, 이러한 레거시 디바이스들이 패킷의 프로세싱을 중지할 뿐만 아니라, 초기에 디코딩된 L-SIG의 길이 필드에 의해 정의된 시간 기간이 경과할 때까지 임의의 추가적인 동작들을 연기하게 한다. 반대로, IEEE 802.11n과 호환가능한 새로운 디바이스들은 HT-SIG 필드들의 회전된 변조를 감지할 것이고, 패킷을 802.11n 패킷으로 프로세싱할 것이다. 게다가, 11n 디바이스는, 패킷이 11a/b/g 디바이스에 의도된 것을 알릴 수 있는데, 이는,

디바이스가 L-SIG(26)에 후속하는 심볼에서 QBPSK 이외의 임의의 변조를 감지하면, 이를 11a/b/g 패킷으로서 무시할 것이기 때문이다. HT-SIG1 및 SIG2 심볼들 이후, MIMO 통신에 적합한 추가적인 트레이닝 필드들이 제공되고, 데이터(28)가 후속된다.

[0029] [0063] 도 4는, IEEE 802.11 군에 다중-사용자 MIMO 기능을 추가한 현재 존재하는 IEEE 802.11ac 표준에 대한 프레임 포맷을 예시한다. IEEE 802.11n과 유사하게, 802.11ac 프레임은, 동일한 레거시 숏 트레이닝 필드(L-STF)(22) 및 롱 트레이닝 필드(L-LTF)(24)를 포함한다. 802.11ac 프레임은 또한 앞서 설명된 바와 같이 레거시 신호 필드 L-SIG(26)를 포함한다.

[0030] [0064] 다음으로, 802.11ac 프레임은, 2개의 심볼 길이인 VHT-SIG(Very High Throughput Signal)-A1(150) 및 A2(152) 필드를 포함한다. 이러한 신호 필드는, 11a/b/g 및 11n 디바이스들에는 존재하지 않는 11ac 특징들과 관련된 추가적인 구성 정보를 제공한다. VHT-SIG-A의 제 1 OFDM 심볼(150)은 BPSK를 이용하여 변조될 수 있어서, 패킷을 청취하는 임의의 802.11n 디바이스는, 그 패킷이 802.11a 패킷인 것으로 믿을 것이고, L-SIG(126)의 길이 필드에서 정의되는 패킷 길이의 지속기간 동안 패킷을 연기시킬 것이다. 11a/g에 따라 구성된 디바이스들은, L-SIG(26) 필드에 후속하는 MAC 헤더 및 서비스 필드를 예상하고 있을 것이다. 이들이 이를 디코딩하려 시도하는 경우, 11n 패킷이 11a/b/g 디바이스에 의해 수신된 경우의 절차와 유사한 방식으로 CRC 실패가 발생할 것이고, 11a/b/g 디바이스들은 또한 L-SIG 필드(26)에서 정의된 지속기간 동안 연기할 것이다. VHT-SIG-A의 제 2 심볼(152)은 90-도 회전된 BPSK로 변조된다. 이러한 회전된 제 2 심볼은, 802.11ac 디바이스가 그 패킷을 802.11ac 패킷으로 식별하도록 허용한다. VHT-SIG A1(150) 및 A2(152) 필드들은, 대역폭 모드에 대한 정보, 단일 사용자의 경우에 대한 변조 및 코딩 방식(MCS), 공간 시간 스트림들(NSTS)의 수, 및 다른 정보를 포함한다. VHT-SIG A1(150) 및 A2(152)는 또한 "1"로 설정된 다수의 예비 비트들을 포함할 수 있다. 레거시 필드들 및 VHT-SIG A1 및 A2 필드들은 이용가능한 대역폭의 각각의 20 MHz에 걸쳐 복제될 수 있다.

[0031] [0065] VHT-STF-A 이후, 802.11ac 패킷은 VHT-STF를 포함할 수 있고, 이는, 다중입력 다중출력(MIMO) 송신에서 자동 이득 제어 추정을 개선하도록 구성된다. 802.11ac 패킷의 다음 1 내지 8개의 필드들은 VHT-LTF들일 수 있다. 이들은, MIMO 채널을 추정하고 그 다음 수신된 신호를 등화하기 위해 이용될 수 있다. 전송된 VHT-LTF들의 수는 사용자당 공간적 스트림들의 수보다 크거나 그와 동일할 수 있다. 마지막으로, 데이터 필드 전의 프리앰블의 마지막 필드는 VHT-SIG-B(154)이다. 이 필드는 BPSK 변조되고, 패킷의 유용한 데이터의 길이에 대한 정보를 제공하고, 다중 사용자(MU) MIMO 패킷의 경우, MCS를 제공한다. 단일 사용자(SU)의 경우, 이 MCS 정보가 대신 VHT-SIG A2에 포함된다. VHT-SIG-B에 후속하여 데이터 심볼들이 송신된다. 802.11ac가 802.11 군에 다양한 새로운 특징들을 도입하였고, 11a/g/n 디바이스들과 하위-호환가능한 프리앰블 설계를 갖는 데이터 패킷을 포함하였고, 또한 11ac의 새로운 특징들을 구현하기 위해 필요한 정보를 제공했지만, 다중 액세스를 위한 OFDMA 톤 할당에 대한 구성 정보는 11ac 데이터 패킷 설계에 의해 제공되지 않는다. IEEE 802.11의 임의의 장래의 버전 또는 OFDM 서브캐리어들을 이용하는 임의의 다른 무선 네트워크 프로토콜에서 이러한 특징들을 구현하기 위해 새로운 프리앰블 구성들이 필요하다. 유리한 프리앰블 설계들이 특히 도 3 내지 도 9를 참조하여 아래에서 표현된다.

[0032] [0066] 도 5는, 이러한 환경에서 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 물리-계층 패킷의 예시적인 구조를 예시한다.

[0033] [0067] 이러한 예시적인 물리-계층 패킷에는, L-STF(22), L-LTF(26) 및 L-SIG(26)를 포함하는 레거시 프리앰블이 포함된다. 이들 각각은 20 MHz를 이용하여 송신될 수 있고, AP가 이용하는 각각 20 MHz의 스펙트럼에 대해 다수의 카피들이 송신될 수 있다.

[0034] [0068] 이 패킷은 또한, HE-SIG1 심볼(455), HE-SIG2 심볼(457) 및 하나 이상의 HE-SIG3 심볼들(459)을 포함한다. 이러한 심볼들의 구조는 IEEE 802.11a/b/g/n/ac 디바이스과 하위-호환가능해야 하고, 또한 그 패킷이 HE 패킷임을 OFDMA HE 디바이스들에 시그널링해야 한다. IEEE 802.11a/b/g/n/ac 디바이스들과 하위-호환가능하기 위해, 이러한 심볼들 각각에 대해 적절한 변조가 이용될 수 있다. 몇몇 구현들에서, 제 1 심볼 HE-SIG1(455)은 BPSK 변조로 변조될 수 있다. 이것은, BPSK 변조된 제 1 SIG 심볼을 또한 갖는 11ac 패킷들의 현재 경우에서와 동일한 효과를 11a/b/g/n 디바이스에 대해 유발시킬 것이다. 이러한 디바이스들의 경우, 후속 HE-SIG 심볼들(457, 459)에 대한 변조가 무엇인지는 중요하지 않다. 제 2 심볼(457)은 BPSK 또는 QPSK 변조될 수 있다. BPSK 변조되면, 11ac 디바이스는, 그 패킷이 11a/b/g 패킷이라고 가정할 것이고, 패킷의 프로세싱을 중지할 것이고, L-SIG(26)의 길이 필드에 의해 정의되는 시간 동안 연기할 것이다. QBPSK 변조되면, 11ac 디바이스는 프리앰블 프로세싱 동안 CRC 에러를 생성할 것이고, 또한 패킷의 프로세싱을 중지할 것이고, L-SIG의 길이 필드에

의해 정의되는 시간 동안 연기할 것이다. 이 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하기 위해, HE-SIG3(459)의 적어도 제 1 심볼은 QBPSK 변조될 수 있다.

[0035] [0069] OFDMA 다중 액세스 통신을 설정하기 위해 필요한 정보는 다양한 위치들에서 HE-SIG 필드들(455, 457 및 459)에 배치될 수 있다. 도 5의 예에서, HE-SIG1(455)은 OFDMA 동작에 대한 톤 할당 정보를 포함한다. HE-SIG3(459)은 각각의 멀티플렉싱된 사용자에 대한 사용자 특정 변조 타입을 정의하는 비트들을 포함한다. 또한, HE-SIG2(457)는, 도 4의 11ac 포맷에서 제공되는 것과 같은 사용자 특정 MIMO 공간적 스트림들을 정의하는 비트들을 포함한다. 도 5의 예는, 4명의 상이한 사용자들에게 특정 서브-대역의 톤들 및 특정 수의 MIMO 공간 시간 스트림들이 각각 할당되도록 허용할 수 있다. 12 비트의 공간 시간 스트림 정보는, 4명의 사용자들 각각에 대해 3개의 비트들을 허용하여, 각각의 사용자에게 1 내지 8개의 스트림들이 할당될 수 있다. 16 비트의 변조 타입 데이터는, 4명의 사용자들 각각에 대해 4 비트들을 허용하여, 4명의 사용자들 각각에게 16개의 상이한 변조(16QAM, 64QAM 등) 중 임의의 변조의 할당을 허용한다. 12 비트의 톤 할당 데이터는, 특정 서브-대역들이 4명의 사용자들 각각에게 할당되도록 허용한다.

[0036] [0070] 서브대역 할당을 위한 하나의 예시적인 SIG 필드 방식이 도 6에 예시된다. 이 예는, IEEE 802.11ac에서 현재 이용되는 것과 유사한 6 비트 그룹 ID 필드 뿐만 아니라 4명의 사용자들 각각에게 서브-대역 톤들을 할당하기 위한 10 비트의 정보를 포함한다. 패킷(130)을 전달하기 위해 이용되는 대역폭은 어떠한 수 MHz의 배수들로 STA들에 할당될 수 있다. 예를 들어, 대역폭은 B MHz의 배수들로 STA들에 할당될 수 있다. B의 값은 1, 2, 5, 10, 15 또는 20 MHz와 같은 값일 수 있다. B의 값들은 도 6의 2개의 비트 할당 입도 필드에 의해 제공될 수 있다. 예를 들어, HE-SIG(155)는, 4개의 가능한 B 값들을 허용하는 하나의 2비트 필드를 포함할 수 있다. 예를 들어, B의 값들은, 할당 입도 필드의 0-3 값들에 대응하는 5, 10, 15 또는 20 MHz일 수 있다. 몇몇 양상들에서, k 비트들의 필드는, 0 내지 N의 수를 정의하는 B의 값을 시그널링하기 위해 이용될 수 있고, 여기서 0은 최소 플렉서블 옵션(최대 입도)을 표현하고, N의 하이 값은 최대 플렉서블 옵션(최소 입도)을 표현한다. 각각의 B MHz 부분은 서브-대역으로 지칭될 수 있다.

[0037] [0071] HE-SIG1은, 각각의 STA에 할당되는 서브-대역들의 수를 나타내기 위해 사용자당 2 비트를 추가로 이용할 수 있다. 이것은, 0-3 서브-대역들이 각각의 사용자에게 할당되도록 허용한다. OFDMA 패킷의 데이터를 수신할 STA들을 식별하기 위해, 802.11ac로부터의 그룹-id(G_ID) 개념이 이용될 수 있다. 6-비트 G_ID는, 이 예에서는, 4개까지의 STA들을 특정한 순서로 식별할 수 있다.

[0038] [0072] 이 예에서, 할당 입도 필드는 "00"으로 설정된다. 이 예에서, 할당 입도 필드는 2-비트 필드이고, 이 필드의 값들은 5, 10, 15 또는 20 MHz에 순서대로 대응할 수 있다. 예를 들어, "00"은 5 MHz의 할당 입도에 대응할 수 있다.

[0039] [0073] 이 예에서, 처음 2개의 비트들은, G_ID에 의해 식별되는 제 1 사용자에 대한 서브-대역들의 수를 부여한다. 여기서, 사용자-1에는 "11" 서브-대역들이 부여된다. 이것은 사용자-1이 3개의 서브-대역들을 수신하는 것에 대응할 수 있다. 각각의 서브-대역이 5 MHz이면, 이것은, 사용자-1에게 15 MHz의 스펙트럼이 할당되는 것을 의미할 수 있다. 유사하게, 사용자-2는 또한 3개의 서브-대역들을 수신하는 한편, 사용자-3은 서브-대역들을 수신하지 않고, 사용자-4는 2개의 서브-대역들을 수신한다. 따라서, 이러한 할당은 40 MHz 신호에 대응할 수 있고, 여기서 사용자-1 및 사용자-2 둘 모두에 대해 15 MHz가 이용되는 한편, 사용자-4는 10 MHz를 수신하고, 사용자-3은 어떠한 서브-대역들도 수신하지 않는다.

[0040] [0074] HE-SIG 심볼들 이후 전송되는 트레이닝 필드들 및 데이터는, 각각의 STA에 할당된 톤들에 따라 AP에 의해 전달된다. 이 정보는 잠재적으로 빔포밍될 수 있다. 이러한 정보를 빔포밍하는 것은, 더 정확한 디코딩을 허용하는 것 및/또는 넌-빔포밍된 송신들보다 더 많은 범위를 제공하는 것과 같은 특정 이점들을 가질 수 있다.

[0041] [0075] 각각의 사용자에게 할당된 공간 시간 스트림들에 따라, 상이한 사용자들은 상이한 수의 HE-LTF들(165)을 요구할 수 있다. 각각의 STA는, 그 STA와 연관된 각각의 공간적 스트림에 대한 채널 추정을 허용하는 다수의 HE-LTF들(165)을 요구할 수 있고, 이는 일반적으로 공간적 스트림들의 수와 동일하거나 그보다 많다. LTF들은 또한 주파수 오프셋 추정 및 시간 동기화를 위해 이용될 수 있다. 상이한 STA들이 상이한 수의 HE-LTF들을 수신할 수 있기 때문에, 몇몇 톤들 상에는 HE-LTF 정보를 그리고 다른 톤들 상에는 데이터를 포함하는 심볼들이 AP로부터 송신될 수 있다.

[0042] [0076] 몇몇 양상들에서, 동일한 OFDM 심볼 상에서 HE-LTF 정보 및 데이터 둘 모두를 전송하는 것은 문제가 될 수 있다. 예를 들어, 이것은, 피크-투-평균 전력비(PAPR)를 너무 높은 레벨까지 증가시킬 수 있다. 따라서,

그 대신, 각각의 STA가 적어도 요구된 수의 HE-LTF들(165)을 수신할 때까지, 송신되는 심볼들의 모든 톤들 상에서 HE-LTF들(165)을 송신하는 것이 유리할 수 있다. 예를 들어, 각각의 STA는, STA와 연관된 공간적 스트림당 하나의 HE-LTF(165)를 수신할 필요가 있을 수 있다. 따라서, AP는, 임의의 STA에 할당되는 공간적 스트림들의 최대수와 동일한 수의 HE-LTF들(165)을 각각의 STA에 송신하도록 구성될 수 있다. 예를 들어, 3개의 STA들에 단일 공간적 스트림이 할당되지만, 제 4 STA에 3개의 공간적 스트림들이 할당되면, 이러한 양상에서, AP는, 페이로드 데이터를 포함하는 심볼들을 송신하기 전에 4개의 STA들 각각에 HE-LTF 정보의 4개의 심볼들을 송신하도록 구성될 수 있다.

[0043] [0077] 임의의 주어진 STA에 할당되는 톤들이 인접할 필요는 없다. 예를 들어, 몇몇 구현들에서, 상이한 수신 STA들의 서브-대역들은 인터리빙될 수 있다. 예를 들어, 사용자-1 및 사용자-2 각각이 3개의 서브-대역들을 수신하는 한편, 사용자-4가 2개의 서브-대역들을 수신하면, 이러한 서브-대역들은 전체 AP 대역폭에 걸쳐 인터리빙될 수 있다. 예를 들어, 이러한 서브-대역들은 1,2,4,1,2,4,1,2와 같은 순서로 인터리빙될 수 있다. 몇몇 양상들에서, 서브-대역들을 인터리빙하는 다른 방법들이 또한 이용될 수 있다. 몇몇 양상들에서, 서브-대역들을 인터리빙하는 것은, 특정 서브-대역에 대한 특정 디바이스로부터의 불량한 수신의 효과 또는 간섭들의 부정적 효과들을 감소시킬 수 있다. 몇몇 양상들에서, AP는, STA가 선호하는 서브-대역들 상에서 STA들에 송신할 수 있다. 예를 들어, 특정 STA들은 다른 서브-대역들보다 몇몇 서브-대역들에서 더 양호한 수신도를 가질 수 있다. 따라서, AP는, STA가 어느 서브-대역들에서 더 양호한 수신도를 가질 수 있는지에 적어도 부분적으로 기초하여 STA들에 송신할 수 있다. 몇몇 양상들에서, 서브-대역들은 또한 인터리빙되지 않을 수 있다. 예를 들어, 서브-대역들은 그 대신 1,1,1,2,2,2,4,4로서 송신될 수 있다. 몇몇 양상들에서, 서브-대역들이 인터리빙되는지 여부가 미리 정의될 수 있다.

[0044] [0078] 도 5의 예에서, HE-SIG3 심볼 변조는, 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하기 위해 이용된다. 패킷이 HE 패킷임을 HE 디바이스들에 시그널링하는 다른 방법들이 또한 이용될 수 있다. 도 7의 예에서, L-SIG(126)는, HE 프리앰블이 레거시 프리앰블에 후속할 것임을 HE 디바이스들에 지시하는 정보를 포함할 수 있다. 예를 들어, L-SIG(26)는, L-SIG(26) 동안 Q 신호에 민감한 HE 디바이스들에 후속 HE 프리앰블의 존재를 나타내는, Q-레일 상의 낮은 에너지의 1-비트 코드를 포함할 수 있다. 매우 낮은 진폭의 Q 신호가 이용될 수 있는데, 그 이유는, 패킷을 송신하기 위해 AP에 의해 이용되는 모든 톤들에 걸쳐 단일 비트 신호가 확산될 수 있기 때문이다. 이 코드는, HE-프리앰블/패킷의 존재를 검출하기 위해 고효율 디바이스들에 의해 이용될 수 있다. 레거시 디바이스들의 L-SIG(26) 검출 감도는 Q-레일 상의 이러한 낮은 에너지의 코드에 의해 현저히 영향받을 필요가 없다. 따라서, 이러한 디바이스들은 L-SIG(26)를 판독할 수 있을 것이고, 그 코드의 존재를 인식하지 못하는 한편, HE 디바이스들은 코드의 존재를 검출할 수 있을 것이다. 이러한 구현에서, HE-SIG 필드들 전부는, 원한다면, BPSK 변조될 수 있고, 레거시 호환가능성과 관련하여 본 명세서에서 설명되는 임의의 기술들이 이러한 L-SIG 시그널링과 함께 이용될 수 있다.

[0045] [0079] 도 8은, 11ac 디바이스들에 의한 하위-호환가능성을 또한 구현하는 다른 방법을 예시한다. 이 예에서, HE-SIG-A1(455)은, 11ac 디바이스가 VHT-SIG 필드를 디코딩하는 경우 요구하는 값으로부터 플립된 값으로 설정되는 비트를 포함할 수 있다. 예를 들어, 802.11ac VHT-SIG-A 필드는, 정확하게 어셈블링된 VHT-SIG-A 필드에서 예비되고 1로 설정되는 비트들 2 및 23을 포함한다. 고효율 프리앰블 HE-SIG-A(455)에서, 이러한 비트들 중 하나 또는 둘 모두는 제로로 설정될 수 있다. 802.11ac 디바이스가, 이러한 플립된 값을 갖는 예비 비트를 포함하는 패킷을 수신하면, 11ac 디바이스는 패킷의 프로세싱을 중지하고, 이를 디코딩불가능한 것으로 취급하는 한편, L-SIG(26)에 특정된 지속기간 동안 패킷을 여전히 연기시킨다. 이러한 구현에서, 11a/b/g/n 디바이스들과의 하위-호환가능성은 HE-SIG1 심볼(455) 상에서 BPSK 변조를 이용함으로써 달성될 수 있고, HE 디바이스들에 시그널링하는 것은, HE-SIG2(457) 또는 HE-SIG3(459)의 하나 이상의 심볼들에 대해 QBPSK 변조를 이용함으로써 달성될 수 있다.

[0046] [0080] 도 9에 예시된 예에 의해 도시된 바와 같이, HE 패킷의 구조는 802.11ac에서 활용되는 패킷 구조에 기초할 수 있다. 이 예에서, 레거시 프리앰블(22, 24, 26) 이후, 도 9에 HE-SIGA1 및 HE-GIGA2로 명명되는 2개의 심볼들이 제공된다. 이것은 도 4의 VHT-SIGA1 및 VHT-SIGA2와 동일한 구조이다. 공간 시간 스트림 할당 및 톤 할당 둘 모두를 이러한 2개의 24 비트 심볼들에 들어맞게 하기 위해, 공간 시간 스트림 옵션들에는 자유도가 거의 제공되지 않는다.

[0047] [0081] 도 9의 예는 또한, HE 트레이닝 필드들 이후 HE-SIGB 심볼(459)을 배치하고, 이는 또한 도 4의 VHT-SIGB 필드(154)와 유사하다.

[0048] [0082] 그러나, 이러한 11ac-기반 프리앰블에 의한 하나의 잠재적 문제는, 이러한 설계가 HE-SIG-B(470)의 공간 제한들에 다다를 수 있다는 점이다. 예를 들어, HE-SIG-B(470)는 적어도 MCS(4 비트) 및 테일 비트(6 비트)를 포함할 필요가 있을 수 있다. 따라서, HE-SIG-B(470)는 적어도 10 비트의 정보를 포함할 필요가 있을 수 있다. 802.11ac 규격에서, VHT-SIG-B는 1 OFDM 심볼이다. 그러나, 각각의 서브-대역의 대역폭에 따라, 단일 OFDM 심볼에는 충분한 수의 비트들이 존재하지 않을 수 있다. 예를 들어, 아래의 표 1은 이러한 잠재적인 문제를 예시한다.

표 1

[0049]

| 사용자당 BW (MHz 단위) | 사용자/OFDM 심볼 당 비트들의 수 | 테일 비트들의 수 | MCS 필드에 대한 나머지 비트들의 수 |
|---|---|---|---|
| 10 | 13 | 6 | 7 |
| 6 | 8 | 6 | 2 |
| 5 | 6 | 6 | 0 |

[0050] [0083] 표 1에 예시된 바와 같이, 각각의 서브-대역이 10 MHz이면, 단일 OFDM 심볼은 13 비트를 제공한다. 이러한 비트들 중 6개는 테일 비트들로서 필요하고, 따라서 MCS 필드에 대해 7 비트가 남는다. 앞서 언급된 바와 같이, MCS 필드는 4 비트를 요구한다. 따라서, 각각의 서브-대역이 적어도 10 MHz이면, HE-SIG-B(470)에 대해 단일 OFMD 심볼이 이용될 수 있고, 이것은 4 비트 MCS 필드를 포함하기에 충분할 수 있다. 그러나, 각각의 서브-대역이 그 대신 5 또는 6 MHz이면, 이것은 OFDM 심볼당 6 또는 8 비트만을 허용할 수 있다. 이러한 비트들 중 6 비트가 테일 비트이다. 따라서, MCS 필드에 대해 0 또는 2 비트만이 이용가능하다. 이것은 MCS 필드를 제공하기에는 불충분하다. 서브-대역 입도가 SIGB 필드들에서 요구되는 정보를 제공하기에는 너무 작은 이러한 경우들에서, HE-SIG-B(470)에 대해 하나보다 많은 OFDM 심볼이 이용될 수 있다. 필요한 심볼들의 수는, 시스템이 허용할 최소 서브-대역과 관련될 것이다. 이것이, IEEE 802.11 군 OFDM 시스템의 13개의 톤들에 대응하는 5 MHz이면, HE-SIG-B에 대한 2개의 심볼들은, HE-SIG-B 정보 MCS 및 테일 비트들에 대한 충분할 길이인 12 비트를 제공하기 위해 BPSK 변조 및 1/2 순방향 에러 정정 코드 레이트를 허용할 것이다. 도 10은, 본 개시의 양상들이 이용될 수 있는 무선 통신 시스템(100)의 예를 예시한다. 무선 통신 시스템(100)은, 예를 들어, IEEE 802.11 표준들과 같은 무선 표준에 따라 동작할 수 있다. 무선 통신 시스템(100)은 STA들(106a, 106b, 106c 및 106d)(총괄적으로 STA들(106))과 통신하는 AP(104)를 포함할 수 있다. 네트워크는 레거시 STA들(106b) 및 고효율(HE) STA들(106a, 106c, 106d) 둘 모두를 포함할 수 있다.

[0051] [0084] AP(104)와 STA들(106) 사이의 무선 통신 시스템(100)에서 송신들을 위해 다양한 프로세스들 및 방법들이 이용될 수 있다. 예를 들어, 신호들은 OFDM/OFDMA 기술들에 따라 AP(104)와 STA들(106) 사이에서 전송 및 수신될 수 있다. 이러한 경우이면, 무선 통신 시스템(100)은 OFDM/OFDMA 시스템으로 지칭될 수 있다.

[0052] [0085] AP(104)로부터 STA들(106) 중 하나 이상으로의 송신을 용이하게 하는 통신 링크는 다운링크(DL)(108)로 지칭될 수 있고, STA들(106) 중 하나 이상으로부터 AP(104)로의 송신을 용이하게 하는 통신 링크는 업링크(UL)(110)로 지칭될 수 있다. 대안적으로, 다운링크(108)는 순방향 링크 또는 순방향 채널로 지칭될 수 있고, 업링크(110)는 역방향 링크 또는 역방향 채널로 지칭될 수 있다. 몇몇 경우들에서, 몇몇 DL(108) 통신들은 HE 패킷(130)과 같은 HE 패킷들일 수 있다. 이러한 HE 패킷들은, 802.11a 및 802.11n과 같은 규격들에 따른 프리앰블 정보와 같은 레거시 프리앰블 정보를 포함할 수 있고, 이는, 레거시 STA(106b)가 HE 패킷(130)을 인식하게 하고, 송신의 지속기간 동안 HE 패킷(130)의 송신을 연기하게 하기에 충분한 정보를 포함한다. 유사하게, HE 패킷들(130)인 DL(108) 통신들은, 앞서 논의된 바와 같이, 어느 디바이스들이 HE 패킷(130)의 정보를 수신할 수 있는지를 HE STA들(106a, 106c, 106d)에 통지하기에 충분한 정보를 포함할 수 있다.

[0053] [0086] AP(104)는 기지국으로 동작하고, 기본 서비스 영역(BSA)(102)에서 무선 통신 커버리지를 제공할 수 있다. AP(104)와 연관되고 통신을 위해 AP(104)를 이용하는 STA들(106)과 함께 AP(104)는 기본 서비스 세트(BSS)로 지칭될 수 있다. 무선 통신 시스템(100)은 중앙 AP(104)를 갖지 않을 수 있지만, 오히려 STA들(106) 사이에서 피어-투-피어 네트워크로서 기능할 수 있음을 주목해야 한다. 따라서, 본 명세서에서 설명되는 AP(104)의 기능들은 대안적으로 STA들(106) 중 하나 이상에 의해 수행될 수 있다.

[0054] [0087] 도 11은, 무선 통신 시스템(100) 내에서 이용될 수 있는 무선 디바이스(202)에서 활용될 수 있는 다양한 컴포넌트들을 예시한다. 무선 디바이스(202)는, 본 명세서에서 설명되는 다양한 방법들을 구현하도록 구성될 수 있는 디바이스의 예이다. 예를 들어, 무선 디바이스(202)는 도 10의 AP(104) 또는 STA들(106) 중 하나를 포

함할 수 있다. 몇몇 양상들에서, 무선 디바이스(202)는, HE 패킷(130)과 같은 HE 패킷들을 송신하도록 구성되는 AP를 포함할 수 있다.

[0055] [0088] 무선 디바이스(202)는, 무선 디바이스(202)의 동작을 제어하는 프로세서(204)를 포함할 수 있다. 프로세서(204)는 또한 중앙 프로세싱 유닛(CPU)으로 지칭될 수 있다. 판독 전용 메모리(ROM) 및 랜덤 액세스 메모리(RAM) 모두를 포함할 수 있는 메모리(206)는 프로세서(204)에 명령들 및 데이터를 제공한다. 메모리(206)의 일부는 또한 비휘발성 랜덤 액세스 메모리(NVRAM)를 포함할 수 있다. 프로세서(204)는 통상적으로, 메모리(206) 내에 저장된 프로그램 명령들에 기초하여 논리적 및 산술적 연산들을 수행한다. 메모리(206)의 명령들은 본 명세서에서 설명되는 방법들을 구현하도록 실행가능할 수 있다. 예를 들어, 무선 디바이스(202)가 AP(104)이면, 메모리(206)는, 무선 디바이스(202)가 HE 패킷(130)과 같은 HE 패킷들을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 메모리(206)는, 무선 디바이스(202)가 레거시 프리앰블, 및 그에 후속하는 HE-SIG 또는 HE-SIG-A를 포함하는 HE 프리앰블을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 몇몇 양상들에서, 무선 디바이스(202)는 프레임 포맷팅 회로(221)를 포함할 수 있고, 프레임 포맷팅 회로(221)는, 무선 디바이스(202)가 본 명세서에 개시된 실시예들에 따른 프레임을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 프레임 포맷팅 회로(221)는, 무선 디바이스(202)가, 레거시 프리앰블 및 고효율 프리앰블 둘 모두를 포함하는 패킷을 송신하도록 허용하기에 충분한 명령들을 포함할 수 있다.

[0056] [0089] 프로세서(204)는 하나 이상의 프로세서들로 구현되는 프로세싱 시스템의 컴포넌트를 포함하거나 컴포넌트일 수 있다. 하나 이상의 프로세서들은, 범용 마이크로프로세서들, 마이크로제어기들, 디지털 신호 프로세서들(DSP들), 필드 프로그래머블 게이트 어레이(FPGA들), 프로그래머블 로직 디바이스들(PLD들), 제어기들, 상태 머신들, 게이트된 로직, 이산 하드웨어 컴포넌트들, 전용 하드웨어 유한 상태 머신들, 또는 정보의 계산들 또는 다른 조작들을 수행할 수 있는 임의의 다른 적절한 엔티티들의 임의의 조합으로 구현될 수 있다.

[0057] [0090] 프로세싱 시스템은 또한, 소프트웨어를 저장하기 위한 머신 판독가능 매체를 포함할 수 있다. 소프트웨어는, 소프트웨어, 펌웨어, 미들웨어, 마이크로코드, 하드웨어 설명 언어로 지칭되든 또는 이와 달리 지칭되든, 임의의 타입의 명령들을 의미하도록 넓게 해석될 것이다. 명령들은 코드를 (예를 들어, 소스 코드 포맷, 2진 코드 포맷, 실행가능한 코드 포맷 또는 코드의 임의의 다른 적절한 포맷으로) 포함할 수 있다. 명령들은, 하나 이상의 프로세서들에 의해 실행되는 경우, 프로세싱 시스템으로 하여금, 본 명세서에서 설명되는 다양한 기능들을 수행하게 한다.

[0058] [0091] 무선 디바이스(202)는 또한, 무선 디바이스(202)와 원격의 위치 사이에서 데이터의 송신 및 수신을 허용하기 위한 송신기(210) 및 수신기(212)를 포함할 수 있는 하우징(208)을 포함할 수 있다. 송신기(210) 및 수신기(212)는 트랜시버(214)로 결합될 수 있다. 안테나(216)는 하우징(208)에 부착되고 트랜시버(214)에 전기적으로 커플링될 수 있다. 무선 디바이스(202)는 또한 다수의 송신기들, 다수의 수신기들 및 다수의 트랜시버들 및/또는 다수의 안테나들을 포함할 수 있다(미도시).

[0059] [0092] 무선 디바이스(202)는 또한, 트랜시버(214)에 의해 수신된 신호들의 레벨을 검출 및 정량화하기 위한 노력으로 이용될 수 있는 신호 검출기(218)를 포함할 수 있다. 신호 검출기(218)는 이러한 신호들을 총 에너지, 심볼 당 서브캐리어 당 에너지, 전력 스펙트럼 밀도 및 다른 신호들로서 검출할 수 있다. 무선 디바이스(202)는 또한 프로세싱 신호들에 이용하기 위한 디지털 신호 프로세서(DSP)(220)를 포함할 수 있다. DSP(220)는 송신을 위한 데이터 유닛을 생성하도록 구성될 수 있다. 몇몇 양상들에서, 데이터 유닛은 물리 계층 데이터 유닛(PPDU)을 포함할 수 있다. 몇몇 양상들에서, PPDU는 패킷으로 지칭된다.

[0060] [0093] 무선 디바이스(202)는 몇몇 양상들에서 사용자 인터페이스(222)를 더 포함할 수 있다. 사용자 인터페이스(222)는 키패드, 마이크로폰, 스피커 및/또는 디스플레이를 포함할 수 있다. 사용자 인터페이스(222)는, 무선 디바이스(202)의 사용자에게 정보를 전달하고 그리고/또는 사용자로부터 입력을 수신하는 임의의 엘리먼트 또는 컴포넌트를 포함할 수 있다.

[0061] [0094] 무선 디바이스(202)의 다양한 컴포넌트들은 버스 시스템(226)에 의해 함께 커플링될 수 있다. 버스 시스템(226)은, 예를 들어, 데이터 버스 뿐만 아니라, 데이터 버스에 부가하여 전력 버스, 제어 신호 버스 및 상태 신호 버스를 포함할 수 있다. 무선 디바이스(202)의 컴포넌트들이, 몇몇 다른 메커니즘을 이용하여 서로 커플링되거나 또는 서로에게 입력들을 제공하거나 수용할 수 있음을 이 분야의 당업자들은 인식할 것이다.

[0062] [0095] 다수의 별개의 컴포넌트들이 도 11에 도시되어 있지만, 컴포넌트들 중 하나 이상은 결합되거나 공통으로 구현될 수 있다. 예를 들어, 프로세서(204)는, 프로세서(204)에 대해 앞서 설명된 기능을 구현할 뿐만 아니라,

신호 검출기(218) 및/또는 DSP(220)에 대해 앞서 설명된 기능을 구현하기 위해 이용될 수 있다. 추가로, 도 11에 예시된 컴포넌트들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 게다가, 아래에서 설명되는 임의의 컴포넌트들, 모듈들, 회로들 등을 구현하기 위해 프로세서(204)가 이용될 수 있거나, 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다.

[0063] [0096] 도 12는, 하위-호환가능한 다중 액세스 무선 통신들을 가능하게 하기 위해 이용될 수 있는 업링크 물리-계층 패킷(830)의 예시적인 구조를 예시한다. 이러한 업링크 메시지에서, 어떠한 레거시 프리앰블도 필요하지 않는데, 이는, AP의 초기 다운링크 메시지에 의해 NAV가 설정되기 때문이다. 따라서, 업링크 패킷(830)은 레거시 프리앰블을 포함하지 않는다. 업링크 패킷(830)은, AP에 의해 전송되는 UL-OFDMA-어나운스 메시지에 대한 응답으로 전송될 수 있다.

[0064] [0097] 업링크 패킷(830)은 다수의 상이한 STA들에 의해 전송될 수 있다. 예를 들어, 다운링크 패킷에서 식별되는 각각의 STA는 업링크 패킷(830)의 일부를 송신할 수 있다. STA들 각각은, 자신이 할당받은 대역폭 또는 대역폭들에서 동시에 송신할 수 있고, 송신들은 단일 패킷으로 AP에 의해 수신될 수 있다.

[0065] [0098] 패킷(830)에서, 각각의 STA는, 앞서 논의된 바와 같이, 초기 다운링크 메시지에서 톤 할당 동안 자신에 할당된 채널들 또는 서브-채널들만을 이용한다. 이것은, AP 상에서 완전하게 직교하는 수신 프로세싱을 허용한다. 이러한 서브-대역들 각각 상에서 메시지들을 수신하기 위해, AP는 파일럿 톤들을 수신해야 한다. 이러한 파일럿 톤들은, 심볼당 위상 오프셋을 추정하여, 잔여 주파수 오프셋으로 인한 또는 위상 잡음으로 인한 데이터 심볼들에 걸친 위상 변경들을 정정하기 위해, 위상 추적을 위해 802.11 패킷들에서 이용된다. 이러한 위상 오프셋은 또한 시간 및 주파수 추적 루프들에 피딩될 수 있다.

[0066] [0099] 파일럿 톤들을 송신하기 위해, 적어도 2개의 상이한 옵션들이 이용될 수 있다. 먼저, 각각의 사용자는, 자신의 할당된 서브-대역들에 속하는 파일럿 톤들을 송신할 수 있다. 그러나, 낮은 대역폭 OFDMA 할당들의 경우, 이것은, 몇몇 사용자들에 대해 충분한 수의 파일럿 톤들을 허용하지 않을 수 있다. 예를 들어, 802.11a/n/ac의 20 MHz 송신에는 4개의 파일럿 톤들이 존재한다. 그러나, 사용자가 오직 5 MHz만을 할당받았다면, 사용자는 자신의 서브-대역에서 오직 하나의 파일럿 톤만을 가질 수 있다. 그 파일럿 톤에서, 딥 페이딩(deep fade)과 같은 어떠한 문제가 발생하면, 양호한 위상 추정을 획득하는 것은 매우 곤란할 수 있다.

[0067] [0100] 파일럿 톤들을 송신하는 다른 가능한 방법은, 각각의 사용자가, 단지 자신의 서브-대역에 속하는 파일럿 톤들이 아닌 모든 파일럿 톤들 상에서 송신하는 것을 수반할 수 있다. 이것은, 사용자당 더 많은 수의 파일럿 톤들이 송신되는 것을 초래할 수 있다. 그러나, 이것은, AP가 각각의 파일럿 톤을 다수의 사용자들로부터 동시에 수신하는 것을 초래할 수 있고, 이것은 AP가 프로세싱하기에 더 곤란할 수 있다. AP는 모든 사용자들에 대한 채널들을 추정할 필요가 있을 것이다. 이를 달성하기 위해, 모든 사용자들의 공간적 스트림들의 합에 대응하는 것과 같은 더 많은 LTF들이 필요할 수 있다. 예를 들어, 4명의 사용자들 각각이 2개의 공간적 스트림들과 연관되면, 이러한 접근법에서 8개의 LTF들이 이용될 수 있다.

[0068] [0101] 따라서, 각각의 STA는 HE-STF(835)를 송신할 수 있다. 패킷(830)에 도시된 바와 같이, HE-STF(835)는 8 μs 동안 송신될 수 있고, 2개의 OFDMA 심볼들을 포함할 수 있다. 각각의 STA는 또한 하나 이상의 HE-LTF(840)를 송신할 수 있다. 패킷(830)에 도시된 바와 같이, HE-LTF(840)는 8 μs 동안 송신될 수 있고, 2개의 OFDMA 심볼들을 포함할 수 있다. 예를 들어, 이전에서와 같이, 각각의 STA는, STA에 할당된 각각의 서브-대역에 대해 HE-LTF(840)를 송신할 수 있다. 각각의 STA는 또한 HE-SIG(845)를 송신할 수 있다. HE-SIG(845)의 길이는 U 각각에 대해 1 OFDMA 심볼 길이(4 μs)일 수 있고, 여기서 U는 송신에서 멀티플렉싱되는 STA들의 수이다. 예를 들어, 4개의 STA들이 업링크 패킷(830)을 전송하고 있으면, HE-SIG(845)는 16 μs일 수 있다. HE-SIG(845) 이후, 추가적인 HE-LTF들(840)이 송신될 수 있다. 마지막으로, 각각의 STA는 데이터(855)를 송신할 수 있다.

[0069] [0102] 결합된 업링크 패킷(830)을 전송하기 위하여, STA들 각각은 다른 STA들과 시간, 주파수, 및 전력적으로 서로 동기화될 수 있다. 그런 패킷에 대해 요구된 타이밍 동기화는 대략 100 ns 정도일 수 있다. 이 타이밍은 AP의 UL-OFDMA-어나운스 메시지에 응답함으로써 조정될 수 있다. 이 타이밍 정확성은 당업자들에게 알려진 몇몇 솔루션들을 사용하여 얻어질 수 있다. 예를 들어, SIFS(short interframe space)를 타이밍하기 위하여 802.11ac 및 802.11n 디바이스들에 의해 사용된 기술들은 결합된 업링크 패킷(830)을 얻기 위하여 필요한 타이밍 정확성을 제공하기에 충분할 수 있다. 이 타이밍 정확성은 또한, 업링크 클라이언트들 사이의 타이밍 에러들 및 왕복 지연 차이들을 흡수하기 위하여 업링크 OFDMA가 400 ns 가드 시간이 되도록 800 ns의 긴 가드 인터벌을 사용함으로써 유지될 수 있다.

[0070] [00103] 업링크 패킷(830)에 의해 처리되어야 하는 다른 기술적 문제는, 전송 디바이스들의 주파수들이 동기화되어야 하는 것이다. 업링크 패킷(830)의 것과 같은 UL-OFDMA 시스템에서 STA들 사이의 주파수-오프셋 동기화를 다루기 위하여 다수의 옵션들이 있다. 첫째, 각각의 STA는 자신의 주파수 차이들에 대해 계산 및 정정할 수 있다. 예를 들어, STA들은 STA들에 전송된 UL-OFDMA-어나운스 메시지에 기초하여 AP에 관하여 주파수 오프셋을 계산할 수 있다. 이 메시지에 기초하여, STA들은 시간-도메인 업링크 신호에 위상 램프(phase ramp)를 적용할 수 있다. AP는 또한, LTF들을 사용하여 각각의 STA에 대한 공통 위상 오프셋을 추정할 수 있다. 예를 들어, STA들에 의해 송신된 LTF들은 주파수에서 직교할 수 있다. 따라서, AP는 STA 임펄스 응답들을 분리하기 위하여 윈도우된(windowed)된 고속 푸리에 역변환(IFFT) 함수를 사용할 수 있다. 2개의 동일한 LTF 심볼들에 걸쳐 이들 임펄스 응답들의 변화는 우리에게 모든 각각의 사용자에 대한 주파수 오프셋 추정을 제공할 수 있다. 예를 들어, STA에서 주파수 오프셋은 시간에 따른 위상 램프를 유도할 수 있다. 따라서, 2개의 동일한 LTF 심볼들이 송신되면, AP는 주파수 오프셋의 추정을 얻기 위하여 2개의 임펄스 응답들에 걸쳐 위상의 기울기를 계산하도록 2개의 심볼들 사이의 차이들을 사용할 수 있을 수 있다. 이런 접근법은 당업자들에게 알려져 있을 수 있는 UL-MU-MIMO 메시지에서 제안된 톤-인터리브(tone-interleave)된 접근법과 유사할 수 있다.

[0071] [00104] 도 13은 고효율 패킷을 2 이상의 무선 통신 디바이스들에 송신하는 예시 방법에 대한 프로세스 흐름도를 예시한다. 이 방법은 AP와 같은 디바이스에 의해 행해질 수 있다.

[0072] [00105] 블록(905)에서, AP는 레거시 프리앰블(legacy preamble)을 송신하고, 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 통지하기에 충분한 정보를 포함한다. 예를 들어, 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 경고하기 위하여 사용될 수 있다. 레거시 패킷은 예비 비트 또는 예비 비트들의 결합을 포함할 수 있다. 이들 예비 비트들은 고효율 프리앰블에 대한 패킷을 계속하여 청취하도록 고효율 디바이스들에게 경고하고, 또한 레거시 디바이스들이 패킷을 연기하게 한다. 몇몇 양상들에서, 레거시 프리앰블을 송신하기 위한 수단 - 레거시 프리앰블은 패킷을 연기할 것을 레거시 디바이스들에게 통지하기에 충분한 정보를 포함함 -은 송신기(transmitter)를 포함할 수 있다.

[0073] [00106] 블록(910)에서, AP는 고효율 신호를 송신하고, 고효율 신호는 톤 할당(allocation) 정보를 포함하고, 톤 할당 정보는 2 이상의 무선 통신 디바이스들을 식별한다. 몇몇 양상들에서, 고효율 신호는 패킷 내 정보를 수신할 STA들을 식별하는 정보를 포함할 수 있고, 어느 서브-대역들이 STA들에 대해 의도되는지를 이들 STA들에게 경고할 수 있는 톤 할당 정보를 포함할 수 있다. 몇몇 양상들에서, 고효율 패킷은 또한 802.11ac 디바이스들이 패킷을 연기하게 하기에 충분한 정보를 포함할 수 있다. 몇몇 양상들에서, 고효율 신호를 송신하기 위한 수단 - 고효율 신호는 톤 할당 정보를 포함하고, 톤 할당 정보는 2 이상의 무선 통신 디바이스들을 식별함 - 은 송신기를 포함할 수 있다. 몇몇 양상들에서, 고효율 신호는, 다수의 공간 스트림들의 표시가 2 이상의 무선 통신 디바이스들 각각에 할당될 수 있다는 것을 더 포함할 수 있다. 예를 들어, 2 이상의 무선 통신 디바이스들 각각에는 하나 이상의 공간 스트림이 할당될 수 있다. 몇몇 양상들에서, 하나 이상의 공간 스트림들을 2 이상의 무선 통신 디바이스들 각각에 할당하기 위한 수단은 송신기 또는 프로세서를 포함할 수 있다.

[0074] [00107] 블록(915)에서, AP는 데이터를 2 이상의 무선 통신 디바이스들에 동시에 송신하고, 데이터는 2 이상의 서브-대역들 상에 포함된다. 예를 들어, AP는 최대 4개의 STA들에 데이터를 송신할 수 있다. 몇몇 양상들에서, 데이터를 2 이상의 무선 통신 디바이스들에 동시에 송신하기 위한 수단 - 데이터는 2 이상의 서브-대역들 상에 포함됨 -은 송신기를 포함할 수 있다.

[0075] [00108] 일부 양상들에서, AP는, IEEE 802.11a/n/ac 디바이스와 같은 레거시 디바이스에 대한 데이터 및 하나 이상의 고효율 디바이스에 대한 데이터 모두를 포함하는 하이브리드 패킷을 송신할 수 있다. 이러한 하이브리드 패킷은 레거시와 고효율 디바이스 모두를 포함하는 혼합된 환경에서의 대역폭의 보다 효율적인 사용을 허용할 수 있다. 예를 들면, 레거시 시스템에서 AP가 80 MHz의 사용하도록 구성된 경우, AP가 80 MHz 전체를 사용할 수 없는 디바이스에 패킷을 송신하는 경우, AP에 할당된 대역폭의 일부는 미사용될 수 있다. 이것은 고효율 패킷들의 사용에 의해 해결되는 하나의 문제이다. 그러나 STA들 중 일부가 고효율 디바이스이고 STA들 일부가 레거시 디바이스인 환경에서, AP가 사용하도록 구성된 전체 대역폭을 사용할 수 없는 레거시 디바이스로 송신할 때 대역폭은 여전히 미사용될 수 있다. 예를 들면, 이러한 시스템의 고효율 패킷들이 전체 대역폭을 사용할 수 있는 반면, 상술한 바와 같이, 레거시 패킷들은 그렇지 않을 수 있다. 따라서, 하이브리드 패킷을 제공하는 것이 유리할 수 있는데, 하이브리드 패킷에서, 레거시 디바이스는 패킷의 대역폭 중 일 부분에서 정보를 수신할 수 있는 반면, 고효율 디바이스는 패킷의 다른 부분에서 정보를 수신할 수 있다. 이러한 패킷은 하이브리드 패킷으로 지칭될 수 있는데, 그 이유는, 패킷의 일부가 IEEE 802.11a/n/ac 같은 레거시-호환 포맷에서 데이터를

송신할 수 있고, 패킷의 일부가 데이터를 고효율 디바이스들로 송신할 수 있기 때문이다.

[0076] [00109] 예시적인 하이브리드 패킷(1400)이 도 14에 도시되어 있다. 이러한 하이브리드 패킷은 AP와 같은 무선 디바이스에 의해 송신될 수 있다. 하이브리드 패킷은 데이터가 레거시 디바이스로 송신되는 레거시 부분, 및 데이터가 고효율 디바이스로 송신되는 고효율 부분을 포함할 수 있다.

[0077] [00110] 하이브리드 패킷(1400)은 복수의 레거시 프리앰블들을 포함할 수 있으며, 이들 각각은 패킷의 대역폭의 일부 부분을 통해 복제된다. 예를 들면, 예시적인 하이브리드 패킷(1400)은 패킷(1400)의 대역폭의 80 MHz를 통해 복제되는 4개의 20 MHz 레거시 프리앰블을 포함하는 80 MHz의 패킷으로 설명된다. 이러한 복제는 80 MHz 대역폭의 일부에서만 동작할 수 있는 다른 장치들이 패킷을 연기하는 것을 보장하기 위해 레거시 포맷들에서 사용될 수 있다. 일부 양상들에서, 네트워크의 디바이스들 각각은 디폴트로 1차 채널만을 모니터링할 수 있다.

[0078] [00111] 하이브리드 패킷(1400)은 IEEE 802.11a/n/ac과 같은 레거시 포맷에 규정된 것과 동일한 L-STF(1405) 및 L-LTF(1410)을 포함할 수 있다. 이들 필드는 상술된 것과 동일할 수 있다. 그러나 하이브리드 패킷(1400)의 L-SIG(1415)는 레거시 패킷의 그것과 다를 수 있다. L-SIG(1415)는 고효율 디바이스에 시그널링하기 위해 사용되는, 패킷이 하이브리드 패킷이라는 정보를 포함할 수 있다. 레거시 디바이스가 패킷에서 정보를 또한 수신할 수 있도록 하기 위해, 이 정보는 레거시 디바이스로부터 은닉되어야 해서, 이 정보는 레거시 디바이스들의 L-SIG(1415) 수신을 방해하지 않는다.

[0079] [00112] L-SIG(1415)는, 정보에 직교하는 1비트 코드를 L-SIG(1415)에 배치함으로써 패킷이 하이브리드 패킷이라는 것을 고효율 디바이스에 시그널링할 수 있다. 예를 들면, 상술한 바와 같이, 1비트 코드는 L-SIG(1415)의 Q-레일에 배치될 수 있다. 레거시 디바이스들은 1 비트 코드를 인지할 수 없을 수 있고 L-SIG(1415)를 정상적인 것으로 판독할 수 있는 반면, 고효율 디바이스는 이러한 1 비트 코드를 명확하게 찾을 수 있고 이것이 존재하는지 여부를 결정할 수 있다. 이 1 비트 코드는 하이브리드 패킷이 전송되고 있음을 고효율 디바이스에 시그널링하기 위해 사용될 수 있다. 일부 양상들에서, 1 비트 코드는, 코드를 찾도록 구성되지 않을 수 있는 레거시 디바이스들로부터 은닉되거나 레거시 디바이스들에 보이지 않을 수 있다. 일부 양상들에서, 레거시 디바이스는 1 비트 코드의 존재로 인한 어떠한 불규칙도 관측하지 않고 L-SIG(1415)를 이해할 수 있다. 일부 양상들에서 1차 채널의 L-SIG(1415)만이 고효율 디바이스가 HE-SIG(1425)에 대한 다른 채널들을 보도록 지시하는 1 비트 코드를 포함할 수 있다. 일부 양상들에서, L-SIG들(1415)의 수는 이 1 비트 표시자를 가질 수 있으며, 여기서, 표시자를 갖는 L-SIG들(1415)의 수는 레거시 패킷에 대해 사용될 채널들의 수와 동일이다. 예를 들면, 레거시 패킷이 제 1 및 제 2 채널 모두를 포함할 수 있지만, 제 3 채널은 포함하지 않으면, 제 1 및 제 2 채널의 L-SIG는 1 비트 표시자를 포함할 수 있는 반면, 제 3 채널의 L-SIG는 이러한 표시자를 포함하지 않을 수 있다. 고효율 디바이스는 1비트 코드를 포함하지 않는 L-SIG를 갖는 제 1 채널을 찾고, HE-SIG(1425)의 존재에 대해 그 채널을 모니터링하도록 구성될 수 있다. 일부 양상들에서, VHT-SIG-A(1420)의 대역폭 정보는 레거시 패킷(1430)이 얼마나 많은 대역폭을 사용할 것인지 및 그에 따라, HE 패킷(1435)이 시작할 수 있는 대역폭에 대한 정보를 포함할 수 있다. 일부 양상들에서, 1 비트 코드만이, 데이터를 HE 디바이스들에 송신하기 위해 사용될 채널들에서 송신될 L-SIG들(1415)에 포함될 수 있다. 예를 들면, 제 1 채널이 레거시 디바이스에 송신하기 위해 사용되고, 다른 세 채널들이 특정 패킷에서 HE 디바이스들에 송신하기 위해 사용되는 경우, 세 다른 채널들에서 송신되는 L-SIG들(1415) 각각은 1 비트 코드를 포함할 수 있다. 일부 양상들에서, HE 패킷에서, 각 L-SIG(1415)는 각 채널이 데이터를 HE 디바이스들에 송신하는데 이용될 수 있다는 것을 표시하기 위해 1 비트 코드를 포함할 수 있다. 일부 양상들에서, 이는 하이브리드 패킷 또는 HE 패킷의 HE 부분에 대해 사용되는 대역폭이 패킷의 L-SIG(1415)를 사용하여 시그널링되게 할 수 있다. 패킷의 HE 부분에 대해 사용된 대역폭이 L-SIG(1415)에서 시그널링되면, 이는 패킷의 HE-SIG(1425) 또는 하이브리드 패킷이 패킷의 HE 부분에 할당된 대역폭의 더 많은 부분에 걸치게 할 수 있다. 예를 들면, HE-SIG(1425)는 HE 패킷에 할당된 대역폭에 걸치게 구성될 수 있다. 일부 양상들에서, HE-SIG(1425)에 대해 20MHz만을 사용하는 것보다, HE-SIG(1425)에 대해 더 많은 대역폭을 사용하는 것은 더 많은 정보가 HE-SIG(1425)에서 송신되게 할 수 있다. 일부 양상들에서, HE-SIG(1425)의 제 1 심볼은 패킷의 HE에 할당된 대역폭의 각각의 20MHz 상에서 중복 송신될 수 있는 반면, HE-SIG(1425)의 나머지 심볼들은 패킷의 HE 부분에 할당된 전체 대역폭을 사용하여 송신될 수 있다. 예를 들면, HE-SIG(1425)의 제 1 심볼은 HE 또는 하이브리드 패킷의 HE 부분에 할당된 대역폭을 송신하는데 사용될 수 있고, 따라서, 후속 심볼들은 패킷의 HE 부분에 할당된 전체 대역폭을 통해 송신될 수 있다.

[0080] [00113] L-SIG(1415)에서 1-비트 코드를 수신하면, 고효율 디바이스들은, HE-SIG(1425)를 찾기 위해, AP에 할당된 대역폭의 보다 높은-대역폭 부분들, 이를 테면 보다 높은-대역폭 채널들에서 확인하도록 구성될 수 있다.

예를 들어, 하이브리드 패킷(1400)에서, 직교 방향으로 1-비트 코드를 갖는 L-SIG(1415)를 수신하면, 고효율 디바이스들은, 레거시 패킷과 함께, 다른 주파수 대역들에서 송신될 수 있는, HE-SIG(1425)와 같은 HE-SIG들에 대해 레거시 디바이스들에 데이터를 전달하는 채널과 떨어져있는 20 MHz 채널들에서 확인하도록 구성될 수 있다. 예를 들어, 예시적인 하이브리드 패킷(1400)에서, HE-SIG(1425)는 VHT-SIG-A(1420)와 동시에 송신되는 것으로 도시되어 있다. 이러한 예에서, 하이브리드 패킷(1400)은, 대역폭의 하위 부분(lower portion) 상에는 IEEE 802.11ac-호환가능한 패킷을 포함할 수 있으며 그리고 대역폭의 상위 부분(higher portion) 상에는 고효율 패킷을 포함할 수 있다. 하이브리드 패킷(1400)은 또한, 하위 부분에 IEEE 802.11a 또는 IEEE 802.11n-호환가능한 패킷을 포함할 수 있다. 중요하게는, 하위 부분이 어떤 타입의 패킷인지에 상관없이, L-SIG(1415)는, 패킷이 하이브리드 패킷임을 고효율 디바이스들에게 시그널링하고, 그에 따라 다른 주파수에서 HE-SIG(1425)를 찾도록 하기에 충분한 시그널링 정보를 포함하도록 구성될 수 있다.

[0081] [00114] 몇몇 양상들에서, HE-SIG(1425)는 이전에 논의된 이전의 고효율 신호 필드들 중 임의의 것과 유사할 수 있다. 몇몇 양상들에서, 고효율 패킷들과 하이브리드 패킷들 모두를 송신하는 AP는, 패킷이 고효율 패킷임을 나타내기 위해, Q-레일에서 1-비트 신호를 이용하기 보다는, HE-SIG(1425) 내에 회전된 BPSK 성상도(QBPSK) 심볼을 갖는 심볼을 이용할 수 있는데, 이는, 패킷이 하이브리드 패킷(1400)과 같은 하이브리드 패킷임을 시그널링하기 위해 Q-레일 상에 1-비트 신호를 이용하는 것이 대신 이용될 수 있기 때문이다. 예를 들어, HE-SIG(1425)는, 이전에 논의된 바와 같이, 이를 테면 그룹 ID를 이용함으로써, 어떤 디바이스 또는 디바이스들이 패킷 내의 정보를 수신할 수 있는지를 고효율 디바이스들에게 나타내는 데에 이용될 수 있다. 따라서, 고효율 디바이스들은 L-STF(1405), L-LTF(1410), 및 L-SIG(1415)를 수신 및 디코딩하도록 구성될 수 있다. L-SIG(1415)가 1-비트 코드를 포함하는 경우, 고효율 디바이스들은, 하이브리드 패킷의 고효율 부분이 그 특정 디바이스에 대한 정보를 포함하는지를 결정하기 위해, 보다 높은 주파수 대역에 있는 HE-SIG(1425)를 로케이팅하고 디코딩하도록 구성될 수 있다.

[0082] [00115] 몇몇 양상들에서, 레거시 패킷은, 도시된 바와 같이, 대역폭의 20 MHz 만을 차지할 수 있다. 하지만, 패킷(1400)의 레거시 부분은 또한, 상이한 양의 대역폭을 또한 차지할 수 있다. 예를 들어, 하이브리드 패킷의 레거시 부분은 40 MHz, 60 MHz, 80 MHz 또는 다른 크기의 레거시 패킷을 포함할 수 있는 한편, 하이브리드 패킷(1400)의 고효율 부분은 이용가능한 대역폭의 나머지를 이용할 수 있다. 몇몇 양상들에서, 20 MHz 이외의 크기들의 채널들이 또한 이용될 수 있다. 예를 들어, 채널들은 5, 10, 15, 40 MHz, 또는 다른 크기들일 수 있다. 몇몇 양상들에서, 레거시 VHT-SIG-A(1420) 다음에, 레거시 패킷(1430)이 1차 채널을 통해 레거시 디바이스에 송신될 수 있다. 몇몇 양상들에서, 레거시 패킷(1430)은 적어도 1차 채널을 포함할 수 있으며, 부가적인 채널들을 또한 포함할 수 있다. 예를 들어, 이러한 레거시 패킷(1430)은, IEEE 802.11a, 802.11n, 또는 802.11ac 디바이스들과 호환가능할 수 있다. 몇몇 양상들에서, 하나 이상의 HE-SIG들(1425) 다음에, 고효율 패킷(1435)이, AP에 대해 이용가능한 대역폭의 적어도 일부를 이용하여, 하나 이상의 고효율 디바이스들에게 송신될 수 있다. 몇몇 양상들에서, 레거시 패킷은 다수의 레거시 디바이스들에게 전송될 수 있다. 예를 들어, 하이브리드 패킷은, 2개 이상의 802.11ac-호환가능한 STA들에 전송되는 MU-MIMO 802.11ac 패킷을 포함할 수 있다.

[0083] [00116] 도 15는 하이브리드 패킷을 송신하는 예시적인 방법(1500)을 도시한다. 이 방법은, 이를 테면 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[0084] [00117] 블록(1505)에서, AP는 대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들에 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 갖는다. 몇몇 양상들에서, 하나 이상의 제 1 디바이스들은 레거시 디바이스들일 수 있다. 몇몇 양상들에서, 대역폭의 제 1 부분은 1차 채널일 수 있다. 몇몇 양상들에서, 제 1 디바이스에 송신하기 위한 수단은 송신기일 수 있다.

[0085] [00118] 블록(1510)에서, AP는 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들에 동시에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 송신은, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들이 전송된 주파수 대역을 로케이팅하기 위해, 능력들의 제 2 세트를 갖는 디바이스들에 대한 표시를 포함하고, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 어떠한 실질적인 영향도 미치지 않도록 전송된다. 몇몇 양상들에서, 하나 이상의 제 2 디바이스들에 송신하기 위한 수단은 송신기일 수 있다. 몇몇 양상들에서, 프리앰블은 레거시 프리앰블일 수 있고, 표시는 레거시 프리앰블 내의 L-SIG 내의 1-비트 코드일 수 있다. 몇몇 양상들에서, 표시는, 1차 채널에서, 또는 1차 채널 및 하나 이상의 다른 채널들에서, 또는 다른 채널들에서, L-SIG 내에 포함될 수 있다.

[0086] [00119] 도 16은 하이브리드 패킷을 수신하는 예시적인 방법을 나타낸다. 일부 양상들에서, 이 방법은 고효율

무선 통신 디바이스와 같은 STA에 의해 사용될 수 있다.

[0087] [00120] 블록(1605)에서, STA는 1차 채널에서 레거시 프리앰블을 수신한다. 일부 양상들에서, 레거시 프리앰블을 수신하기 위한 수단은 수신기일 수 있다.

[0088] [00121] 블록(1610)에서, STA는 레거시 프리앰블이 하나 이상의 넌-1차 채널들에서 고효율 신호 필드를 로케이팅하도록 고효율 디바이스들에 통지하기에 충분한 정보를 포함하는지를 결정한다. 일부 양상들에서, 결정하기 위한 수단은 프로세서 또는 수신기일 수 있다.

[0089] [00122] 블록(1615)에서, STA는 하나 이상의 넌-1차 채널들 중 적어도 하나에서 고효율 신호 필드를 수신한다. 일부 양상들에서, 고효율 신호 필드를 수신하기 위한 수단은 수신기일 수 있다. 일부 양상들에서, STA는 하나 이상의 넌-1차 채널들 중 적어도 하나를 통해 데이터를 추가로 수신할 수 있다. 일부 양상들에서, 데이터를 수신하기 위한 수단은 수신기일 수 있다.

[0090] [00123] 고효율 신호 필드의 지연 확산 보호 및 잠재적 구조들

[0091] [00124] 일부 양상들에서, 옥외 또는 다른 무선 네트워크들은 1㎲를 초과하는 것들과 같은 상대적으로 높은 지연 확산들을 갖는 채널들을 가질 수 있다. 예를 들어, 피코/매크로 셀 타워 액세스 포인트와 같은 높은 고도의 액세스 포인트는 높은 지연 확산들을 가질 수 있다. 802.11a/g/n/ac에 따르는 것들과 같은 다양한 무선 시스템들은 단지 800ns의 사이클릭 프리픽스(CP) 길이를 사용한다. 이 길이의 거의 절반이 송신 및 수신 필터들에 의해 소비될 수 있다. 이러한 비교적 짧은 CP 길이 및 송신 및 수신 필터들로부터의 오버헤드 때문에, 이러한 802.11a/g/n/ac 네트워크들은 높은 지연 확산을 갖는 옥외 전개에 적당하지 않을 수도 있다.

[0092] [00125] 본 개시의 양상들에 따르면, 이러한 레거시 시스템들과 하위 호환성이 있고 800ns보다 더 긴 사이클릭 프리픽스들을 지원하는 패킷 포맷(PHY 파형)이 제공되어, 옥외 전개들에서 2.4 및 5㎓ WiFi 시스템들의 사용을 가능하게 할 수도 있다.

[0093] [00126] 예를 들어, 정보의 하나 이상의 비트들이 L-STF, L-LTF, L-SIG 중 하나 이상에, 또는 HE-SIG와 같은 패킷 프리앰블의 다른 부분에 임베드될 수 있다. 이러한 정보의 하나 이상의 비트들은 위에서와 같이 이들을 디코딩하도록 구성된 디바이스들에 대해 포함될 수 있지만, 레거시(예를 들어, 802 11a/g/n/ac) 수신기들에 의한 디코딩에 영향을 주지 않을 수도 있다. 이러한 비트들은 옥외 세팅, 또는 잠재적으로 높은 지연 확산을 갖는 다른 세팅에서 이러한 패킷의 사용을 가능하게 하기 위해 지연 확산 보호를 포함하는 패킷의 표시를 포함할 수도 있다.

[0094] [00127] 일부 양상들에서, 지연 확산 보호 또는 허용 오차를 제공하는 데 다수의 방법들이 사용될 수도 있다. 예를 들어, 심볼 지속기간을 증가(예를 들어, 동일한 샘플 레이트를 유지하면서 FFT 길이 증가 또는 샘플 레이트를 감소시키도록 다운클록킹)시키는 데 서로 다른 송신 파라미터들이 사용될 수 있다. 심볼 지속기간을 예컨대, 2x 또는 4x로 증가시키는 것은 더 높은 지연 확산들에 대한 허용 오차를 증가시킬 수 있다.

[0095] [00128] 일부 양상들에서, 증가된 심볼 지속기간은 L-SIG 또는 HE-SIG의 필드에서 시그널링될 수 있다. 일부 양상들에서, 네트워크 상의 다른 패킷들은 증가된 심볼 지속기간에 대한 시그널링을 포함하는 것이 아니라, 그보다는 종래의 또는 "정규의" 심볼 지속기간을 갖는 패킷들일 수도 있다. 증가된 심볼 지속기간은 일반적으로 증가된 FFT 크기 및 그에 따라 주파수 에러에 대한 증가된 감도 및 증가된 PAPR을 의미하기 때문에 "정규의" 심볼 지속기간을 확보하는 것은 어떤 경우들에는 바람직할 수도 있다. 또한, 네트워크 내의 모든 각각의 디바이스가 이러한 증가된 지연 확산 허용 오차를 필요로 하는 것은 아닐 것이다. 따라서 어떤 경우들에는, 증가된 FFT 크기가 성능을 손상시킬 수 있고, 따라서 일부 패킷들이 종래의 심볼 지속기간을 사용하는 것이 바람직할 수도 있다.

[0096] [00129] 따라서 일부 양상들에서, 모든 패킷들이 L-SIG 또는 HE-SIG 필드 뒤에 증가된 심볼 지속기간을 포함할 수도 있다. 다른 양상들에서는, L-SIG 또는 HE-SIG에서 증가된 심볼 지속기간을 시그널링하는 정보를 포함하는 패킷들만이 증가된 심볼 지속기간을 포함할 수도 있다. 일부 양상들에서, 증가된 심볼 지속기간에 대한 시그널링은 HE-SIG, 그리고 L-SIG, VHT-SIG-A 또는 패킷 내의 다른 필드 내에 포함될 수도 있다. 일부 양상들에서, 이 시그널링은 예를 들어, L-SIG 또는 HE-SIG와 같은 SIG 필드의 심볼에서 Q-BPSK 회전에 의해 전달될 수도 있다. 일부 양상들에서, 이 시그널링은 패킷의 필드의 허수 축과 같은 직교 레일에서 정보를 숨김으로써 전달될 수도 있다.

[0097] [00130] 일부 양상들에서, 심볼 지속기간 증가는 업링크 또는 다운링크 패킷들 중 어느 하나 또는 둘 모두에 사

용될 수도 있다. 업링크 패킷의 경우, AP는 선행하는 다운링크 패킷에서, 업링크 패킷이 증가된 심볼 지속기간을 사용하여 송신될 수 있음을 시그널링할 수 있다. 예를 들어, 업링크 OFDMA 패킷에서, AP는 더 긴 심볼 지속기간들을 사용하도록 사용자에게 통지하는 톤 할당 메시지를 전송할 수도 있다. 그 경우, 업링크 패킷 자체는 특정 심볼 지속기간을 나타내는 표시를 전달할 필요가 없을 수도 있다. 일부 양상들에서, AP로부터 STA로의 신호는 달리 언급되지 않는 한, 모든 향후의 업링크 패킷들에서 특정 심볼 지속기간을 사용하도록 STA에 통보할 수 있다.

[0098] [00131] 일부 양상들에서, 이러한 지연 확산 보호는 앞서 설명한 것들과 같은 고효율 패킷들에 포함될 수도 있다. 본 명세서에서 제시된 프리앰블 포맷들은 레거시 디바이스들이 패킷이 802.11n, 802.11a 패킷인지 아니면 802.ac 패킷인지를 검출할 수 있게 하면서 지연 확산 보호가 패킷들에 포함될 수 있는 방식을 제공한다.

[0099] [00132] 본 명세서에서 제시된 프리앰블 포맷들은 IEEE 802.11ac(혼합 모드 프리앰블) 패킷에서와 같이 L-SIG-기반 연기를 확보할 수 있다. 802.11 a/an/ac 스테이션들에 의해 디코딩 가능한 프리앰블의 레거시 선택을 하는 것은 동일한 송신에서 레거시 및 HE 디바이스들을 혼합하는 것을 가능하게 할 수 있다. 본 명세서에서 제공된 프리앰블 포맷들은 HE SIG에 대한 보호를 제공할 수 있으며, 이는 강력한 성능의 달성에 도움이 될 수 있다. 예를 들어, 이러한 프리앰블 포맷들은 비교적 엄중한 표준 테스트 시나리오들에서 SIG 에러율을 1% 또는 그 미만으로 감소시키는 데 도움이 될 수 있다.

[0100] [00133] 도 17은 본 개시물의 양상들에 따른, 하나의 예시적인 HE 프리앰블 포맷(preamble format)을 갖는 패킷(packet)을 예시한다. 예시적인 HE 프리앰블 포맷은 VHT 프리앰블 포맷과 비교된다. 예시된 바와 같이, HE 프리앰블 포맷은 제 1 타입의 디바이스(예를 들면, 802.11a/ac/n 디바이스들)에 의해 디코딩가능한(decodable) 하나 이상의 신호(SIG) 필드들 및 제 2 타입의 디바이스들(예를 들면, HE 디바이스들)에 의해 디코딩가능한 하나 이상의 SIG 필드들(HE-SIG1)을 포함할 수 있다. 예시된 바와 같이, 802.111/ac/n 디바이스들은 L-SIG에서 지속기간 필드(duration field)에 기초하여 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다. 예시된 바와 같이, 반복되는 HE-SIG 필드 이후, 패킷이 VHT 패킷인 경우를 디바이스가 이미 알고 있을 수 있으며, 그에 따라 VHT-STF 이득 설정에 문제가 없을 수 있다.

[0101] [00134] 도 17에 도시된 예시적인 포맷에서, HE-SIG1 필드들은 반복되고 그리고 HE 디바이스들에 대해 HE-SIG1에 대한 보호를 제공하는 정규의 가드 인터벌(normal guard interval)(GI)에 의해 선행될 수 있다. 반복되는 HE-SIG1으로 인하여, 이러한 패킷은 낮은 신호-대-잡음비 동작점(lower signal-to-noise ratio operating point)을 가질 수 있으며, 그에 따라 심볼-간-간섭(inter-symbol-interference; ISI)으로부터 보다 강력한 보호들을 제공할 수 있다. 몇몇 양상들에서, L-SIG는, L-SIG가 영향을 받지 않을 수 있는 이후에, 2개의 심볼들에 대한 Q-BPSK 체크들에 기초한 패킷 타입 검출(packet type detection)로서 6Mbps로 송신할 수 있다.

[0102] [00135] 전술된 바와 같이, HE 디바이스들에 HE 패킷을 시그널링하기 위해) 다양한 기술들이 이용될 수 있다. 예를 들면, HE 패킷은 HE-SIG1에서의 CRC 체크에 기초하여, 또는 HE-SIG1의 반복에 기초하여, L-SIG에 직교 레일 표시(orthogonal rail indication)를 배치함으로써 시그널링될 수 있다.

[0103] [00136] HE-SIG2에 대한 지연 확산 보호(delay spread protection)는 다양한 형태들을 취할 수 있다. 예를 들면, HE-SIG2는 부가적인 지연 확산 보호를 제공하기 위해 (20MHz에서) 128 톤들에 걸쳐서 송신될 수 있다. 이는 1.6 $\mu$s의 가드 인터벌을 초래할 수 있지만, 종래의 개수의 톤들을 포함할, L-LTF에 기초하여 계산된 채널 추정들의 보간(interpolation)을 요구할 수 있다. 다른 예로서, HE-SIG2는 동일한 심볼 지속기간을 가질 수 있지만, 1.6 $\mu$s 사이클릭 프리픽스(cyclic prefix)로 전송될 수 있다. 이는 25%의 종래의 값보다 더 사이클릭 프리픽스 오버헤드(cyclic prefix overhead)로 이어질 수 있지만, 보간을 요구하지 않을 수 있다. 일 양상에서, HE-SIG2는 또한, 20 MHz 마다 반복하기보다는, 전체 대역폭에 걸쳐서 전송될 수 있다. 이는, 전체 대역폭을 표시하기 위해, HE-SIG1에 대역폭 비트들이 배치되는 것을 요구할 수 있다.

[0104] [00137] 도 18은 본 개시물의 양상들에 따른, 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다. 도 17에서와 같이, 예시적인 HE 프리앰블 포맷은 VHT 프리앰블 포맷과 비교된다. 이전과 같이, IEEE 802.11 a/ac/n 디바이스들은 L-SIG에서 지속기간 필드에 기초하여 패킷을 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다. 도 18에 도시된 예시적인 포맷에서, HE-SIG1 필드들은 반복될 수 있지만, 제 1 HE-SIG1 필드는 정규의 가드 인터벌(normal guard interval)에 의해 선행될 수 있는 반면, 제 2 HE-SIG1은 정규의 가드 인터벌에 선행한다.

[0105] [00138] HE-SIG1의 이러한 반복은, 제 1 HE-SIG1 이전 및 제 2 HE-SIG1 이후에 배치되는 가드 인터벌과 함께,

HE 디바이스들에 대한 보호를 제공할 수 있다. HE-SIG1 섹션의 중간 부분이 비교적 큰 CP를 갖는 HE-SIG1 심볼로서 나타날 수 있는 점이 주목될 수 있다. 이러한 양상에서, L-SIG 이후의 제 1 심볼에 대한 Q-BPSK 체크가 영향을 받지 않을 수 있다. 그러나, 제 2 HE-SIG1 이후의 가드 인터벌로 인해, 제 2 심볼에 대한 Q-BPSK 체크가 임의의 결과들을 제공할 수 있다. 그러나, 이러한 임의의 결과들은 VHT 디바이스들에 부정적인 영향을 미칠 수 없다. 예를 들면, VHT 디바이스들은 패킷을 802.11ac 패킷으로서 분류할 수 있지만, 이 시점에서 디바이스들은 VHT-SIG CRC 체크를 수행하려고 시도할 수 있으며, 이는 실패할 것이다. 따라서, VHT 디바이스들은, L-SIG 이후의 제 2 심볼에 대한 Q-BPSK 체크의 임의의 결과들에도 불구하고, 이러한 패킷을 여전히 연기할 것이다.

[0106] [00139] 이러한 VHT 디바이스들(IEEE의 802.11ac와 호환가능한 것)과 같은 레거시 디바이스들에 대한 자동-검출 프로세스는, 그러한 디바이스들이 도 18에서의 패킷을 연기하게 할 것이기 때문에, 이러한 패킷들은 6 Mbps를 여전히 전달할 수 있다. 도 17의 패킷에서와 같이, 전술된 다수의 기술들은, 패킷이 HE 패킷인 것을 HE 디바이스들에 시그널링하는데 이용될 수 있다. 마찬가지로, HE 디바이스들은, HE-SIG2에 포함된 필드와 같이, 다수의 방식들로 패킷의 지연 확산 보호에 관한 정보를 제공할 수 있다.

[0107] [00140] 도 19는 본 개시물의 양상들에 따른, 다른 예시적인 HE 프리앰블 포맷을 갖는 패킷을 예시한다. 이전과 같이, 예시적인 HE 프리앰블 포맷은 802.11ac VHT 프리앰블 포맷과 유사하다. 예시된 바와 같이, 802.11a/ac/n 디바이스들은 L-SIG에서 지속기간 필드에 기초하여 패킷을 연기할 수 있다. L-SIG 뒤에는 반복되는 고 효율 SIG(HE-SIG) 필드가 이어질 수 있다.

[0108] [00141] 도 19에 도시된 예시적인 포맷에서, DGI(double guard interval)가 반복되는 HE-SIG1 필드들에 앞설 수 있다. 그러한 이중 가드 인터벌의 사용은 L-SIG 후에 제 1 심볼에 대한 Q-BPSK 체크의 랜덤 결과를 발생시킬 수 있다. 따라서, 일부 레거시 디바이스들은, L-SIG가 6 Mbps의 레이트를 시그널링하면 이러한 패킷을 연기하지 않을 수 있다. 따라서, 그러한 패킷 내의 L-SIG는, 모든 IEEE 802.11a/ac/n 디바이스들이 패킷을 연기하는 것을 보장하기 위해, 6 Mbps 이외의 레이트를 시그널링할 필요가 있을 수 있다. 예를 들면, L-SIG는 9 Mbps의 레이트를 시그널링할 수 있다. 앞서 논의된 기술들과 유사한 기술들은, 패킷이 HE 패킷이라는 것을 시그널링하는데 사용될 수 있고, 패킷이 지연 확산 보호를 포함하는지를 시그널링하는데 사용될 수 있다.

[0109] [00142] 도 17-19에 도시된 것들과 같이, 프리앰블 포맷들에 대한 다양한 최적화가 제공될 수 있다. 예를 들면, 도 18 및 도 19에 도시된 예시적인 포맷들에 대해, 오버헤드를 절약하기 위해, 제 2 HE-SIG1 심볼을 절단하고 다음 심볼을 조기에 시작하는 것이 가능할 수 있다. 게다가, HE-LTF들 후에 SIG-B를 갖는 약간의 이점이 존재할 수 있고, 이것은 MU-MIMO에 대해 사용자 당 비트들을 제공할 수 있다.

[0110] [00143] 도 20은 HE-SIG 1 필드에 대한 예시적인 비트 할당을 예시한다. 예시된 바와 같이, BW 표시를 위한 2-3 비트들, 길이 표시를 위한 8-비트, 더 긴 심볼들이 사용되는 것을 표시하기 위한 비트, 2-3 예비 비트들, CRC를 위한 4 비트들, 및 6 테일 비트들이 존재할 수 있다. 더 긴 심볼들 ON 비트가 HE-SIG1에 제공되면, 이것은 다음 중 어느 하나: HE-SIG2가 지연 확산 보호를 갖는다는 것 또는 HE-SIG2가 증가된 FFT 크기를 사용한 후의 모든 것 중 어느 하나를 시그널링하는데 사용될 수 있다. 위의 HE- SIG 포맷들 – HE-SIG는 HE-SIG1 및 HE-SIG2로 구성됨 – 은 지연 확산 보호를 허용할 수 있고, OFDMA 패킷들과 같이 다중 액세스를 허용하는 패킷들에 사용될 수 있다.

[0111] [00144] 레거시 프리앰블을 갖는 업링크 패킷

[0112] [00145] 도 21은, 하위-호환 가능 다중 액세스 무선 통신들을 가능하게 하는데 사용될 수 있는 업링크 물리 계층 패킷(2100)의 예시적인 구조를 예시한다. 통상적으로, 업링크 패킷에서, 레거시 프리앰블이 필요하지 않을 수 있는데, 왜냐하면 NAV가 AP의 초기 다운링크 메시지에 의해 설정되기 때문이다. AP의 초기 다운링크 메시지는 네트워크 상의 레거시 디바이스들로 하여금 업링크 패킷을 연기하게 할 수 있다. 그러나, 일부 무선 디바이스들은 AP로 송신하는 STA들의 범위 내에 있지만 AP의 범위 외부에 있을 수 있다. 따라서, 이러한 디바이스들은, 자신들이 레거시 디바이스들인 경우에, 자신들이 AP의 초기 다운링크 메시지를 수신하지 않았을 때, AP에 대해 연기하지 않을 수 있다. 이러한 디바이스들은 또한 도 12에서의 것들과 같은 업링크 패킷을 연기하지 않을 수 있는데, 왜냐하면 그러한 패킷들이 레거시 디바이스들이 인식할 수 있는 레거시 프리앰블을 갖지 않기 때문이다. 따라서, 그러한 디바이스의 송신은 업링크 패킷과 간섭할 수 있고, 따라서 레거시 디바이스들로 하여금 패킷을 연기하게 하기에 충분한 레거시 프리앰블을 포함하는 업링크 패킷을 송신하는 것이 바람직할 수 있다. 이러한 업링크 패킷들은 다수의 가능한 형태들을 취할 수 있다. 업링크 패킷(2100)은 레거시 프리앰블을 포함하는 예시적인 업링크 패킷이다. 패킷(2100)이 패킷의 각각의 부분에 대한 시간들을 포함하지만, 이러

한 시간들은 단지 예시적이라는 것을 유의하라. 패킷(2100)의 각각의 부분은 표시된 것보다 더 길거나 더 짧을 수 있다. 일부 양상들에서, 레거시 디바이스들이 프리앰블의 레거시 부분을 디코딩하고 패킷(2100)을 연기하도록 허용하기 위해, L-STF, L-LTF 및 L-SIG와 같은 프리앰블의 레거시 부분들이 나열된 시간들인 것이 유리할 수 있다.

[0113] [00146] 따라서, 패킷(2100)은, 그러한 레거시 디바이스들이 인식할 수 있는 레거시 프리앰블을 제공함으로써, 업링크 패킷을 연기하도록 그러한 레거시 디바이스들에 통지하는데 사용될 수 있다. 이러한 레거시 프리앰블은 L-STF, L-LTF 및 L-SIG를 포함할 수 있다. 패킷(830)에서와 같이, 송신 디바이스들 각각은 자신들의 할당된 대역폭 상에서 그 자신들의 프리앰블을 송신하도록 구성될 수 있다. 이러한 레거시 프리앰블들은, AP의 초기 다운링크 메시지를 청취하지 않은 노드들로부터 업링크 통신들을 보호할 수 있다.

[0114] [00147] 패킷(830)에서와 같이, 다수의 디바이스들 각각, 여기서 N 개의 디바이스들은 자신들의 할당된 대역폭으로 동시에 송신할 수 있다. 레거시 프리앰블 다음에, 각각의 디바이스는 자신의 할당된 톤들 상에서 고효율 프리앰블을 송신할 수 있다. 예를 들면, 각각의 디바이스는 그 자신의 할당된 톤들 상에서 HE-SIG를 송신할 수 있다. 이러한 HE-SIG 다음에, 이후 각각의 디바이스는 HE-STF를 송신할 수 있고, 하나 이상의 HE-LTF들을 송신할 수 있다. 예를 들면, 각각의 디바이스는 단일 HE-STF를 송신할 수 있지만, 그 디바이스에 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들을 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는 가장 높은 수의 공간 스트림들을 갖는 디바이스에 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들을 송신할 수 있다. 공간 스트림들의 이러한 할당은, 예를 들면, AP의 초기 다운링크 메시지에서 이루어질 수 있다. 각각의 디바이스가 동일한 수의 HE-LTF들을 전송하면, 이것은 PAPR(peak-to-average-power ratio)을 감소시킬 수 있다. 그러한 PAPR의 감소가 요구될 수 있다. 추가로, 각각의 디바이스가 동일한 수의 HE-LTF들을 송신하면, 이것은 AP에 대해 수신된 업링크 패킷을 프로세싱하는 것을 더 용이하게 할 수 있다. 예를 들면, 상이한 수의 HE-LTF들이 각각의 디바이스에 의해 전송되면, AP는, 다른 디바이스로부터 데이터를 수신하면서, 하나의 디바이스에 대한 프리앰블을 수신할 수 있다. 이것은 AP에 대해 패킷을 디코딩하는 것을 더 복잡하게 할 수 있다. 따라서, 각각의 디바이스들에 대해 동일한 수의 HE-LTF들을 사용하는 것이 선호될 수 있다. 예를 들면, 송신 디바이스들 각각은 임의의 디바이스가 수신하는 공간 스트림들의 최대수를 결정하고, 그 수에 대응하는 수의 HE-LTF들을 송신하도록 구성될 수 있다.

[0115] [00148] 몇몇 양상들에서, 이러한 패킷의 L-STF는 대략 200ns까지 정도의 작은 사이클릭 시프트들을 포함할 수 있다. 큰 사이클릭 시프트들은 교차-상관에 기초하여 검출 알고리즘을 이용할 수 있는 레거시 디바이스들에 있어 이러한 L-STF들을 발행하게 할 수 있다. 이러한 패킷(2100)의 HE-STF는 대략 800ns 정도의 더 큰 사이클릭 시프트들을 포함할 수 있다. 이는 업링크 패킷(2100)을 수신하는 AP에서 보다 정확한 이득 세팅들을 허용할 수 있다.

[0116] [00149] 도 22는 하위-호환 가능한 다중 액세스 무선 통신들을 가능케 하는데 이용될 수 있는 업링크 물리 계층 패킷(2200)의 다른 예시적인 구조를 예시한다. 이 패킷(2200)은 패킷(2100)과 유사할 수 있지만, 이 패킷(2200)에서, 송신 디바이스들 각각은 HE-STF를 송신하지 않을 수 있다. 대신, 송신 디바이스들 각각은 예컨대, 대략 800nm 정도의 더 큰 사이클릭 시프트들을 갖는 L-STF를 송신할 수 있다. 이는 교차-상관 패킷 검출기들을 갖는 레거시 디바이스들에 영향을 줄 수 있지만, 이는 패킷이 더 짧게 되도록 허용할 수 있는데, 그 이유는 이것이 송신 디바이스들로 하여금 HE-STF를 송신하지 않도록 허용할 수 있기 때문이다. 패킷(2200)이 패킷의 각각의 부분에 대한 시간들을 포함하지만, 이들 시간들은 단지 예시적이며, 패킷의 각각의 부분은 표시된 것보다 더 길거나 짧게 될 수 있다. 몇몇 양상들에서, 이것은 레거시 디바이스들이 프리앰블의 레거시 부분을 디코딩하고 패킷(2200)을 연기하도록 허용하기 위해 나열된 시간들에 대한 L-STF, L-LTF, 및 L-SIG와 같은 프리앰블의 레거시 부분들에 대해 유익할 수 있다.

[0117] [00150] 패킷(2200)에서, 각각의 디바이스는 그 디바이스에 할당된 공간적 스트림들의 수에 대응하는 다수의 HE-LTF들을 송신할 수 있다. 몇몇 양상들에서, 각각의 디바이스는 대신, 가장 높은 수의 공간적 스트림들에 할당되는 디바이스에 할당되는 공간적 스트림들의 수에 대응하는 다수의 HE-LTF들을 송신할 수 있다. 위에서 논의된 바와 같이, 이러한 접근법은 PAPR을 감소시킬 수 있다.

[0118] [00151] 몇몇 양상들에서, 더 긴 심볼 지속기간은 지연 확산 보호 및 타이밍 오프셋으로부터의 보호를 제공할 수 있다. 예를 들어, 업링크 패킷을 송신하는 디바이스들은 동시에 패킷을 송신하기 시작하는 것이 아니라 대신 약간 상이한 시간들에 시작할 수 있다. 더 긴 심볼 지속기간은 또한 이러한 인스턴스들에서 패킷을 해석하는데 있어 AP를 도울 수 있다. 몇몇 양상들에서, 디바이스들은 AP의 다운링크 트리거 메시지의 신호에 기초하

여 더 긴 심볼 지속기간으로 송신하도록 구성될 수 있다. 몇몇 양상들에서, 패킷(830)과 같은 그린-필드 패킷에 대해, 전체 파형은, 레거시 호환성에 대한 필요가 없기 때문에 더 긴 심볼 지속기간에서 송신될 수 있다. 패킷(2100 또는 2200)과 같은 레거시 프리앰블을 포함하는 업링크 패킷에서, 레거시 프리앰블은 종래의 심볼 지속기간으로 송신될 수 있다. 몇몇 양상들에서, 레거시 프리앰블 이후의 부분은 더 긴 심볼 지속기간으로 송신될 수 있다. 몇몇 양상들에서, 더 긴 심볼 지속기간은 더 작은 대역폭의 기존의 IEEE 802.11 톤 플랜을 이용함으로써 달성될 수 있다. 예를 들어, 더 작은 서브-캐리어 간격이 이용될 수 있으며, 이는 다운-클로킹으로서 지칭될 수 있다. 예를 들어, 대역폭의 5MHz 부분은 64-비트 FFT 802.11a/n/ac 톤 플랜을 이용할 수 있는 반면에, 20MHz는 종래식으로 이용될 수 있다. 따라서, 각각의 톤은 이러한 구성에서 통상적인 IEEE 802.11 a/n/ac 패킷보다 4배 더 길 수 있다. 다른 지속기간들이 또한 이용될 수 있다. 예를 들어, 통상적인 IEEE 802.11 a/n/ac 패킷에 있는 한, 2배인 톤들을 이용하는 것이 바람직할 수 있다.

[0119] [00152] 도 23은 패킷을 수신하는 예시적인 방법(2300)을 예시한다. 이 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[0120] [00153] 블록(2305)에서, AP는 대역폭의 제 1 섹션의 제 1 부분을 수신하고, 제 1 부분은 제 1 무선 디바이스에 의해 송신되고, 제 1 부분은 제 1 프리앰블의 고효율 섹션 및 패킷을 연기하도록 레거시 디바이스들에 통지하기에 충분한 정보를 포함하는 제 1 프리앰블의 레거시 섹션을 포함한다. 몇몇 양상들에서, 수신하기 위한 수단은 수신기일 수 있다.

[0121] [00154] 블록(2310)에서, AP는 대역폭의 제 2 섹션에서 제 2 부분을 동시에 수신하고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되며, 제 2 부분은 제 2 프리앰블의 제 2 고효율 섹션 및 패킷을 연기하도록 레거시 디바이스에 통지하기에 충분한 정보를 포함하는 제 2 프리앰블의 레거시 섹션을 포함한다. 몇몇 양상들에서, 동시에 수신하기 위한 수단은 수신기일 수 있다. 몇몇 양상들에서, 제 1 무선 디바이스 및/또는 제 2 무선 디바이스는 다수의 공간적 스트림들을 통해 송신할 수 있다. 몇몇 양상들에서, 제 1 및 제 2 무선 디바이스들에 의해 송신된 프리앰블의 고효율 부분은 다수의 긴 트레이닝 필드를 포함할 수 있다. 몇몇 양상들에서, 더 긴 트레이닝 필드들의 수는 임의의 무선 디바이스에 할당된 최고 수의 공간적 스트림들 또는 그 특정한 디바이스에 할당된 공간적 스트림들의 수에 기초할 수 있다.

[0122] [00155] 몇몇 양상들에서, 업링크 OFDMA 패킷이 MU-MIMO(uplink multi-user multiple input and multiple-output) 패킷의 것을 보다 근접하게 모방하는 구조를 갖는 것이 바람직할 수 있다. 예를 들어, 도 21의 패킷(2100)과 같은 다수의 선행 패킷들은 하나 이상의 HE-LTF들 이전에 HE-SIG를 포함할 수 있다. 유사하게, 도 12의 패킷(830)에서, 송신 디바이스들 각각은 단일 HE-LTF에 이어, HE-SIG에 이어, 잔여 수의 HE-LTF들을 송신한다. 그러나 업링크 MU-MIMO 패킷과 보다 유사한 구조를 갖는 업링크 패킷을 갖기 위해, 패킷에서 모든 HE-LTF들 이후에 HE-SIG가 후속하는 패킷을 갖는 것이 바람직할 수 있다.

[0123] [00156] 그에 따라, 설명된 패킷들 중 임의의 패킷에서, HE-LTF들 모두 다음에 HE-SIG를 송신하는 것이 가능할 수 있다. 일부 양상들에서, HE-SIG가 HE-LTF들 모두 이후에 따라올 경우, 업링크 패킷에서 각각의 송신 디바이스에 의해 사용되는 다수의 공간 스트림들을 시그널링하는 다른 방법을 찾는 것이 바람직할 수 있다. 예를 들어, 앞에서 설명된 패킷들 중 일부에서, 송신 디바이스로부터의 제 1 HE-LTF는, AP로 하여금 그 송신 디바이스로부터 HE-SIG를 디코딩하기에 충분한 정보를 포함할 수 있다. 앞에서 설명된 패킷들 중 일부에서, 송신 디바이스로부터 HE-SIG는 패킷 내 그 디바이스에 의해 사용되는 공간 스트림들의 수에 관한 정보를 포함할 수 있고, 따라서, 일부 양상들에서, HE-SIG는 그 송신 디바이스에 의해 송신될 HE-LTF들의 수를 나타낼 수 있다. 그러나, HE-SIG가 각각의 HE-LTF 다음에 송신되는 경우, 이것과는 상이한 방식으로 송신 디바이스에 의해 사용되는 공간 스트림들의 수를 나타내는 것이 바람직할 수 있다. 예를 들어, 송신 디바이스에 의해 사용되는 공간 스트림들의 수는 AP로부터의 다운링크 메시지에 표시될 수 있다. 예를 들어, 업링크 OFDMA 패킷은 AP로부터의 다운링크 패킷에 응답하여 전송될 수 있는데, 이는 어느 디바이스들이 업링크 OFDMA 패킷을 송신하는지를 나타낸다. 그에 따라, 이 다운링크 패킷은 또한 다수의 공간 스트림들을 각각의 디바이스로 할당할 수 있다.

[0124] [00157] 도 24는 각각의 HE-LTF 이후에 HE-SIG가 송신되는 예시적인 업링크 패킷 구조이다. 업링크 OFDMA 패킷(2400)에서, 송신 디바이스들 각각은 상술된 다른 패킷들에서와 같이, HE-STF(2410)을 송신할 수 있다. HE-STF(2410) 다음에, 송신 디바이스들 각각은 다수의 HE-LTF들(2420)을 송신할 수 있다. 송신 디바이스들 각각은, 그 송신 디바이스에 의해 사용되는 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신할 수 있다. 예를 들어, 송신 디바이스가 2개의 공간 스트림들을 이용하여 송신하고 있는 경우, 그 디바이스는 2개의 HE-LTF들(2420)을 송신할 수 있다. 그의 HE-LTF들(2420) 모두를 송신한 후, 각각의 송신 디바이스는 그 후 HE-

SIG(2430)를 송신한다. 이 HE-SIG(2430)는 상술된 것과 유사한 정보를 포함할 수 있다.

[0125] [00158] 예시된 바와 같이, 패킷(2400)에서, 각각의 송신 디바이스는 그 디바이스에 의해 사용되는 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신한다. 상술된 바와 같이, 다른 양상들에서, 디바이스에 의해 사용되는 다수의 공간 스트림들은 그 디바이스에 의해 전송된 HE-SIG에 표시될 수 있다. 그러나, 패킷(2400)에서, AP가 송신 디바이스가 송신할 수 있는 HE-LTF들(2420)의 수를 예상하기에는 이 표시가 너무 늦게 도달할 수 있기 때문에, 다수의 공간 스트림들이 HE-SIG(2430)에 포함되지 않을 수 있다. 따라서, AP가 주어진 이벤트로부터 공간 스트림들의 수를 결정하는 다른 방법들이 사용될 수 있다. 예를 들어, AP로부터의 다운링크 메시지, 이를 테면, 업링크 OFDMA 패킷(2400)을 트리거링하는 메시지가 다수의 공간 스트림들을 각각의 송신 디바이스로 할당할 수 있다. AP로부터의 예시적인 다운링크 메시지가 도 26에 도시되며, 이 메시지는, 각각의 송신 디바이스가 사용할 수 있는 공간 스트림들의 수가 얼마나 되는지에 관한 정보를 포함한다. 일부 양상들에서, 각각의 송신 디바이스에 의해 사용된 공간 스트림들의 수가 마찬가지로 다른 방식으로 결정될 수 있다. 예를 들어, 각각의 송신 디바이스에 대한 공간 스트림들의 수가 주기적인 다운링크 메시지로, 이를 테면, 비콘으로 전달될 수 있다. 일부 양상들에서, AP는 수신된 패킷(2400)에 기초하여 다수의 공간 스트림들을 결정하도록 구성될 수 있다. 예를 들어, AP는, 예를 들어, 착신하는 패킷(2400)을 분석하고 HE-LTF들(2420)의 종료와 HE-SIG(2430)의 시작을 검출함으로써 얼마나 많은 수의 공간 스트림들이 송신될 수 있는지에 관한 사전 지식없이도 각각의 송신 디바이스에 의해 송신되는 HE-LTF들(2420)의 수를 결정하도록 구성될 수 있다. 다른 방법들 또한, AP로 하여금 다수의 공간 스트림들을 결정하고, 따라서, 패킷(2400)의 각각의 디바이스에 의해 송신되는 HE-LTF들(2420)의 수를 결정할 수 있게 하는 다른 방법들이 사용될 수 있다. 각각의 송신 디바이스로부터 HE-SIG(2430) 다음에, 그 디바이스는 이것이 패킷(2400)에서 송신하기 원하는 데이터(2440)를 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는 패킷(2400)에서 동일한 수의 HE-LTF들(2420)을 송신할 수 있다. 예를 들어, 각각의 송신 디바이스는, 공간 스트림들 중 가장 큰 수가 할당되는 디바이스로 할당된 공간 스트림들의 수에 대응하는 수의 HE-LTF들(2420)을 송신할 수 있다.

[0126] [00159] 도 25는, HE-SIG가 각각의 HE-LTF 이후 송신되는 다른 예시적인 업링크 패킷 구조이다. 패킷(2500)은, 각각의 송신 디바이스가 패킷의 고효율 부분을 송신하기 전에 레거시 프리앰블을 송신하는 혼합 모드 패킷에 대응할 수 있다. 패킷(2500)에서, 각각의 디바이스는 먼저 L-STF(2502), 및 L-LTF(2504), 및 L-SIG(2506)를 포함하는 레거시 프리앰블을 송신한다. 패킷(2500)의 이러한 부분들은 상술된 바와 같이 송신될 수 있다.

[0127] [00160] 레거시 프리앰블에 따르면, 패킷(2500)은 패킷(2400)과 유사하다. 송신 디바이스들 각각은 HE-STF(2510), 그에 후속하는 다수의 HE-LTF들(2520), 그에 후속하는 HE-SIG(2530), 그에 후속하여 송신 디바이스가 AP에 송신하기를 원하는 데이터(2540)를 송신할 수도 있다. 패킷의 이들 부분들 각각은 상술된 방법들과 유사한 방법들로 송신될 수도 있다. 각각의 디바이스에 의해 송신된 HE-LTF들(2520)의 수는, 각각의 디바이스가 송신하고 있는 공간 스트림들의 수에 적어도 부분적으로 기초할 수도 있다. 예를 들어, 2개의 공간 스트림들 상에서 송신하고 있는 디바이스는 2개의 HE-LTF들(2520)을 송신할 수도 있다.

[0128] [00161] 몇몇 양상들에서, 패킷(2500)에서 각각의 디바이스는 동일한 수의 HE-LTF들(2520)을 송신할 수도 있다. 예를 들어, 송신 디바이스들 각각은, 송신 디바이스들 중 임의의 디바이스에 의해 송신되는 가장 높은 수의 공간 스트림들에 대응하는 다수의 HE-LTF들(2520)을 송신할 수도 있다. 따라서, 패킷(2500)에서, 송신 디바이스들 각각은, 얼마나 많은 HE-LTF들(2520)이 패킷에서 송신될지의 정보를 가져야 한다. 이전과 같이, 송신 디바이스들 각각이 동일한 수의 HE-LTF들(2520)을 송신하게 하는 것은, 이것이 패킷의 PAPR을 감소시킬 수도 있으므로 유익할 수도 있다. PAPR에서의 그러한 감소는 상술된 바와 같이, AP가 패킷(2500)을 수신하기 위한 이점들을 초래할 수도 있다. 패킷(2500)에서 각각의 송신 디바이스가 동일한 수의 HE-LTF들(2520)을 송신하면, 이들 디바이스들 각각은 얼마나 많은 HE-LTF들(2520)이 송신될지를 인식해야 한다. 이것은 다수의 방식들로 달성될 수도 있다. 예를 들어, AP는 다운링크 트리거 메시지를 송신 디바이스들에 전송할 수도 있다. 이러한 트리거 메시지는, 어느 디바이스들이 업링크 패킷에서 송신할 수도 있는지, 각각의 디바이스에 할당된 대역폭, 및 각각의 디바이스에 할당된 공간 스트림들의 수와 같은 정보를 포함할 수도 있다. 이러한 트리거 메시지는 또한, 얼마나 많은 HE-LTF들(2520)이 업링크 패킷(2500)에 포함되는지를 송신 디바이스들에 표시할 수도 있다. 예를 들어, 다운링크 메시지는, 각각의 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지를 송신 디바이스들에 표시할 수도 있다. 각각의 송신 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지에 대한 정보를 포함하는 AP로부터의 예시적인 다운링크 트리거 메시지가 도 26에 도시된다. 유사하게, 각각의 디바이스에 할당된 공간 스트림들의 수가 고정될 수도 있다. 예를 들어, 네트워크가 구성될 수도 있으며, 여기서, 각각의 디바이스는 2개의 공간 스트림들만을 사용할 수도 있다. 유사하게, 각각의 디바이스에 할당된 공간 스트림

들의 수는, AP로부터 주기적으로 송신되는 비콘 메시지에서와 같이 메시지에서 운반될 수도 있다. 따라서, 송신 디바이스들은, 대부분의 공간 스트림들에 할당된 디바이스에 할당되는 공간 스트림들의 수에 대응하는 다수의 HE-LTF들(2520)을 송신할 수도 있다. 몇몇 양상들에서, 다른 방법들이 또한, 각각의 송신 디바이스에 의해 송신된 HE-LTF들(2520)의 수를 조정하기 위해 사용될 수도 있다.

[0129] [00162] 각각의 송신 디바이스가 얼마나 많은 공간 스트림들을 사용할 수도 있는지에 대한 정보를 포함하는 AP로부터의 예시적인 다운링크 메시지(2600)가 도 26에 도시된다. 이러한 메시지(2600)는 트리거 메시지 정보(2605)를 포함할 수도 있다. 예를 들어, 이러한 정보(2605)는, 업링크 메시지가 전송될 수도 있는 때에 대한 타이밍 정보를 포함할 수도 있다. 이러한 정보(2605)는, 송신 디바이스들이 트리거 메시지의 수신을 확인해야 하는지에 대한 정보를 더 포함할 수도 있다. 이러한 정보(2605)에 후속하여, 다운링크 메시지(2600)는 디바이스 1의 식별(2610)을 포함할 수도 있다. 이러한 식별(2610)은, 예를 들어, 디바이스 1에 할당되고 디바이스 1을 식별하는 고유한 넘버 또는 값일 수도 있다. 다운링크 메시지(2600)는 또한, 디바이스 1에 할당된 다수의 스트림들(2615)을 포함할 수도 있다. 예를 들어, 디바이스 1은 2개의 공간 스트림들을 할당받을 수도 있다. 다운링크 메시지는 또한, 디바이스 2의 식별(2620), 디바이스 2에 대한 공간 스트림들(2625)의 수, 디바이스 3의 식별(2630), 및 디바이스 3에 대한 공간 스트림들(2635)의 수를 포함할 수도 있다. 몇몇 양상들에서, 다른 수들의 디바이스들은 또한, 다운링크 메시지(2600)에서 식별될 수도 있다. 예를 들어, 2, 3, 4, 5, 6 또는 더 많은 디바이스들이 다운링크 메시지(2600)에서 식별될 수도 있다. 이러한 다운링크 메시지(2600)가 단지 예시적임을 유의한다. 다른 정보가 또한 다운링크 트리거 메시지에 포함될 수도 있으며, 다운링크 메시지(2600)에서 예시한 것과는 상이한 순서 또는 넘버로 포함할 수도 있다.

[0130] [00163] 몇몇 양상들에서, 업링크 OFDMA 패킷에서 송신된 LTF들을 UL MU-MIMO 패킷에서 송신된 것들과 조화시키는 것이 유익할 수도 있다. 예를 들어, UL MU-MIMO 패킷에서, 각각의 송신 디바이스는 모든 톤들에 걸쳐 메시지들을 송신할 수도 있다. 따라서, UL MU-MIMO 패킷 내의 LTF들은, AP와 같은 수신 STA가 각각의 톤 상에서 각각의 송신 STA로부터의 송신들을 인식하게 하는데 충분한 정보를 포함할 필요가 있을 수도 있다. 그러한 LTF 포맷들은 UL MU-MIMO 패킷 및 UL OFDMA 패킷 둘 모두에서 사용될 수도 있다.

[0131] [00164] 예를 들어, LTF들에 대해 사용될 수 있는 하나의 포맷은, UL MU-MIMO 패킷에서든 또는 UL OFDMA 패킷에서든, P-매트릭스 기반 LTF들을 송신하기 위한 것이다. 이 접근에서는, LTF들은 송신 STA들 각각에 의해 각각의 톤 상에서 송신될 수 있다. 각각의 디바이스로부터의 LTF들은, 그들이 서로 직교하는 방식으로 송신될 수 있다. 송신되는 LTF들의 수는 디바이스들 전부에 할당되는 공간 스트림들의 수에 대응할 수 있다. 예를 들어, 두 개의 디바이스들이 하나의 스트림 상에서 각각 송신한다면, 두 개의 LTF들이 전송될 수 있다. 몇몇 양상들에서는, 제 1 LTF에서, 주어진 톤의 값은 H1+H2와 동일할 수 있는데, 여기서 H1은 제 1 디바이스로부터의 신호이고, H2는 제2 디바이스로부터의 신호이다. 다음 차례의 LTF에서, 주어진 톤의 값은 H1-H2와 동일할 수 있다. 이에 따라, 이러한 직교성 때문에, 수신 디바이스는 각각의 톤 상에서 두 개의 송신 디바이스들 각각의 송신을 식별할 수 있다. LTF들에 대한 이러한 포맷은, 예컨대, 이전 IEEE 802.11 포맷들에서 사용되었다. 그러나, P 매트릭스 기반 LTF들에 대한 하나의 잠재적인 문제점은, 송신 디바이스들 중 둘 이상이 서로에 대하여 높은 주파수 오프셋을 갖는다면 이 P 매트릭스 기반 LTF들은 효과적이지 않을 수 있다는 점이다. 그 상황에서는, LTF들의 직교성이 손실될 수 있고, 이에 따라, 패킷을 적절하게 디코딩하는 수신 디바이스의 능력이 손상될 수 있다. 이에 따라, 몇몇 양상들에서는, UL MU-MIMO 패킷 및 UL OFDMA 패킷에 대해 상이한 LTF 포맷을 사용하는 것이 원해질 수 있다.

[0132] [00165] UL MU-MIMO 패킷 및 UL OFDMA 패킷에 대한 다른 가능한 상이한 LTF 포맷은, 톤-인터리빙된 또는 서브-대역 인터리빙된 LTF를 사용하기 위한 것이다. 앞에서와 같이, 송신되는 LTF들의 수는 송신 디바이스들 전부에 의해 전송되는 공간 스트림들의 총 수에 대응할 수 있다. 이러한 LTF 포맷들은, 업링크 패킷을 송신하는 다양한 디바이스들 사이에서 커다란 주파수 오프셋이 존재할 때 특히 유용할 수 있다. 이들 LTF 포맷들은 UL MU-MIMO 패킷에서 사용될 수 있다. UL OFDMA 패킷을 UL MU-MIMO 패킷과 조화시키기 위하여, 이들 LTF 포맷들은 또한 UL OFDMA 패킷에서 사용될 수 있다.

[0133] [00166] 도 27은 UL OFDMA 패킷에서 사용될 수 있는 톤-인터리빙된 LTF의 예시(2700)이다. 예를 들어, 이들 LTF들은 앞서 설명된 UL OFDMA 패킷들 중 임의의 패킷에서 사용될 수 있다. 예를 들어, 이 패킷에서는, 네 개의 공간 스트림들이 존재한다. 이들 공간 스트림들은, 예컨대, 공간 스트림 1-4로서 넘버링될 수 있다. 각각의 공간 스트림이 별개의 디바이스에 의해 송신될 수 있거나, 또는 하나의 디바이스가 공간 스트림들 중 둘 이상을 송신할 수 있다. 이에 따라, 네 개의 공간 스트림들이 UL OFDMA 패킷에 대응할 수 있고, 이 UL OFDMA 패킷은 두 개, 세 개, 또는 네 개의 디바이스들에 의해 송신되고 있다. 네 개의 공간 스트림들이 존재하기 때문

에, 네 개의 LTF들은 LTF1 2705, LTF2 2710, LTF3 2715, 및 LTF4 2720으로 라벨링되어 전송될 수 있다. 각각의 LTF는 다수의 톤들을 포함할 수 있고, 이 다수의 톤들은 여기서 1 내지 8로 넘버링된다. 임의의 수의 톤들이 LTF에 포함될 수 있는데, 이 수는 UL OFDMA 패킷의 데이터 부분에 포함되는 톤들의 수에 대응한다. 이러한 톤-인터리빙된 LTF에서는, LTF1 2705 동안, 제 1 스트림이 톤들 1, 5, 9 등에서 송신할 수 있다. 몇몇 양상들에서, 그러한 톤들 사이의 간격(즉, 1과 5 사이의 간격)은 공간 스트림들의 수에 기초한다. 예를 들어, 예시(2700)에서는, 네 개의 공간 스트림들이 존재하고, 그래서 톤들(각각의 스트림이 이 톤들 상에서 송신함) 사이의 간격이 또한 4이다. LTF1 2705 동안, 제 2 스트림이 톤들 2, 6, 10 등에서 송신할 수 있는 동시에, 제 3 공간 스트림이 톤들 3, 7, 11 등에서 송신할 수 있고 제 4 공간 스트림이 톤들 4, 8, 12 등에서 송신할 수 있다. 다음 차례의 LTF, LTF2 2710에서는, 각각의 공간 스트림이 이전 LTF보다 1 톤만큼 더 높은 톤들 상에서 송신할 수 있다. 예를 들어, LTF1 2705에서는, 스트림 1이 톤들 1 및 5 상에서 송신하는 반면에, LTF2 2710에서는, 스트림 1이 톤들 2 및 5 상에서 송신한다. 이에 따라, 공간 스트림들의 수와 동일한 수의 LTF들 이후, 각각의 공간 스트림은 각각의 톤 상에서 송신했을 수 있다. 이러한 톤-인터리빙된 LTF를 사용하여, 공간 스트림들이 동일한 주파수로 동시에 송신하지 않기 때문에, 교차-스트림 누출(cross-stream leakage)은 오프셋 때문에 쟁점이 아닐 수 있다. 예를 들어, 오프셋은 수 kHz일 수 있다. 몇몇 양상들에서는, 스트림마다 주파수 오프셋을 추정하기 위하여, 최종 LTF 이후 LTF1 2725를 다시 반복하는 것이 유리할 수 있다. 예를 들어, LTF1 2705는 LTF1 2725와 동일할 수 있다. 그러나, 이들 두 개의 LTF들은 비교될 수 있다.

[0134] [00167] 도 28은 UL OFDMA 패킷에서 사용될 수 있는 서브-대역 인터리빙된 LTF의 예시(2800)이다. 예를 들어, 이들 LTF들은 앞서 설명된 UL OFDMA 패킷들 중 임의의 패킷에서 사용될 수 있다. UL OFDMA 패킷은 다수의 공간 스트림들을 포함할 수 있고, 다수의 톤들 상에서 송신될 수 있다. 예를 들어, 예시(2800)는 네 개의 공간 스트림들을 포함한다. 네 개의 공간 스트림들이 존재하기 때문에, 1개 내지 NSC개의 톤들(여기서, NSC는 가드 톤들 및 DC 톤들을 제외한 서브캐리어들의 총 수임)은 네 개의 서브-대역들로 분할된다. 예를 들어, 64개 톤들이 존재한다면, 톤들 1-16이 서브-대역 1일 수 있고, 톤들 17-32가 서브-대역 2일 수 있으며, 톤들 33-48이 서브-대역 3일 수 있고, 그리고 톤들 49-64가 서브-대역 4일 수 있다. 몇몇 양상들에서, 각각의 서브-대역의 톤들의 수는 동일할 수 있거나 또는 대략 동일할 수 있다. 네 개의 LTF들 각각에서, 네 개의 공간 스트림들 각각은 자신의 할당된 서브-대역의 톤들 상에서 송신할 수 있다. 예를 들어, LTF1 2805에서는, 서브-대역 1이 공간 스트림 1에 할당될 수 있고, 서브-대역 2가 공간 스트림 2에 할당될 수 있는 식이다. 후속하는 LTF2 2810에서는, 서브-대역들 각각이 공간 스트림들의 상이한 공간 스트림에 할당될 수 있다. 이에 따라, 네 개의 LTF들 이후, 네 개의 공간 스트림들 각각은 네 개의 서브-대역들 중 각각의 서브-대역 상에서 한 번 송신했을 수 있다.

[0135] [00168] 도면(2700) 및 도면(2800)에 예시된 LTF 구조들은 다수의 이점들을 가질 수 있다. 예를 들어, 이러한 구조는 업링크 클라이언트들 사이에 큰 주파수 오프셋이 존재할 때 더 양호한 성능을 제공할 수 있다. 추가로, 이러한 LTF 구조들은 AP가 톤들 각각 상에서 공간 스트림들 각각에서 송신들을 수신하게 할 것이다. 이것은, 예를 들어, 특정 톤들로부터 특정 다른 톤들로의 스위칭이 요구되었을 경우, 공간 스트림이 특정 톤들로부터 특정 다른 톤들로 스위칭하게 할 수 있다. 추가로, 이것은 AP가 각각의 톤 상에서 주어진 디바이스의 주어진 공간 스트림의 신호 강도를 결정하게 할 수 있다. 이것은 이후 패킷에서, AP가 디바이스가 어떤 톤들 상에서 최적의 신호를 갖는지에 기초하여 톤들을 디바이스에 할당하게 할 수 있다. 예를 들어, AP가 톤들을 다양한 디바이스들에 할당하는 경우, AP는 다른 톤들 상의 일부 톤들 상에서 더 낮은 신호-대-잡음 비 및 더 강한 신호를 가짐을 관측할 수 있다. 따라서, AP는 이후 패킷에서 그러한 더 강한 톤들을 그 디바이스에 할당할 수 있다. 도 29는 UL OFDMA 패킷에서 송신될 수 있는 패킷의 예시적 LTF 부분(2900)이다. 예를 들어, 위에서 설명된 바와 같이, 특정 UL OFDMA 패킷들에서, 패킷의 SIG 부분에서 톤들을 할당하기보다는, 톤들은 어떤 다른 곳에 할당될 수 있다. 예를 들어, 위에서 설명된 바와 같이, 특정 UL OFDMA 패킷들은 AP로부터 송신 디바이스들로 시그널링 메시지에서의 톤들을 할당할 수 있고, 송신 디바이스들은 특정 톤들을 특정 디바이스들에 할당할 수 있다. 따라서, 이전 UL 패킷들에서 SIG는 MCS, 코딩 비트들 및 톤 할당 정보를 포함할 수 있지만, 일부 양상들에서는, 톤 할당 정보가 SIG 필드에 포함될 필요가 없다. 따라서, SIG 필드는 단지, 함께 정보의 6-7 비트들을 포함하는 MCS 및 코딩 비트들, 및 6 비트들일 수 있는 BCC(binary convolutional coding) 테일 비트들을 포함할 수 있다. 따라서, 송신하는 이러한 SIG 필드가 또한 오버헤드로서 CRC 정보의 6 비트들을 포함할 때, 단지 정보의 6-7 비트들만을 포함하는 SIG 필드를 송신하는 것이 비효율적일 수 있다. 추가로, 포함하는 이러한 CRC 정보가 이러한 경우 충분한 이익들을 갖는지 여부가 전혀 명백하지 않다. 따라서, MCS 정보(2910) 및 코딩 비트들(2915)을 포함하는 패킷의 LTF 부분(2900)을 전송하는 것이 요구될 수 있다. 패킷의 LTF 부분에 이러한 정보를 포함시킴으로써, 패킷은 SIG 필드를 포함할 필요가 전혀 없을 수 있다.

[0136] [00169] 이러한 정보는 다수의 방식들에서 패킷의 LTF 부분(2900)에 포함될 수 있다. 예를 들어, 넌-코히런트

복조를 이용할 수 있는 시그널링 메커니즘들이 이용될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 LTF의 톤들 중 일부 또는 그 전부에 걸쳐 낮은-강도 코드에 포함될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 단일 LTF에서, 이를테면, LTF1(2825) 또는 또 다른 LTF에서 송신될 수 있다. 일부 양상들에서, MCS 정보(2910) 및 코딩 비트들(2915)은 다수의 LTF들 각각에 걸쳐 분할될 수 있다. 예를 들어, MCS 정보(2910) 및 코딩 비트들(2915) 중 하나 또는 둘 이상의 비트들은 LTF들 중 둘 또는 셋 이상에 포함될 수 있다. 따라서, 일부 양상들에서, 명시적 SIG 필드가 UL OFDMA 패킷 내에 필요할 수 있는데, 그 이유는 이 정보가 패킷의 LTF들 내에 포함될 수 있기 때문이다.

[0137] [00170] 전형적으로, UL MU-MIMO 패킷에서, 사용자당 SIG 필드는 그 패킷에 대한 LTF들 각각이 송신된 이후에 포함될 수 있다. 예를 들어, 이러한 포맷은 패킷(2400)의 포맷과 유사할 수 있다. 그러나, UL OFDMA 패킷에서, HE-SIG는 패킷(2100)에 예시된 바와 같이, 패킷의 STF들 또는 LTF들 이전에 포함될 수 있다. 일부 양상들에서, UL MU-MIMO 패킷을 UL OFDMA 패킷과 조화(harmonize)시키기 위해, 둘 모두의 위치들에서 SIG 필드를 갖는 패킷을 송신하는 것이 요구될 수 있다. 예를 들어, HE-STF 이전에, 공통 SIG 필드를 포함하고, 또한 모든 HE-LTF들 이후에 사용자당 SIG 필드를 포함하는 패킷이 송신될 수 있다.

[0138] [00171] 도 30은 HE-STF 이전에 공통 SIG 필드를 그리고 모든 HE-LTF들 이후에 사용자당 SIG 필드를 갖는 패킷(3000)의 예시이다. 패킷(3000)에서, 패킷은 레거시 프리앰블을 포함하고, 레거시 쇼트 트레이닝 필드(3005), 레거시 롱 트레이닝 필드(3010) 및 레거시 SIG 필드(3015)를 포함하는 것으로 도시된다. 그러나, 이러한 패킷은 또한 이러한 레거시 프리앰블없이 송신될 수 있다. 레거시 프리앰블 이후, 이러한 프리앰블이 포함되는 경우, 패킷(3000)은 공통 SIG(3020)를 포함한다. 일부 양상들에서, 이러한 공통 SIG(3020)는 이전 UL OFDMA 패킷들 내의 이러한 SIG 필드에 포함되는 정보와 유사한 정보를 포함할 수 있다. 예를 들어, 공통 SIG는 OFDMA 패킷에 포함되는 공간 스트림들의 수를 전달할 수 있다. 예를 들어, UL OFDMA 패킷에서 각각의 송신하는 디바이스는 공통 SIG(3020)의 톤들의 부분을 파퓰러링(popular)할 수 있다. 공통 SIG(3020) 이후, HE-STF(3025) 및 HE-LTF들(3030)이 송신된다. 이러한 필드들은 위의 개시들에 따라 송신될 수 있다. 예를 들어, HE-LTF들(3030)은 도 27 및 28에 예시된 LFT 포맷들에 기초할 수 있다. 임의의 수의 HE-LTF들(3030)이 송신될 수 있다. 예를 들어, 송신되는 HE-LTF들(303)의 수는 패킷(3000)의 일부인 공간 스트림들의 수의 합에 적어도 부분적으로 기초할 수 있다. HE-LTF들(303) 이후, 제 2 SIG 필드가 송신될 수 있다. 이러한 사용자당 SIG(3035)는 UL OFDMA 패킷을 송신하는 디바이스들 각각에 의해 송신될 수 있다. 사용자당 SIG 필드(3035)의 포맷은 UL MU-MIMO 패킷 내의 SIG 필드의 포맷에 기초할 수 있다. 사용자당 SIG 필드(3035) 이후, 데이터(3040)가 송신될 수 있다. 따라서, 패킷(3000)은 다른 UL OFDMA 패킷들 내의 공통 SIG(3020) 및 다른 UL MU-MIMO 패킷들 내의 사용자당 SIG 필드(3035) 둘 모두를 포함할 수 있다. 둘 모두의 SIG 필드들이 패킷(3000)에 포함되기 때문에, 이러한 패킷 포맷은 UL OFDMA 및 UL MU-MIMO 둘 모두에서 재이용될 수 있다.

[0139] [00172] 도 31은 단일 송신으로 하나 이상의 디바이스들에 송신하는 예시적인 방법(3100)을 예시한다. 이러한 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[0140] [00173] 블록(3105)에서, AP는 제 1 포맷에 따라 프리앰블의 제 1 섹션을 송신하고, 프리앰블의 제 1 섹션은, 송신을 연기하도록, 제 1 포맷과 호환가능한 디바이스들에게 통지하기에 충분한 정보를 포함한다. 예컨대, 제 1 포맷은 기존의 IEEE 802.11 표준들 중 하나 이상에 의해 정의된 포맷과 같은 기존의 포맷일 수 있다. 몇몇 양상들에서, 제 1 포맷은 레거시 포맷이라고 지칭될 수 있다. 몇몇 양상들에서, 프리앰블의 제 1 섹션은, 제 2 포맷과 호환가능한 및/또는 능력들의 제 2 세트를 갖는 디바이스들에게, 프리앰블의 다른 섹션이 그들 디바이스들에 송신될 수 있는 것을 경보하기에 충분한 정보를 포함할 수 있다. 몇몇 양상들에서, 제 1 섹션을 송신하기 위한 수단은 송신기를 포함할 수 있다.

[0141] [00174] 블록(3110)에서, AP는 제 2 포맷에 따라 프리앰블의 제 2 섹션을 송신하고, 프리앰블의 제 2 섹션은 톤 할당 정보를 포함하고, 톤 할당 정보는 2개 이상의 무선 통신 디바이스들을 식별한다. 예컨대, 프리앰블의 제 2 섹션은 고효율 프리앰블을 포함할 수 있고, 제 2 포맷은 제 1 포맷보다 더 새로운 IEEE 802.11 포맷을 포함할 수 있다. 몇몇 양상들에서, AP의 제 2 섹션은 2개 이상의 무선 통신 디바이스들을 식별할 수 있고, 그들 디바이스들 각각에게, 송신의 대역폭의 하나 이상의 서브-대역들을 할당할 수 있다. 몇몇 양상들에서, 제 2 섹션을 송신하기 위한 수단은 송신기를 포함할 수 있다.

[0142] [00175] 블록(3115)에서, AP는 2개 이상의 무선 통신 디바이스들에 동시에 데이터를 송신하고, 데이터는 2개 이상의 서브-대역들 상에 포함된다. 몇몇 양상들에서, 서브-대역들 각각은, 송신의 대역폭의 개별적이고 별개인 중첩하지 않는 부분들 상에서 송신될 수 있다. 예컨대, 각각의 서브-대역은 송신의 대역폭의 특정한 부분에 대

응할 수 있고, 각각의 무선 통신 디바이스는, 서브-대역들 중 하나 이상 상에서 데이터를 수신하도록 할당될 수 있다. 따라서, AP는, 송신의 대역폭의 상이한 서브-대역들에서, 2개 이상의 상이한 무선 통신 디바이스들로 상이한 데이터를 동시에 송신할 수 있다. 몇몇 양상들에서, 데이터를 송신하기 위한 수단은 송신기를 포함할 수 있다.

[0143] [00176] 도 32는, 능력들의 제 1 세트를 갖는 하나 이상의 제 1 디바이스들로 송신하고, 동시에, 능력들의 제 2 세트를 갖는 하나 이상의 제 2 디바이스들로 송신하는 예시적인 방법(3200)을 예시한다. 이러한 방법은 AP와 같은 무선 디바이스에 의해 행해질 수 있다.

[0144] [00177] 블록(3205)에서, AP는 대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들로 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 갖는다. 몇몇 양상들에서, 이러한 송신은 1차 채널 상에서 발생할 수 있고, 또한, 주어진 대역폭의 하나 이상의 2차 채널들 상에서 발생할 수 있다. 몇몇 양상들에서, 능력들의 제 1 세트를 갖는 디바이스들은, 특정한 IEEE 802.11 표준들과 호환가능한 디바이스들을 포함할 수 있다.

[0145] [00178] 블록(3210)에서, AP는 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들로 동시에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 여기에서, 송신은, 능력들의 제 2 세트를 갖는 디바이스들이, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들에 대한 대역폭에서의 주파수 대역을 로케이팅하기 위한 표시를 포함하는 프리앰블을 포함하고, 여기에서, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 실질적으로 영향을 미치지 않도록 전송된다. 예컨대, 표시는 프리앰블의 부분의 허수 축 상에 있는 1-비트 코드일 수 있다. 이러한 표시는 낮은 전력으로 전송될 수 있고, 그에 따라, 그러한 표시는, 능력들의 제 1 세트를 갖는 디바이스들에 의한 프리앰블의 수신과 간섭하지 않을 수 있다. 몇몇 양상들에서, 능력들의 제 2 세트는 능력들의 제 1 세트보다 더 새롭고 더 진보될 수 있다. 예컨대, 능력들의 제 1 세트는 "레거시" 포맷에 대응할 수 있는 한편, 능력들의 제 2 세트는 "고효율" 포맷에 대응할 수 있다. 몇몇 양상들에서, 능력들의 제 2 세트를 갖는 디바이스들은 송신에서 표시를 발견하도록 구성될 수 있고, 표시가 발견되는 경우에, 대역폭의 제 2 부분에 포함된 송신의 부분을 로케이팅 및 수신하도록 구성될 수 있다. 몇몇 양상들에서, 대역폭의 제 2 부분에서의 송신은 위에서 설명된 다양한 타입들의 고효율 패킷들에 대응할 수 있다.

[0146] [00179] 몇몇 양상들에서, 표시는 프리앰블에 1-비트 코드로서 포함될 수 있다. 몇몇 양상들에서, 프리앰블은 송신의 대역폭에 걸쳐 이중으로 송신될 수 있다. 몇몇 양상들에서, 표시는 이러한 프리앰블의 특정한 부분들에 포함될 수 있다. 예컨대, 표시는, 능력들의 제 2 세트를 갖는 디바이스들로의 송신들을 포함할 대역폭의 부분들에서 송신되는 프리앰블의 카피들에 포함될 수 있다. 몇몇 양상들에서, 하나 이상의 제 1 디바이스들로 송신하기 위한 수단, 및 하나 이상의 제 2 디바이스들로 동시에 송신하기 위한 수단은 송신기를 포함할 수 있다.

[0147] [00180] 도 33은 제 1 세트의 성능들을 가진 디바이스들 및 제 2 세트의 성능들을 가진 디바이스들 양쪽 모두와 호환가능한 송신을 수신하는 예시적인 방법(3300)을 예시한다. 이 방법은 제 2 세트의 성능들을 가진 STA와 같은 무선 디바이스에 의해 수행될 수 있다.

[0148] [00181] 블록(3305)에서, STA는 대역폭의 제 1 부분에서 프리앰블을 수신하고, 프리앰블은 제 1 세트의 성능들을 가진 디바이스들과 호환가능한 포맷으로 송신된다. 일부 양상들에서, 대역폭의 제 1 부분은 1차 채널을 포함할 수 있고 선택적으로는 하나 또는 둘 이상의 2차 채널들을 포함할 수 있다. 일부 양상들에서, 제 1 세트의 성능들은 IEEE 802.11a 또는 802.11ac와 같은 IEEE 802.11 표준을 포함할 수 있다. 일부 양상들에서, 프리앰블을 수신하기 위한 수단은 수신기를 포함할 수 있다.

[0149] [00182] 블록(3310)에서, STA는 신호 필드를 대역폭의 제 2 부분에 로케이팅하도록 제 2 세트의 성능들을 가진 디바이스들에 통지하기에 충분한 정보를 프리앰블이 포함하고 있는지를 결정하며, 대역폭의 제 2 부분은 대역폭의 제 1 부분과 중첩하지 않는다. 예를 들어, 앞서 나타낸 바와 같이, 프리앰블은 프리앰블의 적어도 일부분의 허수 축 상에 1-비트 코드와 같은 표시를 포함할 수 있다. 따라서, STA는 이러한 정보가 주어진 프리앰블에 존재하는지의 여부를 결정하도록 구성될 수 있다. 일부 양상들에서, 대역폭의 제 2 부분은 하나 또는 둘 이상의 2차 채널들을 포함할 수 있다. 일부 양상들에서, 프리앰블이 정보를 포함하는지를 결정하기 위한 수단은 프로세서 또는 수신기를 포함할 수 있다.

[0150] [00183] 블록(3315)에서, STA는 대역폭의 제 2 부분에서 신호 필드를 수신한다. 예를 들어, 표시는 대역폭의 제 2 부분에 로케이팅하기에 그리고 신호 필드가 대역폭의 제 2 부분에서 송신될 것임을 알게 하기에 충분한 정보를 STA에 제공할 수 있다. 따라서, STA는 대역폭의 이러한 부분에서 신호 필드를 수신하도록 구성될 수

있다. 일부 양상들에서, 신호 필드는, 대역폭의 제 2 부분에서 제 2 세트의 성능들을 가진 디바이스들에 송신되는 "고효율" 프리앰블과 같은 프리앰블의 전부 또는 일부일 수 있다. 일부 양상들에서, 이는, 제 2 세트의 성능들을 가진 디바이스들이, 대역폭의 제 1 부분 상에서 제 1 세트의 성능들을 가진 디바이스들의 수신을 방해함이 없이, 대역폭의 부분들 상에서 AP 또는 다른 디바이스로부터 정보를 수신하도록 허용할 수 있다. 따라서, 앞서 논의된 바와 같이, 이는 더 많은 시간에 대역폭을 더 최대한 사용하는 것을 허용할 수 있기 때문에, 이는 AP 또는 다른 디바이스에 이용가능한 대역폭의 더 효율적인 사용을 허용할 수 있다. 일부 양상들에서, 신호 필드를 수신하기 위한 수단은 수신기를 포함할 수 있다.

[0151] [00184] 도 34는 송신을 수신하는 예시적인 방법(3300)을 예시하며, 여기서, 송신의 부분들은 상이한 무선 디바이스들에 의해 송신된다. 방법은 AP와 같은 무선 디바이스에 의해 수행될 수 있다.

[0152] [00185] 블록(3405)에서, AP는 대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하고, 제 1 부분은 제 1 무선 디바이스에 의해 송신되고 제 1 프리앰블 및 제 1 데이터 섹션을 포함한다. 일부 양상들에서, AP는 사전에 메시지를 제 1 무선 디바이스에 전송하여, 제 1 무선 디바이스가 AP에 송신할 수 있는 시간 및 대역폭을 제 1 무선 디바이스에 통지할 수 있다.

[0153] [00186] 블록(3410)에서, AP는 동시에, 대역폭의 제 2 섹션에서 송신의 제 2 부분을 수신하며, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 프리앰블 및 제 2 데이터 섹션을 포함한다. 일부 양상들에서, 제 1 프리앰블 및 제 2 프리앰블은 트레이닝 필드들을 각각 포함할 수 있다. 일부 양상들에서, 각각의 프리앰블이 포함하는 트레이닝 필드들의 수는 특정 디바이스에 할당된 공간 스트림들의 수에 기초할 수 있다. 예를 들어, 3개의 공간 스트림들이 할당된 디바이스는 하나의 짧은 트레이닝 필드를 송신하고 3개의 긴 트레이닝 필드들을 송신할 수 있다. 유사하게, 하나의 공간 스트림이 할당된 디바이스는 하나의 짧은 트레이닝 필드 및 하나의 긴 트레이닝 필드를 송신할 수 있다. 일부 양상들에서, 각각의 디바이스는, 얼마나 많은 공간 스트림들이 그 특정 디바이스에 할당되었는지에 기초하여 다수의 트레이닝 필드들을 송신할 수 있다. 일부 양상들에서, 각각의 디바이스가 동일한 수의 공간 스트림들을 송신하는 것이 유리할 수 있다. 예를 들어, 각각의 디바이스가 동일한 수의 공간 스트림들을 송신하는 경우, 이는 결합된 송신의 PAPR(peak-to-average power ratio)을 감소시킬 수 있으며, 이는 유리할 수 있다. 일부 양상들에서, 제 1 및 제 2 무선 디바이스들로부터의 송신들은 AP로부터의 메시지에 의해 트리거링될 수 있다. 이러한 메시지는 또한, 디바이스가 얼마나 많은 공간 스트림들을 송신할 수 있는지를 각각의 디바이스에 표시할 수 있고, 각각의 디바이스가 송신해야 하는 트레이닝 필드들의 수를 표시할 수 있다.

[0154] [00187] 도 35는 무선 통신 시스템(100) 내에 채용될 수 있는 무선 디바이스(3502)에서 활용될 수 있는 다양한 컴포넌트들을 도시한다. 무선 디바이스(3502)는 본원에 설명된 다양한 방법들을 구현하도록 구성될 수 있는 디바이스의 일례이다. 예를 들어, 무선 디바이스(3502)는 도 10의 AP(104) 또는 STA들(106) 중 하나를 포함할 수 있다. 일부 양상들에서, 무선 디바이스(3502)는 앞서 설명된 패킷들을 수신하도록 구성된 무선 디바이스를 포함할 수 있다.

[0155] [00188] 무선 디바이스(3502)는 무선 디바이스(3502)의 동작을 제어하는 프로세서(3504)를 포함할 수 있다. 프로세서(3504)는 또한 중앙 프로세싱 유닛(CPU)으로 지칭될 수 있다. ROM(read-only memory) 및 RAM(random access memory) 둘 모두를 포함하는 메모리(3506)는 프로세서(3504)에 명령들 및 데이터를 제공한다. 메모리(3506)의 일부는 또한, NVRAM(non-volatile random access memory)를 포함할 수 있다. 프로세서(3504)는 통상적으로, 메모리(3506) 내에 저장된 프로그램 명령들에 기초하여 논리 및 산술 연산들을 수행한다. 메모리(3506) 내의 명령들은 본원에 설명된 방법들을 구현하도록 실행가능할 수 있다. 예를 들어, 메모리(3506)는 고효율 디바이스로부터 무선 디바이스(3502)가 송신들을 수신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 예를 들어, 메모리(3506)는, 제 1 세트의 성능들을 갖춘 디바이스에 대한 프리앰블 및 제 2 세트의 성능들을 갖춘 디바이스에 대한 제 2 프리앰블을 포함하는 패킷들을 무선 디바이스(3502)가 수신하게 하도록 허용하기에 충분한 명령들을 포함할 수 있다. 일부 양상들에서, 무선 디바이스(3502)는 방법(3300) 및/또는 방법(3400)에 설명되는 바와 같은 패킷들을 무선 디바이스(3502)로 하여금 수신하도록 허용하기에 충분한 명령들을 포함할 수 있는 프레임 수신 회로(3521)를 포함할 수 있다. 방법(3300)에 설명된 바와 같이, 프레임 수신 회로(3521)는, 디바이스로 하여금, 제 1 부분의 대역폭에 프리앰블을 수신하고, 표시가 존재하는지 결정하고, 그리고 제 2 부분의 대역폭에 신호 필드를 수신하도록 허용하기에 충분한 명령들을 포함할 수 있다. 일부 양상들에서, 방법(3400)에 설명된 바와 같이, 프레임 수신 회로(3521)는, 디바이스로 하여금, 제 1 섹션의 대역폭에 제 1 부분의 송신을 수신하고, 그리고 동시에 제 2 섹션의 대역폭에 제 2 부분의 송신을 수신하도록 허용하기에 충분한 명령

들을 포함할 수 있다.

[0156] [00189] 프로세서(3504)는 하나 또는 그 초과의 프로세서들로 구현된 프로세싱 시스템의 컴포넌트를 포함할 수 있거나 또는 그 컴포넌트일 수 있다. 하나 또는 그 초과의 프로세서들은, 범용 마이크로프로세서들, 마이크로컨트롤러들, DSP(digital signal processor)들, FPGA(field programmable gate array)들, PLD(programmable logic device)들, 컨트롤러들, 상태 머신들, 게이티드 로직, 이산 하드웨어 컴포넌트들, 전용 하드웨어 유한 상태 머신들, 또는 계산들 또는 다른 정보 조작들을 수행할 수 있는 임의의 다른 적합한 엔티티들의 임의의 조합으로 구현될 수 있다.

[0157] [00190] 프로세싱 시스템은 또한 소프트웨어를 저장하기 위한 머신-판독가능 매체를 포함할 수 있다. 소프트웨어는, 소프트웨어, 펌웨어, 미들웨어, 마이크로코드, 하드웨어 디스크립션 언어 또는 다른 것들 중 어느 것으로 지칭되든, 임의의 타입의 명령들을 의미하는 것으로 광범위하게 해석될 것이다. 명령들은 (예를 들어, 소스 코드 포맷, 이진 코드 포맷, 실행가능 코드 포맷, 또는 임의의 다른 적합한 코드 포맷 형태의) 코드를 포함할 수 있다. 명령들은, 하나 또는 그 초과의 프로세서들에 의해 실행될 때, 프로세싱 시스템으로 하여금 본원에 설명된 다양한 기능들을 수행하게 한다.

[0158] [00191] 무선 디바이스(3502)는 또한, 무선 디바이스(3502)와 원격 위치 사이에서 데이터의 송신 및 수신을 허용하기 위해 송신기(3510) 및 수신기(3512)를 포함할 수 있는 하우징(3508)을 포함할 수 있다. 송신기(3510) 및 수신기(3512)는 트랜시버(3514)로 조합될 수 있다. 안테나(3516)는 하우징(3508)에 부착될 수 있고 그리고 트랜시버(3514)에 전기적으로 커플링될 수 있다. 무선 디바이스(3502)는 또한, 다수의 송신기들, 다수의 수신기들, 다수의 트랜시버들, 및/또는 다수의 안테나들을 포함할 수 있다(미도시).

[0159] [00192] 무선 디바이스(3502)는 또한 트랜시버(3514)에 의해 수신된 신호들의 레벨을 검출하고 계량화하기 위한 노력으로 이용될 수 있는 신호 검출기(3518)를 포함할 수 있다. 신호 검출기(3518)는, 전체 에너지로서의 이러한 신호들, 심볼당 서브캐리어당 에너지, 전력 스펙트럼 밀도 및 다른 신호들을 검출할 수 있다. 무선 디바이스(3502)는 또한, 신호들을 프로세싱하는데 이용하기 위한 디지털 신호 프로세서(DSP)(3520)를 포함할 수 있다. DSP(3520)는 송신을 위한 데이터 유닛을 생성하도록 구성될 수 있다. 일부 양상들에서, 데이터 유닛은 PPDU(physical layer data unit)를 포함할 수 있다. 일부 양상들에서, PPDU는 패킷으로 지칭된다.

[0160] [00193] 무선 디바이스(3502)는 일부 양상들에서 사용자 인터페이스(3522)를 더 포함할 수 있다. 사용자 인터페이스(3522)는 키패드, 마이크로폰, 스피커, 및/또는 디스플레이를 포함할 수 있다. 사용자 인터페이스(3522)는, 무선 디바이스(3502)의 사용자에게 정보를 전달하고 그리고/또는 사용자로부터 입력을 수신하는 임의의 엘리먼트 또는 컴포넌트를 포함할 수 있다.

[0161] [00194] 무선 디바이스(3502)의 다양한 컴포넌트들은 버스 시스템(3526)에 의해 함께 커플링될 수 있다. 버스 시스템(3526)은, 데이터 버스뿐만 아니라, 예를 들어, 전력 버스, 제어 신호 버스, 및 데이터 버스에 부가하여 상태 신호 버스를 포함할 수 있다. 당업자들은, 무선 디바이스(3502)의 컴포넌트들이 함께 커플링될 수 있거나 또는 몇몇 다른 메커니즘을 이용하여 서로에게 입력들을 수락하거나 또는 제공할 수 있다는 점을 인식할 것이다.

[0162] [00195] 다수의 별개의 컴포넌트들이 도 35에 예시되지만, 컴포넌트들 중 하나 이상은 결합되거나 공통 구현될 수 있다. 예를 들어, 프로세서(3504)는, 프로세서(3504)에 대해 앞서 설명된 기능을 구현할 뿐만 아니라, 신호 검출기(3518) 및/또는 DSP(3520)에 대해 앞서 설명된 기능을 구현하기 위해 이용될 수 있다. 추가로, 도 35에 예시된 컴포넌트들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 게다가, 프로세서(3504)는, 아래에서 설명되는 임의의 컴포넌트들, 모듈들, 회로들 등을 구현하기 위해 이용될 수 있거나, 이들 각각은 복수의 별개의 엘리먼트들을 이용하여 구현될 수 있다. 본 명세서에서 사용되는 바와 같이, 용어 "결정"은 광범위한 동작들을 포함한다. 예를 들어, "결정"은 계산, 컴퓨팅, 프로세싱, 유도, 검사, 검색(예를 들어, 표, 데이터베이스 또는 다른 데이터 구조에서의 검색), 확인 등을 포함할 수 있다. 또한, "결정"은 수신(예를 들어, 정보 수신), 액세스(예를 들어, 메모리 내의 데이터에 액세스) 등을 포함할 수 있다. 또한, "결정"은 해결, 선택, 선정, 설정 등을 포함할 수 있다. 추가로, 본 명세서에서 사용되는 바와 같이, "채널 폭"은 특정한 양상들에서 대역폭으로 또한 지칭될 수 있거나 이를 포함할 수 있다.

[0163] [0196] 본 명세서에서 사용되는 바와 같이, 항목들의 리스트 "중 적어도 하나"로 지칭되는 구문은 단일 멤버들을 포함하여 그 항목들의 임의의 조합을 지칭한다. 예를 들어, "a, b 또는 c 중 적어도 하나"는 a, b, c, a-b, a-c, b-c, 및 a-b-c를 커버하는 것으로 의도된다.

[0164] [0197] 전술한 방법들의 다양한 동작들은, 다양한 하드웨어 및/또는 소프트웨어 컴포넌트(들), 회로들 및/또는 모듈(들)과 같은, 동작들을 수행할 수 있는 임의의 적절한 수단에 의해 수행될 수 있다. 일반적으로, 도면들에 도시된 임의의 동작들은 그 동작들을 수행할 수 있는 대응하는 기능 수단에 의해 수행될 수 있다.

[0165] [0198] 본 개시와 관련하여 설명되는 다양한 예시적인 논리 블록들, 모듈들, 및 회로들은 범용 프로세서, 디지털 신호 프로세서(DSP), 주문형 집적회로(ASIC), 필드 프로그래머블 게이트 어레이(FPGA) 또는 다른 프로그래머블 로직 디바이스(PLD), 이산 게이트 또는 트랜지스터 로직, 이산 하드웨어 컴포넌트들 또는 본 명세서에 설명된 기능들을 수행하도록 설계된 이들의 임의의 조합으로 구현 또는 수행될 수 있다. 범용 프로세서는 마이크로프로세서일 수 있지만, 대안적으로, 프로세서는 상용 프로세서, 제어기, 마이크로제어기, 또는 상태 머신일 수 있다. 또한 프로세서는 컴퓨팅 디바이스들의 조합, 예를 들어 DSP 및 마이크로프로세서의 조합, 복수의 마이크로프로세서들, DSP 코어와 결합된 하나 이상의 마이크로프로세서들, 또는 임의의 다른 이러한 구성으로서 구현될 수 있다.

[0166] [0199] 하나 이상의 양상들에서, 설명된 기능들은 하드웨어, 소프트웨어, 펌웨어 또는 이들의 임의의 조합으로 구현될 수 있다. 소프트웨어로 구현되는 경우, 상기 기능들은 컴퓨터 판독가능 매체 상에 하나 이상의 명령들 또는 코드로서 저장되거나 이를 통해 송신될 수 있다. 컴퓨터 판독가능 매체는, 일 장소로부터 다른 장소로 컴퓨터 프로그램의 전송을 용이하게 하는 임의의 매체를 포함하는 통신 매체 및 컴퓨터 저장 매체 모두를 포함한다. 저장 매체는 컴퓨터에 의해 액세스될 수 있는 임의의 가용한 매체일 수 있다. 예를 들어, 이러한 컴퓨터 판독가능 매체는 RAM, ROM, EEPROM, CD-ROM 또는 다른 광학 디스크 저장소, 자기 디스크 저장 또는 다른 자기 저장 디바이스들, 또는 명령들 또는 데이터 구조들의 형태로 요구되는 프로그램 코드를 저장 또는 반송하는데 사용될 수 있고, 컴퓨터에 의해 액세스될 수 있는 임의의 다른 매체를 포함하지만, 이들로 제한되는 것은 아니다. 또한, 임의의 연결 수단(connection)이 컴퓨터 판독가능 매체로 적절히 지칭된다. 예를 들어, 소프트웨어가 웹사이트, 서버, 또는 다른 원격 소스로부터 동축 케이블, 광섬유 케이블, 연선(twisted pair), 디지털 가입자 라인(DSL), 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들을 이용하여 송신되는 경우, 동축 케이블, 광섬유 케이블, 연선, DSL, 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들이 이러한 매체의 정의에 포함된다. 여기서 사용되는 디스크(disk) 및 디스크(disc)는 컴팩트 디스크(disc(CD)), 레이저 디스크(disc), 광 디스크(disc), 디지털 다기능 디스크(disc)(DVD), 플로피 디스크(disk), 및 블루-레이 디스크(disc)를 포함하며, 여기서 디스크(disk)들은 데이터를 보통 자기적으로 재생하지만, 디스크(disc)들은 레이저들을 이용하여 광학적으로 데이터를 재생한다. 따라서, 몇몇 양상들에서, 컴퓨터 판독가능 매체는 비일시적(non-transitory) 컴퓨터 판독가능 매체(예를 들어, 유형의(tangible) 매체)를 포함할 수 있다. 또한, 다른 양상들에서, 컴퓨터 판독가능 매체는 일시적 컴퓨터 판독가능 매체(예를 들어, 신호)를 포함할 수 있다. 상기한 것들의 조합들 또한 컴퓨터 판독가능 매체의 범위 내에 포함되어야 한다.

[0167] [0200] 본 명세서에 개시된 방법들은 설명된 방법을 달성하기 위한 하나 이상의 단계들 또는 동작들을 포함한다. 방법 단계들 및/또는 동작들은 청구항들의 범위를 벗어나지 않고 서로 교환될 수 있다. 즉, 단계들 또는 동작들의 특정한 순서가 규정되지 않으면, 특정 단계들 및/또는 동작들의 순서 및/또는 이용은 청구항들의 범위를 벗어나지 않고 변형될 수 있다.

[0168] [0201] 설명된 기능들은 하드웨어, 소프트웨어, 펌웨어 또는 이들의 임의의 조합으로 구현될 수 있다. 소프트웨어로 구현되면, 기능들은 컴퓨터 판독가능 매체 상에 하나 이상의 명령들로서 저장될 수 있다. 저장 매체는 컴퓨터에 의해 액세스될 수 있는 임의의 가용한 매체일 수 있다. 예를 들어, 이러한 컴퓨터 판독가능 매체는 RAM, ROM, EEPROM, CD-ROM 또는 다른 광학 디스크 저장소, 자기 디스크 저장소 또는 다른 자기 저장 디바이스들, 또는 명령들 또는 데이터 구조들의 형태로 요구되는 프로그램 코드를 저장 또는 반송하는데 사용될 수 있고, 컴퓨터에 의해 액세스될 수 있는 임의의 다른 매체를 포함하지만, 이들로 제한되는 것은 아니다. 여기서 사용되는 디스크(disk) 및 디스크(disc)는 컴팩트 디스크(disc(CD)), 레이저 디스크(disc), 광 디스크(disc), 디지털 다기능 디스크(disc)(DVD), 플로피 디스크(disk), 및 블루-레이® 디스크(disc)를 포함하며, 여기서 디스크(disk)들은 데이터를 보통 자기적으로 재생하지만, 디스크(disc)들은 레이저를 이용하여 광학적으로 데이터를 재생한다.

[0169] [0202] 따라서, 특정한 양상들은 본 명세서에 제시된 동작들을 수행하기 위한 컴퓨터 프로그램 물건을 포함할 수 있다. 예를 들어, 이러한 컴퓨터 프로그램 물건은 명령들이 저장(및/또는 인코딩)된 컴퓨터 판독가능 매체를 포함할 수 있고, 명령들은, 본 명세서에 설명된 동작들을 수행하도록 하나 이상의 프로세서들에 의해 실행될 수 있다. 특정한 양상들의 경우, 컴퓨터 프로그램 물건은 패키징 재료를 포함할 수 있다.

[0170] [0203] 소프트웨어 또는 명령들이 또한 송신 매체를 통해 송신될 수 있다. 예를 들어, 소프트웨어가 웹사이트, 서버, 또는 다른 원격 소스로부터 동축 케이블, 광섬유 케이블, 연선, 디지털 가입자 라인(DSL), 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들을 이용하여 송신되는 경우, 동축 케이블, 광섬유 케이블, 연선, DSL, 또는 적외선, 라디오, 및 마이크로웨이브와 같은 무선 기술들이 송신 매체의 정의에 포함된다.

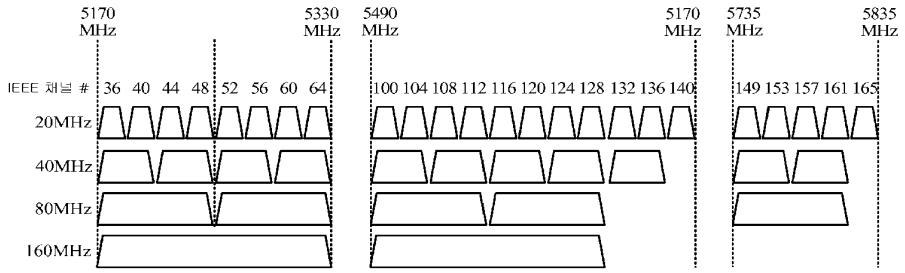
[0171] [0204] 추가로, 본 명세서에 설명된 방법들 및 기술들을 수행하기 위한 모듈들 및/또는 다른 적절한 수단들은 적용가능한 경우 사용자 단말 및/또는 기지국에 의해 획득 및/또는 그렇지 않으면 다운로딩될 수 있음을 인식해야 한다. 예를 들어, 이러한 디바이스는 본 명세서에 설명된 방법들을 수행하기 위한 수단의 전송을 용이하게 하기 위해 서버에 커플링될 수 있다. 대안적으로, 본 명세서에 설명된 다양한 방법들은 저장 수단들(예를 들어, RAM, ROM, 컴팩트 디스크(CD) 또는 플로피 디스크와 같은 물리적 저장 매체 등)을 통해 제공될 수 있어서, 사용자 단말 및/또는 기지국은 저장 수단들을 디바이스에 커플링 또는 제공할 때 다양한 방법들을 획득할 수 있다. 또한, 본 명세서에 설명된 방법들 및 기술들을 디바이스에 제공하기 위한 임의의 다른 적절한 기술이 활용될 수 있다.

[0172] [0205] 청구항들은 전술한 것과 정확히 같은 구성 및 컴포넌트들에 한정되지 않음을 이해해야 한다. 청구항들의 범위를 벗어나지 않으면서 전술한 방법들 및 장치의 배열, 동작 및 세부사항들에서 다양한 변형들, 변경들 및 변화들이 행해질 수 있다.

[0173] [0206] 상기 내용은 본 개시의 양상들에 관한 것이지만, 본 개시의 기본적 범위를 벗어나지 않으면서 본 개시의 다른 양상들 및 추가적 양상들이 고안될 수 있고, 이들의 범위는 후속하는 청구항들에 의해 결정된다.

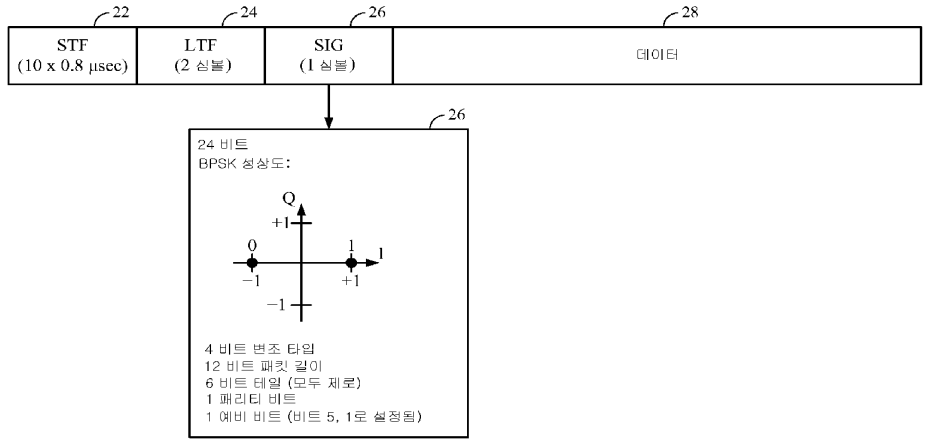
도면

도면1



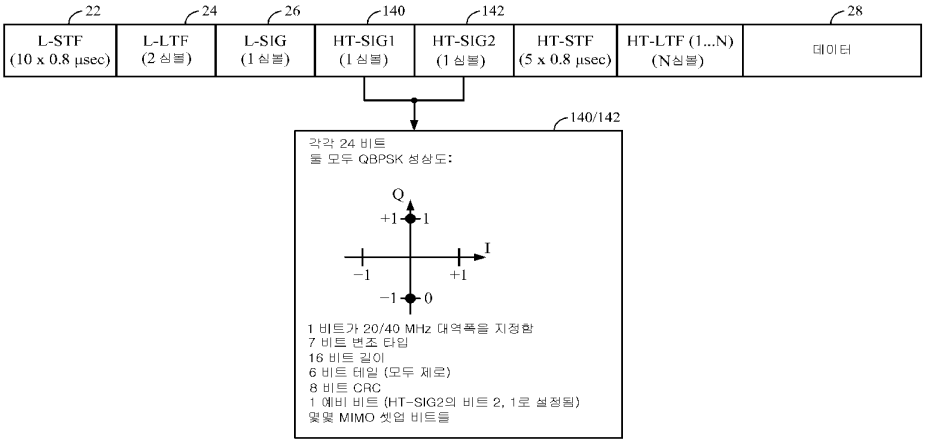
도면2

IEEE 802.11a/b/g 다운링크 패킷:



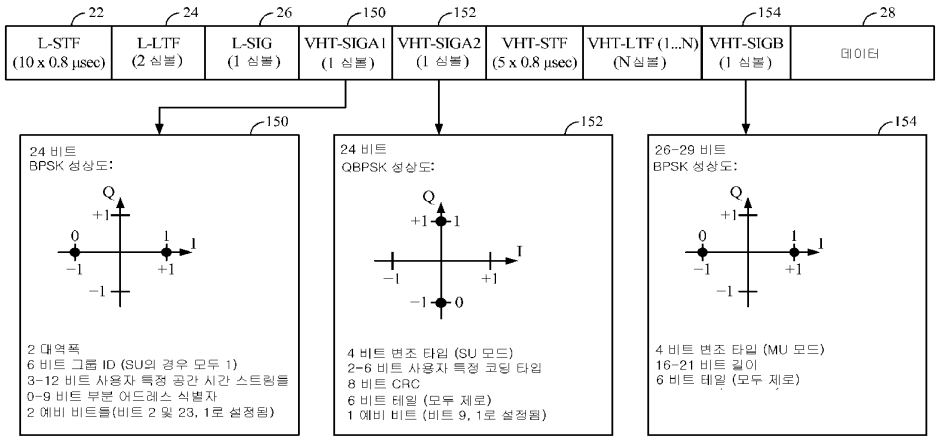

도면3

IEEE 802.11n 다운링크 패킷 :



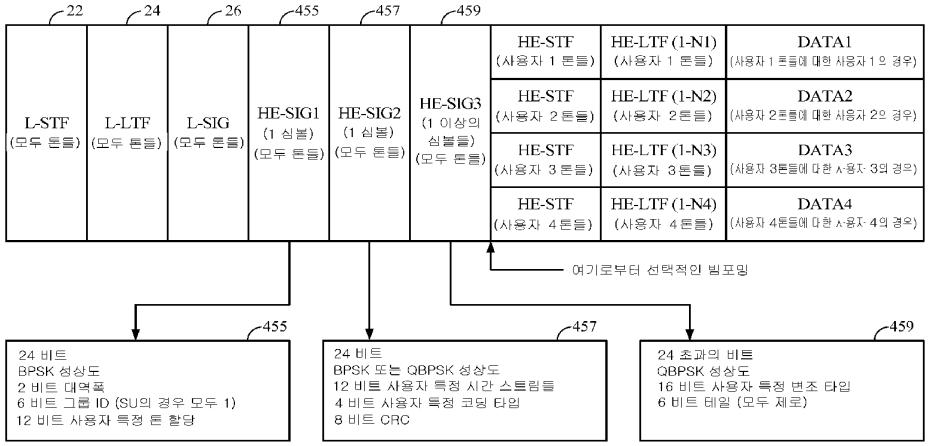
도면4

IEEE 802.11ac 다운링크 패킷:

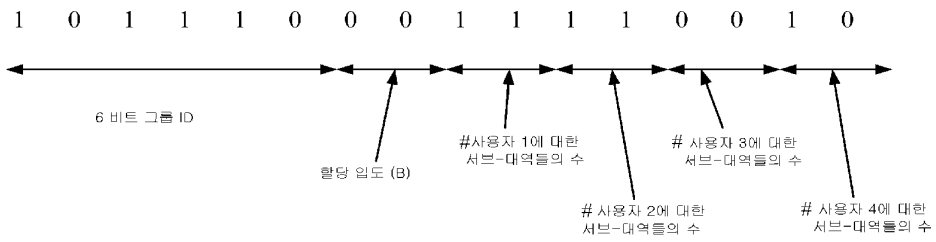



도면5

HE 톤 할당 다운링크 패킷 구현 1:

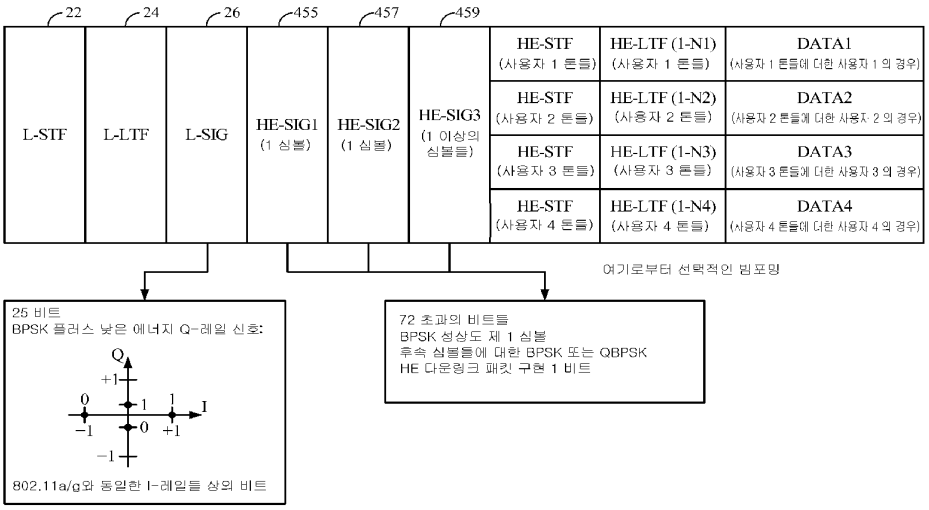



도면6



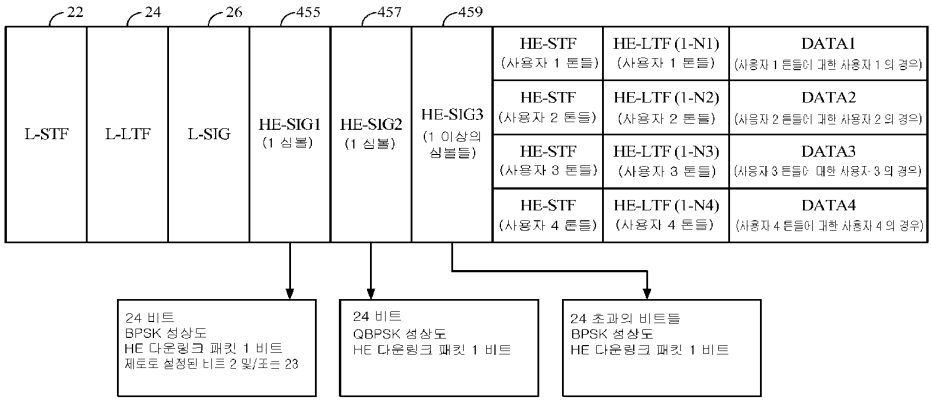
도면7

HE 톤 할당 다운링크 패킷 구현 2:

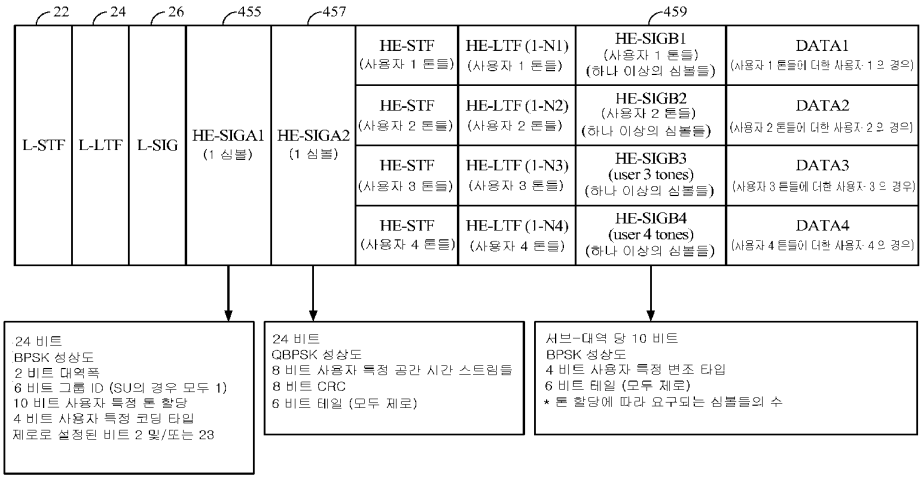



도면8

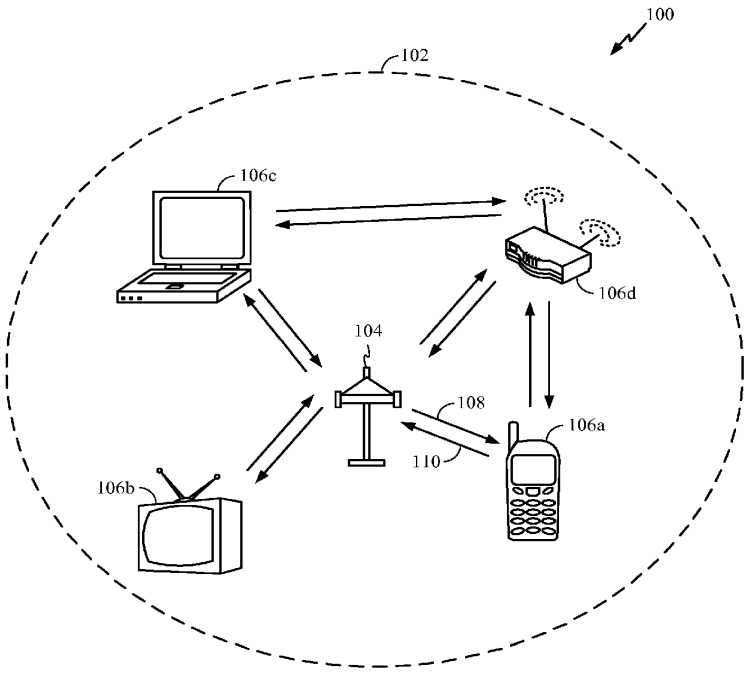
HE 톤 할당 다운링크 패킷 구현 3:



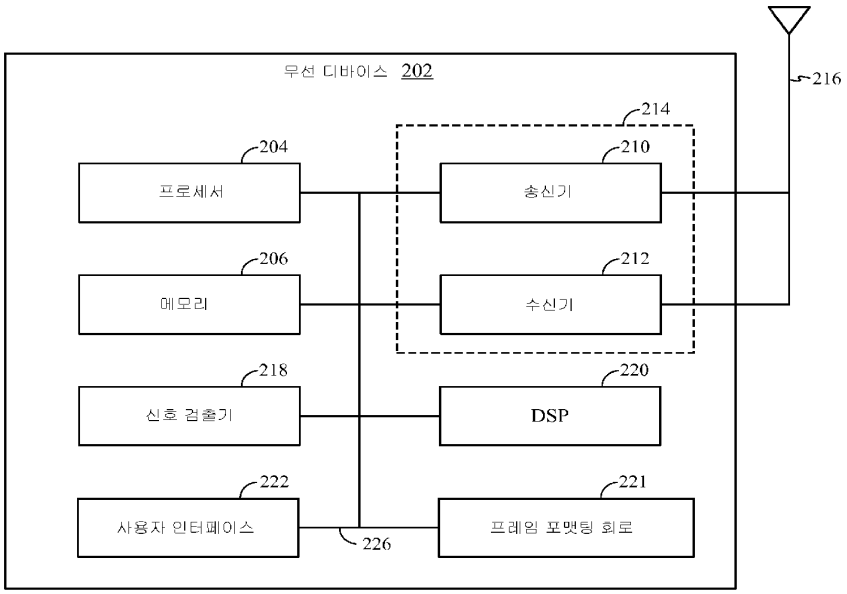
도면9


HE 톤 할당 다운링크 패킷 구현 4:
22
24
26
455
457
459
L-STF
L-LTF
L-SIG
HE-SIGA1 (1 심볼)
HE-SIGA2 (1 심볼)
HE-STF (사용자 1 톤들)
HE-LTF (1-N1) (사용자 1 톤들)
HE-SIGB1 (사용자 1 톤들) (하나 이상의 심볼들)
DATA1 (사용자 1 톤들에 대한 사용자 1 의 경우)
HE-STF (사용자 2 톤들)
HE-LTF (1-N2) (사용자 2 톤들)
HE-SIGB2 (사용자 2 톤들) (하나 이상의 심볼들)
DATA2 (사용자 2 톤들에 대한 사용자 2 의 경우)
HE-STF (사용자 3 톤들)
HE-LTF (1-N3) (사용자 3 톤들)
HE-SIGB3 (user 3 tones) (하나 이상의 심볼들)
DATA3 (사용자 3 톤들에 대한 사용자 3 의 경우)
HE-STF (사용자 4 톤들)
HE-LTF (1-N4) (사용자 4 톤들)
HE-SIGB4 (user 4 tones) (하나 이상의 심볼들)
DATA4 (사용자 4 톤들에 대한 사용자 4 의 경우)
24 비트
BPSK 성상도
2 비트 대역폭
6 비트 그룹 ID (SU의 경우 모두 1)
10 비트 사용자 특정 톤 할당
4 비트 사용자 특정 코딩 타입
제로로 설정된 비트 2 및/또는 23
24 비트
QBPSK 성상도
8 비트 사용자 특정 공간 시간 스트림들
8 비트 CRC
6 비트 테일 (모두 제로)
서브-대역 당 10 비트
BPSK 성상도
4 비트 사용자 특정 변조 타입
6 비트 테일 (모두 제로)
* 톤 할당에 따라 요구되는 심볼들의 수

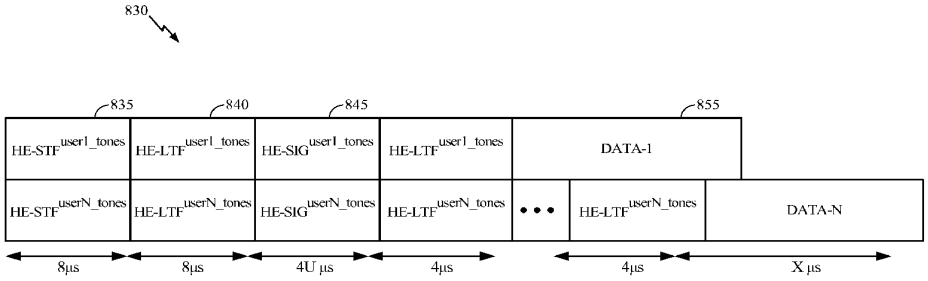
도면10


100
102
106c
106d
104
108
110
106a
106b

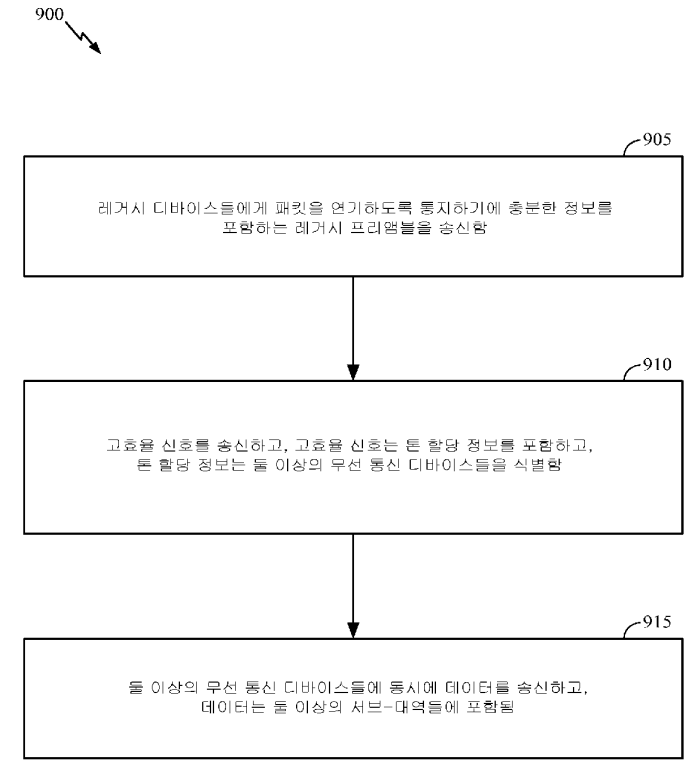
도면11


무선 디바이스 202
216
214
204
프로세서
210
송신기
206
메모리
212
수신기
218
신호 검출기
220
DSP
222
사용자 인터페이스
226
221
프레임 포맷팅 회로

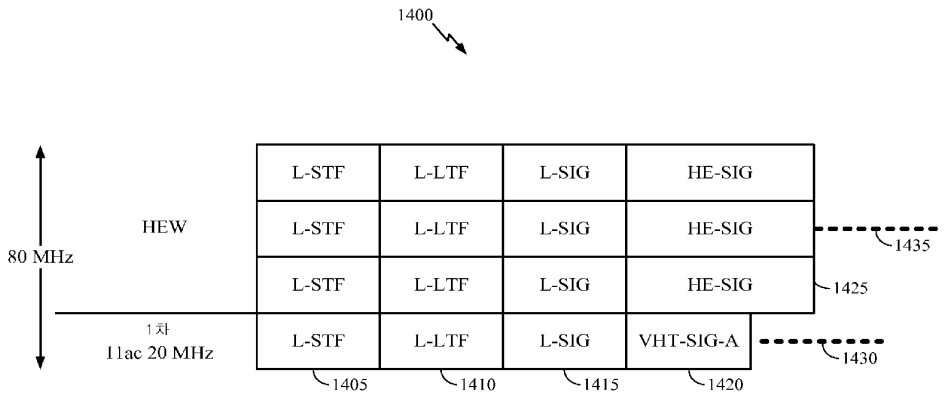
도면12


830
835
840
845
855
HE-STF user1_tones
HE-LTF user1_tones
HE-SIG user1_tones
HE-LTF user1_tones
DATA-1
HE-STF userN_tones
HE-LTF userN_tones
HE-SIG userN_tones
HE-LTF userN_tones
HE-LTF userN_tones
DATA-N
8μs
8μs
4U μs
4μs
4μs
X μs

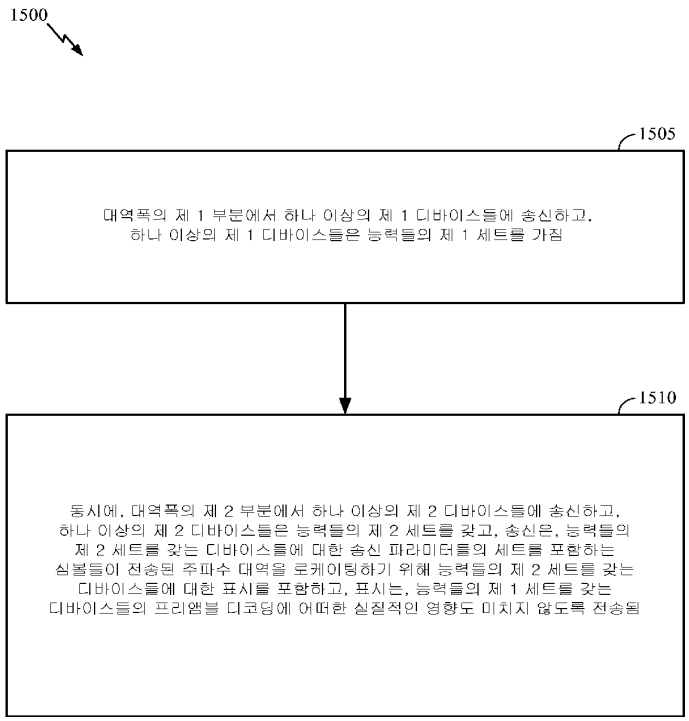
도면13


900
905
레거시 디바이스들에게 패킷을 연기하도록 통지하기에 충분한 정보를 포함하는 레거시 프리앰블을 송신함
910
고효율 신호를 송신하고, 고효율 신호는 톤 할당 정보를 포함하고, 톤 할당 정보는 둘 이상의 무선 통신 디바이스들을 식별함
915
둘 이상의 무선 통신 디바이스들에 동시에 데이터를 송신하고, 데이터는 둘 이상의 서브-대역들에 포함됨

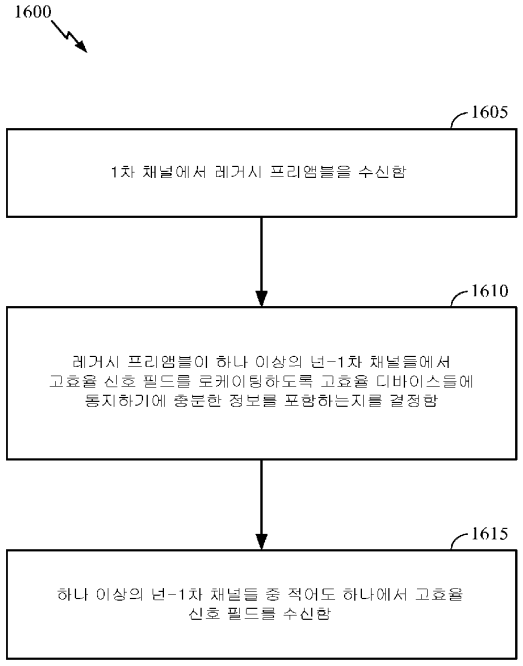
도면14


1400
80 MHz
HEW
1차
11ac 20 MHz
L-STF
L-LTF
L-SIG
HE-SIG
VHT-SIG-A
1405
1410
1415
1420
1425
1430
1435

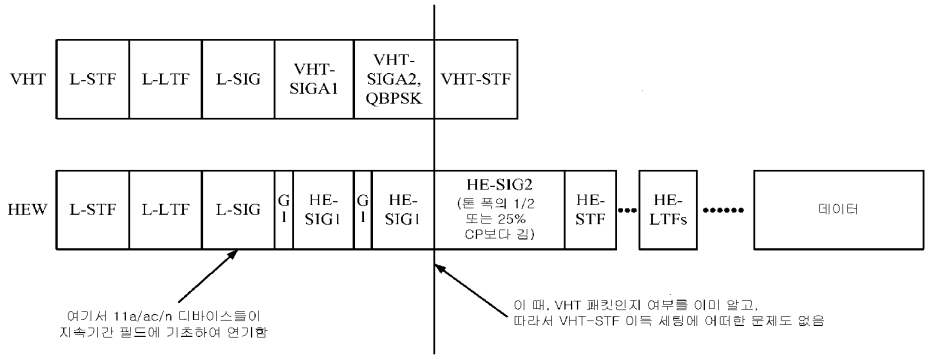
도면15


1500
1505
대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들에 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 가짐
1510
동시에, 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 송신은, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들이 전송된 주파수 대역을 로케이팅하기 위해 능력들의 제 2 세트를 갖는 디바이스들에 대한 표시를 포함하고, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 어떠한 실질적인 영향도 미치지 않도록 전송됨

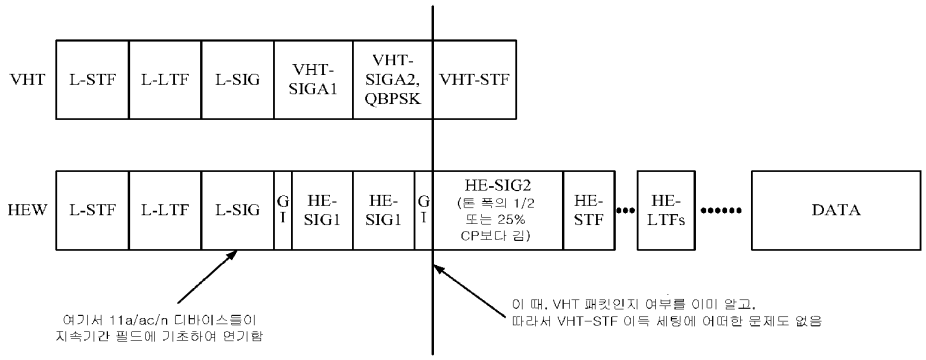
도면16


1600
1605
1차 채널에서 레거시 프리앰블을 수신함
1610
레거시 프리앰블이 하나 이상의 넌-1차 채널들에서 고효율 신호 필드를 로케이팅하도록 고효율 디바이스들에 통지하기에 충분한 정보를 포함하는지를 결정함
1615
하나 이상의 넌-1차 채널들 중 적어도 하나에서 고효율 신호 필드를 수신함

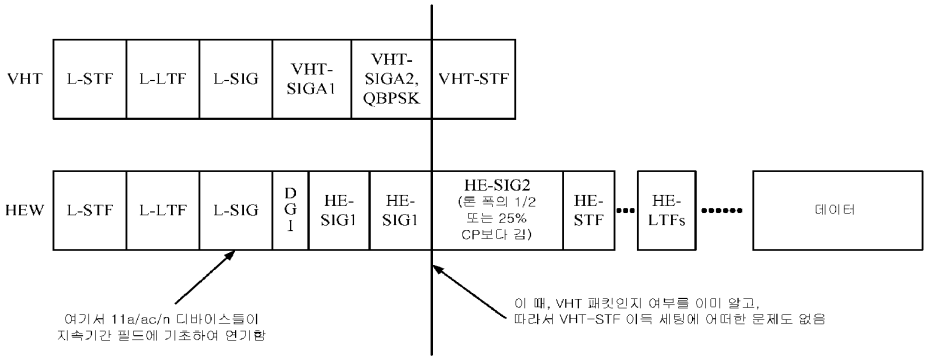
도면17


VHT
L-STF
L-LTF
L-SIG
VHT-SIGA1
VHT-SIGA2, QBPSK
VHT-STF
HEW
L-STF
L-LTF
L-SIG
G I
HE-SIG1
G I
HE-SIG1
HE-SIG2 (톤 폭의 1/2 또는 25% CP보다 김)
HE-STF
HE-LTFs
데이터
여기서 11a/ac/n 디바이스들이 지속기간 필드에 기초하여 연기함
이 때, VHT 패킷인지 여부를 이미 알고, 따라서 VHT-STF 이득 세팅에 어떠한 문제도 없음

도면18



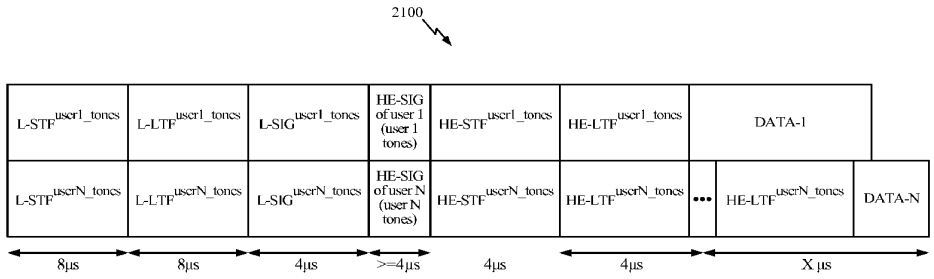

도면19



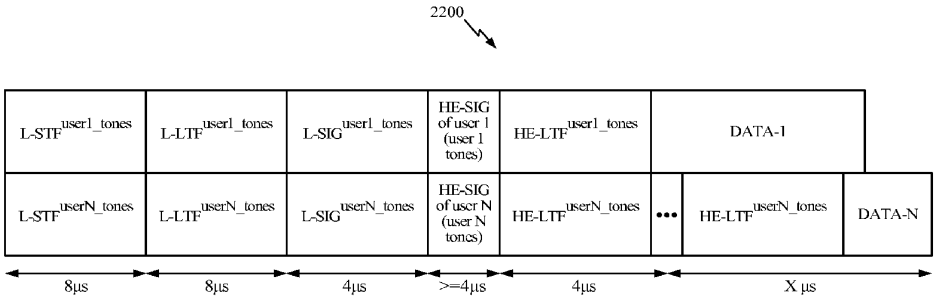

도면20

| 필드 | 비트 수 |
|---|---|
| BW | 2-3 |
| 심볼 길이 | 8 |
| 더 긴 심볼을 ON | 1 |
| 예비됨 | 2-3 |
| CRC | 4 |
| 테일 | 6 |

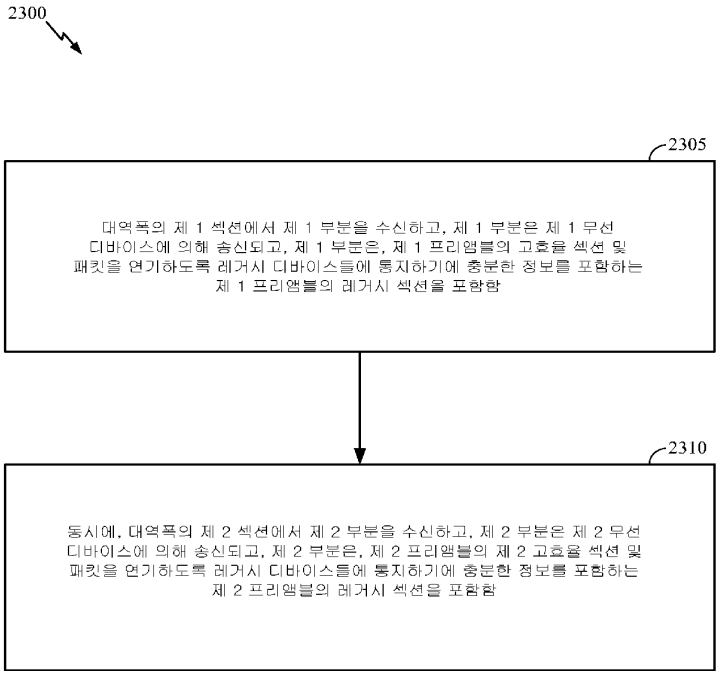
도면21


2100
L-STF^user1_tones
L-LTF^user1_tones
L-SIG^user1_tones
HE-SIG of user 1 (user 1 tones)
HE-STF^user1_tones
HE-LTF^user1_tones
DATA-1
L-STF^userN_tones
L-LTF^userN_tones
L-SIG^userN_tones
HE-SIG of user N (user N tones)
HE-STF^userN_tones
HE-LTF^userN_tones
HE-LTF^userN_tones
DATA-N
8μs
8μs
4μs
>=4μs
4μs
4μs
X μs

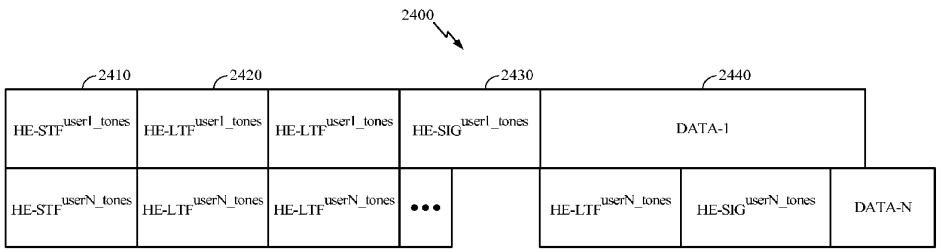
도면22


2200
L-STF^user1_tones
L-LTF^user1_tones
L-SIG^user1_tones
HE-SIG of user 1 (user 1 tones)
HE-LTF^user1_tones
DATA-1
L-STF^userN_tones
L-LTF^userN_tones
L-SIG^userN_tones
HE-SIG of user N (user N tones)
HE-LTF^userN_tones
HE-LTF^userN_tones
DATA-N
8μs
8μs
4μs
>=4μs
4μs
X μs

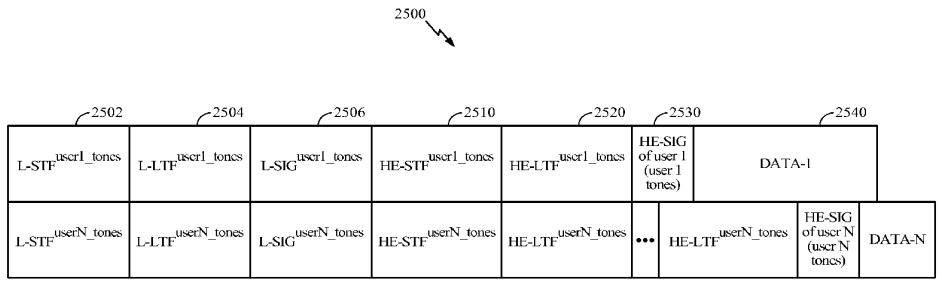
도면23



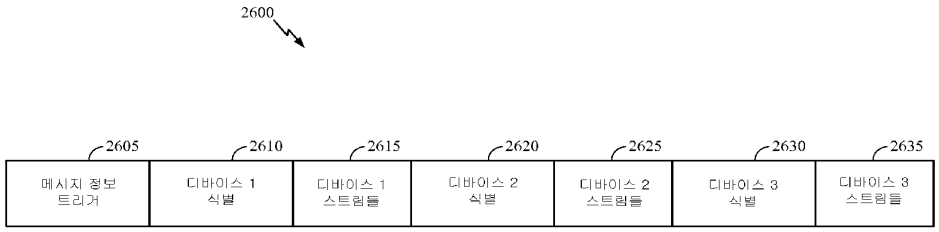

도면24



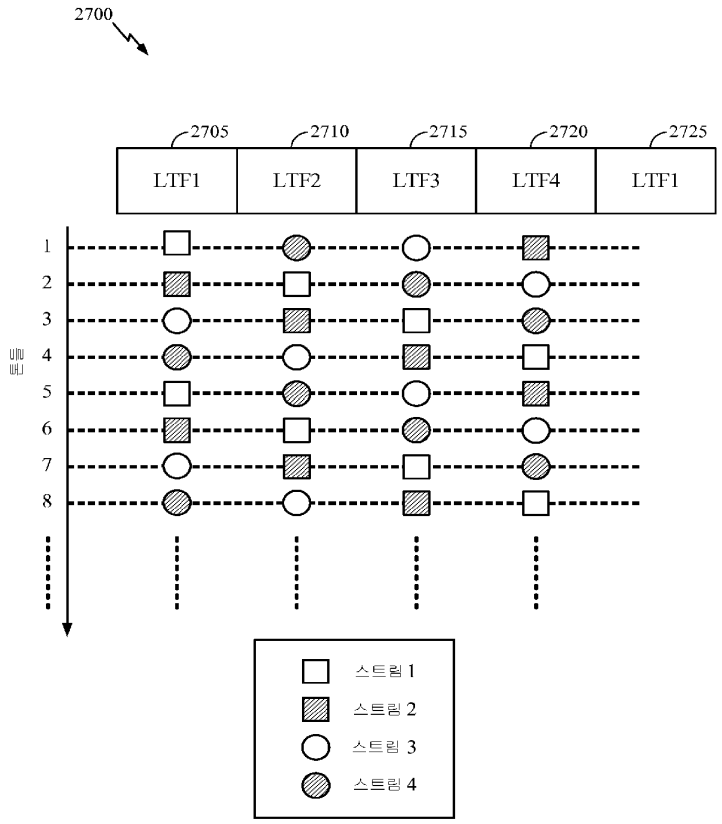

도면25



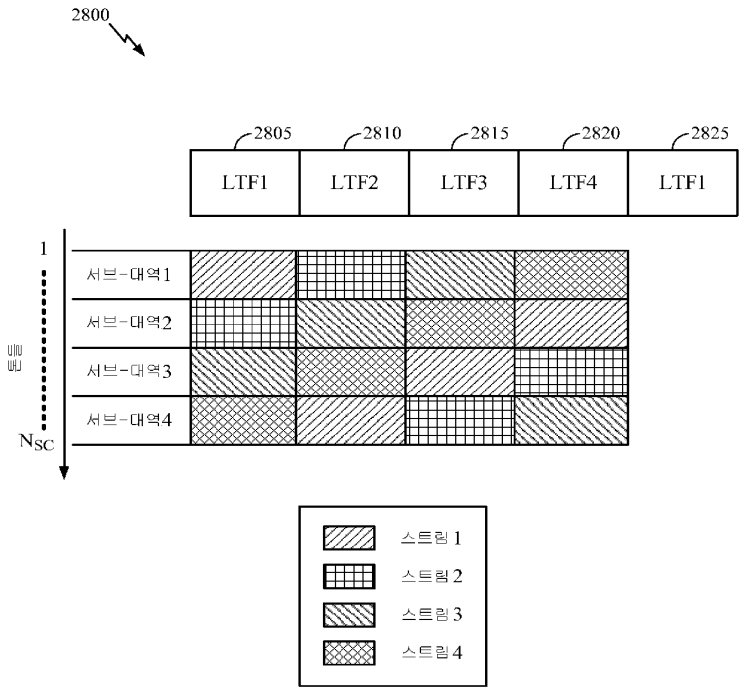
도면26


2600
2605
2610
2615
2620
2625
2630
2635
메시지 정보 트리거
디바이스 1 식별
디바이스 1 스트림들
디바이스 2 식별
디바이스 2 스트림들
디바이스 3 식별
디바이스 3 스트림들

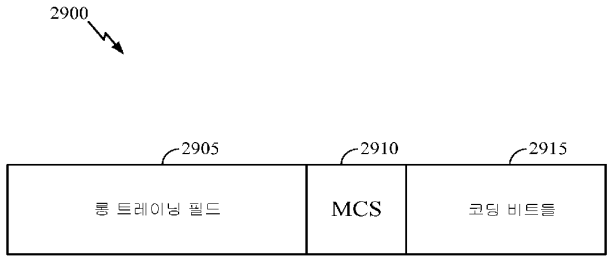
도면27


2700
2705
2710
2715
2720
2725
LTF1
LTF2
LTF3
LTF4
LTF1
톤
1
2
3
4
5
6
7
8
스트림 1
스트림 2
스트림 3
스트림 4

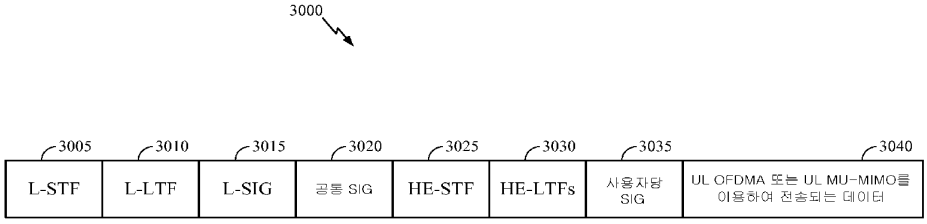
도면28



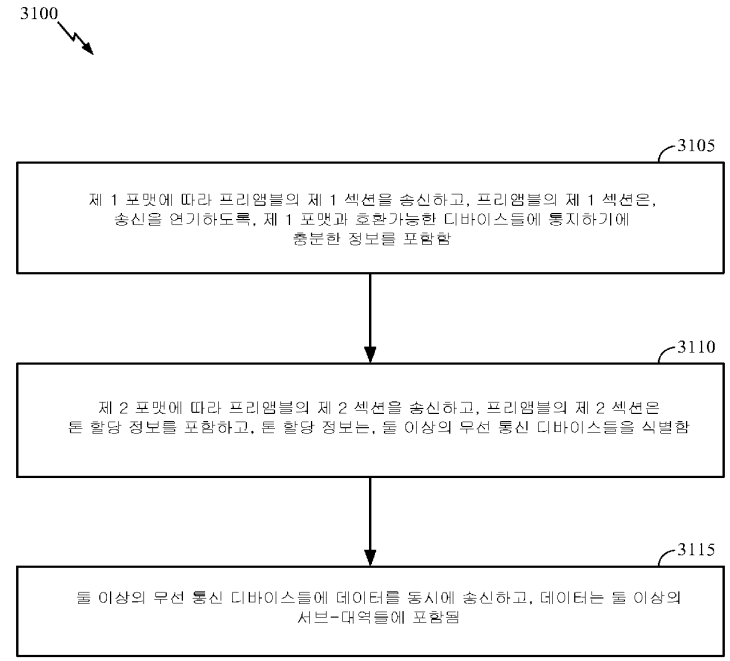

도면29



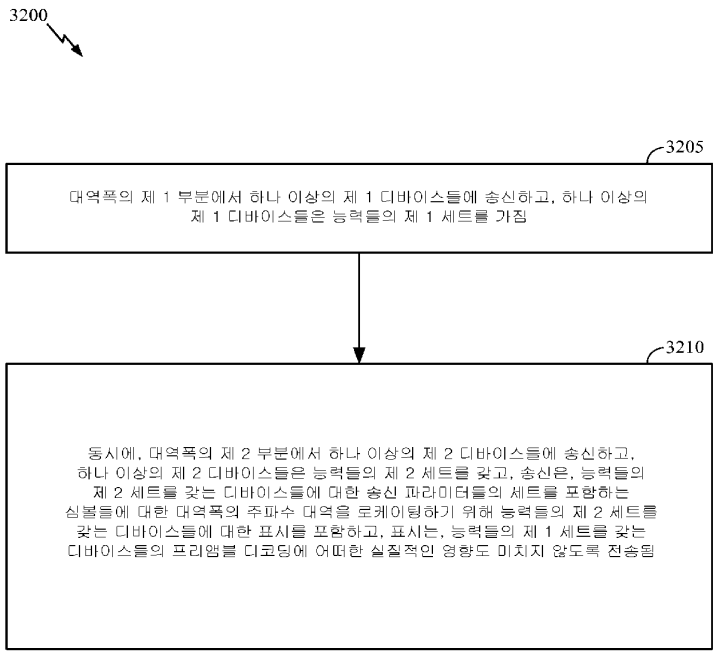

도면30



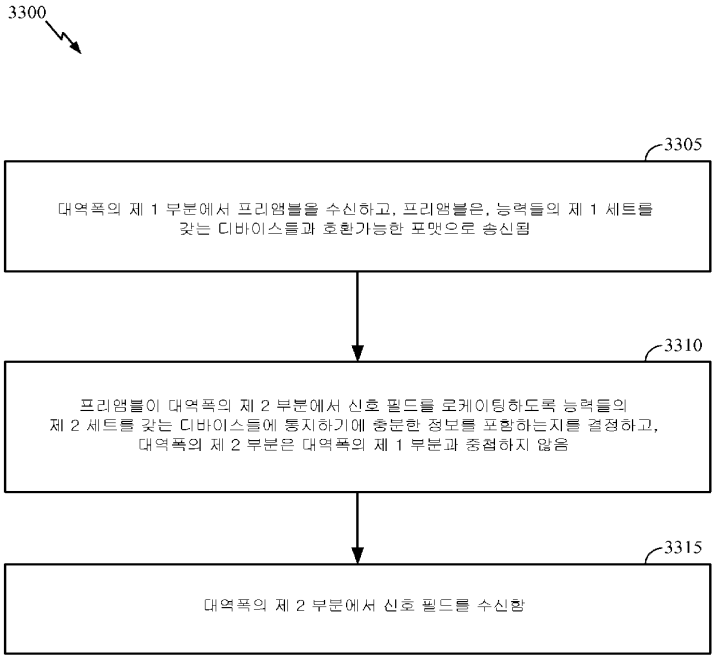
도면31


3100
3105
제 1 포맷에 따라 프리앰블의 제 1 섹션을 송신하고, 프리앰블의 제 1 섹션은, 송신을 연기하도록, 제 1 포맷과 호환가능한 디바이스들에 통지하기에 충분한 정보를 포함함
3110
제 2 포맷에 따라 프리앰블의 제 2 섹션을 송신하고, 프리앰블의 제 2 섹션은 톤 할당 정보를 포함하고, 톤 할당 정보는, 둘 이상의 무선 통신 디바이스들을 식별함
3115
둘 이상의 무선 통신 디바이스들에 데이터를 동시에 송신하고, 데이터는 둘 이상의 서브-대역들에 포함됨

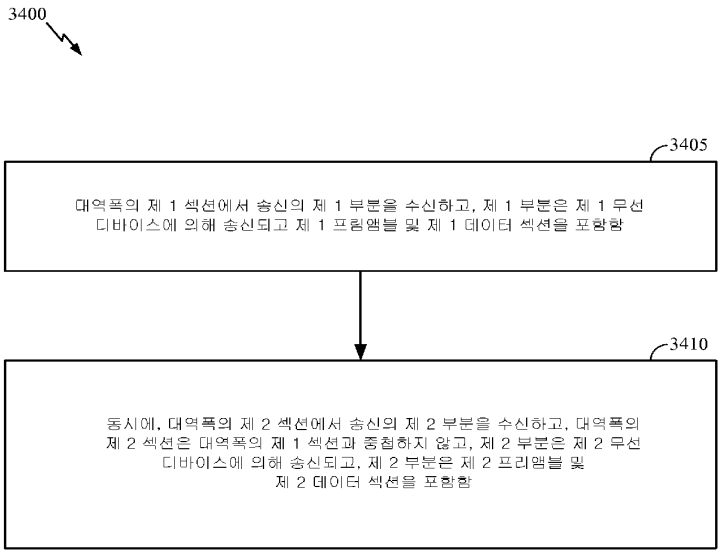
도면32


3200
3205
대역폭의 제 1 부분에서 하나 이상의 제 1 디바이스들에 송신하고, 하나 이상의 제 1 디바이스들은 능력들의 제 1 세트를 가짐
3210
동시에, 대역폭의 제 2 부분에서 하나 이상의 제 2 디바이스들에 송신하고, 하나 이상의 제 2 디바이스들은 능력들의 제 2 세트를 갖고, 송신은, 능력들의 제 2 세트를 갖는 디바이스들에 대한 송신 파라미터들의 세트를 포함하는 심볼들에 대한 대역폭의 주파수 대역을 로케이팅하기 위해 능력들의 제 2 세트를 갖는 디바이스들에 대한 표시를 포함하고, 표시는, 능력들의 제 1 세트를 갖는 디바이스들의 프리앰블 디코딩에 어떠한 실질적인 영향도 미치지 않도록 전송됨

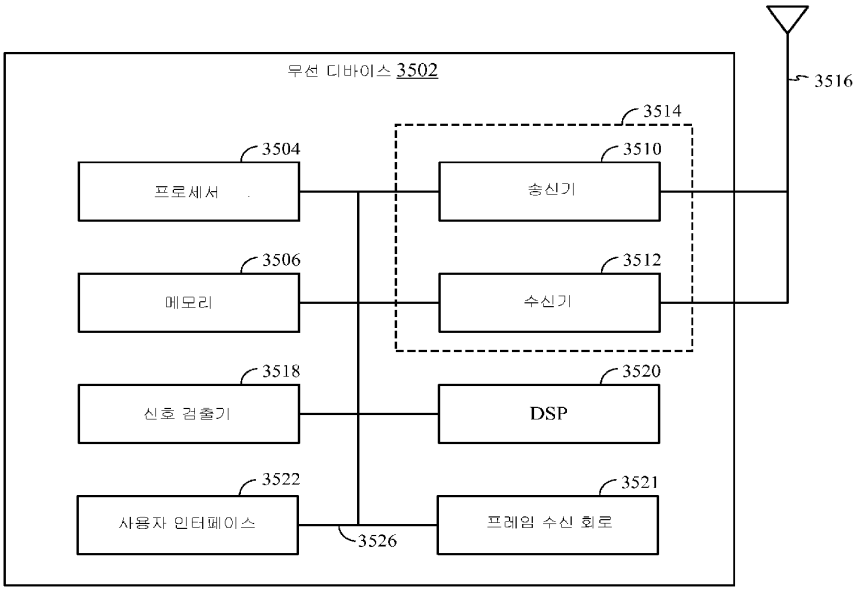
도면33


3300
3305
대역폭의 제 1 부분에서 프리앰블을 수신하고, 프리앰블은, 능력들의 제 1 세트를 갖는 디바이스들과 호환가능한 포맷으로 송신됨
3310
프리앰블이 대역폭의 제 2 부분에서 신호 필드를 로케이팅하도록 능력들의 제 2 세트를 갖는 디바이스들에 통지하기에 충분한 정보를 포함하는지를 결정하고, 대역폭의 제 2 부분은 대역폭의 제 1 부분과 중첩하지 않음
3315
대역폭의 제 2 부분에서 신호 필드를 수신함

도면34


3400
3405
대역폭의 제 1 섹션에서 송신의 제 1 부분을 수신하고, 제 1 부분은 제 1 무선 디바이스에 의해 송신되고 제 1 프리앰블 및 제 1 데이터 섹션을 포함함
3410
동시에, 대역폭의 제 2 섹션에서 송신의 제 2 부분을 수신하고, 대역폭의 제 2 섹션은 대역폭의 제 1 섹션과 중첩하지 않고, 제 2 부분은 제 2 무선 디바이스에 의해 송신되고, 제 2 부분은 제 2 프리앰블 및 제 2 데이터 섹션을 포함함

도면35


무선 디바이스 3502
3516
3514
3504
프로세서
3510
송신기
3506
메모리
3512
수신기
3518
신호 검출기
3520
DSP
3522
사용자 인터페이스
3526
3521
프레임 수신 회로

Unexamined Patent Publication(A)

## Bibliographic Data


| | |
|---|---|
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| **Application Date** | 20121016 |
| **Unexamined Publication No.** | 1020150035569 |
| **Unexamined Publication Date** | 20150406 |
| **Priority Claims** | 61/669,656 \| 20120709 \| US |
| **Agent.** | KIM, Yong In \| Bang Hae Cheol |
| **Inventor** | SEOK,Yongho |
| **Applicant** | LG Electronics Inc. |


## 발명의 명칭

무선 통신 시스템에서 동작 채널 정보를 송수신하는 방법 및 장치

## Title of Invention

METHOD AND APPARATUS FOR TRANSRECEIVING OPERATING CHANNEL INFORMATION IN WIRELESS COMMUNICATION SYSTEM

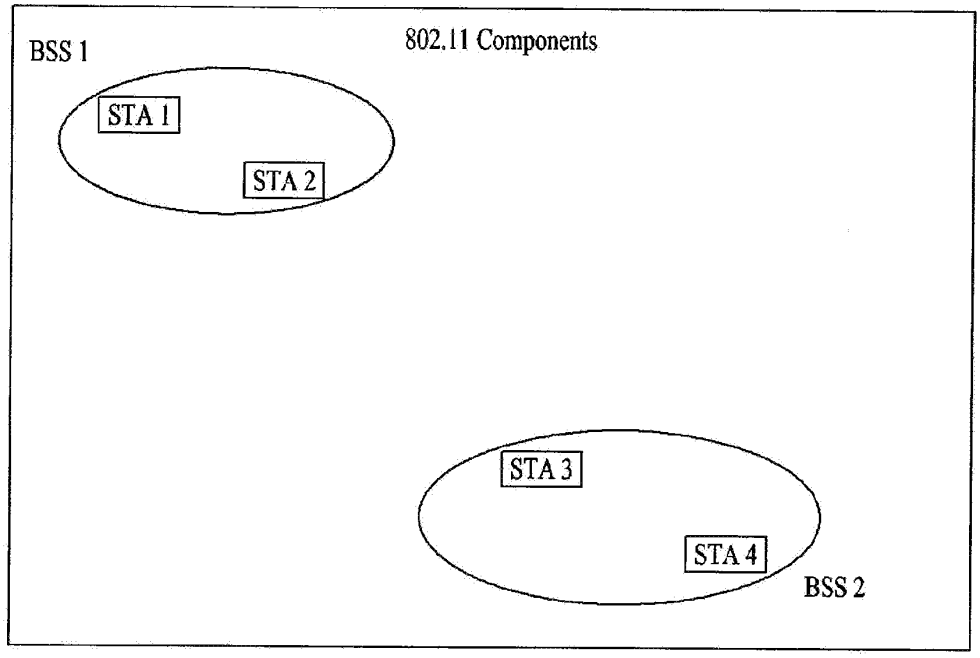
## 요약

본 발명은 무선 통신 시스템에 대한 것으로, 보다 상세하게는 동작 채널 정보를 송수신하는 방법 및 장치가 개시된다. 본 발명의 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고, 상기 SIG 필드는 BW (BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

## Abstract

The invention relates to the radio communication system, and a method and apparatus for more specifically sending and receiving the working channel information are disclosed. The method for providing the operation parameter concerning the station (STA) operating in the white space band according to a preferred embodiment of the present invention includes the step of transmitting the frame including the operation information field including the channel width subfield and the step of transmitting the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble and the SIG field includes the BW (BandWidth) field and the type of PPDU can be determined based on the channel width bottom field and BW field.

## 대표도면(Representative drawing)




## 청구의 범위

청구 **1**항:

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법에 있어서,

채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및

PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 제공 방법.

청구 **2**항:

제 1 항에 있어서,

상기 채널 폭은 하나 이상의 W 채널을 포함하고,

상기 채널 폭 서브필드의 값은,

하나의 W 채널에 대한 제 1 타입 채널 폭;

2 개의 연속적인(contiguous) W 채널들에 대한 제 2 타입 채널 폭;

2 개의 불연속적인(non-contiguous) W 채널들에 대한 제 3

## Scope of Claims

**Claim 1:**

An operation parameter *** comprising the steps of: including the step :

which transmits the frame including the operation information field including

channel width subfield and the step of transmitting the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble as to the method for providing the operation parameter concerning the station (STA) which operates in the white space band;

SIG field including the BW (BandWidth) field; and the type of

PPDU being determined based on the channel width bottom field and BW field.

**Claim 2:**

The operation parameter *** for indicating one among the fifth type channel width

about 2 discontinuous frequency segments of claim 1, wherein

channel width comprises at least one W channel, and the value of

channel width subfield comprise successive W channels of the frequency segment 2 of the fourth type channel width: or

타입 채널 폭;

4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭; 또는

각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭

중에서 하나를 지시하는, 동작 파라미터 제공 방법.

about successive W channels of the third type channel width :

4 about noncontinuous (non-contiguous) W channels o f the second type channel width :

2 about consecutive (contiguous) W channels of the fir st type channel width :

2 about W channel of

one.

**청구 3항:**

제 2 항에 있어서,

상기 채널 폭 서브필드가 상기 제 1 타입 채널 폭을 지시하고 상기 BW 필드가 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하는, 동작 파라미터 제공 방법.

**Claim 3:**

As for claim 2, the operation parameter *** wherein

channel width subfield indicates the first type channel width, and the BW field it indicates ; and the PPDU typ e corresponds to one W channel the first value.

**청구 4항:**

제 3 항에 있어서,

상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**Claim 4:**

As for claim 3, the operation parameter *** wherein

channel width subfield indicates the second type chann el width, and the BW field indicates ; and the PPDU typ e corresponds to successive W channels of 2 the BW fi eld is the second number

channel width subfield indicates the second type chann el width the first value is indicated ; and the PPDU typ e corresponds to one W channel.

**청구 5항:**

제 4 항에 있어서,

상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**Claim 5:**

As for claim 4, the operation parameter *** wherein

channel width subfield indicates the third type channel width, and the BW field indicates ; and the PPDU type corresponds to discontinuous W channels of 2 the BW f ield is the second number

channel width subfield indicates the third type channel width the first value is indicated ; and the PPDU type c orresponds to one W channel.

**청구 6항:**

제 5 항에 있어서,

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고,

**Claim 6:**

As for claim 5, the operation parameter *** wherein the PPDU type

channel width subfield indicates the fourth type chann el width indicates

channel width subfield is the fourth type channel width it corresponds to one W channel, and the PPDU type th e BW field indicates the second number it corresponds to 2 successive W channels and

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

channel width subfield indicates the fourth type channel width and the BW field indicates the third value ; and the PPDU type corresponds to successive W channels of 4.

**청구 7항:**

**Claim 7:**

제 6 항에 있어서,

As for claim 6, the operation parameter *** for corresponding to 2 discontinuous frequency segments wherein the PPDU type

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

channel width subfield indicates the fifth type channel width indicates

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고,

channel width subfield is the fifth type channel width it corresponds to one W channel, and the PPDU type the BW field indicates the second number it corresponds to 2 successive W channels and

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응하는, 동작 파라미터 제공 방법.

channel width subfield indicates the fifth type channel width and the BW field indicates the third value ; and the PPDU type includes successive W channels of each frequency segment 2.

**청구 8항:**

**Claim 8:**

제 2 항에 있어서,

As for claim 2, the operation parameter *** wherein

상기 BW 필드가 제 1 값을 가지고, 상기 채널 폭 서브필드가 제 1, 제 2, 제 3, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하는, 동작 파라미터 제공 방법.

BW field has the first value, and the channel width subfield it indicates ; and the PPDU type corresponds to one W channel the first, the second, the third, the fourth or the fifth type channel width.

**청구 9항:**

**Claim 9:**

제 2 항에 있어서,

As for claim 2, the operation parameter *** wherein

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 2, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

BW field has the second number, and the channel width subfield indicates ; and the PPDU type corresponds to successive W channels of 2 the second, and the four th or the fifth type channel width.

**청구 10항:**

**Claim 10:**

제 2 항에 있어서,

As for claim 2, the operation parameter *** wherein

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 3 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

BW field has the second number, and the channel width subfield indicates ; and the PPDU type corresponds to discontinuous W channels of 2 the third type channel width.

**청구 11항:**

**Claim 11:**

제 2 항에 있어서,

As for claim 2, the operation parameter *** wherein

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 4 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

BW field has the third value, and the channel width subfield indicates ; and the PPDU type corresponds to successive W channels of 4 the fourth type channel width.

**청구 12항:**

**Claim 12:**

제 2 항에 있어서,

As for claim 2, the operation parameter *** for corresponding to 2 discontinuous frequency segments

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응하는, 동작 파라미터 제공 방법.

wherein

BW field has the third value, and the channel width sub field includes the PPDU type is successive W channels of each frequency segment 2 the fifth type channel wi dth is indicated.

**청구 13항:**

**Claim 13:**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대한 동작 파라미터를 수신하는 방법에 있어서,

An operation parameter receiving method comprising the steps of: including the step :

채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하는 단계; 및

which receives the frame including the operation inform ation field including

PPDU(Physical layer convergence procedure(PLCP) Pro tocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하는 단계를 포함하고,

channel width subfield and the step of receiving the SI G (Signal) field of the PPDU (Physical layer convergenc e procedure(PLCP) Protocol Data Unit)) preamble as to the method for receiving the operation parameter abou t the station (STA) which operates in the white space band;

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

SIG field including the BW (BandWidth) field; and the ty pe of

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 수신 방법.

PPDU being determined based on the channel width bot tom field and BW field.

**청구 14항:**

**Claim 14:**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 장치에 있어서,

The type of

다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및

PPDU is the channel width bottom field and the operati on parameter providing apparatus for being determined based on the BW field

상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고,

SIG field includes the BW (BandWidth) field the SIG (Si gnal) field of the PPDU (Physical layer convergence pro cedure(PLCP) Protocol Data Unit)) preamble is further c onfigured to be transmitted

상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하고, PPDU(Physical layer convergence procedure(PLCP) Prot ocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하도록 더 구성되고,

processor transmits the frame including the operation i nformation field including the channel width subfield thr ough the transceiver the processor which is configured to control the apparatus including the transceiver :

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

of configured to performing transmission and/or recepti on with the instrument different with

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 제공 장치.

and transceiver is included as to the apparatus for pro viding the operation parameter concerning the station (STA) operating in the white space band.

**청구 15항:**

**Claim 15:**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 수신하는 장치에 있어서,

The type of

다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및

PPDU is the channel width bottom field and the operati on parameter receiving device for being determined bas ed on the BW field

상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고,

SIG field includes the BW (BandWidth) field the SIG (Si gnal) field of the PPDU (Physical layer convergence pro cedure(PLCP) Protocol Data Unit)) preamble is further c onfigured to be received

상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하고, P

PDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하도록 더 구성되고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 수신 장치.

processor receives the frame including the operation information field including the channel width subfield through the transceiver the processor which is configured to control the apparatus including the transceiver :

of configured to performing transmission and/or reception with the instrument different with

and transceiver is included as to the apparatus for receiving the operation parameter about the station (STA) operating in the white space band.

## 기술분야

이하의 설명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 무선랜 시스템에서의 동작 채널 정보를 송수신하는 방법 및 장치에 대한 것이다.

## Technical Field

The description of less than is related to the radio communication system, a method and apparatus for more specifically sending and receiving the working channel information at the wireless LAN-system.

## 배경기술

무선랜(wireless local area network, WLAN) 기술에 대한 표준은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준으로서 개발되고 있다. IEEE 802.11a 및 b는 2.4. GHz 또는 5 GHz에서 비면허 대역(unlicensed band)을 이용하고, IEEE 802.11b는 11 Mbps의 전송 속도를 제공하고, IEEE 802.11a는 54 Mbps의 전송 속도를 제공한다. IEEE 802.11g는 2.4 GHz에서 직교 주파수 분할 다중화(Orthogonal Frequency Division Multiplexing; OFDM)를 적용하여, 54 Mbps의 전송 속도를 제공한다. IEEE 802.11n은 다중 입출력 OFDM(Multiple Input Multiple Output-OFDM; MIMO-OFDM)을 적용하여, 4 개의 공간적인 스트림(spatial stream)에 대해서 300 Mbps의 전송 속도를 제공한다. IEEE 802.11n에서는 채널 대역폭(channel bandwidth)을 40 MHz까지 지원하며, 이 경우에는 600 Mbps의 전송 속도를 제공한다.

## Background Art

The standard about the wireless LAN (wireless local area network, WLAN) technology is developed as IEEE (Institute of Electrical and Electronics Engineers) 802.11 standard. In the IEEE 802.11a and b is 2.4. GHz or 5 GHz, the non-licensed band (unlicensed band) is used and the IEEE 802.11b provides the transfer rate of 11 Mbps and the IEEE 802.11a provides the transfer rate of 54 Mbps. In the IEEE 802.11g is 2.4 GHz, the orthogonal frequency division multiplex (Orthogonal Frequency Division Multiplexing: OFDM) is applied and the transfer rate of 54 Mbps is provided. The IEEE 802.11n applies *** OFDM (Multiple Input Multiple Output-OFDM: MIMO-OFDM) and the transfer rate of 300 Mbps is provided concerning the spacious stream (spatial stream) of 4. In the IEEE 802.11n, the channel bandwidth is supported to 40 MHz and the transfer rate of 600 Mbps is provided in this case.

현재, TV 화이트 스페이스(TV whitespace, TVWS) 대역에서 비면허 기기(unlicensed device)의 동작을 규정하기 위한 IEEE 802.11af 표준이 개발되고 있다.

In the present, and the TV white space (TV whitespace, TVWS) band, the IEEE 802.11af standard for prescribing the operation of the dome emptiness instrument (unlicensed device) is developed.

TVWS는 TV 방송을 위해 할당된 VHF(Very High Frequency) 대역(54~60, 76~88, 174~216MHz)과 UHF (Ultra High Frequency) 대역(470~698MHz)을 포함하며, 해당 주파수 대역에서 동작하는 면허 기기(licensed device; TV방송 및 무선 마이크 등)의 통신을 저해하지 않는다는 조건하에서 비면허 기기(unlicensed device)에 대해 사용이 허가된 주파수 대역을 의미한다.

VHF (Very High Frequency) bands (54~60, 76~88, 174~216MHz) and the UHF (Ultra High Frequency) band (470~698MHz) in which TVWS is allocated for the TV broadcast are included and the frequency band in which the use is permitted about the dome emptiness instrument (unlicensed device) which does not hinder the communication of license instrument (the licensed device: TV broadcast and wireless microphone etc) operating in the target frequency bandwidth is meant.

512~608MHz, 614~698MHz에서는 특수한 몇 가지 경우를 제외하고 모든 비면허 기기들에게 동작이 허용되어 있으나, 54~60MHz, 76~88MHz, 174~216MHz, 470~512MHz 대역은 고정형 기기(fixed device)간의 통신에만 허용되었다. 고정형 기기란 정해진 위치에서만 전송을 수행하는 기기를 말한다. 이하의 설명에 있어서 화이트 스페이스 대역은 상술한 TVWS를 포함하나, 이에 한정될 필요는 없다.

In 512~608MHz, 614~698MHz, the operation was allowed to all dome emptiness instruments the several kinds case of being special. But 54~60MHz, 76~88MHz, 174~216MHz, 470~512MHz band was allowed to the communication between the fixed type instrument (fixed device). In the position which the fixed type instrument is determined, the instrument performing the transmission is referred to. The white space band includes above-described TVWS as to the description of less than. B

ut there is no need to be thus restricted.

화이트 스페이스 대역을 사용하기 원하는 비면허 기기는 면허 기기에 대한 보호 기능을 제공해야 한다. 따라서 화이트 스페이스 대역에서 전송을 시작하기 전에 반드시 면허 기기가 해당 대역을 점유하고 있는지 여부를 확인하도록 한다. 즉, 화이트 스페이스 대역에서 면허 기기가 사용 중이지 않은 경우에만 비면허 기기의 사용이 허용될 수 있다.

The dome emptiness instrument which desires to use the white space band has to provide the protective about the license instrument. Therefore, in the white space band, before starting the transmission it confirms whether the license instrument certainly occupies the target bandwidth or not. That is, in the white space band, the use of the dome emptiness instrument can be allowed to the case in which the license instrument is not the use.

이를 위하여, 비면허 기기는 인터넷 혹은 전용망을 통해 지리적-위치 데이터베이스(Geo-location DataBase; GDB)에 접속하여 해당 지역에서 사용 가능한 채널 리스트(즉, 사용 가능한 채널(들)의 세트) 정보를 얻어 와야 한다. GDB는 자신에게 등록된 면허 기기의 정보와 해당 면허 기기들의 지리적 위치 및 사용 시간에 따라 동적으로 변화하는 채널 사용 정보를 저장하고 관리하는 데이터 베이스이다. 또한, 화이트 스페이스를 사용하는 비면허 기기들 간의 공존(coexistence) 문제를 해결하기 위해서, 공통 비콘 프레임(common beacon frame) 등과 같은 시그널링 프로토콜 및 스펙트럼 센싱 메커니즘(spectrum sensing mechanism) 등이 이용될 수 있다.

For this, the dome emptiness instrument connects to the geo-location database (Geo-location DataBase: GDB) through the internet or the dedicated network and the usable channel list (in other words, the set of the available channel ()) information has been being obtained from the corresponding area. According to the geographic position of the information of the license instrument in which GDB is registered to oneself and corresponding license instruments and life time, it is the database in which the channel use information which dynamically changes is stored and managed. Moreover, to solve the coexistence problem between dome emptiness instruments using the white space, the common beacon frame, including, the signaling protocol and spectrum sensing mechanism etc. can be used.

IEEE 802.11 시스템에서 TVWS 단말은 TVWS 스펙트럼에서 IEEE 802.11 MAC(Medium Access Control) 계층 및 PHY(Physical) 계층을 이용하여 동작하는 비면허 기기를 지칭할 수 있다. 본 문서에서 별도의 설명이 없으면 스테이션(STA)은 TVWS 스펙트럼에서 동작하는 TVWS 단말을 지칭한다.

In the IEEE 802.11 system, the TVWS terminal can name the IEEE 802.11 MAC (Medium Access Control) layer and the dome emptiness instrument operating using the PHY (Physical) layer in the TVWS spectrum. In the document, if there is no separate description, the TVWS terminal in which the station (STA) operates in the TVWS spectrum is named.

STA은 면허 사용자(TV 사용자 및 무선 마이크 등)를 포함하여 우선 접속이 허용되는 사용자인 우선적 사용자(incumbent user) 또는 프라이머리 사용자(primary user)를 보호하는 기능을 제공해야 한다. 즉, 우선적 사용자가 TVWS를 사용중이면 STA는 해당 채널의 사용을 중단해야 한다. 따라서 STA는 비면허 기기가 사용할 수 있는 가용 채널(즉, 면허 기기가 사용하지 않는 채널)을 알아내서 가용 채널(available channel)에서 동작하여야 한다.

STA includes license user (the TV user and wireless microphone etc) and the preferential user (incumbent user) which is the user in which first the connection is tolerated or the function of protecting the primary user has to be provided. That is, the preferential user as to the STA, has to discontinue the use of the corresponding channel TVWS if it is the busy. Therefore, STA finds the available channel (the channel which in other words, the license instrument does not use) that the dome emptiness instrument can use and it has to operate in the available channel.

STA이 가용 채널을 알아내기 위한 방법에는, 스펙트럼 센싱 메커니즘을 수행하는 방식 및 GDB에 접속하여 TV 채널 스케줄을 알아내는 방식 등이 있다. 스펙트럼 센싱 메커니즘으로 에너지 검출(energy detection) 방식 (수신 신호의 강도가 일정 값 이상이면 우선적 사용자가 사용 중인 것으로 판단하는 방식), 특징부 검출(feature detection) 방식 (디지털 TV 프리엠블(Preamble) 이 검출 되면 우선적 사용자가 사용 중인 것으로 판단하는 방식) 등이 활용될 수 있다. 다음으로, STA는 GDB 에 접속하여 자신의 위치 정보에 기반한 GDB 정보를 획득하여 해당 위치에서 면허 기기의 채널 사용 여부를 알아야 하고, GDB로의 접속 및 정보 획득은 면허 기기를 보호하기에 충분한 빈도로 수행되어야 한다.

In the method in which STA finds the available channel, it has the mode performing the spectrum sensing mechanism and mode etc. connects to GDB and finds the TV channel schedule. Energy detection (energy detection) mode (the mode which the preferential user is the use if the intensity of the reception signal is and determines the constant value or greater), feature detection (feature detection) mode (the mode which the preferential user is the use if it is detected with the digital television preamble etc. can be used as the spectrum sensing mechanism. Next, STA connects to GDB and the GDB information based on its own location information is acquired and channel use acceptance and rejection of the license instrument have to be known at the relevant position and it has to be performed to the frequency in which the connection to GDB and information acquisition is sufficient to protect the license instrumen

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스펙트럼 센싱 방식 또는 GDB를 통하여, 현재 사용 중인 채널과 바로 인접해 있는 채널에서 우선적 사용자가 사용 중인 것으로 판단되면, 단말(또는 STA)과 기지국(또는 Access Point (AP))는 전송 전력을 낮추는 방식으로 우선적 사용자를 보호할 수 있다.

If the preferential user is the use and it is determined in the channel which is in the present use and the adja cent channel through the spectrum sensing mode or GD B , the preferential user can be protected to the mode in which the terminal (or, STA) and base station (or, th e Access Point (AP)) lower the transmission power.

## 발명의 내용

## Summary of Invention

해결하고자 하는 과제

**Problem to be solved**

화이트 스페이스 대역에서의 가용 채널은 주파수 상에서 연속적이지 않을 수도 있다. 이에 따라, 화이트 스페이스 대역에서의 채널 구조는 기존의 무선 랜 채널 구조가 그대로 적용될 수 없다. 화이트 스페이스 대역에서 STA이 올바르게 동작하기 위해서는, AP가 구성하는 기본 서비스 세트(Basic Service Set; BSS)에서 지원하는 채널 구조 및 허용되는 데이터 유닛 타입을 알아야 한다.

The available channel at the white space band is not successive in the frequency domain. Accordingly, the channel structure at the white space band the existing wireless LAN channel structure cannot be like that applied. In the white space band, in order that STA correctly operates the channel structure of supporting and the allowed data unit type have to be known at the basic service set (Basic Service Set: BSS) which AP configures.

본 발명에서는 STA에게 동작 채널에 대한 정보를 올바르고 효율적으로 알려주는 방안을 제공하는 것을 기술적 과제로 한다.

In the present invention, it is done by the technical problem providing the plan right and which efficiently informs the information about the working channel to STA.

본 발명에서 이루고자 하는 기술적 과제들은 이상에서 언급한 기술적 과제들로 제한되지 않으며, 언급하지 않은 또 다른 기술적 과제들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

In the present invention, it is not limited within technical problems which in the above, technical problems to be comprised mention and it will be able to be specifically understood as a person skilled in the art in the technical Field of the Invention which another technical problems which it does not mention looks from the following material.

과제해결 수단

**Means to solve the problem**

상기의 기술적 과제를 해결하기 위하여 본 발명의 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

To solve the technical problem described in the above the method for providing the operation parameter concerning the station (STA) operating in the white space band according to a preferred embodiment of the present invention includes the step of transmitting the frame including the operation information field including the channel width subfield and the step of transmitting the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble and the SIG field includes the BW (BandWidth) field and the type of PPDU can be determined based on the channel width bottom field and BW field.

상기의 기술적 과제를 해결하기 위하여 본 발명의 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대한 동작 파라미터를 수신하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하는 단계를 포함하고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

To solve the technical problem described in the above the method for receiving the operation parameter about the station (STA) operating in the white space band according to the dissimilar embodiment of the invention includes the step of receiving the frame including the operation information field including the channel width subfield and the step of receiving the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble and the SIG field includes the BW (BandWidth) field and the type of PPDU can be determined based on the channel width bottom field

and BW field.

상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 장치는, 다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및 상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하도록 더 구성되고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

The processor which is configured to control the apparatus including the transceiver which is configured to perform transmission and/or reception with the instrument, and transceiver is included and the processor transmits the frame including the operation information field including the channel width subfield through the transceiver and the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble is further configured to be transmitted and the SIG field includes the BW (BandWidth) field and the type of PPDU can be determined based on the channel width bottom field and BW field. As to the transceiver which is configured to perform transmission and/or reception with the instrument, the apparatus for providing the operation parameter concerning the station (STA) operating in the white space band according to another embodiment of the invention is different.

상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 수신하는 장치는, 다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및 상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하도록 더 구성되고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

The processor which is configured to control the apparatus including the transceiver which is configured to perform transmission and/or reception with the instrument, and transceiver is included and the processor receives the frame including the operation information field including the channel width subfield through the transceiver and the SIG (Signal) field of the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) preamble is further configured to be received and the SIG field includes the BW (BandWidth) field and the type of PPDU can be determined based on the channel width bottom field and BW field. As to the transceiver which is configured to perform transmission and/or reception with the instrument, the apparatus for receiving the operation parameter about the station (STA) operating in the white space band according to another embodiment of the invention is different.

상기 본 발명에 따른 실시예들에 있어서 이하의 사항이 공통으로 적용될 수 있다.

The matter of less than can be commonly applied as to the embodiments according to the present invention.

상기 채널 폭은 하나 이상의 W 채널을 포함하고, 상기 채널 폭 서브필드의 값은, 하나의 W 채널에 대한 제 1 타입 채널 폭; 2 개의 연속적인(contiguous) W 채널들에 대한 제 2 타입 채널 폭; 2 개의 불연속적인(non-contiguous) W 채널들에 대한 제 3 타입 채널 폭; 4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭; 또는 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭 중에서 하나를 지시할 수 있다.

The channel width includes at least one W channel and the value of the channel width subfield can indicate one among the discontinuous fifth type channel width including successive W channels of the fourth type channel width: about successive W channels of the third type channel width : 4 about noncontinuous (non-contiguous) W channels of the second type channel width : 2 about consecutive (contiguous) W channels of the first type channel width : 2 about one W channel or each frequency segment 2 toward frequency segments of 2.

상기 채널 폭 서브필드가 상기 제 1 타입 채널 폭을 지시하고 상기 BW 필드가 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응할 수 있다.

In case the channel width subfield indicates the first type channel width and the BW field indicates the first value the PPDU type can correspond to one W channel.

상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 제 2 값을

In case the channel width subfield indicates the second type channel width and the BW field indicates the first value the PPDU type corresponds to one W channel and in case the channel width subfield

지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응할 수 있다.

indicates the second type channel width and the BW field indicates the second number the PPDU type can correspond to successive W channels of 2.

상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응할 수 있다.

In case the channel width subfield indicates the third type channel width and the BW field indicates the first value the PPDU type corresponds to one W channel and in case the channel width subfield indicates the third type channel width and the BW field indicates the second number the PPDU type can correspond to discontinuous W channels of 2.

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고, 상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응할 수 있다.

In case the channel width subfield indicates the fourth type channel width and the BW field indicates the first value the PPDU type corresponds to one W channel and in case the channel width subfield indicates the fourth type channel width and the BW field indicates the second number the PPDU type corresponds to successive W channels of 2 and in case the channel width subfield indicates the fourth type channel width and the BW field indicates the third value the PPDU type can correspond to successive W channels of 4.

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고, 상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응할 수 있다.

In case the channel width subfield indicates the fifth type channel width and the BW field indicates the first value the PPDU type corresponds to one W channel and in case the channel width subfield indicates the fifth type channel width and the BW field indicates the second number the PPDU type corresponds to successive W channels of 2 and in case the channel width subfield indicates the fifth type channel width and the BW field indicates the third value the PPDU type can correspond to discontinuous frequency segments including successive W channels of each frequency segment 2 of 2.

상기 BW 필드가 제 1 값을 가지고, 상기 채널 폭 서브필드가 제 1, 제 2, 제 3, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응할 수 있다.

The BW field has the first value and in case the channel width subfield indicates the first, second, third, fourth or the fifth type channel width the PPDU type can correspond to one W channel.

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 2, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응할 수 있다.

The BW field has the second number and in case the channel width subfield indicates the second, and the fourth or the fifth type channel width the PPDU type can correspond to successive W channels of 2.

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 3 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응할 수 있다.

The BW field has the second number and in case the channel width subfield indicates the third type channel width the PPDU type can correspond to discontinuous W channels of 2.

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 4 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응할 수 있다.

The BW field has the third value and in case the channel width subfield indicates the fourth type channel width the PPDU type can correspond to successive W channels of 4.

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응할 수 있다.

The BW field has the third value and in case the channel width subfield indicates the fifth type channel width the PPDU type can correspond to discontinuous frequency segments including successive W channels of each frequency segment 2 of 2.

본 발명에 대하여 전술한 일반적인 설명과 후술하는 상세한 설명은 예시적인 것이며, 청구항 기재 발명에 대한 추가적인 설명

The detailed explanation which will be described later is illustrative with the general description describing in

을 위한 것이다.

the above about the invention and it is for the additional description about claim material invention.

발명의 효과

**Effects of the Invention**

본 발명에 따르면 STA에게 동작 채널에 대한 정보를 올바르고 효율적으로 알려주는 방법 및 장치가 제공될 수 있다.

According to the present invention, provided is a method and apparatus for being straight and efficiently informing the information about the working channel to STA.

본 발명에서 얻을 수 있는 효과는 이상에서 언급한 효과들로 제한되지 않으며, 언급하지 않은 또 다른 효과들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

In the present invention, it is not limited within effects which in the above, the effect can obtain mentions and it will be able to be specifically understood as a person skilled in the art in the technical Field of the Invention which another effects which it does not mention looks from the following material.

## 발명을 실시하기 위한 구체적인 내용

## Description of Embodiments

이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다.

Hereinafter, referring to the figure, specifically, the embodiment done with desirable according to the present invention is illustrated it is attached. It is the thing in which the detailed explanation disclosed with attached drawing in less than illustrates the illustrative embodiment of the invention and it is not. To show the embodiment in which the invention can be performed and which ones and only. The concrete detail item is included so that the following detailed description provide the complete understanding of the invention. But the person skilled in the art embraces that the invention can be performed without such concrete detail item.

이하의 실시예들은 본 발명의 구성요소들과 특징들을 소정 형태로 결합한 것들이다. 각 구성요소 또는 특징은 별도의 명시적 언급이 없는 한 선택적인 것으로 고려될 수 있다. 각 구성요소 또는 특징은 다른 구성요소나 특징과 결합되지 않은 형태로 실시될 수 있다. 또한, 일부 구성요소들 및/또는 특징들을 결합하여 본 발명의 실시예를 구성할 수도 있다. 본 발명의 실시예들에서 설명되는 동작들의 순서는 변경될 수 있다. 어느 실시예의 일부 구성이나 특징은 다른 실시예에 포함될 수 있고, 또는 다른 실시예의 대응하는 구성 또는 특징과 교체될 수 있다.

It is the embodiment of less thans the things combining elements and characteristics of the present invention in the form of the predetermined. The characteristic can be considered that each element or the characteristic is selective. It can be performed to the element in which each element or the characteristic is different or the form which does not combine with the characteristic. Moreover, the embodiment of some elements and/or the invention combining characteristics can be configured. The order of the operations explained in the embodiments of the invention can be changed. The part configuration or the characteristic of a embodiment can be included in the other embodiment and or it can be replaced with the configuration or the characteristic corresponding to of the other embodiment.

이하의 설명에서 사용되는 특정 용어들은 본 발명의 이해를 돕기 위해서 제공된 것이며, 이러한 특정 용어의 사용은 본 발명의 기술적 사상을 벗어나지 않는 범위에서 다른 형태로 변경될 수 있다.

In the following description, in order to assist your understanding of the present invention, in order to assist your understanding of the present invention, used specific terms are provided and the use of such specific term can be changed to the dissimilar form in the range that does not do not depart from the technical mapping of the invention.

몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

In the publicly known structure it avoids being vague and apparatus thereof, the some case, and the concept of the invention are illustrated around the core function of the shell structure it is omitted and apparatus thereof to one block diagram type. Moreover, in this specification whole, it illustrates for the same components element using the same reference numeral.

본 발명의 실시예들은 무선 접속 시스템들인 IEEE 802 시스템, 3GPP 시스템, 3GPP LTE 및 LTE-A(LTE-Advanced)시스템 및 3GPP2 시스템 중 적어도 하나에 개시된 표준 문서들에 의해 뒷받침될 수 있다. 즉, 본 발명의 실시예들 중 본 발명의 기술적 사상을 명확히 드러내기 위해 설명하지 않은 단계들 또는 부분들은 상기 문서들에 의해 뒷받침될 수 있다. 또한, 본 문서에서 개시하고 있는 모든 용어들은 상기 표준 문서에 의해 설명될 수 있다.

It can be guaranteed by the disclosed standard documents among the IEEE 802 system, in which the embodiments of the invention is radio access systems 3GPP system, and 3GPP LTE, the LTE- A (LTE-Advanced) system and 3GPP2 system in at least one. That is, in order to specifically show the technical mapping of the invention among the embodiments of the invention the step or the parts which does not illustrate can be guaranteed by documents. Moreover, all terms disclosed in the document can be explained by the standard document.

이하의 기술은 CDMA(Code Division Multiple Access), FDMA(Frequency Division Multiple Access), TDMA(Time Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier Frequency Division Multiple Access) 등과 같은 다양한 무선 접속 시스템에 사용될 수 있다. CDMA는 UTRA(Universal Terrestrial Radio Access)나 CDMA2000과 같은 무선 기술(radio technology)로 구현될 수 있다. TDMA는 GSM(Global System for Mobile communications)/GPRS(General Packet Radio Service)/EDGE(Enhanced Data Rates for GSM Evolution)와 같은 무선 기술로 구현될 수 있다. OFDMA는 IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, E-UTRA(Evolved UTRA) 등과 같은 무선 기술로 구현될 수 있다. 명확성을 위하여 이하에서는 IEEE 802.11 시스템을 위주로 설명하지만 본 발명의 기술적 사상이 이에 제한되는 것은 아니다.

The technology of less than can be used for the various radio access system like the CDMA (Code Division Multiple Access), the FDMA (Frequency Division Multiple Access), the TDMA (Time Division Multiple Access), the OFDMA (Orthogonal Frequency Division Multiple Access), the SC- FDMA (Single Carrier Frequency Division Multiple Access) etc. CDMA can be implemented as the wireless technology (radio technology) such as the UTRA (Universal Terrestrial Radio Access) and CDMA2000. TDMA can be implemented as the wireless technology like the GSM (Global System for Mobile communications) / GPRS (General Packet Radio Service) / EDGE (Enhanced Data Rates for GSM Evolution). OFDMA can be implemented as the wireless technology like the IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, the E- UTRA (Evolved UTRA) etc. Hereinafter it illustrates for clarity around the IEEE 802.11 system but the technical mapping of the invention is not limited thereto.

도 1 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

Figure 1 is drawing showing the structure of being illustrative of the IEEE 802.11 system the invention being applied.

IEEE 802.11 구조는 복수개의 구성요소들로 구성될 수 있고, 이들의 상호작용에 의해 상위계층에 대해 트랜스패런트한 STA 이동성을 지원하는 WLAN이 제공될 수 있다. 기본 서비스 세트(Basic Service Set; BSS)는 IEEE 802.11 LAN에서의 기본적인 구성 블록에 해당할 수 있다. 도 1 에서는 2 개의 BSS(BSS1 및 BSS2)가 존재하고 각각의 BSS의 멤버로서 2 개의 STA이 포함되는 것(STA1 및 STA2 는 BSS1에 포함되고, STA3 및 STA4는 BSS2에 포함됨)을 예시적으로 도시한다. 도 1 에서 BSS를 나타내는 타원은 해당 BSS에 포함된 STA들이 통신을 유지하는 커버리지 영역을 나타내는 것으로도 이해될 수 있다. 이 영역을 BSA(Basic Service Area)라고 칭할 수 있다. STA가 BSA 밖으로 이동하게 되면 해당 BSA 내의 다른 STA들과 직접적으로 통신할 수 없게 된다.

The IEEE 802.11 structure comprises the multiple elements. And WLAN supporting the STA mobility making be transparent with their interaction about the higher layer can be provided. The basic service set (Basic Service Set: BSS) can correspond to the primary building block at the IEEE 802.11 LAN. In fig. 1, BSS (the BSS1 and BSS2) of 2 exist and STA of 2 is included as the member of each BSS (the STA1 and STA2 are included in the BSS1 and the STA3 and STA4 are included in the BSS2) are illustratively shown. In fig. 1, the oval showing BSS shows the coverage area in which STAs included in the corresponding BSS maintain the communication it can be understood. This domain can be called the BSA (Basic Service Area). It directly cannot communicate with dissimilar STAs within the corresponding BSA if STA moves from BSA.

IEEE 802.11 LAN에서 가장 기본적인 타입의 BSS는 독립적인 BSS(Independent BSS; IBSS)이다. 예를 들어, IBSS는 2 개의 STA만으로 구성된 최소의 형태를 가질 수 있다. 또한, 가장 단순한 형태이고 다른 구성요소들이 생략되어 있는 도 1 의 BSS(BSS1 또는 BSS2)가 IBSS의 대표적인 예시에 해당할 수 있다. 이러한 구성은 STA들이 직접 통신할 수 있는 경우에 가능하다. 또한, 이러한 형태의 LAN은 미리 계획되어서 구성되는 것이 아니라 LAN이 필요한 경우에 구성될 수 있으며, 이를 애드-혹(ad-hoc) 네트워크라고 칭할 수도 있다.

In the IEEE 802.11 LAN, it is the BSS (Independent BSS: IBSS) in which BSS of the primary type is most independent. For example, it can have the minimum form in which IBSS consists of STA of 2. Moreover, the BSS (the BSS1 or the BSS2) in which elements which are the simple form and are most dissimilar are omitted of fig. 1 can correspond to the typical example of IBSS. It is possible in case such configuration STAs directly can communicate. Moreover, LAN of such form is prepared in advance and it is not formed but if necessary, LAN can be formed and this can be called the ad-hoc network.

STA의 켜지거나 꺼짐, STA가 BSS 영역에 들어오거나 나감

It is turned on of STA or it is put out. STA comes in

등에 의해서, BSS에서의 STA의 멤버십이 동적으로 변경될 수 있다. BSS의 멤버가 되기 위해서는, STA는 동기화 과정을 이용하여 BSS에 조인할 수 있다. BSS 기반구조의 모든 서비스에 액세스하기 위해서는, STA는 BSS에 연관(associated)되어야 한다. 이러한 연관(association)은 동적으로 설정될 수 있고, 분배시스템서비스(Distribution System Service; DSS)의 이용을 포함할 수 있다.

the BSS region or it goes out the membership of STA at BSS can be dynamically changed by the etc. In order that it becomes the member of BSS STA can put the seal on BSS using the synchronizing process. In order that it accesses in all services of the BSS infrastructure STA has to be in BSS the linkage (associated). Such linkage (association) can be dynamically set up and the usage of the distribution system service (Distribution System Service: DSS) is include might.

도 2 는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다. 도 2 에서는 도 1 의 구조에서 분배시스템(Distribution System; DS), 분배시스템매체(Distribution System Medium; DSM), 액세스 포인트(Access Point; AP) 등의 구성요소가 추가된 형태이다.

Figure 2 is drawing showing the structure of being illustrative of being different of the IEEE 802.11 system the invention being applied. In fig. 2, it is the form in which the element including the dispensing system (Distribution System: DS), the dispensing system media (Distribution System Medium: DSM), the access point (Access Point: AP) etc. is added in the structure of fig. 1.

LAN에서 직접적인 스테이션-대-스테이션의 거리는 PHY 성능에 의해서 제한될 수 있다. 어떠한 경우에는 이러한 거리의 한계가 충분할 수도 있지만, 경우에 따라서는 보다 먼 거리의 스테이션 간의 통신이 필요할 수도 있다. 확장된 커버리지를 지원하기 위해서 분배시스템(DS)이 구성될 수 있다.

In LAN, the distance of the direct station - large - station can be limited by the PHY performance. The limit of such distance can be sufficient in case of being. However the communication between the station of the distance distant than the case can be necessary. In order to support the expanded coverage, the dispensing system (DS) can be formed.

DS는 BSS들이 상호연결되는 구조를 의미한다. 구체적으로, 도 1 과 같이 BSS가 독립적으로 존재하는 대신에, 복수개의 BSS들로 구성된 네트워크의 확장된 형태의 구성요소로서 BSS가 존재할 수도 있다.

DS means the structure where BSSs are interconnected. Specifically, as shown in Figure 1, BSS independently exists. BSS can exist as multiple BSSs as the expanded element of the form of the configured network.

DS는 논리적인 개념이며 분배시스템매체(DSM)의 특성에 의해서 특정될 수 있다. 이와 관련하여, IEEE 802.11 표준에서는 무선 매체(Wireless Medium; WM)와 분배시스템매체(DSM)을 논리적으로 구분하고 있다. 각각의 논리적 매체는 상이한 목적을 위해서 사용되며, 상이한 구성요소에 의해서 사용된다. IEEE 802.11 표준의 정의에서는 이러한 매체들이 동일한 것으로 제한하지도 않고 상이한 것으로 제한하지도 않는다. 이와 같이 복수개의 매체들이 논리적으로 상이하다는 점에서, IEEE 802.11 LAN 구조(DS 구조 또는 다른 네트워크 구조)의 유연성이 설명될 수 있다. 즉, IEEE 802.11 LAN 구조는 다양하게 구현될 수 있으며, 각각의 구현예의 물리적인 특성에 의해서 독립적으로 해당 LAN 구조가 특정될 수 있다.

DS is the logical concept and it can be specified with the property of the dispensing system media (DSM). In the IEEE 802.11 standard in connection with the this, the wireless medium (Wireless Medium: WM) and dispensing system media (DSM) are logically classified. It is used for the purpose that each logical media is different and it is used by the different element. In the definition of the IEEE 802.11 standard, it does not limit that it does not limit that it is identical in such medias and it is different. In this way, multiple medias are logically different. Therefore the flexibility of the IEEE 802.11 LAN structure (the DS structure or the network structure of being different) can be explained. That is, the IEEE 802.11 LAN structure can be variously implemented and the corresponding LAN structure can be specified in the independently with the property of being physical of each implementation.

DS는 복수개의 BSS들의 끊김 없는(seamless) 통합을 제공하고 목적지로의 어드레스를 다루는 데에 필요한 논리적 서비스들을 제공함으로써 이동 기기를 지원할 수 있다.

By DS providing the integration which there is no with the disconnection of the multiple BSSs (seamless) and providing necessary logical services to handles the address to the destination location the mobile equipment can be supported.

AP 는, 연관된 STA들에 대해서 WM을 통해서 DS 로의 액세스를 가능하게 하고 STA 기능성을 가지는 개체를 의미한다. AP를 통해서 BSS 및 DS 간의 데이터 이동이 수행될 수 있다. 예를 들어, 도 2 에서 도시하는 STA2 및 STA3 은 STA의 기

AP means the entity making the access to DS possible and has the STA functionality through WM about STAs related with. The data movement between DS and BSS can be performed through AP. For example, while the S

능성을 가지면서, 연관된 STA들(STA1 및 STA4)가 DS로 액세스하도록 하는 기능을 제공한다. 또한, 모든 AP는 기본적으로 STA에 해당하므로, 모든 AP는 어드레스 가능한 개체이다. WM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스와 DSM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스는 반드시 동일할 필요는 없다.

TA2 and the STA3 shown in fig. 2 have the functionality of STA STA (the STA1 and STA4) related with provide the skill accessed to DS. Moreover, the elementarily all APs correspond to STA. Therefore all APs are the entity enabling to address. The need that the certainly the address and the address used for the communication on DSM with AP are identical used for the communication on on WM with AP does not have.

AP에 연관된 STA들 중의 하나로부터 그 AP의 STA 어드레스로 전송되는 데이터는, 항상 비제어 포트(uncontrolled port)에서 수신되고 IEEE 802.1X 포트 액세스 개체에 의해서 처리될 수 있다. 또한, 제어 포트(controlled port)가 인증되면 전송 데이터(또는 프레임)는 DS로 전달될 수 있다.

Transmitted to the STA address of the AP from one of STAs related to AP data can be received and data be always processed by the IEEE 802.1X port access entity at the uncontrolled port. Moreover, the transmitted-data (or, the frame) can be delivered to DS if the control port (controlled port) is authenticated.

도 3 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다. 도 3 에서는 도 2 의 구조에 추가적으로 넓은 커버리지를 제공하기 위한 확장된 서비스 세트(Extended Service Set; ESS)를 개념적으로 나타낸다.

Figure 3 is drawing showing another structure of being illustrative of the IEEE 802.11 system the invention being applied. In fig. 3, the expanded service set (Extended Service Set: ESS) for providing the coverage which is additionally broad in the structure of fig. 2 is conceptually shown.

임의의(arbitrary) 크기 및 복잡도를 가지는 무선 네트워크가 DS 및 BSS들로 구성될 수 있다. IEEE 802.11 시스템에서는 이러한 방식의 네트워크를 ESS 네트워크라고 칭한다. ESS는 하나의 DS에 연결된 BSS들의 집합에 해당할 수 있다. 그러나, ESS는 DS를 포함하지는 않는다. ESS 네트워크는 LLC(Logical Link Control) 계층에서 IBSS 네트워크로 보이는 점이 특징이다. ESS에 포함되는 STA들은 서로 통신할 수 있고, 이동 STA들은 LLC에 트랜스패런트하게 하나의 BSS에서 다른 BSS로 (동일한 ESS 내에서) 이동할 수 있다.

The wireless network having size and complexity of the arbitrary can consist of DS and BSSs. In the IEEE 802.11 system, the network of such mode is called the ESS network. It can correspond to the gathering of BSSs in which ESS is connected to one DS. But ESS does not include DS. In the ESS network is the LLC (Logical Link Control) layer, it is characterized to show as the IBSS network. STAs included in ESS can communicate and it can move from one BSS to dissimilar BSS with (in the same ESS) so that movement STAs make be transparent in LLC.

IEEE 802.11 에서는 도 3 에서의 BSS들의 상대적인 물리적 위치에 대해서 아무것도 가정하지 않으며, 다음과 같은 형태가 모두 가능하다. BSS들은 부분적으로 중첩될 수 있고, 이는 연속적인 커버리지를 제공하기 위해서 일반적으로 이용되는 형태이다. 또한, BSS들은 물리적으로 연결되어 있지 않을 수 있고, 논리적으로는 BSS들 간의 거리에 제한은 없다. 또한, BSS들은 물리적으로 동일한 위치에 위치할 수 있고, 이는 리던던시를 제공하기 위해서 이용될 수 있다. 또한, 하나 (또는 하나 이상의) IBSS 또는 ESS 네트워크들이 하나 (또는 하나 이상의) ESS 네트워크로서 동일한 공간에 물리적으로 존재할 수 있다. 이는 ESS 네트워크가 존재하는 위치에 애드-혹 네트워크가 동작하는 경우나, 상이한 기관(organizations)에 의해서 물리적으로 중첩되는 IEEE 802.11 네트워크들이 구성되는 경우나, 동일한 위치에서 2 이상의 상이한 액세스 및 보안 정책이 필요한 경우 등에서의 ESS 네트워크 형태에 해당할 수 있다.

In the IEEE 802.11, nothing does not assume about the relative physical location of BSS in fig. 3 and the form as follows can do all. BSSs can be partly overlapped and it is the form which generally is used so that this provide the successive coverage. Moreover, BSSs are not physically connected and the limit is logically not in the distance between BSS. Moreover, BSSs can be positioned at the same position and the same position can be used so that this provide redundancy. Moreover, it physically can exist in the same space as one (more than or, one) IBSS or the ESS network one (more than or, one) ESS network. The ad-hoc network operates in the position in which as to the this, the ESS network exists. The position is formed. Physically overlapped with the different engine (organizations) if necessary, the access more than 2 and the different security policy in the same position can correspond to the ESS network configurations at the etc.

도 4 는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다. 도 4 에서는 DS를 포함하는 기반 구조 BSS 의 일례가 도시된다.

Figure 4 is drawing showing the structure of being illustrative of the WLAN system. An example of the infrastructure BSS including DS in fig. 4 is illustrated.

도 4 의 예시에서 BSS1 및 BSS2가 ESS를 구성한다. WLAN 시스템에서 STA는 IEEE 802.11 의 MAC/PHY 규정에 따라 동작하는 기기이다. STA는 AP STA 및 비-AP(non-AP) STA 을 포함한다. Non-AP STA는 랩탑 컴퓨터, 이동 전화기와 같

In the example of fig. 4, the BSS1 and BSS2 configure ESS. In the WLAN system, it is the instrument in which STA operates according to the MAC / PHY rules of the IEEE 802.11. STA includes the AP STA and the non-A P

이 일반적으로 사용자가 직접 다루는 기기에 해당한다. 도 4 의 예시에서 STA1, STA3, STA4 는 non-AP STA에 해당하고, STA2 및 STA5 는 AP STA 에 해당한다.

(non-AP) STA. Generally the user the Non-AP STA falls under the direct instrument handled like the laptop com puter, and the mobile phone. In the example of fig. 4, t he STA1, the STA3 , and the STA4 correspond to the non-AP STA and the STA2 and STA5 correspond to the AP STA.

이하의 설명에서 non-AP STA는 단말(terminal), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장치(User Equipment; UE), 이동국(Mobile Station; MS), 이동단말(Mobile Terminal), 이동 가입자국(Mobile Subscriber Station; MSS) 등으로 칭할 수도 있다. 또한, AP는 다른 무선 통신 분야에서의 기지국(Base Station; BS), 노드-B(Node-B), 발전된 노드-B(evolved Node-B; eNB), 기저 송수신 시스템(Base Transceiver System; BTS), 펨토 기지국(Femto BS) 등에 대응하는 개념이다.

In the following description, the non-AP STA can call the terminal, the wireless transmit-receive unit (Wireles s Transmit/Receive Unit: WTRU), the user equipment (User Equipment: UE), the mobile station (Mobile Statio n: MS), the mobile terminal, the mobile subscriber bure au (Mobile Subscriber Station: MSS) etc. Moreover, it i s the concept in which AP corresponds to the base sta tion (Base Station: BS) at the dissimilar wireless comm unication field, the node - B (Node-B), the developed n ode - B (evolved Node-B: eNB), the base transceiving system (Base Transceiver System: BTS), the femto ba se station (Femto BS) etc.

화이트 스페이스에서의 가용 채널

The available channel at the white space.

화이트 스페이스에서 STA이 동작하기 위해서는 먼허 기기(또는, 우선적 사용자)에 대한 보호 기법이 우선적으로 제공되어야 한다. 따라서, STA는 먼허 기기에 의해 사용되지 않아서 비면허 기기가 사용할 수 있는 가용 채널을 알아내서 가용 채널 상에서 동작해야 한다.

In the white space, the protection technique about the license instrument (or, the preferential user) has to be preferentially provided so that STA operate. Therefore, STA is not used by the license instrument and the avail able channel which the dome emptiness instrument can use is found and it has to operate on the available cha nnel.

STA이 화이트 스페이스(예를 들어, TVWS)에서의 채널(예를 들어, TV 채널) 가용성(availability)을 파악하기 위해서, 스펙트럼 센싱을 수행하거나, GDB에 접속하여 TV 채널 스케줄을 알아낼 수 있다. GDB 정보는 특정 위치에서 먼허 기기의 특정 채널의 사용 스케줄 (즉, 채널 사용 시간) 등의 정보를 포함할 수 있다. TV 채널의 가용성을 파악하기 원하는 STA은, 인터넷 등을 통하여 GDB에 접속해서 자신의 위치 정보에 기반한 GDB 정보를 얻어와야 하며, 이는 먼허 기기를 보호하기에 충분한 시간 단위로 수행되어야 한다.

In order that STA grasps on the channel (for example, the TV channel) solubility (availability) at the white spa ce (for example, TVWS) the spectrum sensing is perfor med or it connects to GDB and the TV channel schedul e can be found. In the GDB information is the specific l ocation, the information including the usage schedule (i n other words, the channel use time) of the special ch annel of the license instrument etc. is include might. S TA which desires to grasp on the solubility of the TV c hannel connects to GDB through the internet etc. and i t has been getting the GDB information based on its ow n location information and it has to be performed by uni t of the time when this is sufficient to protect the licen se instrument.

본 문서에서는 설명의 편의를 위하여 GDB로부터 수신하는 가용 채널 및 주파수에 관한 정보를 화이트 스페이스 맵(White Space Map; WSM)이라 칭할 수 있다. WSM은 STA가 GDB로부터 획득한 채널 및 주파수 정보를 기반으로 TVWS 대역에서 비면허 기기가 사용할 수 있는 채널에 관한 정보를 맵의 형태로 만든 것이다. WSM은 비면허 기기가 사용할 수 있는 가용 채널 리스트 또는 주파수(available channel list or frequencies)에 대한 정보를 포함할 수 있다. 가용 채널 리스트에 포함된 채널들은 법적으로 보호되어야 하는 신호(또는, 사용자)들이 사용하고 있지 않는 채널들이고, 비면허 기기가 GDB에 접속한 시점에서 비면허 기기가 사용 가능한 채널이다. 또는, 비면허 기기가 GDB에 접속한 시점으로부터 특정 시간 이후로부터의 사용 가능 채널에 대한 요청을 했을 경우, 해당 시점으로부터 사용 가능한 채널 및 주파수에 대한 정보를 포함할 수 있다. 다른 실시예로서, 비면허 기기가 GDB에 가용 채널에 대한 요청을 했을 경우, 비면허 기기가 사용할 수 없는 채널을 시그널링 함으로써 사용 가능 채널 및 주파수에 대한 정보를 전달할 수도 있다.

In the document, for the sake of convenience in illustration, the information about the available channel received from GDB and frequency can be called becaus e of being the white space map (White Space Map: WS M). In the TVWS band based on the channel which as to the WSM, STA obtains from GDB and frequency infor mation, the information about the channel which the d ome emptiness instrument can use is established in the form of the map. WSM is the dome emptiness instrume nt may include the information to the available channel list can use or the frequency (available channel list or f requencies). It is channels which signal (or, the user) i n which channels included in the available channel list have to be legally protected does not use and the dom e emptiness instrument is the available channel in the p oint of time when the dome emptiness instrument conn ects to GDB. Or the dome emptiness instrument may in clude the information about the available channel from the target point of time and frequency it requested fro m the point of time when connecting to GDB about the

use feasibility channel from the specific duration after. As the other embodiment, when the dome emptiness in strument requested in GDB about the available channel by signaling the channel which the dome emptiness inst rument cannot use the information for frequency and u se feasibility channel can be delivered.

현재 FCC(Federal Communications Commission)의 TVWS에 대한 규정(regulation)에서는 크게 두 가지 종류의 기기 타입을 정의한다. 즉, 소출력의 개인이 휴대할 수 있는 개인용/휴대용 기기(Personal/Portable Device) 및 고정된 위치에서 동작하는 대출력의 고정된 기기(Fixed Device)이 정의된다. 고정된 기기(Fixed Device)는 고정된 STA으로 칭할 수도 있고, 개인용/휴대용(Personal/Portable) 기기는 P/P STA으로 칭할 수도 있다. 고정된 STA 및 P/P SA는 모두 WLAN 시스템에서 일반적인 STA(즉, STA라는 용어는 AP 및 non-AP를 포함한다)에 해당할 수 있다. 이들 두 종류의 기기는 각각 TVWS에서 동작할 때, 각각 다른 동작 규칙(operation rule)이 적용될 수 있다. 고정된 기기는 그 위치가 변하지 않는 특정 위치에서 신호를 송/수신 한다. 물론 고정된 기기 역시 해당 위치에서 신호를 전송하기 위해서는, GDB에 접속하여 가용 채널 정보를 획득해야 한다. 고정된 기기는 GPS와 같은 위치를 확인할 수 있는 장비가 내장되어 있을 수도 있지만, 설치자(installer)에 의해서 그 위치를 사람이 직접 입력함으로써 그 위치 정보를 GDB에 전달할 수 있다. 물론, 위치를 사람이 직접 입력하는 경우에는 한 번 설치되고 위치가 입력되고 나면 그 위치가 바뀌지 않는다는 것을 전제로 하며, 위치가 변경되는 경우에는 그에 따른 위치도 변경/등록되어야 한다. 고정된 기기는 동종의 다른 고정된 기기를 서비스 할 수도 있고, P/P 기기를 서비스 할 수도 있다. 고정된 기기가 가용 채널 정보를 GDB로부터 받아올 때, 반드시 자신의 기기 타입을 전달하여 자신이 직접 사용할 수 있는 자신의 가용 채널 정보를 받아와야 한다. 동시에, P/P 기기를 위한 서비스를 하기 위해서는 P/P 기기가 사용할 수 있는 가용 채널 정보를 GDB로부터 또는 GDB와 연결되어 있는 프록시(proxy) 서버로부터 추가로 받아와야 한다. 고정된 기기와 P/P 기기가 사용할 수 있는 채널 구간이 다르고, 각각의 동작시 최대 허용 전송 전력과 인접 채널에 대한 요구조건이 다르기 때문에, 각 기기 타입 별로 가용 채널 리스트가 달라지기 때문이다. 예를 들어, 고정된 기기는 54~60 MHz, 76~88 MHz, 174~216 MHz, 470~512 MHz 대역의 주파수 구간 뿐 아니라, 512~608 MHz, 614~698 MHz 대역의 주파수 구간에서도 신호 전송이 허용된다. 그러나, P/P 기기는 512~608 MHz, 614~698 MHz 대역의 주파수 구간 이외의 다른 주파수 대역의 TVWS 대역에서는 신호 전송이 허용되지 않는다. 고정된 기기는 P/P 기기보다 높은 전력으로 신호를 전송할 수 있으며, 실효 등방 방사 전력(Effective Isotropic Radiated Power; EIRP)으로 최대 4 Watt의 전송 전력이 허용된다.

In the rules (regulation) toward TVWS of the current FCC (Federal Communications Commission), it can call STA in which the instrument (Fixed Device) which the f ixed instrument (Fixed Device) of the high power opera ting in the position which defines the instrument type o f two kinds of kind is fixed with the individual / portable apparatus (Personal/Portable Device) in which in other words, the individual of the low power radio can carry i s defined is fixed is fixed and the altogether STA and P / P SA which the individual / portable (Personal/Porta ble) instrument can call P / P STA is fixed can correspo nd to general STA (in other words, the term called STA includes AP and non-AP) in the WLAN system. When th e instrument of these two typeses operates in TVWS t he operation rule which is respectively dissimilar can be applied. It signs in the specific location in which as to t he fixed instrument, the position does not change with transmission/reception. Of course, in the fixed instrume nt is the relevant position, in order that the signal is tr ansmitted it connects to GDB and the available channel information has to be acquired. The equipment in which the fixed instrument can confirm the position like GPS is embedded. However the location information can be del ivered to GDB since human directly inputs the position with the installer. Of course, it bases that the position does not exchange if the position is installed in case hu man directly inputs the position and the position is inpu tted and the position according to the same has to be registered in case the position is changed. The fixed in strument can serve the dissimilar and fixed instrument of the allogenic and P / P instrument can be served. W hen the fixed instrument has been receiving the availab le channel information from GDB its own instrument typ e is delivered to the certainly and its own available cha nnel information which oneself directly can use has bee n being received. Simultaneously, it is to do the service for P / P instrument and or the available channel inform ation which P / P instrument can use has been being a dditionally received from GDB from the proxy server con nected to GDB. The fixed instrument and the channel s ection which P / P instrument can use are different and the requirement specification for the adjacent channel and maximum permissible transmission power differs in e ach operation. Therefore each instrument type the ava ilable channel list is due to be especially changed. For example, as to the fixed instrument, the signal transmis sion is allowed in 512~608 MHz not only the frequency section of 54~60 MHz, 76~88 MHz, 174~216 MHz, 470 ~512 MHz band, and the frequency section of 614~69 8 MHz band. But in P / P instrument is 512~608 MHz, a nd the TVWS band of the dissimilar frequency band exc ept the frequency section of 614~698 MHz band, the s ignal transmission is not allowed. The fixed instrument can transmit the signal with the electricity higher than P / P instrument and the transmission power of the max imum 4 Watt is allowed to the effective isotropically ra diated power (Effective Isotropic Radiated Power: EIR P).

P/P 기기는 특정되지 않은 위치에서 신호를 송/수신 할 수 있는 장비이며, 그 위치가 변할 수 있다는 점이 특징이다. 대부분의 경우 사람이 휴대 할 수 있는 장비로서, 그 이동성을 예측할 수 없다. 가용 주파수 대역은 512~608 MHz, 614~698 MHz의 주파수 구간이고, 최대 전송 전력은 100mW (EIRP)이다. P/P 기기는, 자신의 위치에 대한 식별 능력(identification capability), 즉, 지리적-위치결정 능력(geo-location capability)과 인터넷 액세스를 통한 GDB로의 접속 능력을 갖고 있는지 여부에 따라서, 모드 II 기기(Mode II device)와 모드 I 기기(Mode I device)의 두 가지 종류로 분류될 수 있다. 즉, 모드 II 기기는 지리적-위치결정 능력과 인터넷 액세스 능력을 가지며, GDB에 접속해서 자신의 위치에서의 가용 채널에 대한 정보를 획득한 후 해당 위치에서 TVWS 상에서 동작할 수 있다. 또한, 모드 II 기기는 가용 채널정보를 GDB로부터 획득한 후, 모드 I 기기에게 통신을 시작할 수 있도록 명령할 수 있는 신호(예를 들어, 인에이블(enable) 신호)를 전송함으로써 네트워크를 시작할 수 있다. 한편, 모드 I 기기에게는 지리적-위치결정 능력이나 GDB 액세스 능력이 요구되지 않으며, GDB에 액세스하여 유효한 가용 채널 정보를 가지고 있는 모드 II 기기 또는 고정된 기기에 의해 제어 받아서 동작하는 것이 요구된다. 모드 II 기기에 해당하는 P/P 기기가 다른 P/P 기기를 서비스 할 수 있고, 또는 모드 II 에 해당하는 P/P 기기가 고정된 기기에게 서비스를 제공할 수도 있다. 이 경우, 모드 II P/P 기기는 고정된 기기를 위한 가용 채널 정보를 GDB로부터 획득하여 고정된 기기에게 전달할 수 있다.

In the position in which P / P instrument is not specified, it is the equipment for signing with transmission/reception and with the point that the position can change is distinct feature. In case of the majority, it is the equipment in which human can carry and the mobility cannot be predicted. The usable frequency zone is 512~608 MHz, and the max transmit power it is the frequency section of 614~698 MHz are 100mW (EIRP). P / P instrument can be classified as two kinds of kind of the mode I instrument (Mode I device) and mode II instrument (Mode II device) according to acceptance and rejection whether it has the recognizability (identification capability) about its own position, in other words, the access capability to GDB through the geo-location decision-making capability (geo-location capability) and internet access. That is, the mode II instrument has the geo-location decision-making capability and internet access capability and it connects to GDB and the information about the available channel at its own position can be operated after doing the acquisition in the relevant position on TVWS. Moreover, by transmitting the signal (for example, the enable signal) which it can command in order to start the communication to the mode I instrument, after doing the acquisition the mode II instrument can start the network the available channel information from GDB. In the meantime, the geo-location decision-making capability or the GDB access capability is not required to the mode I instrument and the fixed instrument is required that it accesses in GDB and it is controlled with the mode II instrument having with the effective available channel information or the instrument and the instrument operates. P / P instrument corresponding to the mode II instrument can serve dissimilar P / P instrument and or the service can be provided to the instrument in which P / P instrument corresponding to the mode II is fixed. In this case, it can deliver to the instrument obtaining the available channel information for the instrument in which the mode II P / P instrument is fixed from GDB and is fixed.

한편, GDB는 DTV나 마이크로-폰 등의 우선적 사용자의 채널 사용 스케줄 및 보호 범위(protection contour)를 고려하여, 비면허 기기가 요청하는 위치에서의 가용 채널 정보를 계산하여 비면허 기기에게 전달할 수 있다. GDB에서 가용 채널 정보를 계산할 때 고려하는 파라미터들은 기기 타입, 동작하고자 하는 위치, 전송 전력 그리고 스펙트럼 마스크(spectrum mask) 등이 있다. 기기 타입에 따라서, FCC 규정에서는 인접채널에 대한 사용 여부도 달라지는데, 예를 들어 DTV가 30번 채널에서 사용 중일 때, 29번과 31번 채널이 비어 있더라도 고정된 기기는 29번 및 31번 채널들을 사용할 수 없지만, P/P 기기는 이 두 채널을 사용할 수 있다. 이는, 고정된 기기의 경우에 전송 전력이 높아서 인접 채널에 대한 간섭을 유발할 가능성이 높기 때문이다.

In the meantime, GDB calculates the available channel information at the position which the dome emptiness instrument requests in consideration of the channel usage schedule and scope of protection (protection contour) of the preferential user including DTV or the micro-phone etc. and it can deliver to the dome emptiness instrument. In GDB, the instrument type, the position, to operate the transmission power and spectral mask (spectrum mask) etc. have parameters which it considers when estimating the available channel information. According to the instrument type, the availability about the adjacent channel is changed from the FCC rules. When for example, DTV is the use in 30 burn channel , the instrument which is fixed although 29 burn and 31 burn channel are vacant cannot use 29 burn and 31 burn channels. However P / P instrument can use this two channel. As to this, in case of the fixed instrument, the possibility of the transmission power being high and inducing the interference about the adjacent channel is due to be high.

이하에서는 설명의 편의를 위해서 화이트 스페이스의 일례로서 TVWS를 들어서 본 발명의 예시들에 대해서 설명하지만, 본 발명의 범위가 이에 제한되는 것은 아니다. 즉, 본 발명의 범위는, 특정 위치에서의 사용 가능한 채널에 대한 정보를 제공하는

Hereinafter, for the sake of convenience in illustration, as an example, TVWS is given of the white space and it illustrates for the examples of the invention. However the scope of the present invention is not limited theret

DB에 의해서 제어되는 모든 화이트 스페이스에서의 동작에 대해서 적용되는 본 발명의 예시들을 포함한다. 예를 들어, 현재 시점에서는 화이트 스페이스에 해당하지 않지만, 추후 화이트 스페이스에 해당할 것으로 기대되는 다른 주파수 대역에서도 GDB에 의해 제어되는 비면허 장비의 동작이 허용될 것으로 기대되며, 이에 대해서 적용되는 본 발명의 원리에 따른 예시들은 본 발명의 범위에 포함될 수 있다. 또한, 본 발명에서는 설명의 편의를 위해서 현재 최종 규칙이 발표된 TVWS에 대한 FCC 규칙을 기반으로 본 발명의 원리에 대해서 설명하지만, 본 발명의 범위는 FCC 규칙에 따른 화이트 스페이스 대역 상에서의 동작에만 제한되는 것은 아니고, 다른 규칙을 준수하는 화이트 스페이스 대역 상에서의 본 발명의 원리에 따른 예시들을 포함한다.

o. That is, the scope of the present invention includes the examples of the invention applied to the operation at all white spaces controlled with DB providing the info rmation about the available channel at the specific loca tion. For example, in at the moment, it does not corres pond to the white space. However the operation of the dome emptiness equipment for being controlled in the d issimilar frequency band corresponding to the afterward white space with GDB be allowed and the example acco rding to the principles of the inventions which with resp ect to this, is applied can be included in the scope of t he present invention. Moreover, in the present inventio n, for the sake of convenience in illustration, it illustrat es for the principles of the invention based on the FCC rule about TVWS in which the current final rule is anno unced. However the scope of the present invention is not limited in the operation on the white space band ac cording to the FCC rule and the examples according to the principles of the invention on the white space band observing the dissimilar rule are included.

화이트 스페이스에서의 링크 셋업

The link set-up at the white space.

본 실시형태는 TVWS에서의 링크 셋업 과정에 대한 것이다. 특히 모드 I 기기와 모드 II 기기(또는 고정된 기기) 간의 링크 셋업을 위한 구체적인 예시들에 대해서 설명한다. 링크 셋업은 네트워크 발견(network discovery), 인증(Authenticatio n), 연관(association) 등의 과정으로 진행된다. 특히, 화이트 스페이스 대역에서 동작하는 모드 I 기기의 경우에는 링크 셋업 시에 가용 채널 정보의 획득 과정이 요구된다.

This embodiment is related to the link set-up process at TVWS. Especially, it illustrates for the detailed exam ples for the link set-up between the mode I instrument and the mode II instrument (the fixed instrument). The link set-up is progressed as the process including the n etwork discovery, the authentication, the linkage (asso ciation) etc. Especially, in case of the mode I instrume nt operating in the white space band, the acquisition p rocess of the available channel information is required o f the link set-up.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

Figure 5 is a flowchart for illustrating the link set-up process of being illustrative according to one example o f the invention.

단계 S510에서 모드 II 기기 또는 고정된 기기(이하에서는, 모드 II 기기/고정된 기기로 표현함)는 인터넷 등을 통해 GDB에 액세스하여, 현재 자신의 위치에서 사용가능한 채널 리스트(예를 들어, WSM)을 획득할 수 있다. 모드 II 기기/고정된 기기는 가용 채널 리스트 중에서 특정 채널(들)을 선택할 수 있다.

In the step S510, the fixed mode II instrument or the instrument (hereinafter it expresses in the instrument fi xed with the mode II instrument /) accesses in GDB thr ough the internet etc. and the usable channel list (for example, WSM) can be obtained in the position of the current oneself. The instrument fixed with the mode II i nstrument / can select the special channel between th e available channel list and the special channel (***).

단계 S520에서, 모드 II 기기/고정된 기기는 비콘을 전송하여 BSS를 구성할 수 있다. 비콘 프레임에는 송신측(예를 들어, 모드 II 기기/고정된 기기)의 기기 타입 등이 포함될 수 있고, 이에 따라 링크 셋업이 가능함을 수신측(예를 들어, 모드 I 기기)에게 알릴 수 있다. 또한, 비콘 프레임에는 가용 채널 리스트에 대한 정보 등이 포함될 수 있다. 또한, 비콘 프레임은 주기적으로 전송될 수 있다.

In the step S520, the instrument fixed with the mode II instrument / transmits the beacon and BSS can be con figured. In the beacon frame, the instrument type of th e transmission side (the instrument fixed with for exam ple, the mode II instrument /) etc. can be included and it can inform the receiving side (for example, the mode I instrument) accordingly that the link set-up is possibl e. Moreover, the beacon frame includes the information about the available channel list etc. Moreover, the bea con frame can be periodically transmitted.

단계 S530에서, BSS에 참여하기 원하는 모드 I 기기는 TVWS에 대한 스캐닝 과정을 수행할 수 있다. 만약, 모드 I 기기가 현재 자신의 위치에서 사용 가능한 채널 리스트를 알고 있는 경우에는 사용 가능한 채널 리스트 상의 채널에 대해서만 수동적(passive) 또는 능동적(active) 스캐닝을 수행할 수 있다.

In the step S530, the mode I instrument which desires to participate in BSS can perform the scanning process about TVWS. In case the mode I instrument knows the usable channel list at the position of the current onesel f the passive or the active scanning can be performed about the channel of the available channel list conditio n.

수동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 모드 II 기기/고정된 기기로부터의 비콘 전송을 듣는(listen) 과정을 의미한다. 능동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 프로브 요청 프레임(probe request frame)을 전송하고, 모드 II 기기/고정된 기기로부터 프로브 응답 프레임(probe response frame)을 수신하는 것을 의미한다.

The passive scanning means the process of hearing the beacon transmission from the instrument (listen) in which the mode I instrument is fixed on the scanning channel with the mode II instrument /. As to the active scanning, the mode I instrument transmits the probe request frame on the scanning channel and it means receiving the probe response frame from the instrument fixed with the mode II instrument /.

모드 II 기기/고정된 기기는 모드 I 기기의 스캐닝 부담을 줄이기 위해서, 비콘 프레임, 프로브 응답 프레임 등에 사용가능한 채널 리스트를 포함시킬 수 있다. 본 발명에서, 모드 II 기기/고정된 기기가 GDB로부터 획득한 가용 채널 리스트는 WSM이라고 칭할 수 있다.

In order that the instrument fixed with the mode II instrument / reduces the scanning burden of the mode I instrument the usable channel list can be included in the beacon frame, the probe response frame etc. In the present invention, the available channel list which the instrument fixed with the mode II instrument / obtains from GDB can call WSM.

도 6(a)는 WSM의 일례를 나타내는 도면이다.

It is drawing showing an example of Figure 6(a) is WSM.

도 6(a)의 예시에서, 기기 타입(device type) 필드는 WSM을 전송하는 단말이 모드 II 기기인지 또는 고정된 기기인지를 나타낸다. 맵 ID(Map ID) 필드는 가용 채널 리스트의 ID를 나타낸다. 채널 번호(Channel Number) 필드는 TVWS에서 모드 II 기기/고정된 기기가 사용할 수 있는 채널 번호를 나타낸다. 채널 번호는 TV 채널 번호, 스펙트럼 범위 등으로 표현될 수 있으며, 주파수 영역에서 가용 채널을 특정할 수 있는 정보로서의 의미를 가진다. 최대 전력 레벨(Maximum Power Level) 필드는 가용 채널에서 모드 II 기기/고정된 기기의 최대 전송 전력을 나타낸다. 낸다. 유효 시간(Valid Time) 필드는 가용 채널을 지속적으로 사용할 수 있는 기간을 나타낸다. 유효 시간 필드는 필수적이 아니라 선택적(optional)으로 포함될 수도 있다. 이러한 WSM은 비콘 프레임, 프로브 응답 프레임, 또는 다른 형태의 프레임을 통하여 전송될 수 있다. 또한, 도 6(a)의 WSM의 포맷은 단지 예시적인 것이며, 가용 채널에 대한 정보를 포함하는 다른 형태의 WSM이 본 발명의 예시들에서 적용될 수 있음을 밝힌다.

In the example of Figure 6(a), or the instrument type (device type) field shows whether the terminal transmitting WSM is the mode II instrument or not whether it is the fixed instrument or not. The map ID field shows ID of the available channel list. In the channel number field is TVWS, the channel number which the instrument fixed with the mode II instrument / can use is shown. The channel number can be expressed as the TV channel number, the spectrum range etc. and it has the meaning as the information which can specify the available channel in the frequency domain. In the maximum power level field is the available channel, the max transmit power of the instrument fixed with the mode II instrument / is shown. It makes. The effective time (Valid Time) field shows the period using the available channel. The validity time field is essential it is not but it can be included to the optional. Such WSM can be transmitted through the beacon frame, and the dissimilar frame of the probe response frame or the form. Moreover, the format of WSM of Figure 6(a) is only illustrative and dissimilar WSM including the information about the available channel of the form announces at the examples of the invention being applied.

여기서, 모드 I 기기가 BSS에 참여하기 위해서는 모드 II 기기/고정된 기기의 제어를 받아서 동작해야 한다. 따라서, 모드 I 기기는 모드 II 기기/고정된 기기와 링크 셋업을 수행해야 한다.

Here, in order to participate in BSS the control of the instrument fixed with the mode II instrument / is received and the mode I instrument has to operate. Therefore, the mode I instrument has to perform the instrument and the link set-up fixed with the mode II instrument /.

단계 S540에서, 모드 I 기기는 스캐닝 과정이 완료된 후에 BSS에 참여하기 위해서 연관(association) 과정을 수행할 수 있다. 이를 위해서, 모드 I 기기는 연관 요청 프레임을 모드 II 기기/고정된 기기에게 전송할 수 있다. 아래의 표 1은 연관 요청 프레임의 예시적인 포맷을 나타낸다.

In the step S540, in order to participate in BSS after the scanning process is completed, the mode I instrument can perform the linkage (association) process. For this, the mode I instrument can transmit the linkage request frame to the instrument fixed with the mode II instrument /. The following table 1 shows the illustrative format of the linkage request frame.

[표 1]

[Table 1]

상기 표 1은 연관 요청 프레임에 포함될 수 있는 정보들의 일부 예시를 나타낸 것이며 추가적인 정보들이 더 포함될 수 있다.

The additional information can be more included while the table 1 shows the partial indication of the informati

on which can be included in the linkage request frame.

본 발명의 예시에서는, 모드 II 기기/고정된 기기가 모드 I 기기의 기기 타입을 확인할 수 있도록, 모드 I 기기는 연관 요청 프레임에 기기 ID(device ID) 정보를 더 포함시킬 수 있다. 이에 따라, 모드 II 기기/고정된 기기는, 연관을 요청한 모드 I 기기의 기기 ID (예를 들어, FCC ID, 시리얼 번호 등)를 확인하여, 해당 모드 I 기기가 TVWS 동작을 위해 요구되는 규정을 만족하는지를 판단할 수 있다. 기기 ID를 확인한 후, 모드 II 기기/고정된 기기는, 연관 응답 프레임을 모드 I 기기에게 전송할 수 있다.

In the example of the invention, in order that the instrument fixed with the mode II instrument / confirms the instrument type of the mode I instrument the mode I instrument more can include the device ID information in the linkage request frame. Accordingly, the device ID (for example, the FCC ID, the serial number etc) of the mode I instrument in which the instrument fixed with th e mode II instrument / requests linkage is confirmed an d it can determine whether it is satisfied the rules in w hich the target mode I instrument is required for the T VWS operation. The instrument which is the device ID f ixed after doing the confirmation with the mode II instr ument / can transmit the linkage response frame to the mode I instrument.

이러한 본 발명의 예시에 따르면, 연관 과정이 모두 완료된 후에 모드 I 기기가 모드 II 기기/고정된 기기에게 기기 ID를 제공하는 방식에 비하여, 연관 과정 이후의 동작이 단순화되고, 연관 과정 중에 연관 요청을 전송한 기기를 식별할 수 있으므로, 링크 셋업의 효율성, 신속성 및 정확도가 향상될 수 있다.

According to the example of such invention, the operation of the linkage process after is simplified in co mparison with the mode which provides the device ID f or the instrument in which the mode I instrument is fixe d with the mode II instrument / after the linkage proce ss is altogether completed and the instrument transmit ting the linkage request among the linkage process can be distinguished. Therefore the effectiveness of the lin k set-up, and the speed and accuracy can be improve d.

도 6(b)은 기기 ID 의 예시적인 포맷을 나타내는 도면이다.

It is drawing in which Figure 6(b) shows the illustrative format of the device ID.

기기 타입 필드는 연관 요청을 전송하는 기기가 모드 I 기기, 모드 II 기기/고정된 기기인지를 나타낸다. FCC ID는 연관 요청을 전송하는 기기가 속하는 규제 관리자(regulatory administrator)에 의해 할당된 기기 ID 값에 해당한다. FCC ID 필드는 미국의 규제 관리자에 의해서 할당되는 기기 ID에 해당하는 값이며, 다른 규제 도메인에서의 적절한 기기 식별정보를 포함하는 필드로 대체될 수 있다. 기기 시리얼 번호 필드는 연관 요청을 전송하는 기기의 시리얼 번호(예를 들어, 제조자(manufacturer)에 의해 할당되는 식별 번호)에 대한 정보를 포함할 수 있다.

It shows whether it is the instrument in which the instrument in which the instrument type field transmits the linkage request is fixed with the mode I instrument, and the mode II instrument / or not. It corresponds to the device ID value allocated with the regulation mana gement person (regulatory administrator) in which the i nstrument in which the FCC ID transmits the linkage re quest is sort. It is the value corresponding to the devic e ID in which the FCC ID field is allocated by the regula tion management person of the U.S. and it can be repl aced with the field including the proper device identific ation information at the dissimilar regulatory domain. Th e instrument serial number field may include the informa tion toward the serial number (the identification numbe r allocated with for example, the manufacturer) of the i nstrument transmitting the linkage request.

만약 연관 요청 프레임을 전송하는 기기가 모드 II 기기/고정된 기기인 경우에는 링크 셋업 과정은 연관 요청/응답 과정 만으로 완료될 수 있다. 왜냐하면, 모드 II 기기/고정된 기기는 GDB에 액세스하여 가용 채널 리스트(예를 들어, WSM)을 이미 가지고 있고, 다른 모드 II 기기/고정된 기기의 제어를 받을 필요가 없기 때문이다. 즉, 모드 II 기기가 링크 셋업을 수행하는 경우에는 단계 S540에서 링크 셋업 과정이 완료될 수 있다.

In case of being the instrument in which the instrument transmitting the linkage request frame is fixed with the mode II instrument / the link set-up process can be co mpleted to the linkage request / response process. Bec ause, the instrument fixed with the mode II instrumen t / accesses in GDB and it already has the available ch annel list (for example, WSM) and there is due to be no need to receive the control of the instrument fixed wit h the mode II instrument / dissimilar. That is, the link s et-up process can be completed in the step S540 in ca se the mode II instrument performs the link set-up.

한편, 연관 요청 프레임을 전송하는 기기가 모드 I 기기인 경우에는, 연관 요청/응답 과정이 성공적으로 완료된 후에, 단계 S550에서 보안 셋업(security setup) 과정을 수행하게 된다. 보안 셋업은, 예를 들어, EAPOL(Extensible Authentication

In the meantime, in case the instrument transmitting the linkage request frame is the mode I instrument afte r the linkage request / response process is successfully completed the security set up (security setup) process

Protocol over LAN) 프레임을 통한 4-웨이 핸드쉐이킹을 통해서, 프라이빗 키 셋업(private key setup)을 하는 과정을 포함할 수 있다.

is performed in the step S550. The security set up, for example, can comprise the process of the private key s et up (private key setup) through 4- way handshaking through the EAPOL (Extensible Authentication Protocol over LAN) frame.

모드 II 기기/고정된 기기와 모드 I 기기 간에는 보안 셋업이 반드시 수행되어야 한다. 이는 모드 II 기기/고정된 기기가 모드 I 기기에게 WSM을 전달할 때에, 무결성 확인(integrity chec k) 등이 요구되기 때문이다.

The security set up has to be certainly performed between the instrument and the mode I instrument fixe d with the mode II instrument /. When the instrument i n which this is fixed with the mode II instrument / deliv ers WSM to the mode I instrument the integrity checki ng etc. are due to be required.

단계 S560에서 모드 I 기기는, 보안 셋업이 완료된 후에, 모드 II 기기/고정된 기기에게 채널 가용성(Channel Availability) 요청 프레임(또는 채널 가용성 질의(Channel Availability Qu ery; CAQ) 요청 프레임)을 전송하여 사용가능한 채널의 리스트(예를 들어, WSM)을 요청할 수 있다. 모드 II 기기/고정된 기기는, 채널 가용성 응답 프레임(또는 CAQ 응답 프레임)을 모드 I 기기에게 전송함으로써 가용 채널 리스트(예를 들어, W SM)를 제공할 수 있다.

In the step S560, after the security set up the mode I instrument is finished the channel solubility (Channel Av ailability) request frame (or, the channel solubility quer y (Channel Availability Query: CAQ) request frame) is tr ansmitted to the instrument fixed with the mode II inst rument / and the list (for example, WSM) of the availab le channel can be requested. The instrument fixed with the mode II instrument / provides the mode I instrumen t the channel solubility response frame (or, the CAQ re sponse frame) with the available channel list (for exam ple, WSM) it transmits.

도 6(c)는 채널 가용성 요청 프레임의 예시적인 포맷을 나타내고, 도 6(d)는 채널 가용성 응답 프레임의 예시적인 포맷을 나타낸다.

Figure 6(c) shows the illustrative format of the channel solubility request frame and Figure 6(d) shows the illust rative format of the channel solubility response frame.

카테고리 필드는 해당 프레임이 속하는 분류를 나타낸다. 본 예시에서 카테고리 필드는, 채널 가용성 요청/응답이 속하는 액션 프레임을 나타내는 값으로 설정될 수 있다. 액션 필드는 해당 프레임이 어떤 동작에 관련된 것인지를 나타내는 기능을 한다. 본 예시에서 액션 필드는 채널 가용성 요청/응답에 대한 특정 값으로 설정될 수 있다. 다이얼로그 토큰 필드는 액션 응답과 액션 요청을 매칭시키는 기능을 하며, 동시에 여러 개의 액션 요청이 존재하는 경우를 위하여 사용될 수 있다. 다이얼로그 토큰 필드는 요청 STA(예를 들어, 모드 I 기기)에 의해서 설정되는 값을 포함할 수 있다.

The category field shows the classification in which the correspondence frame belongs. In this example, it can be set up as the value in which the category field sho ws the action frame in which the channel solubility req uest / response belongs. The action field functions to s how whether the correspondence frame relates to any kind of operation or not. In this example, the action fiel d can be set up as the definite value about the channe l solubility request / response. The dialog token field fu nctions to match the action reply and action request a nd it can be used for the case where several action re quests simultaneously exist. The value in which the dial og token field is set up with the request STA (for exam ple, the mode I instrument) is include might.

채널 가용성 응답 프레임을 통해서, 모드 I 기기는 가용 채널 리스트(예를 들어, WSM)을 수신함으로써, 모드 II 기기/고정된 기기와의 링크 셋업 과정을 완료할 수 있다. 링크 셋업이 완료되면, 모드 I 기기는 모드 II 기기/고정된 기기와 데이터, 제어, 관리 프레임 등에 대한 상호 송수신을 시작할 수 있다.

The mode I instrument receives the available channel list (for example, WSM) through the channel solubility r esponse frame. In that way the link set-up process wit h the instrument fixed with the mode II instrument / ca n be completed. When the link set-up is completed, th e mode I instrument can start the inter transceiver incl uding the instrument and data, fixed with the mode II i nstrument / the control, the management frame etc.

링크 셋업 이후에는, 단계 S570에서 도시하는 바와 같이, 모드 I 기기는 모드 II 기기/고정된 기기로부터 CVS(Contact Verif ication Signal)을 주기적으로 수신할 수 있다. CVS는 링크 셋업 상태를 유효하게 유지하는 기능을 할 수 있다.

As shown in the step S570 after the link set-up, the mode I instrument periodically can receive the CVS (Co ntact Verification Signal) from the instrument fixed with the mode II instrument /. CVS tellingly functions to mai ntain the link set up state.

또한, 도 6(d)는 CVS 프레임의 예시적인 포맷에서 나타내는 바와 같이, 모드 II 기기/고정된 기기로부터 전송되는 CVS는 모드 II 기기/고정된 기기가 가지고 있는 WSM의 맵 ID를 포함할 수 있다. 이에 따라, 모드 I 기기는 현재 유효한 채널이 무엇

Moreover, the instrument in which CVS transmitted from the instrument which as shown in Figure 6(d) is th e illustrative format of the CVS frame, is fixed with the mode II instrument / is fixed with the mode II instrume

인지를 주기적으로 확인할 수 있고, CVS의 맵 ID로 지시되지 않는 WSM은 유효하지 않은 것으로 결정할 수 있다. 즉, 모드 I 기기가 CVS 프레임을 수신한 경우, 자신이 가지고 있는 WSM의 맵 ID와 비교하여 상이한 경우에, 채널 가용성 요청 프레임을 모드 II 기기/고정된 기기에게 전송하여 새로운 가용 채널 리스트(예를 들어, WSM)을 요청할 수 있다.

nt / may include the map ID of WSM had. Accordingly, the mode I instrument periodically can confirm whether the current effective channel is the what and WSM whi ch is not indicated to the map ID of CVS is not effectiv e and it can determine. That is, in case the mode I inst rument receives the CVS frame in case it compares wit h the map ID of WSM of oneself and it is different the channel solubility request frame is transmitted to the in strument fixed with the mode II instrument / and the n ew available channel list (for example, WSM) can be re quested.

전술한 본 발명의 실시형태에서는 화이트 스페이스에서 동작하는 기기의 타입에 따른 효율적이고 신속한 링크 셋업을 수행/지원하는 방안에 대하여 설명하였다. 이러한 링크 셋업을 수행함으로써 모드 I 기기는 모드 II 기기/고정된 기기의 제어를 받아서 BSS에 참여할 수 있다. 이하에서는, BSS를 구성한 모드 II 기기/고정된 기기가, 해당 BSS에서의 동작에 필요한 정보를 제공하는 방안에 대한 본 발명의 예시들에 대하여 설명한다.

The performance / the link set-up efficient and which is quick according to the type of the instrument which i n the above preferred embodiment, operates in the whi te space of the above-described invention describe the plan. By performing such link set-up the mode I instrum ent receives the control of the instrument fixed with th e mode II instrument / and it can participate in BSS. H ereinafter, it illustrates for the examples of the inventio n about the plan in which the instrument fixed with the mode II instrument / configures BSS provides the nece ssary information to the operation at the corresponding BSS.

BSS 동작 정보

BSS operation information.

어떤 BSS에서의 STA(또는 모드 I 기기)의 동작은, 해당 BSS에서의 동작에 필요한 정보(예를 들어, 동작 정보 요소)에 의해서 제어된다. 상기 동작 정보 요소는, 기기 타입에 따라서 적용되는 동작 파라미터들을 지정할 수 있다. 상기 동작 정보는 BSS 을 구성한 AP(또는 모드 II 기기/고정된 기기)에 의해서, 비콘 프레임, 프로브 응답 프레임 또는 다른 형태의 프레임을 통하여 전송될 수 있다.

The operation of the STA (or, the mode I instrument) at any kind of BSS is controlled in the operation at the corresponding BSS with the necessary information (for example, the operation information element). The opera tion information element can designate operation param eters applied according to the instrument type. Using t he AP (the instrument which or is fixed with the mode I I instrument /) in which the operation information confi gures BSS, it can be transmitted through the beacon fr ame, and the dissimilar frame of the probe response fra me or the form.

도 7은 동작 정보 요소의 포맷을 나타내는 도면이다. 도 7의 동작 정보 요소는 TVWS에서의 동작에 대한 파라미터를 포함하는 의미로서, TVWS 동작 정보 요소라고 칭할 수도 있다. 또한, TVWS에서의 고수율(High Throughput; HT) BSS에서의 동작에 대한 파라미터를 포함하는 의미로서, TVHT 동작 정보 요소라고 칭할 수도 있다. 이하에서는, 경제성을 위하여 동작 정보 요소 또는 동작 요소라고 통칭하기로 한다.

Figure 7 is drawing showing the format of the operation information element. As the meaning that the operation information element of fig. 7 includes the parameter ab out the operation at TVWS, it can call the TVWS opera tion information element. Moreover, as the meaning incl uding the parameter about the operation at the high yi eld (High Throughput: HT) BSS at TVWS, it can call th e TVHT operation information element. Hereinafter, it d ecides to name for the economical efficiency as the op eration information element or the action element.

도 7에서 요소 ID(Element ID) 필드는, 동작 정보 요소에 대해서 미리 정해진 소정의 값을 가질 수 있다. 길이(Length) 필드는, 후속하는 필드들의 길이에 해당하는 값을 가질 수 있다. 동작 정보(Operation Information) 필드는, 동작 채널에 대한 대역폭(bandwidth) 및 중심 주파수(center frequency) 등의 정보를 포함하며, 동작 정보 필드의 서브필드(subfield)에 대한 구체적인 내용은 표 2를 참조하여 후술한다. 기본 MCS 세트(Basic MCS Set) 필드는, BSS 내의 모든 STA에 의해서 지원되는 MCS(Modulation and coding scheme)에 해당하는 값을 가질 수 있다.

In fig. 7, the element ID field can have the predetermined predetermined value about the operation information element. The length field can have the valu e corresponding to the length of the subsequent fields. The operation information field contains the information including the bandwidth and center frequency about th e working channel etc. and the detailed content towar d the subfield of the operation information field describ es later with reference to the table 2. The basis MCS s et (Basic MCS Set) field can have the value correspond ing to MCS (Modulation and coding scheme) supported by all STAs within BSS.

아래의 표 2를 참조하여 도 7의 동작 정보 필드의 포맷 및 서브

It illustrates for the content of the format of the

필드의 내용에 대해서 설명한다. 도 7의 동작 정보 필드는 TVWS 동작 정보 필드 또는 TVHT 동작 정보 필드라고 칭할 수도 있다.

operation information field of fig. 7 and subfield with reference to the following table 2. The operation information field of fig. 7 can call the TVWS operation information field or the TVHT operation information field.

[표 2]

[Table 2]

상기 표 2에서 나타내는 동작 정보 필드의 구체적인 내용에 대하여 설명하기에 앞서, 본 발명에서 설명하는 WLAN 채널의 구조를 표현하기 위한 용어에 대해서 설명한다.

Before it illustrates for the detailed content of the operation information field showing in the table 2. The structure of the WLAN channel which in the present invention, it illustrates is illustrated for the term for expressing.

먼저, BSS의 동작 채널은 WLAN 채널로 표현될 수 있고, WLAN 채널을 구성하는 기본적인 단위의 채널은 W MHz 크기의 대역폭으로 정의된다. 이하의 설명에서는 상기 기본적인 단위의 채널을 #34#W 채널#34#라고 칭한다. WLAN 채널은, 하나의 W 채널 또는 복수개의 W 채널들로 구성될 수 있다. 복수개의 W 채널이 주파수 축 상에서 연속적(contiguous)으로 위치할 수도 있고, 불연속적(non-contiguous)으로 위치할 수도 있다. 세그먼트(segment)는 하나의 W 채널 또는 연속적인 복수개의 W 채널들로 구성된다.

In advance, the working channel of BSS can be expressed as the WLAN channel and the channel of the primary unit comprising the WLAN channel is defined as the bandwidth of W MHz size. In the following description, the channel of the above-mentioned primary unit is called the "W channel ". The WLAN channel can be formed of one W channel or the multiple W channels. Multiple W channels can be positioned on the frequency axis to the continuous (contiguous) and it can be positioned to the discontinuously (non-contiguous). The segment consists of one W channel or the successive multiple W channels.

또한, 프라이머리 채널(primary channel)은 데이터 유닛(예를 들어, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit))의 전송을 위해서 기본적으로 사용되는 채널이며, 비콘 등의 기본적인 신호 전송을 위하여 사용될 수 있다. 프라이머리 채널은 하나의 W 채널에 대응하거나, 또는 2 개의 연속적인 W 채널(즉, 2W 채널)에 대응할 수도 있다. 한편, 세컨더리(secondary) 채널은 프라이머리 채널 이외의 채널을 의미한다.

Moreover, it is the channel in which the primary channel is elementarily used for the transmission of data unit (for example, the PPDU (Physical layer convergence procedure(PLCP) Protocol Data Unit)) and the channel can be used for the primary signal transmission including the beacon etc. The primary channel corresponds to one W channel or it or can correspond to successive W channel (in other words, 2W channel) of 2. In the meantime, the secondary channel means the channel except the primary channel.

상기 표 2에서 프라이머리 채널 폭(Primary Channel Width) 서브필드는, 프라이머리 채널의 대역폭을 나타낸다. 각 국가별로 TV 채널의 대역폭은 상이하기 때문에, TVWS에서 정의되는 WLAN 동작 채널 중에서 프라이머리 채널의 폭 역시 국가별로 상이하게 정의될 수 있다. 따라서, BSS 내에서 STA이 올바르게 동작하기 위해서는 프라이머리 채널의 폭을 알려주는 것이 필요하다. 상기 표 2에서는 프라이머리 채널이 W MHz의 폭을 가지고, W의 값은 6, 7 또는 8 MHz 중의 하나인 것을 예시적으로 나타낸다.

In the table 2, the primary channel width subfield shows the bandwidth of the primary channel. The bandwidth of the TV channel is different to each each country. Therefore it is different the width of the primary channel can be defined as each country among the WLAN working channel defined in TVWS. Therefore, the width is necessary to inform the width of the primary channel so that STA correctly operate in BSS. It illustratively shows is one of value of W is 6, and 7 or 8 MHz the primary channel has the width of W MHz in the table 2s.

상기 표 2의 채널 폭(Channel Width) 서브필드는, BSS가 지원하는 동작 채널의 채널 대역폭을 나타낸다. TVWS의 경우에, 가용 채널은 주파수 축 상에서 반드시 연속적으로 존재하지는 않는다. 따라서, TVWS에서의 WLAN 동작 채널은 연속적인 구조와 불연속적인 구조를 모두 지원해야 한다.

The channel width subfield of the table 2 shows the channel bandwidth of the working channel which BSS supports. In case of TVWS, the available channel certainly consecutively does not exist on the frequency axis. Therefore, the WLAN working channel at TVWS altogether has to support with the structure of being successive and the structure of being discontinuous.

도 8은 TVWS에서 WLAN 동작 채널의 예시적인 형태를 나타내는 도면이다.

Figure 8 is drawing in TVWS, the illustrative form of the WLAN working channel is shown.

상기 도 8 및 상기 표 2에서 예시적으로 나타내는 바와 같이, BSS가 지원하는 동작 채널은 다음과 같은 5 가지 형태의 구조를 가질 수 있다. 첫 번째 예시는 동작 채널이 하나의 W 채널로

In the above is 8 and table 2, as shown in the figure, the working channel which BSS supports illustratively can have the structure of 5 branch type as follows. It is

구성되는 경우이며, 이를 #34#W 동작 채널 폭#34#이라고 표현할 수 있다 (도 8(a)). 두 번째 예시는 동작 채널이 연속적인 2개의 W 채널로 구성되는 경우이며, 이를 #34#2W 동작 채널 폭#34#이라고 표현할 수 있다 (도 8(b)). 세 번째 예시는 동작 채널이 불연속적인 2 개의 W 채널로 구성되는 경우이며, 이를 #34#W+W 동작 채널 폭#34#이라고 표현할 수 있다(도 8(c)). 네 번째 예시는 동작 채널이 연속적인 4 개의 W 채널로 구성되는 경우이며, 이를 #34#4W 동작 채널 폭#34#이라고 표현할 수 있다(도 8(d)). 다섯 번째 예시는 동작 채널이 불연속적인 2 개의 주파수 단위(즉, 세그먼트)로 구성되면서 각각의 주파수 단위가 연속적인 2 개의 W 채널로 구성되는 경우이며, 이를 #34#2W+2W 동작 채널 폭#34#이라고 표현할 수 있다 (도 8(e)).

the case where the working channel consists of one W channel in the first example and it is the case it can express this as the "W working channel width " where the second example consists of W channel in which the working channel is successive of 2 and this can be expressed as the "2W working channel width " the third example is the case where the working channel consists of discontinuous W channel of 2 and it is the case it can express this as the "W+W working channel width " where the fourth example consists of W channel in which the working channel is successive of 4 and it is the case of consisting of W channel in which each frequency unit is successive of 2 while it can express this as the "4W working channel width " the fifth example consists of the frequency unit (in other words, the segment) in which the working channel is discontinuous of 2 and this can be expressed as the "2W+2W working channel width " (the drawing 8 (d)) (fig. 8 (e)).

상기 채널 폭 서브필드에 기초하여, 다음과 같은 PPDU 전송 규칙(transmission rule)이 적용될 수 있다.

The PPDU transmission rule as follows can be applied based on the channel width subfield.

PPDU 전송 규칙의 첫 번째 예시는 다음의 표 3과 같이 정의될 수 있다.

It can be defined in the first example of the PPDU transmission rule like the following table 3.

[표 3]

[Table 3]

PPDU 전송 규칙의 두 번째 예시는 다음의 표 4와 같이 정의될 수 있다.

It can be defined in the second example of the PPDU transmission rule like the following table 4.

[표 4]

[Table 4]

상기 첫 번째 및 두 번째 PPDU 전송 규칙은, 4W 동작 채널 폭을 지원하는 BSS와 2W+2W 동작 채널 폭을 지원하는 BSS 에서, 2W MHz PPDU 전송이 허용되는지 또는 W+W MHz PPDU 전송이 허용되는지에서 차이점을 가진다. 가용채널에서 연속적인 채널이 많은 경우에는 첫 번째 PPDU 전송 규칙(즉, 상기 표 3의 규칙)을 선택하는 것이 바람직하고, 불연속적인 채널이 많은 경우에는 두 번째 PPDU 전송 규칙(즉, 상기 표 4의 규칙)을 선택하는 것이 바람직하다.

The first and the second PPDU transmission rule have BSS supporting 4W working channel width and the difference in the paper in which or the W+W MHz PPDU transmission is allowed whether 2W MHz PPDU transmission is allowed in BSS supporting 2W+2W working channel width or not. It is the be desirable to choose the first PPDU transmission rule (in other words, the rule of the table 3) in case the successive channel is many in the available channel and it is the be desirable to choose the second PPDU transmission rule (in other words, the rule of the table 4) in case the discontinuous channel is many.

전술한 바와 같이 2W, W+W, 4W, 2W+2W 동작 채널 폭의 경우에는 복수개의 허용되는 PPDU 전송이 존재한다. 그 중에서 어떤 타입의 PPDU가 이용되는지를 명확하게 결정하는 것이 요구된다. 본 발명에서는 BSS가 지원하는 동작 채널 폭 및 PPDU 대역폭에 기초하여 PPDU 타입(즉, 허용되는 PPDU 전송 타입)을 결정하는 방안을 제안한다.

As described above, in case of 2W, W+W, 4W, in case of 2W+2W working channel width, multiple allowed PPDU transmissions exist. Among them, it is required to specifically determine whether PPDU of any kind of type is used or not. In the present invention, the working channel width which BSS supports and the plan determining the PPDU type (the allowed PPDU transfer type) based on the PPDU bandwidth are proposed.

먼저, PPDU는 PLCP 프리앰블 필드, PLCP 헤더 필드 및 데이터 필드를 포함할 수 있다. PLCP 프리앰블 필드는 트레이닝 필드(training field) 등을 포함한다. PLCP 헤더 필드는 SIG(Signal) 필드 등을 포함한다. 데이터 필드는 PSDU 등을 포함한

In advance, PPDU comprises the PLCP preamble field, and the PLCP header field and the data field. The PLCP preamble field includes the training field etc. The PLCP header field includes the SIG (Signal) field etc. The dat

다. 여기서, PLCP 헤더 필드에 포함되는 SIG 필드는, BW(Bandwidth) 필드를 포함한다. BW 필드는 2 비트 크기로 정의되며, 기본적으로는 X, 2X, 4X 또는 8X/4X+4X의 PPDU 대역폭을 지시하는 기능을 한다 (예를 들어, X=20 MHz).

a field includes PSDU etc. Here, the SIG field included in the PLCP header field includes the BW (Bandwidth) field. The BW field is defined as 2 bit size and X, 2X, and the PPDU bandwidth of 4X or 8X / 4X+4X function to be elementarily indicated (for example, the X=20 MHz).

또한, 전술한 바와 같이, TVWS에서는 W(=6, 7 또는 8 MHz) 크기의 프라이머리 채널을 기반으로 BSS 동작 채널 폭이 W, 2W, W+W, 4W 또는 2W+2W 형태로 설정되며, 각각의 동작 채널 폭에 대해서 허용되는 PPDU 전송은 상기 표 3 또는 표 4와 같이 설정될 수 있다.

Moreover, as described above, in TVWS, the BSS working channel width is set up based on the primary channel of W (the =6, and 7 or 8 MHz) size in the form of the W, 2W, W+W, 4W or 2W+2W and the PPDU transmission allowed to each working channel width can be set up like the table 3 or the table 4.

요컨대, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서 정의되는 PPDU 대역폭은 X, 2X, 4X 또는 8X/4X+4X의 형태로 정의되는 반면, TVWS에서 동작하는 BSS에서 지원가능한 동작 채널 폭에 따른 PPDU 전송의 대역폭은 W, 2W, W+W, 4W 또는 2W+2W 의 형태를 가진다. 즉, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서 정의되는 PPDU 대역폭을 그대로 사용하는 경우에, TVWS에서의 BSS 동작 채널 폭에 따라 허용되는 PPDU 전송 대역폭을 올바르게 나타낼 수 없다. 예를 들어, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서는 X+X 또는 2X+2X와 같은 형태의 PPDU 타입을 설정할 수 없다.

In short, whereas the PPDU bandwidth defined with the BW field within the SIG field of the PLCP header is defined in the form of X, 2X, and 4X or 8X / 4X+4X the bandwidth of the PPDU transmission according to the working channel width enabling to assist has the form of the W, 2W, W+W, 4W or 2W+2W in BSS operating in TVWS. That is, in case the PPDU bandwidth defined with the BW field within the SIG field of the PLCP header is like that used the PPDU transmission bandwidth allowed according to the BSS working channel width at TVWS cannot be correctly shown. For example, it is according to due to the BW field within the SIG field of the PLCP header and the PPDU type of the form like the X+X or 2X+2X cannot be created.

따라서, 본 발명에서는 BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여 PPDU 타입을 결정하는 새로운 방안에 대해서 제안한다.

Therefore, in the present invention, it suggests about the working channel width (in other words, the value of the Channel Width subfield of the table 2) which BSS supports and the new plan determining the PPDU type based on the PPDU bandwidth (in other words, the value of the BW field within the SIG field of the PLCP header).

구체적인 예시로서, 상기 SIG 필드의 BW 필드가 제 1 값(또는 00)인 경우에, W MHz 대역폭의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 2 값(또는 01)인 경우에, 2W 또는 W+W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 3 값(또는 10)인 경우에, 4W 또는 2W+2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 이를 정리하면 아래의 표 5와 같다.

As the detailed example, in case the BW field of the SIG field is the first value (or, 00) the PPDU type of W MHz bandwidth is set up and it can define. Moreover, in case the BW field of the SIG field is the second number (or, 01) the PPDU type of 2W or the W+W MHz is set up and it can define. Moreover, in case the BW field of the SIG field is the third value (or, 10) the PPDU type of 4W or 2W+2W MHz is set up and it can define. This is made to be equal to the following table 5 it organizes.

[표 5]

[Table 5]

상기 표 5에서와 같이 SIG 필드의 BW 값에 따른 PPDU 타입이 정의되는 경우에, BSS에서 지원하는 동작 채널 폭을 고려하면 특정 PPDU 타입(즉, 허용되는 PPDU 전송 타입)이 명확하게 결정될 수 있다.

As shown in table 5, in case the PPDU type according to the BW value of the SIG field is defined the specific PPDU type (the allowed PPDU transfer type) can be specifically determined in consideration of the working channel width supported in BSS.

예를 들어, 상기 표 3과 같은 동작 채널 폭에 따라 허용되는 PPDU 전송의 타입과, 상기 표 5와 같은 BW 필드에 다른 PPDU 타입을 동시에 고려하는 것을 가정한다. 이 경우에, 동작 채널 폭이 W인 경우에 W MHz의 PPDU 전송만이 허용되므로, B

For example, it assumes simultaneously considering the dissimilar PPDU type in the BW field like the type of the PPDU transmission allowed according to the working channel width like the table 3 and table 5. In this case, it

W는 제1값만이 관련된다. 동작 채널 폭이 2W인 경우에 W MHz 또는 2W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 2W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 W+W인 경우에 W MHz 또는 W+W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 W+W MHz PPDU 전송(왜냐하면, 2W MHz PPDU 전송은 W+W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 4W인 경우에 W MHz, 2W MHz 또는 4W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 4W 동작 채널 폭에서 허용되지 않음)을 지시하고, BW가 제3값이면 4W MHz PPDU 전송(왜냐하면, 2W+2W MHz PPDU 전송은 4W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 2W+2W인 경우에 W MHz, 2W MHz 또는 2W+2W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 2W+2W 동작 채널 폭에서 허용되지 않음)을 지시하고, BW가 제3값이면 2W+2W MHz PPDU 전송(왜냐하면, 4W MHz PPDU 전송은 2W+2W 동작 채널 폭에서 허용되지 않음)을 지시한다. 이를 정리하면 다음의 표 6과 같다.

is allowed only the PPDU transmission of W MHz in case the working channel width is W. Therefore BW relates only the first value. The PPDU transmission of W MHz or 2W MHz is allowed in case the working channel width is 2W and W MHz PPDU transmission is indicated if BW is the first value and 2W MHz PPDU transmission (the W+W MHz PPDU transmission is not Because allowed in 2W working channel width) is indicated if BW is the second number. The PPDU transmission of W MHz or the W+W MHz is allowed in case the working channel width is the W+W and W MHz PPDU transmission is indicated if BW is the first value and the W+W MHz PPDU transmission (2W MHz PPDU transmission is not Because allowed in the W+W working channel width) is indicated if BW is the second number. W MHz, and the PPDU transmission of 2W MHz or 4W MHz are allowed in case the working channel width is 4W and W MHz PPDU transmission is indicated if BW is the first value and 2W MHz PPDU transmission (the W+W MHz PPDU transmission is not Because allowed in 4W working channel width) is indicated if BW is the second number and 4W MHz PPDU transmission (2W+2W MHz PPDU transmission is not Because allowed in 4W working channel width) is indicated if BW is the third value. W MHz, and the PPDU transmission of 2W MHz or 2W+2W MHz are allowed in case the working channel width is 2W+2W and W MHz PPDU transmission is indicated if BW is the first value and 2W MHz PPDU transmission (the W+W MHz PPDU transmission is not Because allowed in 2W+2W working channel width) is indicated if BW is the second number and 2W+2W MHz PPDU transmission (4W MHz PPDU transmission is not Because allowed in 2W+2W working channel width) is indicated if BW is the third value. This is made to be equal to the following table 6 it organizes.

[표 6]

[Table 6]

또한, 본 발명은 상기 표 3 및 표 4의 조합에 의해 PPDU 타입을 결정하는 방안을 포함한다. 이를 정리하면 표 7과 같이 표현할 수 있으며, 구체적인 설명은 생략한다.

Moreover, the invention comprises the table 3 and the plan determining the PPDU type by the combination of the table 4. It can express if this is organized and the detailed description omits.

[표 7]

[Table 7]

상기 표 6 및 표 7의 예시에서 나타내는 바와 같이, BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여, BSS가 지원하는 동작 채널 폭에 따라 허용되는 특정 PPDU 타입을 명확하게 지시할 수 있고, 기존의 BW 필드에서 지시되지 않는 형태(예를 들어, W+W 또는 2W+2W)의 PPDU 타입을 명확하게 지시할 수 있다.

As shown in the example of the table 6 and table 7, the specific PPDU type allowed according to the working channel width which BSS supports can be specifically indicated based on the working channel width (in other words, the value of the Channel Width subfield of the table 2) and the PPDU bandwidth (in other words, the value of the BW field within the SIG field of the PLCP header) which BSS supports and the PPDU type which is not indicated in the existing BW field of the form (for example, the W+W or 2W+2W) can be specifically indicated.

한편, 상기 표 5의 예시와 달리 상기 PLCP 헤더의 SIG 필드 내의 BW 필드의 4 개의 상태(state)를 모두 이용하는 경우에, 동작 채널 폭에 따라 허용되는 PPDU 타입을 지시하는 방안을 위 예시들과 다르게 정의할 수 있다. 예를 들어, BW 필드가 제

In the meantime, in case the state of 4 of the BW field within the SIG field of the PLCP header is altogether used to the example of the table 5 it is different from exa mples the plan indicating the PPDU type allowed accord

1 값(또는 00)인 경우에, W MHz 대역폭의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, BW 필드가 제 2 값(또는 01)인 경우에, 2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 3 값(또는 10)인 경우에, 4W 또는 2W+2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, BW 필드가 제 4 값(또는 11)인 경우에, W+W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 이를 정리하면 아래의 표 8과 같다.

ing to the working channel width can be defined. For example, in case the BW field is the first value (or, 00) the PPDU type of W MHz bandwidth is set up and it can define. Moreover, in case the BW field is the second number (or, 01) the PPDU type of 2W MHz is set up and it can define. Moreover, in case the BW field of the SIG field is the third value (or, 10) the PPDU type of 4W or 2W+2W MHz is set up and it can define. Moreover, in case the BW field is the fourth value (or, 11) the PPDU type of the W+W MHz is set up and it can define. This is made to be equal to the following table 8 it organizes.

[표 8]

[Table 8]

이 경우, 상기 표 3 및 표 4의 예시와 달리, 동작 채널 폭에 따라 허용되는 PPDU 전송을 다음의 표 9와 같이 정의될 수 있다.

In this case, it can be the allowed PPDU transmission defined to the example of the table 3 and table 4 according to the working channel width like the following table 9.

[표 9]

[Table 9]

이 경우, BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여, BSS가 지원하는 동작 채널 폭에 따라 허용되는 특정 PPDU 타입을 아래의 표 10과 같이 명확하게 지시할 수 있다.

In this case, as shown in table 10, the specific PPDU type allowed according to the working channel width which BSS supports can be specifically indicated based on the working channel width (in other words, the value of the Channel Width subfield of the table 2) and the PPDU bandwidth (in other words, the value of the BW field within the SIG field of the PLCP header) which BSS supports of the lower part.

[표 10]

[Table 10]

상기 표 2를 다시 참조하여, 프라이머리 채널 오프셋(Primary Channel Offset) 서브필드는, 주파수 세그먼트의 대역폭이 2W MHz 또는 4W MHz 인 경우에 프라이머리 채널의 위치를 나타낸다.

The table 2 is again referred to and the position of the primary channel is shown in case the bandwidth of the frequency segment the primary channel offset subfield is 2W MHz or 4W MHz.

예를 들어, 상기 도 8(e)의 예시에서와 같이 하나의 주파수 세그먼트가 2W 대역폭으로 정의되고, 2 개의 주파수 세그먼트(주파수 세그먼트 0 및 1)이 정의되고, 프라이머리 채널이 주파수 세그먼트 0에 위치하는 경우를 가정할 수 있다. 이 경우, 프라이머리 채널 오프셋이 0 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 첫 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 1 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 두 번째 W 채널에 위치하는 것을 나타낼 수 있다.

For example, the above is defined as one frequency segment 2W bandwidth the example of 8 (e) and frequency segment (the frequency segment 0 and 1) of 2 are defined and the case where the primary channel is positioned in the frequency segment 0 can be assumed. In this case, the primary channel is positioned at the first W channel of the frequency segment 0 if the primary channel offset has 0 value and it can show that the primary channel is positioned at the second W channel of the frequency segment 0 if the primary channel offset has 1 value.

다른 예시로서, 상기 도 8(d)의 예시에서와 같이 프라이머리 채널이 4 MHz 대역폭의 주파수 세그먼트에 존재하는 경우에, 프라이머리 채널 오프셋이 0 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 첫 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 1 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 두 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 2 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 세 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 3 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 네 번째 W 채널에 위치하는 것을 나타낼 수 있다.

Like other above as the example, is the example of 8s (d), in case the primary channel exists in the frequency segment of 4 MHz bandwidth the primary channel is positioned at the first W channel of the frequency segment 0 if the primary channel offset has 0 value and the primary channel is positioned at the second W channel of the frequency segment 0 if the primary channel offset has 1 value and the primary channel is positioned at the third W channel of the frequency segment 0 if the primary channel offset has 2 value and it can show that the primary channel is positioned at the fourth W channel of the frequency segment 0 if the primary channel offset has 3 value.

상기 표 2의 세컨더리 채널 오프셋(Secondary Channel Offset) 서브필드는, 프라이머리 채널의 위치를 기준으로 세컨더리 채널의 상대적인 위치를 나타낸다. 세컨더리 채널 오프셋이 1 값을 가지면 세컨더리 채널은 프라이머리 채널에 비하여 높은 주파수에 위치하고, 세컨더리 채널 오프셋이 3 값을 가지면 세컨더리 채널은 프라이머리 채널에 비하여 낮은 주파수에 위치하고, 세컨더리 채널 오프셋이 0 값을 가지면 세컨더리 채널이 존재하지 않음을 나타낼 수 있다.

The secondary channel offset subfield of the table 2 shows the relative position of the secondary channel based on the position of the primary channel. If the secondary channel offset has 1 value the secondary channel is positioned in the frequency high in comparison with the primary channel and if the secondary channel offset has 3 value the secondary channel is positioned in the frequency which is low in comparison with the primary channel and it can show that the secondary channel is nonexistent if the secondary channel offset has 0 value.

상기 표 2의 채널 중심 주파수 세그먼트 0(Channel Center Frequency Segment 0) 서브필드는, 주파수 세그먼트 0의 채널 중심 주파수 값을 나타낸다. 주파수 세그먼트 0는 프라이머리 채널을 포함하는 세그먼트를 의미한다. 예를 들어, 동작 채널 폭이 W, 2W 또는 4W MHz인 경우에는 하나의 주파수 세그먼트가 존재하므로, 채널 중심 주파수 세그먼트 0 서브필드는 해당 주파수 세그먼트의 중심 주파수를 나타낼 수 있다. 한편, 동작 채널 폭이 W+W 또는 2W+2W MHz인 경우에는 2개의 주파수 세그먼트(주파수 세그먼트 0 및 1)가 존재하므로, 채널 중심 주파수 세그먼트 0 서브필드는 그 중에서 주파수 세그먼트 0의 중심 주파수를 나타낼 수 있다.

The channel center frequency segment 0 subfield of the table 2 shows the channel center frequency value of the frequency segment 0. The segment in which the frequency segment 0 includes the primary channel is meant. For example, one frequency segment exists in case the working channel width is W, and 2W or 4W MHz. Therefore the channel center frequency segment 0 subfield can show the center frequency of the corresponding frequency segment. In the meantime, frequency segment (the frequency segment 0 and 1) of 2 exist in case the working channel width is the W+W or 2W+2W MHz. Therefore the channel center frequency segment 0 subfield among them can show the center frequency of the frequency segment 0.

상기 표 2의 채널 중심 주파수 세그먼트 1(Channel Center Frequency Segment 1) 서브필드는, 주파수 세그먼트 1의 채널 중심 주파수 값을 나타낸다. 연속적인 채널의 경우에는 하나의 주파수 세그먼트(즉, 주파수 세그먼트 0) 만이 존재하므로, 채널 중심 주파수 세그먼트 1 서브필드는 불연속적인 채널에 대해서만 정의된다. 예를 들어, 동작 채널 폭이 W+W 또는 2W+2W MHz 인 경우에 2 개의 주파수 세그먼트(주파수 세그먼트 0 및 1)가 존재하므로, 채널 중심 주파수 세그먼트 1 서브필드는 그 중에서 주파수 세그먼트 1의 중심 주파수를 나타낼 수 있다.

The channel center frequency segment 1 subfield of the table 2 shows the channel center frequency value of the frequency segment 1. In case of the successive channel, it exists only one frequency segment (in other words, the frequency segment 0). Therefore it is defined about the channel in which the channel center frequency segment 1 subfield is discontinuous. For example, frequency segment (the frequency segment 0 and 1) of 2 exist in case the working channel width is the W+W or 2W+2W MHz. Therefore the channel center frequency segment 1 subfield among them can show the center frequency of the frequency segment 1.

상기 표 2에서 허용되는 기기 타입(Allowed Device Type) 서브필드는, 각각의 주파수 세그먼트에 대해서 기기의 타입 별로 사용이 허용되는지 여부를 나타낸다. 구체적으로, 각각의 주파수 세그먼트에 대해서 고정된 기기의 사용이 허용되는지, 또는 P/P 기기의 사용이 허용되는지 여부를, 허용되는 기기 타입 서브필드를 통하여 지시할 수 있다. 예를 들어, TV 채널에 인접한 가용채널에 대해서는 고정된 기기(예를 들어, 전송 전력이 높은 기기)의 사용이 허용되지 않는 반면, P/P 기기의 사용은 허용될 수 있다. 만약 주파수 세그먼트 1이 TV 채널에 인접한 경우에 고정된 기기의 사용은 허용되지 않고 P/P 기기의 사용은 허용될 수 있다. 따라서, BSS를 구성하는 AP 는 각각의 주파수 세그먼트에 대해서 어떤 타입의 기기의 사용이 허용되는지를 알려줄 수 있다.

The instrument type (Allowed Device Type) subfield allowed in the table 2 shows whether the use is especially allowed to each frequency segment with the type of the instrument or not. Specifically, the use of the instrument fixed about each frequency segment is allowed whether or it can indicate through the allowed instrument type subfield whether the use of P / P instrument is allowed. For example, whereas the use of the instrument (the instrument in which for example, the transmission power is high) fixed about the available channel adjacent to the TV channel is not allowed the use of P / P instrument can be allowed. In case the frequency segment 1 is adjacent to the TV channel the fixed use of the instrument can not be allowed and the use of P / P instrument can be allowed. Therefore, AP comprising BSS can inform whether the use of the instrument of any kind of type is allowed to each frequency segment or not.

상기 도 7의 동작 정보 요소에 포함되는 상기 표 2의 동작 정보 필드의 서브필드들에 의해서, BSS가 동작하는 채널의 대역폭, 주파수 축 상에서의 위치, 기기별 가용 여부 등이 정의된다. 또한 상기 표 3 내지 표 10에서 설명하는 예시들에 따라서 상기

Using the subfields of the operation information field where the above is included in the operation information element of 7 of the table 2, the bandwidth of the channel, in which BSS operates the position on the frequ

동작 채널에서 허용되는 PPDU 타입이 명확하게 결정될 수 있다.

ency axis, the instrument availability etc. are defined. Moreover, according to examples illustrated in the table 3 through the table 10, the PPDU type allowed in the working channel can be specifically set.

전술한 본 발명의 다양한 실시예에서 설명한 사항들은 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있다.

The above-described matter of the inventions are independently applied or in various embodiments, it illustrates it can be implemented so that the embodiment more than 2 is simultaneously applied.

도 9는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

Figure 9 is a block diagram showing the configuration of the wireless device according to a preferred embodiment of the present invention.

AP(10)는 프로세서(11), 메모리(12), 송수신기(13)를 포함할 수 있다. STA(20)는 프로세서(21), 메모리(22), 송수신기(23)를 포함할 수 있다. 송수신기(13 및 23)는 무선 신호를 송신/수신할 수 있고, 예를 들어, IEEE 802 시스템에 따른 물리 계층을 구현할 수 있다. 프로세서(11 및 21)는 송수신기(13 및 21)와 연결되어 IEEE 802 시스템에 따른 물리 계층 및/또는 MAC 계층을 구현할 수 있다. 프로세서(11 및 21)는 전술한 본 발명의 다양한 실시예에 따른 동작을 수행하도록 구성될 수 있다. 또한, 전술한 본 발명의 다양한 실시예에 따른 AP 및 STA의 동작을 구현하는 모듈이 메모리(12 및 22)에 저장되고, 프로세서(11 및 21)에 의하여 실행될 수 있다. 메모리(12 및 22)는 프로세서(11 및 21)의 내부에 포함되거나 또는 프로세서(11 및 21)의 외부에 설치되어 프로세서(11 및 21)와 공지의 수단에 의해 연결될 수 있다.

The AP (10) may include the processor (11), the memory (12), and the transceiver (13). The STA (20) may include the processor (21), the memory (22), and the transceiver (23). Transceiver (13 and 23) can receive the radio signal with the transmission / and for example, the physical layer according to the IEEE 802 system can be implemented. Processor (11 and 21) are connected to transceiver (13 and 21) and the physical layer according to the IEEE 802 system and/or the MAC layer can be implemented. The operation according to the various embodiment of the invention in which processor (11 and 21) describe in the above is configured to be performed. Moreover, the module implementing the operation of AP according to the above-described various embodiment of the invention and STA is stored in memory (12 and 22) and the module can be carried out by processor (11 and 21). Memory (12 and 22) are included inside processor (11 and 21) or it is installed outside processor (11 and 21) and it can be connected by processor (11 and 21) and publicly known means.

위와 같은 AP 및 STA 장치의 구체적인 구성은, 전술한 본 발명의 다양한 실시예에서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있으며, 중복되는 내용은 명확성을 위하여 설명을 생략한다.

The matters which in various embodiments, the detailed configuration of the STA apparatus and AP as in the above illustrates of the above-described invention are independently applied or it can be implemented so that the embodiment more than 2 is simultaneously applied and the overlapped content omits the description for clarity.

상술한 본 발명의 실시예들은 다양한 수단을 통해 구현될 수 있다. 예를 들어, 본 발명의 실시예들은 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다.

It can be implemented through the means in which the embodiment of the inventions are various. For example, the embodiments of the invention can be implemented by hardware, the firmware, software or their combination etc.

하드웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 하나 또는 그 이상의 ASICs(Application Specific Integrated Circuits), DSPs(Digital Signal Processors), DSPDs(Digital Signal Processing Devices), PLDs(Programmable Logic Devices), FPGAs(Field Programmable Gate Arrays), 프로세서, 컨트롤러, 마이크로 컨트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

In case of the implementation by hardware, the method according to the embodiments of the invention can be implemented by one or more the ASICs (Application Specific Integrated Circuits), the DSPs (Digital Signal Processors), the DSPDs (Digital Signal Processing Devices), the PLDs (Programmable Logic Devices), the FPGAs (Field Programmable Gate Arrays), processor, controller, microcontroller, the microprocessor etc.

펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차 또는 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리 유닛에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리 유닛은 상기 프로세서 내부 또는 외부에 위치하여, 이미 공지된 다양한 수단에 의해 상기 프로세서와 데이터

In case of the implementation by firmware or software, it can be implemented in the form of the function in which in the above, the method according to the embodiments of the invention is explained or the module, performing operations the procedure or the function etc. The software code is stored in the memory unit and it can

를 주고 받을 수 있다.

be driven with the processor. The memory unit is positi oned at the inner part of processor or the outside and the processor and data can be given and can be taken with the various publicly known means.

상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

As described above, it was provided so that the person skilled in the art implemented the invention and the det ailed explanation about the embodiment done with the desirable of the disclosed invention performed. In the a bove case, it illustrated with reference to the embodim ent done with desirable of the invention. However it wil l be able to understand it is various changing the inven tion in the range that it does not deviate from thought and domain of the present invention in which the unskill ed person skilled in the art of the target technology pa rt is written in the following scope of claims with the c orrection. Therefore, the invention relates to be not he re and to be limited in embodiments showing up to give the range of the strongest coinciding with the principle ses disclosed herein and the characteristics which are novel.

## 산업상 이용 가능성

상술한 바와 같은 본 발명의 다양한 실시형태들은 IEEE 802.11 시스템을 중심으로 설명하였으나, 다양한 이동통신 시스템에 동일한 방식으로 적용될 수 있다.

## Industrial Availability

The various embodiment of the invention as described aboves illustrated around the IEEE 802.11 system. But i t can be applied to the various mobile communication s ystem to the same mode.

## 도면에 대한 간단한 설명

본 명세서에 첨부되는 도면은 본 발명에 대한 이해를 제공하기 위한 것으로서 본 발명의 다양한 실시형태들을 나타내고 명세서의 기재와 함께 본 발명의 원리를 설명하기 위한 것이다.

도 1은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

도 2는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다.

도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다.

도 4는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

도 6(a)는 WSM의 일례를 나타내는 도면이다.

도 6(b)은 기기 ID 의 예시적인 포맷을 나타내는 도면이다.

도 6(c)는 채널 가용성 요청 프레임의 예시적인 포맷을 나타내는 도면이다.

도 6(d)는 채널 가용성 응답 프레임의 예시적인 포맷을 나타내는 도면이다.

도 7은 동작 정보 요소의 포맷을 나타내는 도면이다.

도 8은 TVWS에서 WLAN 동작 채널의 예시적인 형태를 나타내는 도면이다.

## Brief explanation of the drawing

Drawing appended to this specification is designed to provide the understanding about the invention and the various embodiments of the invention is to be shown a nd the principles of the invention is to be illustrated wit h the description of specification.

Figure 1 is drawing showing the structure of being illust rative of the IEEE 802.11 system the invention being a pplied.

Figure 2 is drawing showing the structure of being illust rative of being different of the IEEE 802.11 system the invention being applied.

Figure 3 is drawing showing another structure of being i llustrative of the IEEE 802.11 system the invention bein g applied.

Figure 4 is drawing showing the structure of being illust rative of the WLAN system.

Figure 5 is a flowchart for illustrating the link set-up pr ocess of being illustrative according to one example of the invention.

It is drawing showing an example of Figure 6(a) is WS M.

It is drawing in which Figure 6(b) shows the illustrative format of the device ID.

It is drawing in which Figure 6(c) shows the illustrative format of the channel solubility request frame.

도 9는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

It is drawing in which Figure 6(d) shows the illustrative format of the channel solubility response frame.

Figure 7 is drawing showing the format of the operation information element.

Figure 8 is drawing in TVWS, the illustrative form of the WLAN working channel is shown.

Figure 9 is a block diagram showing the configuration of the wireless device according to a preferred embodime nt of the present invention.

**Disclaimer**

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(54) 발명의 명칭 **무선 통신 시스템에서 동작 채널 정보를 송수신하는 방법 및 장치**

(57) 요 약

본 발명은 무선 통신 시스템에 대한 것으로, 보다 상세하게는 동작 채널 정보를 송수신하는 방법 및 장치가 개시된다. 본 발명의 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위 필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

명 세 서

청구범위

**청구항 1**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법에 있어서,

채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및

PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 제공 방법.

**청구항 2**

제 1 항에 있어서,

상기 채널 폭은 하나 이상의 W 채널을 포함하고,

상기 채널 폭 서브필드의 값은,

하나의 W 채널에 대한 제 1 타입 채널 폭;

2 개의 연속적인(contiguous) W 채널들에 대한 제 2 타입 채널 폭;

2 개의 불연속적인(non-contiguous) W 채널들에 대한 제 3 타입 채널 폭;

4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭; 또는

각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭

중에서 하나를 지시하는, 동작 파라미터 제공 방법.

**청구항 3**

제 2 항에 있어서,

상기 채널 폭 서브필드가 상기 제 1 타입 채널 폭을 지시하고 상기 BW 필드가 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하는, 동작 파라미터 제공 방법.

**청구항 4**

제 3 항에 있어서,

상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 5**

제 4 항에 있어서,

상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 6**

제 5 항에 있어서,

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고,

상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 7**

제 6 항에 있어서,

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고,

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고,

상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응하는, 동작 파라미터 제공 방법.

**청구항 8**

제 2 항에 있어서,

상기 BW 필드가 제 1 값을 가지고, 상기 채널 폭 서브필드가 제 1, 제 2, 제 3, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하는, 동작 파라미터 제공 방법.

**청구항 9**

제 2 항에 있어서,

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 2, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 10**

제 2 항에 있어서,

상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 3 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 11**

제 2 항에 있어서,

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 4 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응하는, 동작 파라미터 제공 방법.

**청구항 12**

제 2 항에 있어서,

상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응하는, 동작 파라미터 제공 방법.

**청구항 13**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대한 동작 파라미터를 수신하는 방법에 있어서,

채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하는 단계; 및

PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하는 단계를 포함하고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 수신 방법.

**청구항 14**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 장치에 있어서,

다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및

상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고,

상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하도록 더 구성되고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 제공 장치.

**청구항 15**

화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 수신하는 장치에 있어서,

다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및

상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고,

상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하도록 더 구성되고,

상기 SIG 필드는 BW(BandWidth) 필드를 포함하고,

상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정되는, 동작 파라미터 수신 장치.

## 발명의 설명

### 기 술 분 야

[0001] 이하의 설명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 무선랜 시스템에서의 동작 채널 정보를 송수신하는 방법 및 장치에 대한 것이다.

### 배 경 기 술

[0002] 무선랜(wireless local area network, WLAN) 기술에 대한 표준은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준으로서 개발되고 있다. IEEE 802.11a 및 b는 2.4. GHz 또는 5 GHz에서 비면허 대역(unlicensed band)을 이용하고, IEEE 802.11b는 11 Mbps의 전송 속도를 제공하고, IEEE 802.11a는 54 Mbps의 전송 속도를 제공한다. IEEE 802.11g는 2.4 GHz에서 직교 주파수 분할 다중화(Orthogonal Frequency Division Multiplexing; OFDM)를 적용하여, 54 Mbps의 전송 속도를 제공한다. IEEE 802.11n은 다중입출력 OFDM(Multiple Input Multiple Output-OFDM; MIMO-OFDM)을 적용하여, 4 개의 공간적인 스트림(spatial stream)에 대해서 300 Mbps의 전송 속도를 제공한다. IEEE 802.11n에서는 채널 대역폭(channel bandwidth)을 40 MHz까지 지원하며, 이 경우에는 600 Mbps의 전송 속도를 제공한다.

[0003] 현재, TV 화이트 스페이스(TV whitespace, TVWS) 대역에서 비면허 기기(unlicensed device)의 동작을 규정하기 위한 IEEE 802.11af 표준이 개발되고 있다.

[0004] TVWS는 TV 방송을 위해 할당된 VHF(Very High Frequency) 대역(54~60, 76~88, 174~216MHz)과 UHF(Ultra High Frequency) 대역(470~698MHz)을 포함하며, 해당 주파수 대역에서 동작하는 면허 기기(licensed device; TV방송 및 무선 마이크 등)의 통신을 저해하지 않는다는 조건 하에서 비면허 기기(unlicensed device)에 대해 사용이 허가된 주파수 대역을 의미한다.

[0005] 512~608MHz, 614~698MHz에서는 특수한 몇 가지 경우를 제외하고 모든 비면허 기기들에게 동작이 허용되어 있으나, 54~60MHz, 76~88MHz, 174~216MHz, 470~512MHz 대역은 고정형 기기(fixed device)간의 통신에만 허용되었다. 고정형 기기란 정해진 위치에서만 전송을 수행하는 기기를 말한다. 이하의 설명에 있어서 화이트 스페이스 대역은 상술한 TVWS를 포함하나, 이에 한정될 필요는 없다.

[0006] 화이트 스페이스 대역을 사용하기 원하는 비면허 기기는 면허 기기에 대한 보호 기능을 제공해야 한다. 따라서 화이트 스페이스 대역에서 전송을 시작하기 전에 반드시 면허 기기가 해당 대역을 점유하고 있는지 여부를 확인하도록 한다. 즉, 화이트 스페이스 대역에서 면허 기기가 사용 중이지 않은 경우에만 비면허 기기의 사용이 허용될 수 있다.

[0007] 이를 위하여, 비면허 기기는 인터넷 혹은 전용망을 통해 지리적-위치 데이터베이스(Geo-location DataBase; GDB)에 접속하여 해당 지역에서 사용 가능한 채널 리스트(즉, 사용 가능한 채널(들)의 세트) 정보를 얻어 와야 한다. GDB는 자신에게 등록된 면허 기기의 정보와 해당 면허 기기들의 지리적 위치 및 사용 시간에 따라 동적으로 변화하는 채널 사용 정보를 저장하고 관리하는 데이터 베이스이다. 또한, 화이트 스페이스를 사용하는 비면허 기기들 간의 공존(coexistence) 문제를 해결하기 위해서, 공통 비콘 프레임(common beacon frame) 등과 같은 시그널링 프로토콜 및 스펙트럼 센싱 메커니즘(spectrum sensing mechanism) 등이 이용될 수 있다.

[0008] IEEE 802.11 시스템에서 TVWS 단말은 TVWS 스펙트럼에서 IEEE 802.11 MAC(Medium Access Control) 계층 및 PHY(Physical) 계층을 이용하여 동작하는 비면허 기기를 지칭할 수 있다. 본 문서에서 별도의 설명이 없으면 스테이션(STA)은 TVWS 스펙트럼에서 동작하는 TVWS 단말을 지칭한다.

[0009] STA은 면허 사용자(TV 사용자 및 무선 마이크 등)를 포함하여 우선 접속이 허용되는 사용자인 우선적 사용자(incumbent user) 또는 프라이머리 사용자(primary user)를 보호하는 기능을 제공해야 한다. 즉, 우선적 사용자가 TVWS를 사용중이면 STA는 해당 채널의 사용을 중단해야 한다. 따라서 STA는 비면허 기기가 사용할 수 있는 가용 채널(즉, 면허 기기가 사용하지 않는 채널)을 알아내서 가용 채널(available channel)에서 동작하여야 한다.

[0010] STA이 가용 채널을 알아내기 위한 방법에는, 스펙트럼 센싱 메커니즘을 수행하는 방식 및 GDB에 접속하여 TV 채널 스케줄을 알아내는 방식 등이 있다. 스펙트럼 센싱 메커니즘으로 에너지 검출(energy detection) 방식 (수신 신호의 강도가 일정 값 이상이면 우선적 사용자가 사용 중인 것으로 판단하는 방식), 특징부 검출(feature detection) 방식 (디지털 TV 프리앰블(Preamble) 이 검출 되면 우선적 사용자가 사용 중인 것으로 판단하는 방식) 등이 활용될 수 있다. 다음으로, STA는 GDB 에 접속하여 자신의 위치 정보에 기반한 GDB 정보를 획득하여 해당 위치에서 면허 기기의 채널 사용 여부를 알아야 하고, GDB로의 접속 및 정보 획득은 면허 기기를 보호하기에 충분한 빈도로 수행되어야 한다.

[0011] 스펙트럼 센싱 방식 또는 GDB를 통하여, 현재 사용 중인 채널과 바로 인접해 있는 채널에서 우선적 사용자가 사용 중인 것으로 판단되면, 단말(또는 STA)과 기지국(또는 Access Point(AP))는 전송 전력을 낮추는 방식으로 우선적 사용자를 보호할 수 있다.

## 발명의 내용

### 해결하려는 과제

[0012] 화이트 스페이스 대역에서의 가용 채널은 주파수 상에서 연속적이지 않을 수도 있다. 이에 따라, 화이트 스페이스 대역에서의 채널 구조는 기존의 무선 랜 채널 구조가 그대로 적용될 수 없다. 화이트 스페이스 대역에서 STA이 올바르게 동작하기 위해서는, AP가 구성하는 기본 서비스 세트(Basic Service Set; BSS)에서 지원하는 채널 구조 및 허용되는 데이터 유닛 타입을 알아야 한다.

[0013] 본 발명에서는 STA에게 동작 채널에 대한 정보를 올바르고 효율적으로 알려주는 방안을 제공하는 것을 기술적

과제로 한다.

[0014] 본 발명에서 이루고자 하는 기술적 과제들은 이상에서 언급한 기술적 과제들로 제한되지 않으며, 언급하지 않은 또 다른 기술적 과제들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

## 과제의 해결 수단

[0015] 상기의 기술적 과제를 해결하기 위하여 본 발명의 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하는 단계를 포함하고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

[0016] 상기의 기술적 과제를 해결하기 위하여 본 발명의 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대한 동작 파라미터를 수신하는 방법은, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하는 단계; 및 PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하는 단계를 포함하고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

[0017] 상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 제공하는 장치는, 다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및 상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 전송하도록 더 구성되고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

[0018] 상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 대역에서 동작하는 스테이션(STA)에 대해서 동작 파라미터를 수신하는 장치는, 다른 기기와의 송수신을 수행하도록 구성된 송수신기; 및 상기 송수신기를 포함하는 상기 장치를 제어하도록 구성된 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 통해서, 채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 수신하고, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit)) 프리앰블의 SIG(Signal) 필드를 수신하도록 더 구성되고, 상기 SIG 필드는 BW(BandWidth) 필드를 포함하고, 상기 PPDU의 타입은 상기 채널 폭 하위필드 및 상기 BW 필드에 기초하여 결정될 수 있다.

[0019] 상기 본 발명에 따른 실시예들에 있어서 이하의 사항이 공통으로 적용될 수 있다.

[0020] 상기 채널 폭은 하나 이상의 W 채널을 포함하고, 상기 채널 폭 서브필드의 값은, 하나의 W 채널에 대한 제 1 타입 채널 폭; 2 개의 연속적인(contiguous) W 채널들에 대한 제 2 타입 채널 폭; 2 개의 불연속적인(non-contiguous) W 채널들에 대한 제 3 타입 채널 폭; 4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭; 또는 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭 중에서 하나를 지시할 수 있다.

[0021] 상기 채널 폭 서브필드가 상기 제 1 타입 채널 폭을 지시하고 상기 BW 필드가 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응할 수 있다.

[0022] 상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 2 타입 채널 폭을 지시하고 상기 BW 필드가 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응할 수 있다.

[0023] 상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 3 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응할 수 있다.

[0024] 상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에,

상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고, 상기 채널 폭 서브필드가 상기 제 4 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응할 수 있다.

[0025] 상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 1 값을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응하고, 상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 상기 제 2 값을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응하고, 상기 채널 폭 서브필드가 상기 제 5 타입 채널 폭을 지시하고 상기 BW 필드가 제 3 값을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응할 수 있다.

[0026] 상기 BW 필드가 제 1 값을 가지고, 상기 채널 폭 서브필드가 제 1, 제 2, 제 3, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 하나의 W 채널에 대응할 수 있다.

[0027] 상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 2, 제 4 또는 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 연속적인 W 채널들에 대응할 수 있다.

[0028] 상기 BW 필드가 제 2 값을 가지고, 상기 채널 폭 서브필드가 제 3 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 2 개의 불연속적인 W 채널들에 대응할 수 있다.

[0029] 상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 4 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 4 개의 연속적인 W 채널들에 대응할 수 있다.

[0030] 상기 BW 필드가 제 3 값을 가지고, 상기 채널 폭 서브필드가 제 5 타입 채널 폭을 지시하는 경우에, 상기 PPDU 타입은 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대응할 수 있다.

[0031] 본 발명에 대하여 전술한 일반적인 설명과 후술하는 상세한 설명은 예시적인 것이며, 청구항 기재 발명에 대한 추가적인 설명을 위한 것이다.

## 발명의 효과

[0032] 본 발명에 따르면 STA에게 동작 채널에 대한 정보를 올바르고 효율적으로 알려주는 방법 및 장치가 제공될 수 있다.

[0033] 본 발명에서 얻을 수 있는 효과는 이상에서 언급한 효과들로 제한되지 않으며, 언급하지 않은 또 다른 효과들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

## 도면의 간단한 설명

[0034] 본 명세서에 첨부되는 도면은 본 발명에 대한 이해를 제공하기 위한 것으로서 본 발명의 다양한 실시형태들을 나타내고 명세서의 기재와 함께 본 발명의 원리를 설명하기 위한 것이다.

도 1은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

도 2는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다.

도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다.

도 4는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

도 6(a)는 WSM의 일례를 나타내는 도면이다.

도 6(b)은 기기 ID 의 예시적인 포맷을 나타내는 도면이다.

도 6(c)는 채널 가용성 요청 프레임의 예시적인 포맷을 나타내는 도면이다.

도 6(d)는 채널 가용성 응답 프레임의 예시적인 포맷을 나타내는 도면이다.

도 7은 동작 정보 요소의 포맷을 나타내는 도면이다.

도 8은 TVWS에서 WLAN 동작 채널의 예시적인 형태를 나타내는 도면이다.

도 9는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

## 발명을 실시하기 위한 구체적인 내용

[0035] 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다.

[0036] 이하의 실시예들은 본 발명의 구성요소들과 특징들을 소정 형태로 결합한 것들이다. 각 구성요소 또는 특징은 별도의 명시적 언급이 없는 한 선택적인 것으로 고려될 수 있다. 각 구성요소 또는 특징은 다른 구성요소나 특징과 결합되지 않은 형태로 실시될 수 있다. 또한, 일부 구성요소들 및/또는 특징들을 결합하여 본 발명의 실시예를 구성할 수도 있다. 본 발명의 실시예들에서 설명되는 동작들의 순서는 변경될 수 있다. 어느 실시예의 일부 구성이나 특징은 다른 실시예에 포함될 수 있고, 또는 다른 실시예의 대응하는 구성 또는 특징과 교체될 수 있다.

[0037] 이하의 설명에서 사용되는 특정 용어들은 본 발명의 이해를 돕기 위해서 제공된 것이며, 이러한 특정 용어의 사용은 본 발명의 기술적 사상을 벗어나지 않는 범위에서 다른 형태로 변경될 수 있다.

[0038] 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

[0039] 본 발명의 실시예들은 무선 접속 시스템들인 IEEE 802 시스템, 3GPP 시스템, 3GPP LTE 및 LTE-A(LTE-Advanced)시스템 및 3GPP2 시스템 중 적어도 하나에 개시된 표준 문서들에 의해 뒷받침될 수 있다. 즉, 본 발명의 실시예들 중 본 발명의 기술적 사상을 명확히 드러내기 위해 설명하지 않은 단계들 또는 부분들은 상기 문서들에 의해 뒷받침될 수 있다. 또한, 본 문서에서 개시하고 있는 모든 용어들은 상기 표준 문서에 의해 설명될 수 있다.

[0040] 이하의 기술은 CDMA(Code Division Multiple Access), FDMA(Frequency Division Multiple Access), TDMA(Time Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier Frequency Division Multiple Access) 등과 같은 다양한 무선 접속 시스템에 사용될 수 있다. CDMA는 UTRA(Universal Terrestrial Radio Access)나 CDMA2000과 같은 무선 기술(radio technology)로 구현될 수 있다. TDMA는 GSM(Global System for Mobile communications)/GPRS(General Packet Radio Service)/EDGE(Enhanced Data Rates for GSM Evolution)와 같은 무선 기술로 구현될 수 있다. OFDMA는 IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, E-UTRA(Evolved UTRA) 등과 같은 무선 기술로 구현될 수 있다. 명확성을 위하여 이하에서는 IEEE 802.11 시스템을 위주로 설명하지만 본 발명의 기술적 사상이 이에 제한되는 것은 아니다.

[0041] 도 1 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

[0042] IEEE 802.11 구조는 복수개의 구성요소들로 구성될 수 있고, 이들의 상호작용에 의해 상위계층에 대해 트랜스패런트한 STA 이동성을 지원하는 WLAN이 제공될 수 있다. 기본 서비스 세트(Basic Service Set; BSS)는 IEEE 802.11 LAN에서의 기본적인 구성 블록에 해당할 수 있다. 도 1 에서는 2 개의 BSS(BSS1 및 BSS2)가 존재하고 각각의 BSS의 멤버로서 2 개의 STA이 포함되는 것(STA1 및 STA2 는 BSS1에 포함되고, STA3 및 STA4는 BSS2에 포함됨)을 예시적으로 도시한다. 도 1 에서 BSS를 나타내는 타원은 해당 BSS에 포함된 STA들이 통신을 유지하는 커버리지 영역을 나타내는 것으로도 이해될 수 있다. 이 영역을 BSA(Basic Service Area)라고 칭할 수 있다. STA가 BSA 밖으로 이동하게 되면 해당 BSA 내의 다른 STA들과 직접적으로 통신할 수 없게 된다.

[0043] IEEE 802.11 LAN에서 가장 기본적인 타입의 BSS는 독립적인 BSS(Independent BSS; IBSS)이다. 예를 들어, IBSS는 2 개의 STA만으로 구성된 최소의 형태를 가질 수 있다. 또한, 가장 단순한 형태이고 다른 구성요소들이 생략되어 있는 도 1 의 BSS(BSS1 또는 BSS2)가 IBSS의 대표적인 예시에 해당할 수 있다. 이러한 구성은 STA들이 직

접 통신할 수 있는 경우에 가능하다. 또한, 이러한 형태의 LAN은 미리 계획되어서 구성되는 것이 아니라 LAN이 필요한 경우에 구성될 수 있으며, 이를 애드-혹(ad-hoc) 네트워크라고 칭할 수도 있다.

[0044] STA의 켜지거나 꺼짐, STA가 BSS 영역에 들어오거나 나감 등에 의해서, BSS에서의 STA의 멤버십이 동적으로 변경될 수 있다. BSS의 멤버가 되기 위해서는, STA는 동기화 과정을 이용하여 BSS에 조인할 수 있다. BSS 기반구조의 모든 서비스에 액세스하기 위해서는, STA는 BSS에 연관(associated)되어야 한다. 이러한 연관(association)은 동적으로 설정될 수 있고, 분배시스템서비스(Distribution System Service; DSS)의 이용을 포함할 수 있다.

[0045] 도 2 는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다. 도 2 에서는 도 1 의 구조에서 분배시스템(Distribution System; DS), 분배시스템매체(Distribution System Medium; DSM), 액세스 포인트(Access Point; AP) 등의 구성요소가 추가된 형태이다.

[0046] LAN에서 직접적인 스테이션-대-스테이션의 거리는 PHY 성능에 의해서 제한될 수 있다. 어떠한 경우에는 이러한 거리의 한계가 충분할 수도 있지만, 경우에 따라서는 보다 먼 거리의 스테이션 간의 통신이 필요할 수도 있다. 확장된 커버리지를 지원하기 위해서 분배시스템(DS)이 구성될 수 있다.

[0047] DS는 BSS들이 상호연결되는 구조를 의미한다. 구체적으로, 도 1 과 같이 BSS가 독립적으로 존재하는 대신에, 복수개의 BSS들로 구성된 네트워크의 확장된 형태의 구성요소로서 BSS가 존재할 수도 있다.

[0048] DS는 논리적인 개념이며 분배시스템매체(DSM)의 특성에 의해서 특정될 수 있다. 이와 관련하여, IEEE 802.11 표준에서는 무선 매체(Wireless Medium; WM)와 분배시스템매체(DSM)을 논리적으로 구분하고 있다. 각각의 논리적 매체는 상이한 목적을 위해서 사용되며, 상이한 구성요소에 의해서 사용된다. IEEE 802.11 표준의 정의에서는 이러한 매체들이 동일한 것으로 제한하지도 않고 상이한 것으로 제한하지도 않는다. 이와 같이 복수개의 매체들이 논리적으로 상이하다는 점에서, IEEE 802.11 LAN 구조(DS 구조 또는 다른 네트워크 구조)의 유연성이 설명될 수 있다. 즉, IEEE 802.11 LAN 구조는 다양하게 구현될 수 있으며, 각각의 구현예의 물리적인 특성에 의해서 독립적으로 해당 LAN 구조가 특정될 수 있다.

[0049] DS는 복수개의 BSS들의 끊김 없는(seamless) 통합을 제공하고 목적지로의 어드레스를 다루는 데에 필요한 논리적 서비스들을 제공함으로써 이동 기기를 지원할 수 있다.

[0050] AP 는, 연관된 STA들에 대해서 WM을 통해서 DS 로의 액세스를 가능하게 하고 STA 기능성을 가지는 개체를 의미한다. AP를 통해서 BSS 및 DS 간의 데이터 이동이 수행될 수 있다. 예를 들어, 도 2 에서 도시하는 STA2 및 STA3 은 STA의 기능성을 가지면서, 연관된 STA들(STA1 및 STA4)가 DS로 액세스하도록 하는 기능을 제공한다. 또한, 모든 AP는 기본적으로 STA에 해당하므로, 모든 AP는 어드레스 가능한 개체이다. WM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스와 DSM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스는 반드시 동일할 필요는 없다.

[0051] AP에 연관된 STA들 중의 하나로부터 그 AP의 STA 어드레스로 전송되는 데이터는, 항상 비제어 포트(uncontrolled port)에서 수신되고 IEEE 802.1X 포트 액세스 개체에 의해서 처리될 수 있다. 또한, 제어 포트(controlled port)가 인증되면 전송 데이터(또는 프레임)는 DS로 전달될 수 있다.

[0052] 도 3 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다. 도 3 에서는 도 2 의 구조에 추가적으로 넓은 커버리지를 제공하기 위한 확장된 서비스 세트(Extended Service Set; ESS)를 개념적으로 나타낸다.

[0053] 임의의(arbitrary) 크기 및 복잡도를 가지는 무선 네트워크가 DS 및 BSS들로 구성될 수 있다. IEEE 802.11 시스템에서는 이러한 방식의 네트워크를 ESS 네트워크라고 칭한다. ESS는 하나의 DS에 연결된 BSS들의 집합에 해당할 수 있다. 그러나, ESS는 DS를 포함하지는 않는다. ESS 네트워크는 LLC(Logical Link Control) 계층에서 IBSS 네트워크로 보이는 점이 특징이다. ESS에 포함되는 STA들은 서로 통신할 수 있고, 이동 STA들은 LLC에 트랜스패런트하게 하나의 BSS에서 다른 BSS로 (동일한 ESS 내에서) 이동할 수 있다.

[0054] IEEE 802.11 에서는 도 3 에서의 BSS들의 상대적인 물리적 위치에 대해서 아무것도 가정하지 않으며, 다음과 같은 형태가 모두 가능하다. BSS들은 부분적으로 중첩될 수 있고, 이는 연속적인 커버리지를 제공하기 위해서 일반적으로 이용되는 형태이다. 또한, BSS들은 물리적으로 연결되어 있지 않을 수 있고, 논리적으로는 BSS들 간의 거리에 제한은 없다. 또한, BSS들은 물리적으로 동일한 위치에 위치할 수 있고, 이는 리던던시를 제공하기 위해서 이용될 수 있다. 또한, 하나 (또는 하나 이상의) IBSS 또는 ESS 네트워크들이 하나 (또는 하나 이상의) ESS

네트워크로서 동일한 공간에 물리적으로 존재할 수 있다. 이는 ESS 네트워크가 존재하는 위치에 애드-혹 네트워크가 동작하는 경우나, 상이한 기관(organizations)에 의해서 물리적으로 중첩되는 IEEE 802.11 네트워크들이 구성되는 경우나, 동일한 위치에서 2 이상의 상이한 액세스 및 보안 정책이 필요한 경우 등에서의 ESS 네트워크 형태에 해당할 수 있다.

[0055] 도 4 는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다. 도 4 에서는 DS를 포함하는 기반 구조 BSS 의 일례가 도시된다.

[0056] 도 4 의 예시에서 BSS1 및 BSS2가 ESS를 구성한다. WLAN 시스템에서 STA는 IEEE 802.11 의 MAC/PHY 규정에 따라 동작하는 기기이다. STA는 AP STA 및 비-AP(non-AP) STA을 포함한다. Non-AP STA는 랩탑 컴퓨터, 이동 전화기와 같이 일반적으로 사용자가 직접 다루는 기기에 해당한다. 도 4 의 예시에서 STA1, STA3, STA4 는 non-AP STA에 해당하고, STA2 및 STA5 는 AP STA 에 해당한다.

[0057] 이하의 설명에서 non-AP STA는 단말(terminal), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장치(User Equipment; UE), 이동국(Mobile Station; MS), 이동단말(Mobile Terminal), 이동 가입자국(Mobile Subscriber Station; MSS) 등으로 칭할 수도 있다. 또한, AP는 다른 무선 통신 분야에서의 기지국(Base Station; BS), 노드-B(Node-B), 발전된 노드-B(evolved Node-B; eNB), 기저 송수신 시스템(Base Transceiver System; BTS), 펨토 기지국(Femto BS) 등에 대응하는 개념이다.

[0058] 화이트 스페이스에서의 가용 채널

[0059] 화이트 스페이스에서 STA이 동작하기 위해서는 면허 기기(또는, 우선적 사용자)에 대한 보호 기법이 우선적으로 제공되어야 한다. 따라서, STA는 면허 기기에 의해 사용되지 않아서 비면허 기기가 사용할 수 있는 가용 채널을 알아내서 가용 채널 상에서 동작해야 한다.

[0060] STA이 화이트 스페이스(예를 들어, TVWS)에서의 채널(예를 들어, TV 채널) 가용성(availability)을 파악하기 위해서, 스펙트럼 센싱을 수행하거나, GDB에 접속하여 TV 채널 스케줄을 알아낼 수 있다. GDB 정보는 특정 위치에서 면허 기기의 특정 채널의 사용 스케줄 (즉, 채널 사용 시간) 등의 정보를 포함할 수 있다. TV 채널의 가용성을 파악하기 원하는 STA은, 인터넷 등을 통하여 GDB에 접속해서 자신의 위치 정보에 기반한 GDB 정보를 얻어와야 하며, 이는 면허 기기를 보호하기에 충분한 시간 단위로 수행되어야 한다.

[0061] 본 문서에서는 설명의 편의를 위하여 GDB로부터 수신하는 가용 채널 및 주파수에 관한 정보를 화이트 스페이스 맵(White Space Map; WSM)이라 칭할 수 있다. WSM은 STA가 GDB로부터 획득한 채널 및 주파수 정보를 기반으로 TVWS 대역에서 비면허 기기가 사용할 수 있는 채널에 관한 정보를 맵의 형태로 만든 것이다. WSM은 비면허 기기가 사용할 수 있는 가용 채널 리스트 또는 주파수(available channel list or frequencies)에 대한 정보를 포함할 수 있다. 가용 채널 리스트에 포함된 채널들은 법적으로 보호되어야 하는 신호(또는, 사용자)들이 사용하고 있지 않는 채널들이고, 비면허 기기가 GDB에 접속한 시점에서 비면허 기기가 사용 가능한 채널이다. 또는, 비면허 기기가 GDB에 접속한 시점으로부터 특정 시간 이후로부터의 사용 가능 채널에 대한 요청을 했을 경우, 해당 시점으로부터 사용 가능한 채널 및 주파수에 대한 정보를 포함할 수 있다. 다른 실시예로서, 비면허 기기가 GDB에 가용 채널에 대한 요청을 했을 경우, 비면허 기기가 사용할 수 없는 채널을 시그널링 함으로써 사용 가능 채널 및 주파수에 대한 정보를 전달할 수도 있다.

[0062] 현재 FCC(Federal Communications Commission)의 TVWS에 대한 규정(regulation)에서는 크게 두 가지 종류의 기기 타입을 정의한다. 즉, 소출력의 개인이 휴대할 수 있는 개인용/휴대용 기기(Personal/Portable Device) 및 고정된 위치에서 동작하는 대출력의 고정된 기기(Fixed Device)이 정의된다. 고정된 기기(Fixed Device)는 고정된 STA으로 칭할 수도 있고, 개인용/휴대용(Personal/Portable) 기기는 P/P STA으로 칭할 수도 있다. 고정된 STA 및 P/P SA는 모두 WLAN 시스템에서 일반적인 STA(즉, STA라는 용어는 AP 및 non-AP를 포함한다)에 해당할 수 있다. 이들 두 종류의 기기는 각각 TVWS에서 동작할 때, 각각 다른 동작 규칙(operation rule)이 적용될 수 있다. 고정된 기기는 그 위치가 변하지 않는 특정 위치에서 신호를 송/수신 한다. 물론 고정된 기기 역시 해당 위치에서 신호를 전송하기 위해서는, GDB에 접속하여 가용 채널 정보를 획득해야 한다. 고정된 기기는 GPS와 같은 위치를 확인할 수 있는 장비가 내장되어 있을 수도 있지만, 설치자(installer)에 의해서 그 위치를 사람이 직접 입력함으로써 그 위치 정보를 GDB에 전달할 수 있다. 물론, 위치를 사람이 직접 입력하는 경우에는 한 번 설치되고 위치가 입력되고 나면 그 위치가 바뀌지 않는다는 것을 전제로 하며, 위치가 변경되는 경우에는 그에 따른 위치도 변경/등록되어야 한다. 고정된 기기는 동종의 다른 고정된 기기를 서비스 할 수도 있고, P/P 기기를 서비스 할 수도 있다. 고정된 기기가 가용 채널 정보를 GDB로부터 받아 올 때, 반드시 자신의 기기 타입을

전달하여 자신이 직접 사용할 수 있는 자신의 가용 채널 정보를 받아와야 한다. 동시에, P/P 기기를 위한 서비스를 하기 위해서는 P/P 기기가 사용할 수 있는 가용 채널 정보를 GDB로부터 또는 GDB와 연결되어 있는 프록시(proxy) 서버로부터 추가로 받아와야 한다. 고정된 기기와 P/P 기기가 사용할 수 있는 채널 구간이 다르고, 각각의 동작시 최대 허용 전송 전력과 인접 채널에 대한 요구조건이 다르기 때문에, 각 기기 타입 별로 가용 채널 리스트가 달라지기 때문이다. 예를 들어, 고정된 기기는 54~60 MHz, 76~88 MHz, 174~216 MHz, 470~512 MHz 대역의 주파수 구간 뿐 아니라, 512~608 MHz, 614~698 MHz 대역의 주파수 구간에서도 신호 전송이 허용된다. 그러나, P/P 기기는 512~608 MHz, 614~698 MHz 대역의 주파수 구간 이외의 다른 주파수 대역의 TVWS 대역에서는 신호 전송이 허용되지 않는다. 고정된 기기는 P/P 기기보다 높은 전력으로 신호를 전송할 수 있으며, 실효 등방 방사 전력(Effective Isotropic Radiated Power; EIRP)으로 최대 4 Watt의 전송 전력이 허용된다.

[0063] P/P 기기는 특정되지 않은 위치에서 신호를 송/수신 할 수 있는 장비이며, 그 위치가 변할 수 있다는 점이 특징이다. 대부분의 경우 사람이 휴대 할 수 있는 장비로서, 그 이동성을 예측할 수 없다. 가용 주파수 대역은 512~608 MHz, 614~698 MHz 의 주파수 구간이고, 최대 전송 전력은 100mW (EIRP)이다. P/P 기기는, 자신의 위치에 대한 식별 능력(identification capability), 즉, 지리적-위치결정 능력(geo-location capability)과 인터넷 액세스를 통한 GDB로의 접속 능력을 갖고 있는지 여부에 따라서, 모드 II 기기(Mode II device)와 모드 I 기기(Mode I device)의 두 가지 종류로 분류될 수 있다. 즉, 모드 II 기기는 지리적-위치결정 능력과 인터넷 액세스 능력을 가지며, GDB에 접속해서 자신의 위치에서의 가용 채널에 대한 정보를 획득한 후 해당 위치에서 TVWS 상에서 동작할 수 있다. 또한, 모드 II 기기는 가용 채널정보를 GDB로부터 획득한 후, 모드 I 기기에게 통신을 시작할 수 있도록 명령할 수 있는 신호(예를 들어, 인에이블(enable) 신호)를 전송함으로써 네트워크를 시작할 수 있다. 한편, 모드 I 기기에게는 지리적-위치결정 능력이나 GDB 액세스 능력이 요구되지 않으며, GDB에 액세스하여 유효한 가용 채널 정보를 가지고 있는 모드 II 기기 또는 고정된 기기에 의해 제어 받아서 동작하는 것이 요구된다. 모드 II 기기에 해당하는 P/P 기기가 다른 P/P 기기를 서비스 할 수 있고, 또는 모드 II 에 해당하는 P/P 기기가 고정된 기기에게 서비스를 제공할 수도 있다. 이 경우, 모드 II P/P 기기는 고정된 기기를 위한 가용 채널 정보를 GDB로부터 획득하여 고정된 기기에게 전달할 수 있다.

[0064] 한편, GDB는 DTV나 마이크로-폰 등의 우선적 사용자의 채널 사용 스케줄 및 보호 범위(protection contour)를 고려하여, 비면허 기기가 요청하는 위치에서의 가용 채널 정보를 계산하여 비면허 기기에게 전달할 수 있다. GDB에서 가용 채널 정보를 계산할 때 고려하는 파라미터들은 기기 타입, 동작하고자 하는 위치, 전송 전력 그리고 스펙트럼 마스크(spectrum mask) 등이 있다. 기기 타입에 따라서, FCC 규정에서는 인접채널에 대한 사용 여부도 달라지는데, 예를 들어 DTV가 30번 채널에서 사용 중일 때, 29번과 31번 채널이 비어 있더라도 고정된 기기는 29번 및 31번 채널들을 사용할 수 없지만, P/P 기기는 이 두 채널을 사용할 수 있다. 이는, 고정된 기기의 경우에 전송 전력이 높아서 인접 채널에 대한 간섭을 유발할 가능성이 높기 때문이다.

[0065] 이하에서는 설명의 편의를 위해서 화이트 스페이스의 일례로서 TVWS를 들어서 본 발명의 예시들에 대해서 설명하지만, 본 발명의 범위가 이에 제한되는 것은 아니다. 즉, 본 발명의 범위는, 특정 위치에서의 사용 가능한 채널에 대한 정보를 제공하는 DB에 의해서 제어되는 모든 화이트 스페이스에서의 동작에 대해서 적용되는 본 발명의 예시들을 포함한다. 예를 들어, 현재 시점에서는 화이트 스페이스에 해당하지 않지만, 추후 화이트 스페이스에 해당할 것으로 기대되는 다른 주파수 대역에서도 GDB에 의해 제어되는 비면허 장비의 동작이 허용될 것으로 기대되며, 이에 대해서 적용되는 본 발명의 원리에 따른 예시들은 본 발명의 범위에 포함될 수 있다. 또한, 본 발명에서는 설명의 편의를 위해서 현재 최종 규칙이 발표된 TVWS에 대한 FCC 규칙을 기반으로 본 발명의 원리에 대해서 설명하지만, 본 발명의 범위는 FCC 규칙에 따른 화이트 스페이스 대역 상에서의 동작에만 제한되는 것은 아니고, 다른 규칙을 준수하는 화이트 스페이스 대역 상에서의 본 발명의 원리에 따른 예시들을 포함한다.

[0066] 화이트 스페이스에서의 링크 셋업

[0067] 본 실시형태는 TVWS에서의 링크 셋업 과정에 대한 것이다. 특히 모드 I 기기와 모드 II 기기(또는 고정된 기기) 간의 링크 셋업을 위한 구체적인 예시들에 대해서 설명한다. 링크 셋업은 네트워크 발견(network discovery), 인증(Authentication), 연관(association) 등의 과정으로 진행된다. 특히, 화이트 스페이스 대역에서 동작하는 모드 I 기기의 경우에는 링크 셋업 시에 가용 채널 정보의 획득 과정이 요구된다.

[0068] 도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

[0069] 단계 S510에서 모드 II 기기 또는 고정된 기기(이하에서는, 모드 II 기기/고정된 기기로 표현함)는 인터넷 등을 통해 GDB에 액세스하여, 현재 자신의 위치에서 사용가능한 채널 리스트(예를 들어, WSM)을 획득할 수 있다. 모드 II 기기/고정된 기기는 가용 채널 리스트 중에서 특정 채널(들)을 선택할 수 있다.

[0070] 단계 S520에서, 모드 II 기기/고정된 기기는 비콘을 전송하여 BSS를 구성할 수 있다. 비콘 프레임에는 송신측(예를 들어, 모드 II 기기/고정된 기기)의 기기 타입 등이 포함될 수 있고, 이에 따라 링크 셋업이 가능함을 수신측(예를 들어, 모드 I 기기)에게 알릴 수 있다. 또한, 비콘 프레임에는 가용 채널 리스트에 대한 정보 등이 포함될 수 있다. 또한, 비콘 프레임은 주기적으로 전송될 수 있다.

[0071] 단계 S530에서, BSS에 참여하기 원하는 모드 I 기기는 TVWS에 대한 스캐닝 과정을 수행할 수 있다. 만약, 모드 I 기기가 현재 자신의 위치에서 사용 가능한 채널 리스트를 알고 있는 경우에는 사용 가능한 채널 리스트 상의 채널에 대해서만 수동적(passive) 또는 능동적(active) 스캐닝을 수행할 수 있다.

[0072] 수동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 모드 II 기기/고정된 기기로부터의 비콘 전송을 듣는(listen) 과정을 의미한다. 능동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 프로브 요청 프레임(probe request frame)을 전송하고, 모드 II 기기/고정된 기기로부터 프로브 응답 프레임(probe response frame)을 수신하는 것을 의미한다.

[0073] 모드 II 기기/고정된 기기는 모드 I 기기의 스캐닝 부담을 줄이기 위해서, 비콘 프레임, 프로브 응답 프레임 등에 사용가능한 채널 리스트를 포함시킬 수 있다. 본 발명에서, 모드 II 기기/고정된 기기가 GDB로부터 획득한 가용 채널 리스트는 WSM이라고 칭할 수 있다.

[0074] 도 6(a)는 WSM의 일례를 나타내는 도면이다.

[0075] 도 6(a)의 예시에서, 기기 타입(device type) 필드는 WSM을 전송하는 단말이 모드 II 기기인지 또는 고정된 기기인지를 나타낸다. 맵 ID(Map ID) 필드는 가용 채널 리스트의 ID를 나타낸다. 채널 번호(Channel Number) 필드는 TVWS에서 모드 II 기기/고정된 기기가 사용할 수 있는 채널 번호를 나타낸다. 채널 번호는 TV 채널 번호, 스펙트럼 범위 등으로 표현될 수 있으며, 주파수 영역에서 가용 채널을 특정할 수 있는 정보로서의 의미를 가진다. 최대 전력 레벨(Maximum Power Level) 필드는 가용 채널에서 모드 II 기기/고정된 기기의 최대 전송 전력을 나타낸다. 낸다. 유효 시간(Valid Time) 필드는 가용 채널을 지속적으로 사용할 수 있는 기간을 나타낸다. 유효 시간 필드는 필수적이 아니라 선택적(optional)으로 포함될 수도 있다. 이러한 WSM은 비콘 프레임, 프로브 응답 프레임, 또는 다른 형태의 프레임을 통하여 전송될 수 있다. 또한, 도 6(a)의 WSM의 포맷은 단지 예시적인 것이며, 가용 채널에 대한 정보를 포함하는 다른 형태의 WSM이 본 발명의 예시들에서 적용될 수 있음을 밝힌다.

[0076] 여기서, 모드 I 기기가 BSS에 참여하기 위해서는 모드 II 기기/고정된 기기의 제어를 받아서 동작해야 한다. 따라서, 모드 I 기기는 모드 II 기기/고정된 기기와 링크 셋업을 수행해야 한다.

[0077] 단계 S540에서, 모드 I 기기는 스캐닝 과정이 완료된 후에 BSS에 참여하기 위해서 연관(association) 과정을 수행할 수 있다. 이를 위해서, 모드 I 기기는 연관 요청 프레임을 모드 II 기기/고정된 기기에게 전송할 수 있다. 아래의 표 1은 연관 요청 프레임의 예시적인 포맷을 나타낸다.

[0078] [표 1]

| Order | Information | Notes |
|---|---|---|
| 1 | Capability | |
| 2 | Listen Interval | |
| 3 | SSID | |
| 4 | Supported rates | |
| 5 | Extended Supported Rates | The Extended Supported Rates element is present if there are more than eight supported rates, and it is optional otherwise. |
| 6 | Power Capability | The Power Capability element is present if dot11SpectrumManagementRequired is true or dot11RadioMeasurementActivated is true. |
| 7 | Supported Channels | The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false. |
| 8 | RSN | The RSN element is present if dot11RSNAActivated is true. |
| 9 | QoS Capability | The QoS Capability element is present if dot11QosOption-Implemented is true. |

[0079]

[0080] 상기 표 1은 연관 요청 프레임에 포함될 수 있는 정보들의 일부 예시를 나타낸 것이며 추가적인 정보들이 더 포함될 수 있다.

[0081] 본 발명의 예시에서는, 모드 II 기기/고정된 기기가 모드 I 기기의 기기 타입을 확인할 수 있도록, 모드 I 기기

는 연관 요청 프레임에 기기 ID(device ID) 정보를 더 포함시킬 수 있다. 이에 따라, 모드 II 기기/고정된 기기는, 연관을 요청한 모드 I 기기의 기기 ID (예를 들어, FCC ID, 시리얼 번호 등)를 확인하여, 해당 모드 I 기기가 TVWS 동작을 위해 요구되는 규정을 만족하는지를 판단할 수 있다. 기기 ID를 확인한 후, 모드 II 기기/고정된 기기는, 연관 응답 프레임을 모드 I 기기에게 전송할 수 있다.

[0082] 이러한 본 발명의 예시에 따르면, 연관 과정이 모두 완료된 후에 모드 I 기기가 모드 II 기기/고정된 기기에게 기기 ID를 제공하는 방식에 비하여, 연관 과정 이후의 동작이 단순화되고, 연관 과정 중에 연관 요청을 전송한 기기를 식별할 수 있으므로, 링크 셋업의 효율성, 신속성 및 정확도가 향상될 수 있다.

[0083] 도 6(b)은 기기 ID 의 예시적인 포맷을 나타내는 도면이다.

[0084] 기기 타입 필드는 연관 요청을 전송하는 기기가 모드 I 기기, 모드 II 기기/고정된 기기인지를 나타낸다. FCC ID는 연관 요청을 전송하는 기기가 속하는 규제 관리자(regulatory administrator)에 의해 할당된 기기 ID 값에 해당한다. FCC ID 필드는 미국의 규제 관리자에 의해서 할당되는 기기 ID에 해당하는 값이며, 다른 규제 도메인에서의 적절한 기기 식별정보를 포함하는 필드로 대체될 수 있다. 기기 시리얼 번호 필드는 연관 요청을 전송하는 기기의 시리얼 번호(예를 들어, 제조자(manufacturer)에 의해 할당되는 식별 번호)에 대한 정보를 포함할 수 있다.

[0085] 만약 연관 요청 프레임을 전송하는 기기가 모드 II 기기/고정된 기기인 경우에는 링크 셋업 과정은 연관 요청/응답 과정 만으로 완료될 수 있다. 왜냐하면, 모드 II 기기/고정된 기기는 GDB에 액세스하여 가용 채널 리스트(예를 들어, WSM)을 이미 가지고 있고, 다른 모드 II 기기/고정된 기기의 제어를 받을 필요가 없기 때문이다. 즉, 모드 II 기기가 링크 셋업을 수행하는 경우에는 단계 S540에서 링크 셋업 과정이 완료될 수 있다.

[0086] 한편, 연관 요청 프레임을 전송하는 기기가 모드 I 기기인 경우에는, 연관 요청/응답 과정이 성공적으로 완료된 후에, 단계 S550에서 보안 셋업(security setup) 과정을 수행하게 된다. 보안 셋업은, 예를 들어, EAPOL(Extensible Authentication Protocol over LAN) 프레임을 통한 4-웨이 핸드쉐이킹을 통해서, 프라이빗 키 셋업(private key setup)을 하는 과정을 포함할 수 있다.

[0087] 모드 II 기기/고정된 기기와 모드 I 기기 간에는 보안 셋업이 반드시 수행되어야 한다. 이는 모드 II 기기/고정된 기기가 모드 I 기기에게 WSM을 전달할 때에, 무결성 확인(integrity check) 등이 요구되기 때문이다.

[0088] 단계 S560에서 모드 I 기기는, 보안 셋업이 완료된 후에, 모드 II 기기/고정된 기기에게 채널 가용성(Channel Availability) 요청 프레임(또는 채널 가용성 질의(Channel Availability Query; CAQ) 요청 프레임)을 전송하여 사용가능한 채널의 리스트(예를 들어, WSM)을 요청할 수 있다. 모드 II 기기/고정된 기기는, 채널 가용성 응답 프레임(또는 CAQ 응답 프레임)을 모드 I 기기에게 전송함으로써 가용 채널 리스트(예를 들어, WSM)를 제공할 수 있다.

[0089] 도 6(c)는 채널 가용성 요청 프레임의 예시적인 포맷을 나타내고, 도 6(d)는 채널 가용성 응답 프레임의 예시적인 포맷을 나타낸다.

[0090] 카테고리 필드는 해당 프레임이 속하는 분류를 나타낸다. 본 예시에서 카테고리 필드는, 채널 가용성 요청/응답이 속하는 액션 프레임을 나타내는 값으로 설정될 수 있다. 액션 필드는 해당 프레임이 어떤 동작에 관련된 것인지를 나타내는 기능을 한다. 본 예시에서 액션 필드는 채널 가용성 요청/응답에 대한 특정 값으로 설정될 수 있다. 다이얼로그 토큰 필드는 액션 응답과 액션 요청을 매칭시키는 기능을 하며, 동시에 여러 개의 액션 요청이 존재하는 경우를 위하여 사용될 수 있다. 다이얼로그 토큰 필드는 요청 STA(예를 들어, 모드 I 기기)에 의해서 설정되는 값을 포함할 수 있다.

[0091] 채널 가용성 응답 프레임을 통해서, 모드 I 기기는 가용 채널 리스트(예를 들어, WSM)을 수신함으로써, 모드 II 기기/고정된 기기와의 링크 셋업 과정을 완료할 수 있다. 링크 셋업이 완료되면, 모드 I 기기는 모드 II 기기/고정된 기기와 데이터, 제어, 관리 프레임 등에 대한 상호 송수신을 시작할 수 있다.

[0092] 링크 셋업 이후에는, 단계 S570에서 도시하는 바와 같이, 모드 I 기기는 모드 II 기기/고정된 기기로부터 CVS(Contact Verification Signal)을 주기적으로 수신할 수 있다. CVS는 링크 셋업 상태를 유효하게 유지하는 기능을 할 수 있다.

[0093] 또한, 도 6(d)는 CVS 프레임의 예시적인 포맷에서 나타내는 바와 같이, 모드 II 기기/고정된 기기로부터 전송되는 CVS는 모드 II 기기/고정된 기기가 가지고 있는 WSM의 맵 ID를 포함할 수 있다. 이에 따라, 모드 I 기기는 현재 유효한 채널이 무엇인지를 주기적으로 확인할 수 있고, CVS의 맵 ID로 지시되지 않는 WSM은 유효하지 않은

것으로 결정할 수 있다. 즉, 모드 I 기기가 CVS 프레임을 수신한 경우, 자신이 가지고 있는 WSM의 맵 ID와 비교하여 상이한 경우에, 채널 가용성 요청 프레임을 모드 II 기기/고정된 기기에게 전송하여 새로운 가용 채널 리스트(예를 들어, WSM)을 요청할 수 있다.

[0094] 전술한 본 발명의 실시형태에서는 화이트 스페이스에서 동작하는 기기의 타입에 따른 효율적이고 신속한 링크 셋업을 수행/지원하는 방안에 대하여 설명하였다. 이러한 링크 셋업을 수행함으로써 모드 I 기기는 모드 II 기기/고정된 기기의 제어를 받아서 BSS에 참여할 수 있다. 이하에서는, BSS를 구성한 모드 II 기기/고정된 기기가, 해당 BSS에서의 동작에 필요한 정보를 제공하는 방안에 대한 본 발명의 예시들에 대하여 설명한다.

[0095] BSS 동작 정보

[0096] 어떤 BSS에서의 STA(또는 모드 I 기기)의 동작은, 해당 BSS에서의 동작에 필요한 정보(예를 들어, 동작 정보 요소)에 의해서 제어된다. 상기 동작 정보 요소는, 기기 타입에 따라서 적용되는 동작 파라미터들을 지정할 수 있다. 상기 동작 정보는 BSS 을 구성한 AP(또는 모드 II 기기/고정된 기기)에 의해서, 비콘 프레임, 프로브 응답 프레임 또는 다른 형태의 프레임을 통하여 전송될 수 있다.

[0097] 도 7은 동작 정보 요소의 포맷을 나타내는 도면이다. 도 7의 동작 정보 요소는 TVWS에서의 동작에 대한 파라미터를 포함하는 의미로서, TVWS 동작 정보 요소라고 칭할 수도 있다. 또한, TVWS에서의 고수율(High Throughput; HT) BSS에서의 동작에 대한 파라미터를 포함하는 의미로서, TVHT 동작 정보 요소라고 칭할 수도 있다. 이하에서는, 경제성을 위하여 동작 정보 요소 또는 동작 요소라고 통칭하기로 한다.

[0098] 도 7에서 요소 ID(Element ID) 필드는, 동작 정보 요소에 대해서 미리 정해진 소정의 값을 가질 수 있다. 길이(Length) 필드는, 후속하는 필드들의 길이에 해당하는 값을 가질 수 있다. 동작 정보(Operation Information) 필드는, 동작 채널에 대한 대역폭(bandwidth) 및 중심 주파수(center frequency) 등의 정보를 포함하며, 동작 정보 필드의 서브필드(subfield)에 대한 구체적인 내용은 표 2를 참조하여 후술한다. 기본 MCS 세트(Basic MCS Set) 필드는, BSS 내의 모든 STA에 의해서 지원되는 MCS(Modulation and coding scheme)에 해당하는 값을 가질 수 있다.

[0099] 아래의 표 2를 참조하여 도 7의 동작 정보 필드의 포맷 및 서브필드의 내용에 대해서 설명한다. 도 7의 동작 정보 필드는 TVWS 동작 정보 필드 또는 TVHT 동작 정보 필드라고 칭할 수도 있다.

[0100] [표 2]

| | |
|---|---|
| Primary Channel width<br>(2 bits) | Indicate the primary channel bandwidth (W).<br>Set to 0 for 6 MHz<br>Set to 1 for 7 MHz.<br>Set to 2 for 8 MHz.<br>The value 3 is reserved. |
| Channel Width<br>(3 bits) | Set to 0 for W operating channel width.<br>Set to 1 for 2W operating channel width.<br>Set to 2 for W+W operating channel width.<br>Set to 3 for 4W operating channel width.<br>Set to 4 for 2W+2W operating channel width.<br>Values in the range 5 to 7 are reserved. |
| Primary Channel Offset<br>(2bits) | Indicates the offset of the primary channel between the contiguous operating channel width.<br>Set to 0 if the first W MHz of the frequency segment 0 is the primary channel.<br>Set to 1 if the second W MHz of the frequency segment 0 is the primary channel.<br>Set to 2 if the third W MHz of the frequency segment 0 is the primary channel.<br>Set to 2 if the fourth W MHz of the frequency segment 0 is the primary channel. |

[0101]

| | |
|---|---|
| Secondary Channel offset (2bits) | Indicates the offset of the secondary channel relative to the primary channel.<br>Set to 1 (SCA) if the secondary channel is above the primary channel<br>Set to 3 (SCB) if the secondary channel is below the primary channel<br>Set to 0 (SCN) if no secondary channel is present<br>The value 2 is reserved |
| Channel Center Frequency Segment 0 (8 bits) | For W MHz or 2W MHz or 4W MHz operating channel width, indicates the channel center frequency index for the W MHz or 2W MHz or 4W MHz channel on which the TV White Space BSS operates.<br>For W+W MHz or 2W+2W MHz operating channel width, indicates the channel center frequency index for the W MHz or 2W MHz channel of frequency segment 0 on which the VHT BSS operates.<br>Reserved otherwise. |
| Channel Center Frequency Segment 1 (8 bits) | For an W+W MHz or 2W+2W MHz operating channel width, indicates the channel center frequency index of the W MHz or 2W MHz channel of frequency segment 1 on which the VHT BSS operates.<br>Reserved otherwise. |
| Allowed Device Type (8 bits) | Bit 0: Indicate that fixed device is allowd to use Channel Center Frequency Segment 0.<br>Bit 1: Indicate that peronal portable device is allowd to use Channel Center Frequency Segment 0.<br>Bit 2: Indicate that fixed device is allowd to use Channel Center Frequency Segment 1.<br>Bit 3: Indicate that peronal portable device is allowd to use Channel Center Frequency Segment 1.<br>Bit 4 – Bit 7: Reserved. |

[0102]

[0103] 상기 표 2에서 나타내는 동작 정보 필드의 구체적인 내용에 대하여 설명하기에 앞서, 본 발명에서 설명하는 WLAN 채널의 구조를 표현하기 위한 용어에 대해서 설명한다.

[0104] 먼저, BSS의 동작 채널은 WLAN 채널로 표현될 수 있고, WLAN 채널을 구성하는 기본적인 단위의 채널은 W MHz 크기의 대역폭으로 정의된다. 이하의 설명에서는 상기 기본적인 단위의 채널을 "W 채널"라고 칭한다. WLAN 채널은, 하나의 W 채널 또는 복수개의 W 채널들로 구성될 수 있다. 복수개의 W 채널이 주파수 축 상에서 연속적(contiguous)으로 위치할 수도 있고, 불연속적(non-contiguous)으로 위치할 수도 있다. 세그먼트(segment)는 하나의 W 채널 또는 연속적인 복수개의 W 채널들로 구성된다.

[0105] 또한, 프라이머리 채널(primary channel)은 데이터 유닛(예를 들어, PPDU(Physical layer convergence procedure(PLCP) Protocol Data Unit))의 전송을 위해서 기본적으로 사용되는 채널이며, 비콘 등의 기본적인 신호 전송을 위하여 사용될 수 있다. 프라이머리 채널은 하나의 W 채널에 대응하거나, 또는 2 개의 연속적인 W 채널(즉, 2W 채널)에 대응할 수도 있다. 한편, 세컨더리(secondary) 채널은 프라이머리 채널 이외의 채널을 의미한다.

[0106] 상기 표 2에서 프라이머리 채널 폭(Primary Channel Width) 서브필드는, 프라이머리 채널의 대역폭을 나타낸다. 각 국가별로 TV 채널의 대역폭은 상이하기 때문에, TVWS에서 정의되는 WLAN 동작 채널 중에서 프라이머리 채널의 폭 역시 국가별로 상이하게 정의될 수 있다. 따라서, BSS 내에서 STA이 올바르게 동작하기 위해서는 프라이머리 채널의 폭을 알려주는 것이 필요하다. 상기 표 2에서는 프라이머리 채널이 W MHz의 폭을 가지고, W의 값은

6, 7 또는 8 MHz 중의 하나인 것을 예시적으로 나타낸다.

[0107] 상기 표 2의 채널 폭(Channel Width) 서브필드는, BSS가 지원하는 동작 채널의 채널 대역폭을 나타낸다. TVWS의 경우에, 가용 채널은 주파수 축 상에서 반드시 연속적으로 존재하지는 않는다. 따라서, TVWS에서의 WLAN 동작 채널은 연속적인 구조와 불연속적인 구조를 모두 지원해야 한다.

[0108] 도 8은 TVWS에서 WLAN 동작 채널의 예시적인 형태를 나타내는 도면이다.

[0109] 상기 도 8 및 상기 표 2에서 예시적으로 나타내는 바와 같이, BSS가 지원하는 동작 채널은 다음과 같은 5 가지 형태의 구조를 가질 수 있다. 첫 번째 예시는 동작 채널이 하나의 W 채널로 구성되는 경우이며, 이를 "W 동작 채널 폭"이라고 표현할 수 있다 (도 8(a)). 두 번째 예시는 동작 채널이 연속적인 2개의 W 채널로 구성되는 경우이며, 이를 "2W 동작 채널 폭"이라고 표현할 수 있다 (도 8(b)). 세 번째 예시는 동작 채널이 불연속적인 2 개의 W 채널로 구성되는 경우이며, 이를 "W+W 동작 채널 폭"이라고 표현할 수 있다(도 8(c)). 네 번째 예시는 동작 채널이 연속적인 4 개의 W 채널로 구성되는 경우이며, 이를 "4W 동작 채널 폭"이라고 표현할 수 있다(도 8(d)). 다섯 번째 예시는 동작 채널이 불연속적인 2 개의 주파수 단위(즉, 세그먼트)로 구성되면서 각각의 주파수 단위가 연속적인 2 개의 W 채널로 구성되는 경우이며, 이를 "2W+2W 동작 채널 폭"이라고 표현할 수 있다 (도 8(e)).

[0110] 상기 채널 폭 서브필드에 기초하여, 다음과 같은 PPDU 전송 규칙(transmission rule)이 적용될 수 있다.

[0111] PPDU 전송 규칙의 첫 번째 예시는 다음의 표 3과 같이 정의될 수 있다.

[0112] [표 3]

| 동작 채널 폭 | 허용되는 PPDU 전송 |
|---|---|
| W | W MHz PPDU 전송 |
| 2W | W MHz 또는 2W MHz PPDU 전송 |
| W+W | W MHz 또는 W+W MHz PPDU 전송 |
| 4W | W MHz, 2W MHz 또는 4W MHz PPDU 전송 |
| 2W+2W | W MHz, 2W MHz 또는 2W+2W MHz PPDU 전송 |

[0113]

[0114] PPDU 전송 규칙의 두 번째 예시는 다음의 표 4와 같이 정의될 수 있다.

[0115] [표 4]

| 동작 채널 폭 | 허용되는 PPDU 전송 |
|---|---|
| W | W MHz PPDU 전송 |
| 2W | W MHz 또는 2W MHz PPDU 전송 |
| W+W | W MHz 또는 W+W MHz PPDU 전송 |
| 4W | W MHz, W+W MHz 또는 4W MHz PPDU 전송 |
| 2W+2W | W MHz, W+W MHz 또는 2W+2W MHz PPDU 전송 |

[0116]

[0117] 상기 첫 번째 및 두 번째 PPDU 전송 규칙은, 4W 동작 채널 폭을 지원하는 BSS와 2W+2W 동작 채널 폭을 지원하는 BSS 에서, 2W MHz PPDU 전송이 허용되는지 또는 W+W MHz PPDU 전송이 허용되는지에서 차이점을 가진다. 가용채널에서 연속적인 채널이 많은 경우에는 첫 번째 PPDU 전송 규칙(즉, 상기 표 3의 규칙)을 선택하는 것이 바람직하고, 불연속적인 채널이 많은 경우에는 두 번째 PPDU 전송 규칙(즉, 상기 표 4의 규칙)을 선택하는 것이 바람직하다.

[0118] 전술한 바와 같이 2W, W+W, 4W, 2W+2W 동작 채널 폭의 경우에는 복수개의 허용되는 PPDU 전송이 존재한다. 그 중에서 어떤 타입의 PPDU가 이용되는지를 명확하게 결정하는 것이 요구된다. 본 발명에서는 BSS가 지원하는 동작 채널 폭 및 PPDU 대역폭에 기초하여 PPDU 타입(즉, 허용되는 PPDU 전송 타입)을 결정하는 방안을 제안한다.

[0119] 먼저, PPDU는 PLCP 프리앰블 필드, PLCP 헤더 필드 및 데이터 필드를 포함할 수 있다. PLCP 프리앰블 필드는 트레이닝 필드(training field) 등을 포함한다. PLCP 헤더 필드는 SIG(Signal) 필드 등을 포함한다. 데이터 필드

는 PSDU 등을 포함한다. 여기서, PLCP 헤더 필드에 포함되는 SIG 필드는, BW(Bandwidth) 필드를 포함한다. BW 필드는 2 비트 크기로 정의되며, 기본적으로는 X, 2X, 4X 또는 8X/4X+4X의 PPDU 대역폭을 지시하는 기능을 한다(예를 들어, X=20 MHz).

[0120] 또한, 전술한 바와 같이, TVWS에서는 W(=6, 7 또는 8 MHz) 크기의 프라이머리 채널을 기반으로 BSS 동작 채널 폭이 W, 2W, W+W, 4W 또는 2W+2W 형태로 설정되며, 각각의 동작 채널 폭에 대해서 허용되는 PPDU 전송은 상기 표 3 또는 표 4와 같이 설정될 수 있다.

[0121] 요컨대, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서 정의되는 PPDU 대역폭은 X, 2X, 4X 또는 8X/4X+4X의 형태로 정의되는 반면, TVWS에서 동작하는 BSS에서 지원가능한 동작 채널 폭에 따른 PPDU 전송의 대역폭은 W, 2W, W+W, 4W 또는 2W+2W 의 형태를 가진다. 즉, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서 정의되는 PPDU 대역폭을 그대로 사용하는 경우에, TVWS에서의 BSS 동작 채널 폭에 따라 허용되는 PPDU 전송 대역폭을 올바르게 나타낼 수 없다. 예를 들어, 상기 PLCP 헤더의 SIG 필드 내의 BW 필드에 의해서는 X+X 또는 2X+2X와 같은 형태의 PPDU 타입을 설정할 수 없다.

[0122] 따라서, 본 발명에서는 BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여 PPDU 타입을 결정하는 새로운 방안에 대해서 제안한다.

[0123] 구체적인 예시로서, 상기 SIG 필드의 BW 필드가 제 1 값(또는 00)인 경우에, W MHz 대역폭의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 2 값(또는 01)인 경우에, 2W 또는 W+W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 3 값(또는 10)인 경우에, 4W 또는 2W+2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 이를 정리하면 아래의 표 5와 같다.

[0124] [표 5]

| SIG 필드의 BW 값 | PPDU 타입 |
|---|---|
| 제1값 | W MHz |
| 제2값 | 2W MHz 또는 W+W MHz |
| 제3값 | 4W MHz 또는 2W+2W MHz |

[0125]

[0126] 상기 표 5에서와 같이 SIG 필드의 BW 값에 따른 PPDU 타입이 정의되는 경우에, BSS에서 지원하는 동작 채널 폭을 고려하면 특정 PPDU 타입(즉, 허용되는 PPDU 전송 타입)이 명확하게 결정될 수 있다.

[0127] 예를 들어, 상기 표 3과 같은 동작 채널 폭에 따라 허용되는 PPDU 전송의 타입과, 상기 표 5와 같은 BW 필드에 다른 PPDU 타입을 동시에 고려하는 것을 가정한다. 이 경우에, 동작 채널 폭이 W인 경우에 W MHz의 PPDU 전송만이 허용되므로, BW는 제1값만이 관련된다. 동작 채널 폭이 2W인 경우에 W MHz 또는 2W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 2W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 W+W인 경우에 W MHz 또는 W+W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 W+W MHz PPDU 전송(왜냐하면, 2W MHz PPDU 전송은 W+W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 4W인 경우에 W MHz, 2W MHz 또는 4W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 4W 동작 채널 폭에서 허용되지 않음)을 지시하고, BW가 제3값이면 4W MHz PPDU 전송(왜냐하면, 2W+2W MHz PPDU 전송은 4W 동작 채널 폭에서 허용되지 않음)을 지시한다. 동작 채널 폭이 2W+2W인 경우에 W MHz, 2W MHz 또는 2W+2W MHz의 PPDU 전송이 허용되며, BW가 제1값이면 W MHz PPDU 전송을 지시하고, BW가 제2값이면 2W MHz PPDU 전송(왜냐하면, W+W MHz PPDU 전송은 2W+2W 동작 채널 폭에서 허용되지 않음)을 지시하고, BW가 제3값이면 2W+2W MHz PPDU 전송(왜냐하면, 4W MHz PPDU 전송은 2W+2W 동작 채널 폭에서 허용되지 않음)을 지시한다. 이를 정리하면 다음의 표 6과 같다.

[0128] [표 6]

| 동작 채널 폭 | SIG 필드의 BW 값 | PPDU 타입 |
|---|---|---|
| W | 제1값 | W MHz |
| 2W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| W+W | 제1값 | W MHz |
| | 제2값 | W+W MHz |
| 4W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| | 제3값 | 4W MHz |
| 2W+2W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| | 제3값 | 2W+2W MHz |

[0129]

[0130] 또한, 본 발명은 상기 표 3 및 표 4의 조합에 의해 PPDU 타입을 결정하는 방안을 포함한다. 이를 정리하면 표 7과 같이 표현할 수 있으며, 구체적인 설명은 생략한다.

[0131] [표 7]

| 동작 채널 폭 | SIG 필드의 BW 값 | PPDU 타입 |
|---|---|---|
| W | 제1값 | W MHz |
| 2W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| W+W | 제1값 | W MHz |
| | 제2값 | W+W MHz |
| 4W | 제1값 | W MHz |
| | 제2값 | W+W MHz |
| | 제3값 | 4W MHz |
| 2W+2W | 제1값 | W MHz |
| | 제2값 | W+W MHz |
| | 제3값 | 2W+2W MHz |

[0132]

[0133] 상기 표 6 및 표 7의 예시에서 나타내는 바와 같이, BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여, BSS가 지원하는 동작 채널 폭에 따라 허용되는 특정 PPDU 타입을 명확하게 지시할 수 있고, 기존의 BW 필드에서 지시되지 않는 형태(예를 들어, W+W 또는 2W+2W)의 PPDU 타입을 명확하게 지시할 수 있다.

[0134] 한편, 상기 표 5의 예시와 달리 상기 PLCP 헤더의 SIG 필드 내의 BW 필드의 4 개의 상태(state)를 모두 이용하는 경우에, 동작 채널 폭에 따라 허용되는 PPDU 타입을 지시하는 방안을 위 예시들과 다르게 정의할 수 있다. 예를 들어, BW 필드가 제 1 값(또는 00)인 경우에, W MHz 대역폭의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, BW 필드가 제 2 값(또는 01)인 경우에, 2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, 상기 SIG 필드의 BW 필드가 제 3 값(또는 10)인 경우에, 4W 또는 2W+2W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 또한, BW 필드가 제 4 값(또는 11)인 경우에, W+W MHz의 PPDU 타입이 설정되는 것으로 정의할 수 있다. 이를 정리하면 아래의 표 8과 같다.

[0135] [표 8]

| SIG 필드의 BW 값 | PPDU 타입 |
|---|---|
| 제1값 | W MHz |
| 제2값 | 2W MHz |
| 제3값 | 4W MHz 또는 2W+2W MHz |
| 제4값 | W+W MHz |

[0136]

[0137] 이 경우, 상기 표 3 및 표 4의 예시와 달리, 동작 채널 폭에 따라 허용되는 PPDU 전송을 다음의 표 9와 같이 정의될 수 있다.

[0138] [표 9]

| 동작 채널 폭 | 허용되는 PPDU 전송 |
|---|---|
| W | W MHz PPDU 전송 |
| 2W | W MHz 또는 2W MHz PPDU 전송 |
| W+W | W MHz 또는 W+W MHz PPDU 전송 |
| 4W | W MHz, 2W MHz, W+W MHz 또는 4W MHz PPDU 전송 |
| 2W+2W | W MHz, 2W MHz, W+W MHz 또는 2W+2W MHz PPDU 전송 |

[0139]

[0140] 이 경우, BSS가 지원하는 동작 채널 폭(즉, 상기 표 2의 Channel Width 서브필드의 값) 및 PPDU 대역폭(즉, PLCP 헤더의 SIG 필드 내의 BW 필드의 값)에 기초하여, BSS가 지원하는 동작 채널 폭에 따라 허용되는 특정 PPDU 타입을 아래의 표 10과 같이 명확하게 지시할 수 있다.

[0141] [표 10]

| 동작 채널 폭 | SIG 필드의 BW 값 | PPDU 타입 |
|---|---|---|
| W | 제1값 | W MHz |
| 2W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| W+W | 제1값 | W MHz |
| | 제2값 | W+W MHz |
| 4W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| | 제3값 | 4W MHz |
| | 제4값 | W+W MHz |
| 2W+2W | 제1값 | W MHz |
| | 제2값 | 2W MHz |
| | 제3값 | 2W+2W MHz |
| | 제4값 | W+W MHz |

[0142]

[0143] 상기 표 2를 다시 참조하여, 프라이머리 채널 오프셋(Primary Channel Offset) 서브필드는, 주파수 세그먼트의 대역폭이 2W MHz 또는 4W MHz 인 경우에 프라이머리 채널의 위치를 나타낸다.

[0144] 예를 들어, 상기 도 8(e)의 예시에서와 같이 하나의 주파수 세그먼트가 2W 대역폭으로 정의되고, 2 개의 주파수 세그먼트 (주파수 세그먼트 0 및 1)이 정의되고, 프라이머리 채널이 주파수 세그먼트 0에 위치하는 경우를 가정할 수 있다. 이 경우, 프라이머리 채널 오프셋이 0 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 첫 번

째 W 채널에 위치하고, 프라이머리 채널 오프셋이 1 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 두 번째 W 채널에 위치하는 것을 나타낼 수 있다.

[0145] 다른 예시로서, 상기 도 8(d)의 예시에서와 같이 프라이머리 채널이 4 MHz 대역폭의 주파수 세그먼트에 존재하는 경우에, 프라이머리 채널 오프셋이 0 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 첫 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 1 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 두 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 2 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 세 번째 W 채널에 위치하고, 프라이머리 채널 오프셋이 3 값을 가지면 프라이머리 채널은 주파수 세그먼트 0의 네 번째 W 채널에 위치하는 것을 나타낼 수 있다.

[0146] 상기 표 2의 세컨더리 채널 오프셋(Secondary Channel Offset) 서브필드는, 프라이머리 채널의 위치를 기준으로 세컨더리 채널의 상대적인 위치를 나타낸다. 세컨더리 채널 오프셋이 1 값을 가지면 세컨더리 채널은 프라이머리 채널에 비하여 높은 주파수에 위치하고, 세컨더리 채널 오프셋이 3 값을 가지면 세컨더리 채널은 프라이머리 채널에 비하여 낮은 주파수에 위치하고, 세컨더리 채널 오프셋이 0 값을 가지면 세컨더리 채널이 존재하지 않음을 나타낼 수 있다.

[0147] 상기 표 2의 채널 중심 주파수 세그먼트 0(Channel Center Frequency Segment 0) 서브필드는, 주파수 세그먼트 0의 채널 중심 주파수 값을 나타낸다. 주파수 세그먼트 0는 프라이머리 채널을 포함하는 세그먼트를 의미한다. 예를 들어, 동작 채널 폭이 W, 2W 또는 4W MHz인 경우에는 하나의 주파수 세그먼트가 존재하므로, 채널 중심 주파수 세그먼트 0 서브필드는 해당 주파수 세그먼트의 중심 주파수를 나타낼 수 있다. 한편, 동작 채널 폭이 W+W 또는 2W+2W MHz인 경우에는 2 개의 주파수 세그먼트(주파수 세그먼트 0 및 1)가 존재하므로, 채널 중심 주파수 세그먼트 0 서브필드는 그 중에서 주파수 세그먼트 0의 중심 주파수를 나타낼 수 있다.

[0148] 상기 표 2의 채널 중심 주파수 세그먼트 1(Channel Center Frequency Segment 1) 서브필드는, 주파수 세그먼트 1의 채널 중심 주파수 값을 나타낸다. 연속적인 채널의 경우에는 하나의 주파수 세그먼트(즉, 주파수 세그먼트 0) 만이 존재하므로, 채널 중심 주파수 세그먼트 1 서브필드는 불연속적인 채널에 대해서만 정의된다. 예를 들어, 동작 채널 폭이 W+W 또는 2W+2W MHz 인 경우에 2 개의 주파수 세그먼트(주파수 세그먼트 0 및 1)가 존재하므로, 채널 중심 주파수 세그먼트 1 서브필드는 그 중에서 주파수 세그먼트 1의 중심 주파수를 나타낼 수 있다.

[0149] 상기 표 2에서 허용되는 기기 타입(Allowed Device Type) 서브필드는, 각각의 주파수 세그먼트에 대해서 기기의 타입 별로 사용이 허용되는지 여부를 나타낸다. 구체적으로, 각각의 주파수 세그먼트에 대해서 고정된 기기의 사용이 허용되는지, 또는 P/P 기기의 사용이 허용되는지 여부를, 허용되는 기기 타입 서브필드를 통하여 지시할 수 있다. 예를 들어, TV 채널에 인접한 가용채널에 대해서는 고정된 기기(예를 들어, 전송 전력이 높은 기기)의 사용이 허용되지 않는 반면, P/P 기기의 사용은 허용될 수 있다. 만약 주파수 세그먼트 1이 TV 채널에 인접한 경우에 고정된 기기의 사용은 허용되지 않고 P/P 기기의 사용은 허용될 수 있다. 따라서, BSS를 구성하는 AP 는 각각의 주파수 세그먼트에 대해서 어떤 타입의 기기의 사용이 허용되는지를 알려줄 수 있다.

[0150] 상기 도 7의 동작 정보 요소에 포함되는 상기 표 2의 동작 정보 필드의 서브필드들에 의해서, BSS가 동작하는 채널의 대역폭, 주파수 축 상에서의 위치, 기기별 가용 여부 등이 정의된다. 또한 상기 표 3 내지 표 10에서 설명하는 예시들에 따라서 상기 동작 채널에서 허용되는 PPDU 타입이 명확하게 결정될 수 있다.

[0151] 전술한 본 발명의 다양한 실시예에서 설명한 사항들은 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있다.

[0152] 도 9는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

[0153] AP(10)는 프로세서(11), 메모리(12), 송수신기(13)를 포함할 수 있다. STA(20)는 프로세서(21), 메모리(22), 송수신기(23)를 포함할 수 있다. 송수신기(13 및 23)는 무선 신호를 송신/수신할 수 있고, 예를 들어, IEEE 802 시스템에 따른 물리 계층을 구현할 수 있다. 프로세서(11 및 21)는 송수신기(13 및 21)와 연결되어 IEEE 802 시스템에 따른 물리 계층 및/또는 MAC 계층을 구현할 수 있다. 프로세서(11 및 21)는 전술한 본 발명의 다양한 실시예에 따른 동작을 수행하도록 구성될 수 있다. 또한, 전술한 본 발명의 다양한 실시예에 따른 AP 및 STA의 동작을 구현하는 모듈이 메모리(12 및 22)에 저장되고, 프로세서(11 및 21)에 의하여 실행될 수 있다. 메모리(12 및 22)는 프로세서(11 및 21)의 내부에 포함되거나 또는 프로세서(11 및 21)의 외부에 설치되어 프로세서(11 및 21)와 공지의 수단에 의해 연결될 수 있다.

[0154] 위와 같은 AP 및 STA 장치의 구체적인 구성은, 전술한 본 발명의 다양한 실시예에서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있으며, 중복되는 내용은 명확성을 위하여

설명을 생략한다.

[0155] 상술한 본 발명의 실시예들은 다양한 수단을 통해 구현될 수 있다. 예를 들어, 본 발명의 실시예들은 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다.

[0156] 하드웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 하나 또는 그 이상의 ASICs(Application Specific Integrated Circuits), DSPs(Digital Signal Processors), DSPDs(Digital Signal Processing Devices), PLDs(Programmable Logic Devices), FPGAs(Field Programmable Gate Arrays), 프로세서, 컨트롤러, 마이크로 컨트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

[0157] 펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차 또는 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리 유닛에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리 유닛은 상기 프로세서 내부 또는 외부에 위치하여, 이미 공지된 다양한 수단에 의해 상기 프로세서와 데이터를 주고 받을 수 있다.

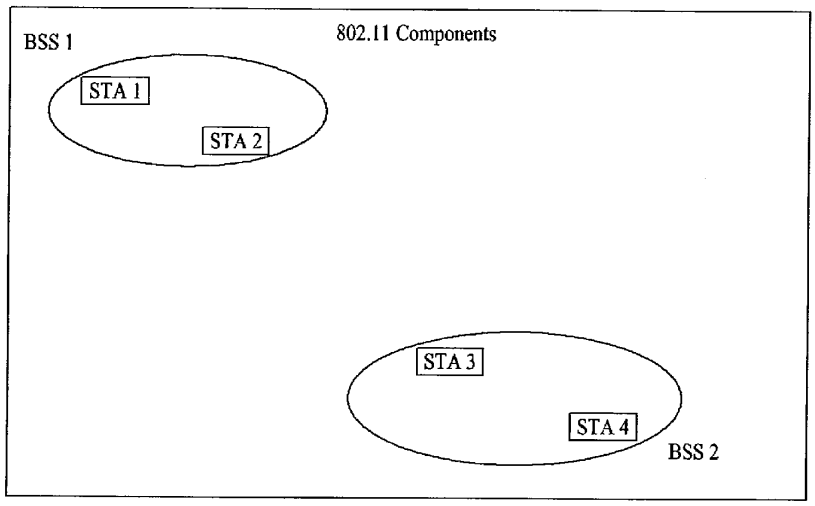
[0158] 상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

## 산업상 이용가능성

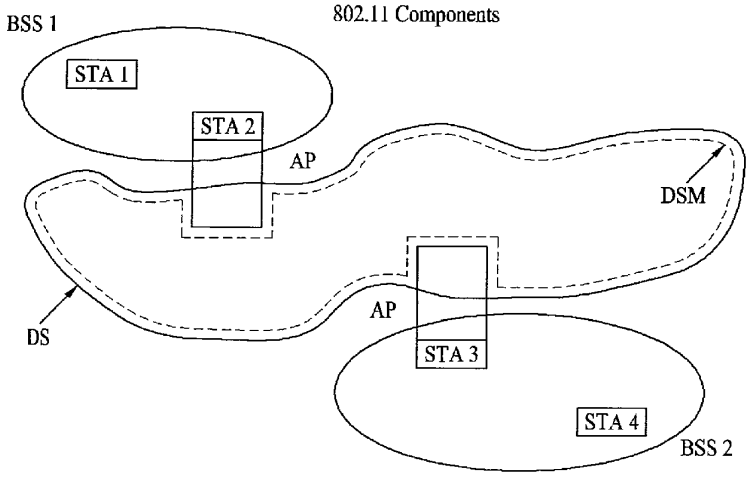
[0159] 상술한 바와 같은 본 발명의 다양한 실시형태들은 IEEE 802.11 시스템을 중심으로 설명하였으나, 다양한 이동통신 시스템에 동일한 방식으로 적용될 수 있다.

## 도면

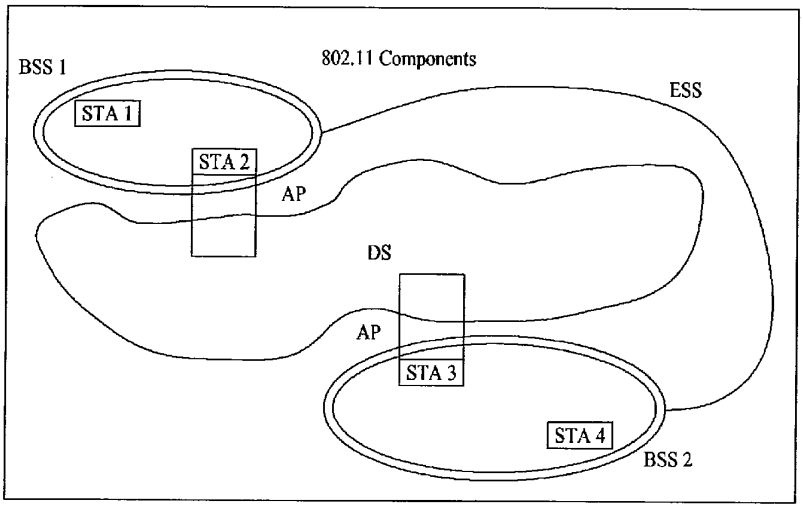
### 도면1



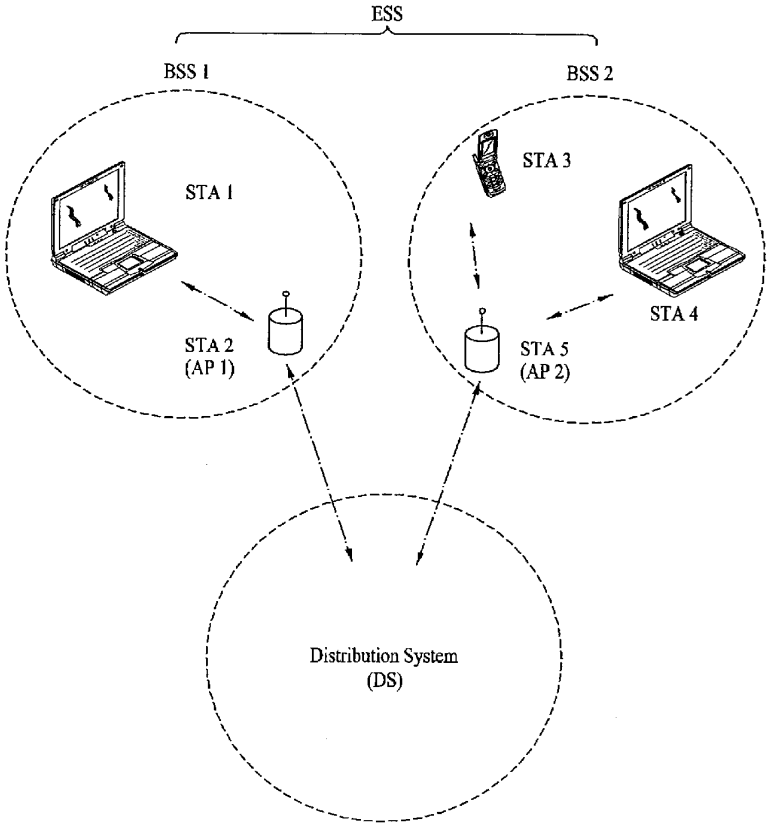
도면2


802.11 Components
BSS 1
STA 1
STA 2
AP
DSM
DS
AP
STA 3
STA 4
BSS 2

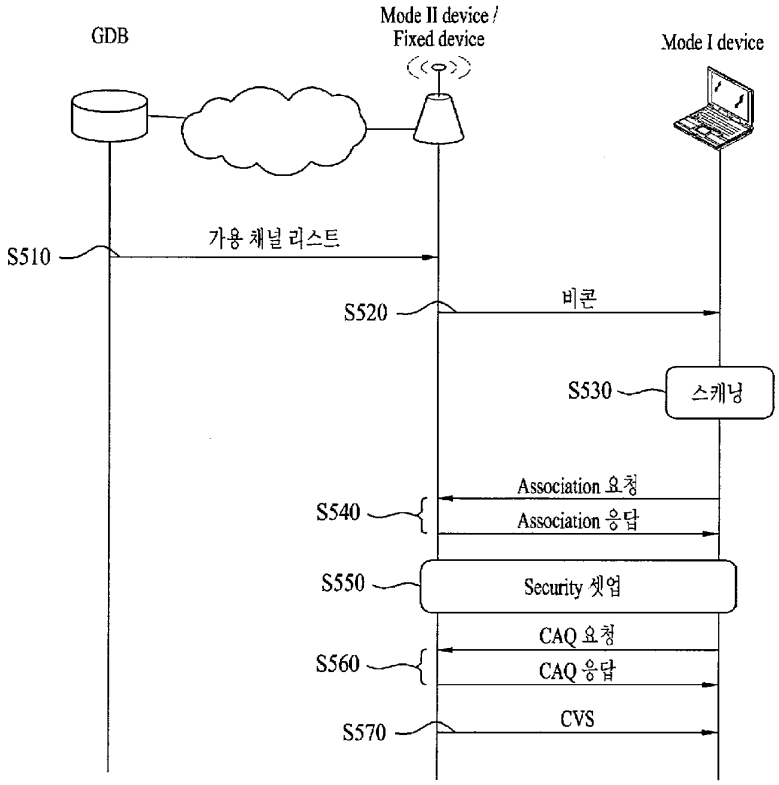
도면3


802.11 Components
BSS 1
ESS
STA 1
STA 2
AP
DS
AP
STA 3
STA 4
BSS 2

도면


ESS
BSS 1
BSS 2
STA 1
STA 3
STA 4
STA 2
(AP 1)
STA 5
(AP 2)
Distribution System
(DS)

도면5


GDB
Mode II device / Fixed device
Mode I device
S510
가용 채널 리스트
S520
비콘
S530
스캐닝
S540
Association 요청
Association 응답
S550
Security 셋업
S560
CAQ 요청
CAQ 응답
S570
CVS

도면6

These three fields are repeated, as determined by the Length field

| | Device Type | Map ID | Channel Number | Maximum Power Level | Valid Time (Optional) |
|---|---|---|---|---|---|
| Octets : | 1 | 1 | 1 | 1 | 1 |

(a)

| | Device Type | FCC ID | Device Serial Number |
|---|---|---|---|
| Octets : | 1 | 14 | 1 |

(b)

| | Category | Action | Dialog Token |
|---|---|---|---|
| Octets : | 1 | 1 | 1 |

(c)

| | Category | Action | Dialog Token | White Space Map IE |
|---|---|---|---|---|
| Octets : | 1 | 1 | 1 | Variable |

(d)

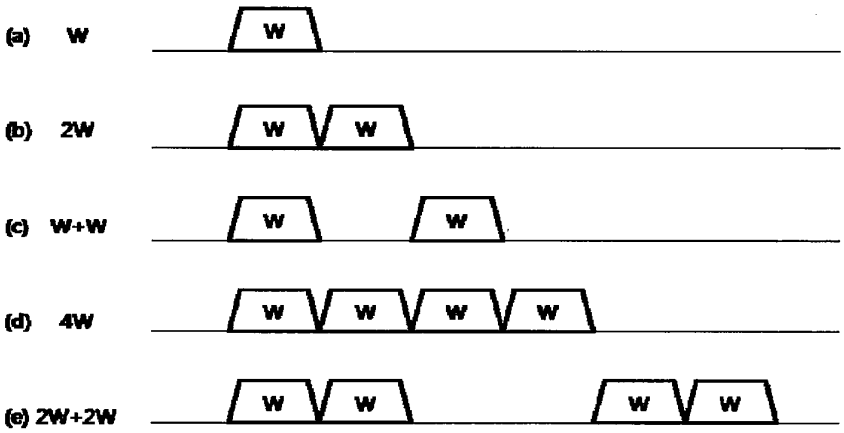
| | Category | Action | Map ID |
|---|---|---|---|
| Octets : | 1 | 1 | 1 |

(e)

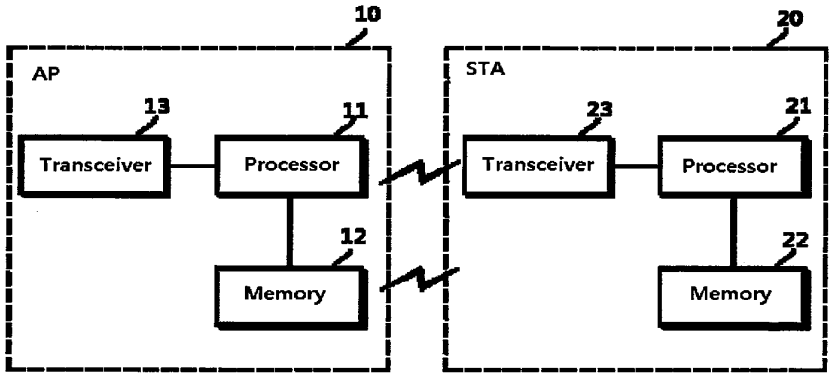
도면7

| Element ID | Length | Operation Information | Basic MCS Set |
|---|---|---|---|
| 1 octet | 1 octet | 4 octet | 2 octet |

도면8


(a) W
W
(b) 2W
W
W
(c) W+W
W
W
(d) 4W
W
W
W
W
(e) 2W+2W
W
W
W
W

도면9


10
AP
13
Transceiver
11
Processor
12
Memory
20
STA
23
Transceiver
21
Processor
22
Memory

## Bibliographic Data

| | |
|---|---|
| **Int.Cl.** | H04W 16/10 \| H04W 88/08 |
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| **Registration Date** | 20160323 |
| **Application No.** | 1020147003209 |
| **Application Date** | 20120809 |
| **Unexamined Publication No.** | 1020140070528 |
| **Unexamined Publication Date** | 20140610 |
| **Priority Claims** | 61/522,681 \| 20110811 \| US<br>61/536,049 \| 20110919 \| US<br>61/538,094 \| 20110922 \| US |
| **Requested Date of Examination** | 20140206 |
| **Agent.** | Envision Patent & Law Firm |
| **Inventor** | PARK,JongHyun \| SOHN,IllSoo \| KIM,EunSun \| SEOK,YongHo |
| **Applicant** | LG Electronics Inc. |
| **Rightholder** | LG Electronics Inc. |

## 발명의 명칭

무선랜 시스템에서 동적 주파수 선택 방법 및 장치

## Title of Invention

Method and apparatus of dynamic frequency selection in wireless local area network system

## 요약

무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법이 제공된다. 상기 방법은 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고 및 상기 침묵 기간동안 채널 측정을 수행하는 것을 포함한다.



## Abstract

In the wireless LAN, the dynamic frequency selection method by the main part sub channel and the access point (Access Point: AP) which is set up in order to communicate on the part sub channel is provided within the BSS (Basic Service Set). The method transmits the silence element (quiet element) and the frame including the silence channel element (quiet channel element). The silence element defines the silent period (quiet interval) in which the transmission is not generated and the silence channel element indicates that the part sub channel becomes silence for the silent period and it includes the silence channel element indicating the condition that the main part sub channel can be used for the silent period and performing the channel measurement for the silent period.



## 대표도면(Representative drawing)

| 요소 ID | 길이 | AP 침묵 모드 | 침묵 카운트 | 침묵 주기 | 침묵 지속기간 | 침묵 오프셋 |
|---|---|---|---|---|---|---|
| Octers: 1 | 1 | 1 | 1 | 1 | 2 | 2 |

## 청구의 범위

청구 **1**항:

무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법에 있어서,

침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고; 및

상기 침묵 기간동안 채널 측정을 수행하는 것;을 포함함을 특징으로 하는 방법.

청구 **2**항:

제 1항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들인 것을 특징으로 하는 방법.

청구 **3**항:

제 2항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가짐을 특징으로 하는 방법.

청구 **4**항:

## Scope of Claims

**Claim 1:**

The dynamic frequency selection method by the main part sub channel within the BSS (Basic Service Set) and the access point (Access Point: AP) which is set up in order to communicate on the part sub channel in the wireless LAN, wherein the method are characterized in that the silence element

silence element (quiet element) and the frame including the silence channel element (quiet channel element) are transmitted the silent period (quiet interval) in which the transmission is not generated is defined ; the silence channel element indicates that the part sub channel becomes silence for the silent period ; and the silence channel element includes the condition that the main part sub channel can be used for the silent period is instructed, and the channel measurement is performed for the silent period.

**Claim 2:**

As for claim 1, the first sub channel and the method in which the second sub channel is non-successive sub channels.

**Claim 3:**

As for claim 2, the first sub channel and the method for being characterized that the second sub channel has 80MHz bandwidth.

**Claim 4:**

제 1항에 있어서, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함함을 특징으로 하는 방법.

As for claim 1, the method wherein the silence channel element is characterized including the AP silence mode field that indicates acceptance and rejection the communication about AP is allowed in the main part sub channel for the silent period.

청구 **5**항:

**Claim 5:**

제 4항에 있어서,

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정되고, 및

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정됨을 특징으로 하는 방법.

As for claim 4, the method the AP silence mode field is set up as 1 so that it indicate that the communication about AP is allowed for

silent period in the main part sub channel ; and for being characterized that the AP silence mode field is set up as 0 so that it indicate that the communication about AP is not allowed for

silent period in the main part sub channel.

청구 **6**항:

**Claim 6:**

제 1항에 있어서, 상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함함을 특징으로 하는 방법.

As for claim 1, the method for being characterized to perform the channel measurement including sensing the presence of radar in the subchannel.

청구 **7**항:

**Claim 7:**

제 6항에 있어서, 상기 방법은,

상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하는 것을 더 포함함을 특징으로 하는 방법.

As for claim 6, the method the method the presence of radar is sensed in

subchannel ; and for being characterized further including choosing the new channel of BSS for the channel shift and advertising.

청구 **8**항:

**Claim 8:**

제 1항에 있어서, 상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함함을 특징으로 하는 방법.

As for claim 1, the silence channel element is the silence count field, the silence period field, and the silent duration duration field and the method for being characterized further including one among the silence offset field the AP silence field set up as 1 is comprised the silence channel element indicates the communication about AP is allowed for the silent period in the main part sub channel.

청구 **9**항:

**Claim 9:**

무선랜에서 BSS(Basic Service Set)내 액세스 포인트(Access Point; AP)에 있어서, 상기 AP는 주 서브채널 및 부 서브채널 중 하나에서 동적 주파수 선택을 수행하도록 설정되되, 상기 AP는,

AP as to the access point (Access Point: AP), within the BSS (Basic Service Set) is the main part sub channel and AP which is set up among the part sub channel in order to perform the dynamic frequency selection in one ; it includes the controller in which AP is functionally combined with

트랜시버; 및

transceiver :

상기 트랜시버와 기능적으로 결합된 컨트롤러를 포함하되, 상기 컨트롤러는,

and transceiver ; the controller transmits

침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간 동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고, 및

silence element (quiet element) and the frame including the silence channel element (quiet channel element) ; the silence element defines the silent period (quiet interval) in which the transmission is not generated ; the silence channel element indicates that the part sub channel becomes silence for the silent period ; the silence c

상기 침묵 기간동안 채널 측정을 수행하도록 설정된 것을 특징으로 하는 AP.

hannel element indicates the condition that the main p art sub channel can be used for the silent period ; and is set up in order to perform the channel measurement for

silent period. In the wireless LAN.

청구 **10**항:

**Claim 10:**

제 9항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들인 것을 특징으로 하는 AP.

As for claim 9, the first sub channel and AP in which the second sub channel is non-successive sub channel s.

청구 **11**항:

**Claim 11:**

제 2항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가짐을 특징으로 하는 AP.

As for claim 2, the first sub channel and AP which is characterized that the second sub channel has 80MHz bandwidth.

청구 **12**항:

**Claim 12:**

제 9항에 있어서, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함함을 특징으로 하는 AP.

As for claim 9, AP wherein the silence channel element is characterized including the AP silence mode field tha t indicates acceptance and rejection the communicatio n about AP is allowed in the main part sub channel for t he silent period.

청구 **13**항:

**Claim 13:**

제 12항에 있어서,

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정되고, 및

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정됨을 특징으로 하는 AP.

As for claim 12, AP which the AP silence mode field is set up as 1 in order to indicate that the communication about AP is allowed for

silent period in the main part sub channel ; and is char acterized that the AP silence mode field is set up as 0 i n order to indicate that the communication about AP is not allowed for

silent period in the main part sub channel.

청구 **14**항:

**Claim 14:**

제 9항에 있어서, 상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함함을 특징으로 하는 AP.

As for claim 9, AP which is characterized to perform the channel measurement including sensing the presen ce of radar in the subchannel.

청구 **15**항:

**Claim 15:**

제 14항에 있어서, 상기 컨트롤러는,

상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하도록 설정된 것을 특징으로 하는 AP.

As for claim 14, AP which the controller the presence of radar is sensed in

subchannel ; and is set up in order to choose the new channel of BSS for the channel shift and it creates a p ublic sensation.

청구 **16**항:

**Claim 16:**

제 9항에 있어서, 상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함함을 특징으로 하는 AP.

As for claim 9, the silence channel element is the silence count field, the silence period field, and the sile nt duration duration field and AP which is characterized further including one among the silence offset field the AP silence field set up as 1 is comprised the silence ch annel element indicates the communication about AP is allowed for the silent period in the main part sub chann

el.

## 기술분야

본 발명은 무선통신에 관한 것으로, 보다 상세하게는 무선랜 시스템에서의 동적 주파수 선택 방법 및 이를 지원하는 장치에 관한 것이다.

## Technical Field

The invention relates to the wireless communication, more specifically to the dynamic frequency selecting method at the wireless LAN-system and the apparatus for supporting this.

## 배경기술

최근 정보통신 기술의 발전과 더불어 다양한 무선 통신 기술이 개발되고 있다. 이 중에서 무선랜(WLAN)은 무선 주파수 기술을 바탕으로 개인 휴대용 정보 단말기(Personal Digital Assistant, PDA), 랩탑 컴퓨터, 휴대형 멀티미디어 플레이어(Portable Multimedia Player, PMP) 등과 같은 휴대형 단말기를 이용하여 가정이나 기업 또는 특정 서비스 제공지역에서 무선으로 인터넷에 접속할 수 있도록 하는 기술이다.

## Background Art

Recently, the various radio transmission technology is developed with the power generation of information and communication technology. Among these, in the assumption using the mobile terminal or the enterprise or the particular service providing area including the wireless LAN (WLAN) is the natural disposition the individual personal digital assistance (Personal Digital Assistant, PDA) the wireless frequency technology, the laptop computer, the portable multimedia player (Portable Multimedia Player, PMP) etc, it is the technology which wirelessly connects to the internet.

WLAN 기술의 표준화 기구인 IEEE(Institute of Electrical and Electronics Engineers) 802가 1980년 2월에 설립된 이래, 많은 표준화 작업이 수행되고 있다. 초기의 WLAN 기술은 IEEE 802.11을 통해 2.4GHz 주파수를 사용하여 주파수 호핑, 대역 확산, 적외선 통신 등으로 1~2Mbps의 속도를 지원한 이래, 최근에는 OFDM(Orthogonal Frequency Division Multiplex)을 적용하여 최대 54Mbps의 속도를 지원할 수 있다. 이외에도 IEEE 802.11에서는 QoS(Quality for Service)의 향상, 액세스 포인트(Access Point) 프로토콜 호환, 보안 강화(Security Enhancement), 무선 자원 측정(Radio Resource measurement), 차량 환경을 위한 무선 접속(Wireless Access Vehicular Environment), 빠른 로밍(Fast Roaming), 메쉬 네트워크(Mesh Network), 외부 네트워크와의 상호 작용(Interworking with External Network), 무선 네트워크 관리(Wireless network Management) 등 다양한 기술의 표준을 실용화 또는 개발 중에 있다.

IEEE (Institute of Electrical and Electronics Engineers) 802 which are the standardization organizations of the WLAN technology are established in 1980 year February. Since then many standardization is performed. The archaic WLAN technology supports the speed of 1~2Mbps with the frequency hopping, the bandwidth spread, the infrared communication etc. through the IEEE 802.11 using 2.4GHz frequency. Since then recently the OFDM (Orthogonal Frequency Division Multiplex) is applied and the speed of the maximum 54Mbps can be supported. Besides, in the IEEE 802.11, it has the various technologies of standards including the wireless access (Wireless Access Vehicular Environment) for the improvement, the access point protocol compatible, the reinforcing security (Security Enhancement), the radio resource measurement, vehicle environment of the QoS (Quality for Service), the fast roaming (Fast Roaming), the mesh network, the interaction (Interworking with External Network) with the foreign network, the wireless network management etc. among the put to practical use or development.

IEEE 802.11 중에서 IEEE 802.11b는 2.4GHz 대역의 주파수를 사용하면서 최고 11Mbs의 통신 속도를 지원한다. IEEE 802.11b 이후에 상용화된 IEEE 802.11a는 2.4GHz 대역이 아닌 5GHz 대역의 주파수를 사용함으로써 상당히 혼잡한 2.4GHz 대역의 주파수에 비해 간섭에 대한 영향을 줄였으며, OFDM 기술을 사용하여 통신 속도를 최대 54Mbps까지 향상시켰다. 그러나 IEEE 802.11a는 IEEE 802.11b에 비해 통신 거리가 짧은 단점이 있다. 그리고 IEEE 802.11g는 IEEE 802.11b와 마찬가지로 2.4GHz 대역의 주파수를 사용하여 최대 54Mbps의 통신속도를 구현하며, 후방 호환성(Backward Compatibility)을 만족하고 있어 상당한 주목을 받고 있는데, 통신 거리에 있어서도 IEEE 802.11a보다 우위에 있다.

The communication speed of the maximum 11Mbs is supported while the IEEE 802.11b uses the frequency of 2.4GHz band among the IEEE 802.11. Since the IEEE 802.11a commercialized after the IEEE 802.11b used the frequency of 5GHz band which was not 2.4GHz band the influence about the interference was reduced in comparison with the frequency of 2.4GHz band which was considerably in confusion and the communication speed was improved using the OFDM technology to the maximum 54Mbps. But the disadvantage that the communication distance is short in comparison with the IEEE 802.11b has the IEEE 802.11a. And the IEEE 802.11g implements the communication speed of the maximum 54Mbps like the IEEE 802.11b using the frequency of 2.4GHz band and it is satisfied the backward compatibility and it is noticed. Of being considerable it is in the predominately as to the communication distance than the IEEE 802.11a.

또한, 무선랜에서 취약점으로 지적되어온 통신 속도에 대한 한계를 극복하기 위하여 비교적 최근에 제정된 기술 규격으로서 IEEE 802.11n이 있다. IEEE 802.11n은 네트워크의 속도와 신뢰성을 증가시키고, 무선 네트워크의 운영 거리를 확장하는데 목적을 두고 있다. 보다 구체적으로, IEEE 802.11n에서는 데이터 처리 속도가 최대 540Mbps 이상인 고처리율(High Throughput, HT)을 지원하며, 또한 전송 에러를 최소화하고 데이터 속도를 최적화하기 위해 송신부와 수신부 양단 모두에 다중 안테나를 사용하는 MIMO(Multiple Inputs and Multiple Outputs) 기술에 기반을 두고 있다. 또한, 이 규격은 데이터 신뢰성을 높이기 위해 중복되는 사본을 여러 개 전송하는 코딩 방식을 사용할 뿐만 아니라, 속도를 증가시키기 위해 직교 주파수 분할 다중(Orthogonal Frequency Division Multiplex, OFDM)을 사용할 수도 있다.

Moreover, in the wireless LAN, it has the IEEE 802.11n as the technical specification which relatively recently is instituted it overcomes the limit about the communication speed which has been being indicated for the weak point. The IEEE 802.11n increases the speed and reliability of the network and the operation distance of the wireless network is expanded but the purpose sets. More specifically, in the IEEE 802.11n, the high throughput (High Throughput, HT) in which the data processing speed is the maximum 540Mbps or greater is supported and it is based on MIMO (Multiple Inputs and Multiple Outputs) technology which use the multiple antenna in the transmission unit and receiving unit both ends everyone in order to minimize moreover, the transmission error and optimize the data speed. Moreover, the coding scheme transmitting the copy in which this standard is overlapped in order to enhance the data authenticity, with the some is used. In addition the onal frequency division multiplexing (Orthogonal Frequency Division Multiplex, OFDM) can be used in order to increase the speed.

WLAN의 보급이 활성화되고 또한 이를 이용한 어플리케이션이 다양화됨에 따라, 최근에는 IEEE 802.11n이 지원하는 데이터 처리 속도보다 더 높은 처리율을 지원하기 위한 새로운 WLAN 시스템에 대한 필요성이 대두되고 있다. 초고처리율(Very High Throughput, VHT) 무선랜 시스템은 1Gbps 이상의 데이터 처리 속도를 지원하기 위하여 최근에 새롭게 제안되고 있는 IEEE 802.11 무선랜 시스템 중의 하나이다.

The supply of WLAN is activated and the necessity of the new WLAN system for supporting the processing ratio which is much higher than the data processing speed which recently the IEEE 802.11n supports it is varied of moreover, the application using the same emerges. It is one of IEEE 802.11 wireless LAN-system which recently is freshly proposed so that the draft processing ratio (Very High Throughput, VHT) wireless LAN-system support the data processing speed more than 1Gbps.

VHT 무선랜 시스템의 표준화를 진행하고 있는 IEEE 802.11 TGac에서는 1Gbps 이상의 쓰루풋을 제공하기 위하여 8X8 MIMO 및 80MHz 또는 그 이상의 채널 대역폭을 사용하는 방안에 대한 연구가 활발하게 진행되고 있다.

In the IEEE 802.11 TGac progressing the standardization of the VHT wireless LAN-system, the research about the plan which uses 8X8 MIMO and 80MHz or the channel bandwidth described in the above in order to provide the throughput more than 1Gbps actively proceeds.

80MHz 또는 그 이상의 채널 대역폭을 사용하는 경우 해당 대역을 사용하고 있는 다른 사용자와의 간섭 문제가 심각해 질 수 있다. 경우에 따라서는 해당 대역을 사용하고 있는 사용자가 우선적으로 보호되어야 하거나, 해당 주파수 대역을 사용함에 있어 준수되어야 할 규제사항에 의해 해당 주파수 대역의 상황에 따라 해당 주파수 대역의 사용이 제한될 수 있다.

The interference problem with the dissimilar user using the target bandwidth 80MHz or the channel bandwidth described in the above in case the use is serious. The user using the target bandwidth has to be preferentially protected according to case or the use of the target frequency bandwidth can be curbed with the regulatory consideration to be observed in using the target frequency bandwidth according to the situation of the target frequency bandwidth.

이러한 환경에서 해당 주파수 대역을 사용하기 위하여 해당 주파수 대역에 대해 우선순위를 가지고 있는 사용자를 보호하기 위하여 또는 행정적/정책적 규제사항을 만족시키기 위하여 대상 주파수 대역을 검사하는 절차가 필요하다. 검사 결과에 따라 적응적으로 채널의 대역폭을 조정하거나 채널을 스위칭하는 동적 주파수 선택 방법이 적용될 수 있다. 동적 주파수 선택 절차의 한 전제가 되는 채널을 상태를 검사하는 방법에 있어, 넓은 대역폭을 갖는 채널을 대상으로 함에 따라 발생할 수 있는 무선 자원의 낭비를 최소화하는 효율적인 방법에 대한 고려가 필요하다.

In such environment, in order to protect the user having with priority about the target frequency bandwidth in order to use the target frequency bandwidth, , or the procedure of inspecting the object frequency band in order to satisfy the administrative / policy regulatory consideration, is necessary. According to the check result, the dynamic frequency selecting method for adaptively controlling the bandwidth of the channel or switching the channel can be applied. It need the consideration about the efficient method for minimizing the waste of the radio resource which can be generated against the channel having the wide bandwidth according to box as to the method for inspecting state the premised channel of the dynamic frequency selection procedure.

## 발명의 내용

해결하고자 하는 과제

본 발명이 해결하고자 하는 과제는 광대역의 동작 채널을 지원하는 무선랜 시스템에서의 동적 주파수 선택(Dynamic Frequency Selection; DFS) 절차를 지원하는 관리 정보를 전송하는 방법을 제공하는 것이다.

본 발명이 해결하고자 하는 다른 과제는 복수의 서브 채널을 포함하는 동작채널을 지원하는 무선랜 시스템에서 특정 서브 채널을 선택적으로 침묵시키는 방법을 제공하는 것이다.

과제해결 수단

일 양태에서, 무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법이 제공된다. 상기 방법은 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고 및 상기 침묵 기간동안 채널 측정을 수행하는 것을 포함한다.

상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들일 수 있다.

상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가질 수 있다.

상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함할 수 있다.

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정될 수 있다. 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정될 수 있다.

상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함할 수 있다.

상기 방법은 상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하는 것을 더 포함할 수 있다.

## Summary of Invention

**Problem to be solved**

The method for transmitting the management information supporting the dynamic frequency selection (Dynamic Frequency Selection: DFS) procedure at the wireless LAN-system in which the technical problem supports the working channel of the broadband is provided.

The method for selectively muting the specific sub channel in the wireless LAN-system in which the dissimilar subject which the invention solves supports the working channel including multiple sub channels is provided.

**Means to solve the problem**

In one aspect, the dynamic frequency selection method by the main part sub channel and the access point (Access Point: AP) which is set up in order to communicate on the part sub channel is provided from the wireless LAN within the BSS (Basic Service Set). The method transmits the silence element (quiet element) and the frame including the silence channel element (quiet channel element). The silence element defines the silent period (quiet interval) in which the transmission is not generated and the silence channel element indicates that the part sub channel becomes silence for the silent period and it includes the silence channel element indicating the condition that the main part sub channel can be used for the silent period and performing the channel measurement for the silent period.

It has the first sub channel and the second sub channel with the non-successive sub channel farm work number.

The first sub channel and the second sub channel can have 80MHz bandwidth.

The silence channel element is the communication about AP in the main part sub channel for the silent period may include the AP silence mode field which indicates whether it is allowed or not.

In the main part sub channel for the silent period, in order to indicate that the communication about AP is allowed the AP silence mode field can be set up as 1. In the main part sub channel for the silent period, in order to indicate that the communication about AP is not allowed the AP silence mode field can be set up as 0.

May include to perform the channel measurement sensing the presence of radar in the subchannel.

In the method is the subchannel, if the presence of radar is sensed , it may further include the new channel of BSS for the channel shift being chosen and creating a public sensation.

상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함할 수 있다.

In the silence channel element is the main part sub channel for the silent period, if indicate that the communication about AP is allowed, the AP silence field set up as 1 is comprised , the silence channel element may further include one among the silence count field, the silence period field, and the silent duration duration field and silence offset field.

다른 양태에 있어서, 무선랜에서 BSS(Basic Service Set)내 액세스 포인트(Access Point; AP)가 제공된다. 상기 AP는 주 서브채널 및 부 서브채널 중 하나에서 동적 주파수 선택을 수행하도록 설정된다. 상기 AP는 트랜시버 및 상기 트랜시버와 기능적으로 결합된 컨트롤러를 포함한다. 상기 컨트롤러는 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간 동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고, 및 상기 침묵 기간동안 채널 측정을 수행하도록 설정된다.

As to the dissimilar form, the access point (Access Point: AP) is provided from the wireless LAN within the BSS (Basic Service Set). In AP is one among the main part sub channel and part sub channel, it is set up in order to perform the dynamic frequency selection. AP comprises the transceiver, the transceiver, and the functionally combined controller. The controller transmits the silence element (quiet element) and the frame including the silence channel element (quiet channel element). The silence element defines the silent period (quiet interval) in which the transmission is not generated and the silence channel element indicates that the part sub channel becomes silence for the silent period and the silence channel element indicates the condition that the main part sub channel can be used for the silent period and the condition is set up in order to perform the channel measurement for the silent period.

발명의 효과

**Effects of the Invention**

광대역의 동작채널을 지원하는 무선랜 시스템에서 동작채널을 구성하는 일부 채널의 환경 변화에 능동적으로 대응하여 채널의 환경 변화에 따른 채널 활용도의 저하을 최소화 할 수 있다.

In the wireless LAN-system supporting the working channel of the broadband, the possessively corresponds to the environmental change of the partial channel comprising the working channel and the degradation of the channel application level according to the environmental change of the channel can be minimized.

## 발명을 실시하기 위한 구체적인 내용

## Description of Embodiments

이하, 첨부 도면을 참조하여 본 발명의 실시예에 따른 무선 통신 시스템에서의 관리 절차 및 이를 지원하는 장치에 대하여 상세히 설명한다. 이하의 실시예에서는 무선 통신 시스템 중에서 무선랜(wireless local area network, WLAN) 시스템을 예를 들어 설명하지만 이것은 단지 예시적인 것이다. 따라서 후술하는 본 발명의 실시예는 그 성질상 허용되지 않는 경우를 제외하고 무선랜 시스템 이외의 다른 무선 통신 시스템에서도 동일하게 적용될 수 있을 것이다. 이 경우 후술하는 본 발명의 실시예에서 사용되는 무선랜 시스템에 고유한 용어들이나 단어들은 해당 무선 통신 시스템에서 관용적으로 사용되는 다른 용어들이나 단어들로 적절하게 변형될 수 있을 것이다.

Hereinafter, it particularly illustrates for the management process at the radio communication system according to a preferred embodiment of the present invention and the apparatus for supporting this with reference to the attached view. In an embodiment of less than, it illustrates but this is for example only illustrative the wireless LAN (wireless local area network, WLAN) system among the radio communication system. Therefore, it is identical in the dissimilar radio communication system except the wireless LAN-system the embodiment of the invention which will be described later will be able to be applied the case which is not permitted with the property phase. In this case, in an embodiment of the invention which will be described later, it will be able to be appropriately transformed into into the terms inherent in the used wireless LAN-system, the terms, or the dissimilar words in which words are tolerant used in the corresponding radio communication system.

도 1 및 도 2는 각각 본 발명의 실시예가 적용될 수 있는 무선랜 시스템의 일례에 대한 구성을 간략히 도시한 것이다.

As to figures 1 and 2, the embodiment of the invention briefly shows the configuration about an example of the wireless LAN-system which can be applied.

도 1 및 도 2를 참조하면, 무선랜 시스템은 하나 또는 그 이상의 기본 서비스 세트(Basic Service Set, BSS)를 포함한다.

Referring to figures 1 and 2, the wireless LAN-system includes one or more the basic service set (Basic Servi

BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 스테이션(Station, STA)의 집합으로서, 특정 영역을 가리키는 개념은 아니다. BSS는 인프라스트럭쳐 BSS(infrastructure BSS), 독립 BSS(Independent BSS, IBSS) 및 메쉬 BSS(mesh BSS, MBSS) 등으로 구분할 수 있다. 도 1은 인프라스트럭처 BSS를, 도 2는 IBSS를 나타낸 것이다. 인프라스트럭쳐 BSS(BSS1, BSS2)는 하나 또는 그 이상의 STA(STA1, STA3, STA4), 분배 서비스(Distribution Service)를 제공하는 STA인 액세스 포인트(Access Point, AP), 및 다수의 AP(AP1, AP2)를 연결시키는 분배 시스템(Distribution System, DS)을 포함한다. 반면, IBSS는 AP를 포함하지 않기 때문에 모든 STA이 이동 스테이션(STA6, STA7, STA8))으로 이루어져 있으며, DS에로의 접속이 허용되지 않아서 자기 완비적 네트워크(self-contained network)를 이룬다. MBSS는 메쉬 포인트(mesh point, MP)들로 구성된 네트워크로서 자기 완비적 네트워크의 다른 일례이다.

ce Set, BSS). It is the gathering of the station (Station, STA) in which BSS is successfully comprised the synchronization and communicating and it is not concept indicating the given area. BSS can classify according to the infrastructure BSS, the independent BSS (Independent BSS, IBSS) and mesh BSS (mesh BSS, MBSS) etc. Figure 1 shows fig. 2 is IBSS the infrastructure BSS is shown. The infrastructure BSS (BSS1, BSS2) comprises one or more the STA (STA1, STA3, STA4), the access point (Access Point, AP) which is STA providing the distribution service, and the dispensing system (Distribution System, DS) connecting multiple AP (AP1, AP2). On the other hand, all STAs are made of the mobile station (STA6, STA7, STA8)) because IBSS does not include AP and the connection to DS is not tolerated and it is comprised the magnetism totality network (self-contained network). MBSS is an example of the magnetism totality network of being different as mesh point (mesh point, MP) the configured network.

STA은 IEEE 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리층(Physical Layer) 인터페이스를 포함하는 임의의 기능 매체로서, 광의로는 AP와 비AP 스테이션(Non-AP Station)을 모두 포함한다. 무선 통신을 위한 STA은 프로세서(Processor)와 트랜시버(transceiver)를 포함하고 사용자 인터페이서와 디스플레이 수단 등을 포함할 수 있다. 프로세서는 무선 네트워크를 통해 전송할 프레임을 생성하거나 또는 상기 무선 네트워크를 통해 수신된 프레임을 처리하도록 고안된 기능 유닛으로서, 스테이션을 제어하기 위한 여러 가지 기능을 수행한다. 그리고 트랜시버는 상기 프로세서와 기능적으로 연결되어 있으며 스테이션을 위하여 무선 네트워크를 통해 프레임을 송수신하도록 고안된 유닛이다.

It is the media access control (Medium Access Control, MAC) in which STA follows the rules of the IEEE 802.11 standard and the arbitrary function media including the physical layer interface about the wireless medium and AP and non-AP station the altogether are included in the broad sense. STA for the wireless communication comprises the processor and the user interface and display means etc. the transceiver is included. The processor produces the frame transmitted through the wireless network or it is the functional unit which is designed in order to process the frame received through the wireless network and the various function for controlling the station is performed. And it is the unit which is designed for the station while the transceiver is connected to the processor in order to send and receive the frame through the wireless network.

STA 중에서 사용자가 조작하는 휴대용 단말은 비AP STA (STA1, STA3, STA4, STA6, STA7, STA8)으로서, 단순히 STA이라고 할 때는 비AP STA(non-AP STA)을 가리키기도 한다. 비AP STA은 무선 송수신 유닛(Wireless Transmit/Receive Unit, WTRU), 사용자 장비(User Equipment, UE), (Mobile Station, MS), 휴대용 단말(Mobile Terminal), 또는 이동 가입자 유닛(Mobile Subscriber Unit) 등의 다른 명칭으로도 불릴 수 있다.

The portable terminal which the user manipulates among STA is the ratio AP STA (STA1, STA3, STA4, STA6, STA7, STA8) and the ratio AP STA (non-AP STA) is indicated when being just called STA. The ratio AP STA can be called through the dissimilar name including the wireless transmit-receive unit (Wireless Transmit/Receive Unit, WTRU), the user equipment (User Equipment, UE), (Mobile Station, MS), the portable terminal (Mobile Terminal) or the mobile subscriber unit etc.

그리고 AP(AP1, AP2)는 자신에게 결합된 STA(Associated Station)을 위하여 무선 매체를 경유하여 DS에 대한 접속을 제공하는 기능 개체이다. AP를 포함하는 인프라스트럭쳐 BSS에서 비AP STA들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이나, 비AP STA들간 다이렉트 링크가 설정된 경우에는 비AP STA들 사이에서도 직접 통신이 가능하다. AP는 엑세스 포인트라는 명칭 외에 집중 제어기, 기지국(Base Station, BS), 노드-B, BTS(Base Transceiver System), 또는 사이트 제어기 등으로 불릴 수도 있다.

And in case the policy, or the direct link going with ratio AP STA is set up that the communication between ratio AP STAs are made in the infrastructure BSS which is the functional entity in which the AP (AP1, AP2) provides the connection about DS to oneself for the combined STA (Associated Station) via the wireless medium includes AP via AP the direct communication is possible AP can be called as the centralized controller, the base station (Base Station, BS), node -B, the BTS (Base Transceiver System) or the site controller etc. between ratio AP STAs besides the name called the access point.

복수의 인프라스트럭쳐 BSS는 분배 시스템(Distribution System, DS)을 통해 상호 연결될 수 있다. DS를 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다. ESS에 포함되는 STA들은 서로 통신할 수 있으

Multiple infrastructure BSSs can be interconnected through the dispensing system (Distribution System, DS). It says to be multiple BSSs connected through DS the extended service set (Extended Service Set, ESS).

며, 동일한 ESS 내에서 비AP STA은 끊김 없이 통신하면서 하나의 BSS에서 다른 BSS로 이동할 수 있다.

STAs included in ESS can communicate and while the ratio AP STA continuously communicates in the same ESS it can move from one BSS to dissimilar BSS.

DS는 하나의 AP가 다른 AP와 통신하기 위한 메커니즘으로서, 이에 의하면 AP가 자신이 관리하는 BSS에 결합되어 있는 STA들을 위해 프레임을 전송하거나 또는 어느 하나의 STA이 다른 BSS로 이동한 경우에 프레임을 전달하거나 유선 네트워크 등과 같은 외부 네트워크와 프레임을 전달할 수가 있다. 이러한 DS는 반드시 네트워크일 필요는 없으며, IEEE 802.11에 규정된 소정의 분배 서비스를 제공할 수 있다면 그 형태에 대해서는 아무런 제한이 없다. 예컨대, DS는 메쉬 네트워크와 같은 무선 네트워크이거나 또는 AP들을 서로 연결시켜 주는 물리적인 구조물일 수도 있다.

As the mechanism for communicating with AP in which as to the DS, one AP is different, the frame is transmitted for STAs in which AP is combined in BSS which oneself administers or in case of moving to BSS in which one STA is different the frame is delivered or the foreign network and frame including the wired network etc. can be delivered to the according to this. The need that such DS is certainly the network does not have and if the predetermined distribution service prescribed in the IEEE 802.11 can be provided, there is no any limit about the form. For example, DS may be the wireless network like the mesh network. And it or can be the physical structure connecting APs.

도 3은 무선랜 시스템의 BSS에서 동작채널로 설정될 수 있는 채널을 그 대역폭과 함께 예시한 것이다.

In fig. 3 is BSS of the wireless LAN-system, the channel which can be set up as the working channel is exemplified with the bandwidth.

BSS의 동작채널이라 함은 AP가 자신과 결합된(associated) STA들에게 제어 정보 및/또는 관리 정보를 제공하기 위하여 전송하는 프레임을 전송하기 위하여 사용하는 채널을 의미한다. 비콘 프레임은 제어 정보 및/또는 관리 정보를 제공하기 위하여 AP가 전송하는 프레임의 일례이다. IBSS에서는 동작채널은 DFS owner가 비콘 프레임을 전송하는 채널을 의미할 수 있다. DFS owner는 IBSS에서 동작채널의 변경이 필요할 경우 스위칭할 대상 채널을 선택할 책임이 있는 STA을 의미한다.

The channel which it uses in order to transmit the frame which it transmits that the frame does because of being the working channel of BSS so that AP provide the control information and/or the management information to oneself and bonded (associated) STAs, is meant. It is an example of the frame which AP transmits so that the beacon frame provide the control information and/or the management information. In IBSS, the working channel can mean the channel in which the DFS owner transmits the beacon frame. In the DFS owner is IBSS, STA in which it has the responsibility choosing the object channel which switches in case of the change of the working channel being necessary is meant.

도 3의 예에서 채널 대역폭의 기본 단위는 20MHz로 설정되어 있고, 이하 이를 기준으로 설명하나 이는 예시에 불과하며, 채널 대역폭의 기본 단위은 20MHz에 한정되지 아니하고 사용 대역의 주파수 상황 등을 고려하여 다양하게 설정될 수 있다. VHT 무선랜 시스템은 광대역폭(wide band)의 동작채널을 지원할 수 있다. VHT BSS는 VHT 무선랜 시스템의 BSS로서 VHT BSS에서는 VHT 동작 요소(VHT Operation element)를 포함하는 비콘 프레임이 브로드캐스팅(broadcasting) 된다. VHT 동작 요소는 광대역폭의 동작채널을 지원하기 위한 정보를 포함한다. 보다 구체적으로 VHT 동작 요소는 채널 대역폭(channel width) 정보, 채널 중심 주파수(channel center frequency) 정보를 포함할 수 있다. 비인접한 복수의 주파수 대역을 동작채널로 사용하는 경우 비인접한(non-contiguous) 각각의 주파수 부분(segment)별 중심 주파수를 지시하는 정보가 포함될 수 있다.

In the example of fig. 3, the base unit of the channel bandwidth is set up as 20MHz and it hereinafter illustrates based on this but this is nothing but the example and it can be not restricted in the base unit silver 20MHz of the channel bandwidth and it be variously set up in consideration of the frequency domain yellow light of the use band. The VHT wireless LAN-system can support the working channel of the optical bandwidth (wide band). In the VHT BSS is the VHT BSS as BSS of the VHT wireless LAN-system, it becomes the beacon frame including the VHT action element (VHT Operation element) with the broadcasting (broadcasting). The information in which the VHT action element supports the working channel of the optical bandwidth is contained. More specifically, the VHT action element may include the channel bandwidth (channel width) information, and the channel center frequency information. The information indicating each frequency part (segment) much center frequency which is not adjacent the multiple frequency bands which is not adjacent to the working channel in case the use (non-contiguous) can be included.

도 3의 예는 20MHz, 40MHz, 80MHz, 160MHz, 80MHz+80MHz의 채널 대역폭(channel bandwidth)을 갖는 동작채널이 설정될 수 있음을 예시하고 있다. 여기에서 80MHz+80MHz의 동작채널이라 함은 서로 비인접한 2개의 80MHz 채널로 구성된 동작 채널을 의미한다.

The example of fig. 3 exemplifies that the working channel having the channel bandwidth of 20MHz, 40MHz, 80MHz, 160MHz, 80MHz+80MHz can be set up. Here, the working channel consisting of 80MHz channel which is each other not adjacent to do because of being the working channel of 80MHz+80MHz of 2 is meant.

주 채널(primary channel)은 BSS의 멤버인 모든 STA들을 위한 공통 채널이다. 부 채널(secondary channel)은 주 채널과 연관된 채널(associated channel)로 동작 채널의 대역폭 확장을 위해 사용될 수 있다.

It is the common channel for all STAs in which the main channel (primary channel) is the member of BSS. The subchannel (secondary channel) can be used as the channel (associated channel) related to the main channel for the bandwidth extension of the working channel.

주 40MHz 채널(primary 40 MHz channel)은 80MHz, 160MHz 또는 80MHz+80MHz VHT BSS에서 40MHz PPDUs (PLCP(physical layer convergence procedure) protocol data units)를 전송하는데 사용되는 서브채널을 의미한다. 주 80MHz 채널(primary 80 MHz channel)은 160MHz 또는 80MHz+80MHz VHT BSS에서 80MHz PPDUs를 전송하는데 사용되는 서브채널을 의미한다. 여기에서 'n' MHz PPDU라 함은 해당 PPDU의 전송벡터 파라미터(TXVECTOR parameter) CH_BANDWIDTH가 CBW 'n'으로 설정된 PPDU를 의미한다.

In the main part 40MHz channel (primary 40 MHz channel) is 80MHz, and 160MHz or 80MHz+80MHz VHT BSS, the sub channel which is used to transmit 40MHz PPDUs (PLCP(physical layer convergence procedure) protocol data units) is meant. In the main part 80MHz channel (primary 80 MHz channel) is 160MHz or 80MHz+80MHz VHT BSS, the sub channel which is used to transmit 80MHz PPDUs is meant. Here, PPDU in which the transfer vector parameter (TXVECTOR parameter) CH BANDWIDTH of the corresponding PPDU is set up as the CBW 'n' is meant to says to be 'n' MHz PPDU.

부 40MHz 채널(secondary 40MHz channel)은 80MHz VHT BSS에서 인접한 주 40MHz 채널에 인접한 서브채널이며, 주 40MHz 채널과 함께 80MHz 채널을 구성한다. 160 또는 80+80MHz VHT BSS에서 부 40MHz 채널은 인접한 주 40 MHz 채널과 함께 주 80MHz 채널을 구성한다.

It is the sub channel adjacent to the main part 40MHz channel in which the part 40MHz channel (secondary 40MHz channel) is adjacent in 80MHz VHT BSS and 80MHz channel is organized with the main part 40MHz channel. In 160 or 80+80MHz VHT BSS, the main part 80MHz channel is organized with the main part 40MHz channel in which the part 40MHz channel is adjacent.

부 80MHz 채널(secondary 80MHz channel)은 160 또는 80+80MHz VHT BSS에서 주 20MHz 채널을 포함하지 아니하는 80MHz 서브채널이며, 주 80MHz 채널과 함께 160MHz 또는 80+80 MHz 채널을 구성한다.

In the part 80MHz channel (secondary 80MHz channel) is 160 or 80+80MHz VHT BSS, it is 80MHz sub channel not including the main part 20MHz channel and 160MHz or 80+80 MHz channel is organized with the main part 80MHz channel.

40, 80, 160 또는 80+80 MHz VHT BSS에서 주 20MHz 채널을 포함하지 아니하는 채널을 보조채널(non-primary channel)이라 한다.

The channel not including 40, 80, and the main part 20MHz channel in 160 or 80+80 MHz VHT BSS says to be joined with the secondary channel (non-primary channel).

도 4는 도 1 또는 도 2에 도시된 것과 같은 무선랜 시스템 또는 이를 포함하거나 이와 실질적으로 균등한 무선 통신 시스템에서의 본 발명의 일 실시예에 따른 무선 네트워크의 관리 절차를 보여 주기 위한 동작 절차도이다. 도 4에 도시되어 있는 제1 STA(2)과 제2 STA(4) 사이에서의 동작 절차도는 인프라스트럭쳐 BSS를 구성하는 비AP STA과 AP 사이에 진행되는 절차일 수 있지만, 본 실시예가 여기에만 한정되는 것이 아니라는 것은 자명하다. 예를 들어, IBSS를 구성하는 비AP STA들 사이에서의 동작이나 메쉬 네트워크 시스템을 구성하는 MP들 사이의 동작, 또는 다른 무선 통신 시스템을 구성하는 단말들 또는 단말과 기지국 사이의 동작에서도, 그 본질상 적용이 불가능한 것을 제외하고는, 본 실시예는 동일 또는 균등한 방식으로 적용이 될 수 있다.

The operation procedure drawing at the first STA (2) and the second STA (4) interval which fig. 4 is the wireless LAN-system as shown or the operation procedure including the same or creating the management process of the wireless network according to a preferred embodiment of the present invention at the radio communication system which is substantially equal from this in the figures 1 or 2 is illustrated in fig. 4 can be the ratio AP STA comprising the infrastructure BSS and the procedure of being progressed between AP. However it is obvious that this embodiment is not restricted to excitation. For example, the identity phase application excludes the disable from the operation between the terminals comprising the operation between MP comprising the operation at the ratio AP STA interval comprising IBSS or the mesh network system or the dissimilar radio communication system or the terminal and base station and this embodiment can be applied to the identity or the equal mode.

도 4를 참조하면, 본 발명의 실시예에 따른 무선 통신 시스템에서의 라디오 측정 절차는 그 예비 과정으로서 탐색 절차(Scanning Procedure, S10), 인증 절차(Authentication Procedure, S20), 및/또는 결합 절차(Association Procedure, S3

Referring to Figure 4, the radio calibration procedure at the radio communication system according to a preferred embodiment of the present invention further includes the dynamic frequency selection procedure (Dynamic

0)를 포함하며, 상기 예비 과정(S10 내지 S30) 이후에 수행되는 동적 주파수 선택 절차(Dynamic Frequency Selection Procedure, S40)를 더 포함한다. 본 발명의 실시예의 일 측면에 의하면, 상기 예비 과정들 중에서 적어도 일부 절차는 필수적인 절차가 아닌 임의적인 절차일 수 있다.

Frequency Selection Procedure, S40) which includes the search procedure (Scanning Procedure, S10), and the authentication process (Authentication Procedure, S20) and / or the bonding process (Association Procedure, S30) and is performed after the backup procedure (the S10 to the S30) as the backup procedure. According to one side of the embodiment of the present invention., it can be the arbitrary procedure which is not procedure where at least some of backup procedures procedure is essential.

도 4를 참조하면, 제1 STA(1)과 제2 STA(4) 사이에는 탐색(scanning) 절차(S10)가 먼저 수행된다. 탐색 절차(S10)는 제1 STA(2)이 결합 절차(S30)에서 결합할 대상이 되는 후보 스테이션을 찾는 과정인데, 예컨대 인프라스트럭쳐 BSS에서 비AP STA이 AP를 찾는 과정이라고 볼 수 있다. 하지만, 보다 넓은 의미의 탐색 절차(S10)는 IBSS인 경우에는 비AP STA이 이웃 비AP STA을 찾는 과정이나 메쉬 네트워크인 경우는 이웃 MP를 찾는 과정도 포함한다고 볼 수 있다.

Referring to Figure 4, the search (scanning) procedure (S10) is performed between the first STA (1) and the second STA (4) in advance. It is the process of seeking for the candidate station in which the object in which the first STA (2) combines in the bonding process (S30) becomes the search procedure (S10). It can look as the process where the ratio AP STA finds AP in for example, the infrastructure BSS. However, it can look that the process or the process where the case of being the mesh network finds the neighbor MP includes where the ratio AP STA finds the neighbor ratio AP STA in case the search procedure (S10) of the meaning of being more broad is IBSS.

이러한 탐색 절차는 두 가지 유형이 있다. 첫 번째 유형은 수동 스캔(Passive Scan) 방법으로서, 제2 STA(4) 등으로부터 전송되는 비콘 프레임(Beacon Frame)을 이용하는 방법이다. 이에 의하면, 무선랜에 접속하고자 하는 제1 STA(2)은 해당 BSS(또는 IBSS)를 관리하는 AP인 제2 STA(4) 등으로부터 주기적으로 전송되는 비콘 프레임을 수신하여, 접속 가능한 BSS를 찾을 수 있다.

Two kinds of type has such search procedure. The first type is the method for using the beacon frame transmitted from the second STA (4) etc as the manual scan (Passive Scan) method. According to this, the beacon frame periodically transmitted from the second STA (4) etc. is AP in which the first STA (2) to connect to the wireless LAN manages the corresponding BSS (or, IBSS) is received and connectable BSS can be found.

다른 탐색 절차 유형으로 능동 스캔(Active Scan) 방법이 적용될 수 있다. 능동 스캔 절차에 의하면, 무선랜 시스템에 접속하고자 하는 제1 STA(2)이 먼저 프로브 요청 프레임(Probe Request Frame)을 전송한다. 그리고 상기 프로브 요청 프레임을 수신한 제2 STA(4), 예컨대 AP는 자신이 관리하는 BSS의 서비스 세트 아이디(Service Set ID, SSID)와 자신이 지원하는 능력치(Capability) 등의 정보가 포함된 프로브 응답 프레임(Probe Response Frame)을 제1 STA(2)에게 전송한다. 따라서 제1 STA(2)은 수신된 프로브 응답 프레임을 통해 후보 AP의 존재와 함께 상기 후보 AP에 관한 여러 가지 정보를 알 수가 있다.

The active scan method can be applied to the dissimilar search procedure type. According to the active scan procedure, the first STA (2) to connect to the wireless LAN-system transmits the probe request frame in advance. And the second STA (4), for example, AP receiving the probe request frame transmits the probe response frame in which the information including the service set ID (Service Set ID, SSID) and capacity value (Capability) of BSS which oneself administers etc. is included oneself supports to the first STA (2). Therefore, many information about the candidate AP can be known through the probe response frame in which the first STA (2) is received with the presence of the candidate AP.

탐색 과정(S10)에서 비콘 프레임이나 프로브 응답 프레임을 전송하는 제2 STA(4)은 동적 주파수 선택(Dynamic Frequency Selection, DFS) 절차에서 사용될 수 있는 정보를 비콘 프레임이나 프로브 응답 프레임을 통해 전송할 수 있다. DFS 절차에서 사용될 수 있는 정보의 일례로 침묵 요소(Quiet element) 및/또는 침묵 채널 요소(Quiet channel element)가 비콘 프레임 또는 프로브 응답 프레임에 포함될 수 있다. 비콘 프레임이나 프로브 응답 프레임에 포함될 수 있는 DFS 절차에서 활용되는 정보는 이후 다시 구체적으로 설명하기로 한다.

In the searcher process (S10), the information in which the beacon frame or the second STA (4) transmitting the probe response frame can be used in the dynamic frequency selection (Dynamic Frequency Selection, DFS) procedure can be transmitted through the beacon frame or the probe response frame. For example, the silence element (Quiet element) and/or the silence channel element (Quiet channel element) can be included in the beacon frame or the probe response frame of the information which can be used in the DFS procedure. Then specifically the beacon frame or the information used for the probe response frame in the DFS procedure of being included again decides to illustrate.

계속해서 도 4를 참조하면, 제1 STA(2)과 제2 STA(4) 사이에 인증 절차(S20)가 진행된다. 인증 절차(S20)는 무선 통신

And then, referring to Figure 4, the authentication process (S20) is progressed between the first STA (2)

에 참여하는 개체들 사이에 인증 절차와 암호화 방식 등을 협상하는 과정이다. 예를 들어, 제1 STA(2)이 탐색 절차(S10)에서 찾은 하나 이상의 AP들 중에서 결합하고자 하는 제2 STA, 예컨대 AP와 인증 절차(S20)를 수행할 수 있다. WLAN에서는 대부분의 경우에 오픈 시스템(Open System) 인증방식을 사용하기 때문에, AP인 제2 STA(4)은 제1 STA(2)으로부터의 인증 요청에 대하여 아무런 조건 없이 인증 과정을 수행한다. 보다 강화된 인증방식으로 IEEE 802.1x 기반 EAP-TLS(Extensible Authentication Protocol-Transport Layer Security), EAP-TTLS(Extensible Authentication Protocol-Tunneled Transport Layer Security), EAP-FAST(Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling), PEAP (Protected Extensible Authentication Protocol) 등이 있다.

and the second STA (4). It is the process of negotiating the authentication process and cipher system etc. between entities in which the authentication process (S20) participates in the wireless communication. For example, the second STA, to combine among at least one APs which the first STA (2) finds in the search procedure (S10) for example, AP and authentication process (S20) can be performed. In WLAN, the open system certification system is used in case of the majority. Therefore the second STA (4) which is AP performs the authentication procedure about the authentication request from the first STA (2) without any condition. It has the IEEE 802.1x base EAP- TLS (Extensible Authentication Protocol-Transport Layer Security), the EAP- TTLS (Extensible Authentication Protocol-Tunneled Transport Layer Security), the EAP- FAST (Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling), the PEAP (Protected Extensible Authentication Protocol) etc to more strengthened certification system.

인증 절차(S20)에서 성공적으로 인증을 완료하고 나면 제1 STA(2)은 결합 절차를 수행한다(S30). 본 단계의 결합 절차는 제1 STA(2)이 비AP STA이고 제2 STA(4)이 AP인 경우 등에 수행되는 임의적인 절차일 수 있다. 결합 절차(S30)는 제1 STA(2)과 제2 STA(4) 사이에 식별 가능한 연결, 즉 무선 링크를 설정하는 것을 의미한다. 결합 절차(S30)를 위해, 제1 STA(2)은 우선 인증 절차(S20)를 성공적으로 완료한 제2 STA(4)에게 결합 요청 프레임(Association Request Frame)을 전송하고, 제2 STA(4)는 이에 대한 응답으로 '성공(Successful)'이라는 상태값을 갖는 결합 응답 프레임(Association Response Frame)을 제1 STA(2)에게 전송한다. 상기 결합 응답 프레임에는 제1 STA(2)과의 결합을 식별할 수 있는 식별자, 예컨대 결합 아이디(Association ID, AID)가 포함된다.

In the authentication process (S20), in case if the authentication is successfully completed, the first STA (2) performs the bonding process (S30) the first STA (2) the bonding process of the main step is the ratio AP STA and the second STA (4) is AP it can be the arbitrary procedure of being performed in the etc. the bonding process (S30) means setting up the identiable connection, in other words, the radio link between the first STA (2) and the second STA (4) the association request frame is transmitted for the bonding process (S30) to the second STA (4) in which first the first STA (2) successfully completes the authentication process (S20) and the second STA (4) transmits the association response frame having the state value it is 'pass (Successful)' with the response about this to the first STA (2). The association response frame includes the identifier, distinguishing the combination with the first STA (2) for example, the coupling eye di (Association ID, AID).

결합 절차(S30)가 성공적으로 완료된 후라도 가변적인 채널 상황으로 인하여 제1 STA(2)과 AP인 제2 STA(4)과의 연결 상태가 나빠지는 경우에, 제1 STA(2)은 접속 가능한 다른 AP와 다시 결합 과정을 수행할 수 있는데, 이를 재결합 절차(Re-association Procedure)라고 한다. 이러한 재결합 절차는 전술한 결합 절차(S30)와 상당히 유사하다. 보다 구체적으로, 재결합 절차에서는 제1 STA(2)은 현재 결합되어 있는 AP가 아닌 다른 AP(전술한 탐색 과정(S10)에서 찾은 후보 AP들 중에서 인증 절차(S20)를 성공적으로 완료한 AP)에게 재결합 요청 프레임을 전송하고, 상기 다른 AP는 재결합 응답 프레임을 제1 STA(2)에게 전송한다. 다만, 재결합 요청 프레임에는 이전에 결합한 AP에 관한 정보가 더 포함되며, 이 정보를 통하여 재결합 AP는 기존 AP인 제2 STA(4)에 버퍼링되어 있는 데이터를 제1 STA(2)에게 전달할 수가 있다.

In case it is after when the bonding process (S30) is successfully completed the connected state with the second STA (4) which is the first STA (2) and AP becomes bad due to the variable state of channel the combining process can be again performed with dissimilar AP in which the first STA (2) is connectable. This is done as the recombination procedure (Re-association Procedure). It is considerably similar to the bonding process (S30) in which such recombination procedure describes in the above. More specifically, in the recombination procedure, the first STA (2) transmits the reassociation request frame to the dissimilar AP (AP which successfully completes the authentication process (S20) within candidate APs found in the above-described searcher process (S10)) that is not current combined AP and the above-mentioned dissimilar AP transmits the reassociation response frame to the first STA (2). But in the reassociation request frame, the information about AP combining is previously more included and buffered data can be delivered to the second STA (4) in which the recombination AP is the existing AP through this information to the first STA (2).

상술한 결합 및 재결합 절차에서 제1 STA(2)은 제2 STA(4)에게 제1 STA(2)이 동작 가능한 채널들의 목록(list)을 제공할 수 있다. 채널들의 목록은 결합 요청 프레임 또는 재결합 요청

The first STA (2) in the above-described combination and recombination procedure provide the second STA (4) with the list of the channels in which the first STA

프레임에 포함되어 전송될 수 있다.

(2) is operable. The list of the channels can be contain ed and transmitted in the association request frame or the reassociation request frame.

인증 절차(S20)를 완료하거나 또는 이에 추가하여 결합 절차(S30)를 완료한 제1 STA(2)과 제2 STA(4) 사이에 동적 주파수 선택 절차가 진행될 수 있다(S40). 도 4에서는 인프라스트럭쳐 BSS에서 결합 절차(S30)를 완료한 제1 STA(2)과 제2 STA(4) 사이에서 위치 절차가 진행되는 것으로 도시되어 있지만, 후술하는 본 발명의 실시예에 따른 동적 주파수 선택 절차(S40)는 이에 한정되는 것은 아니다. 즉, 본 발명의 실시예에 따른 동적 주파수 선택 절차는 서로간에 무선 링크를 설정하고 있는 두 개의 STA 사이이면, 그것이 비AP STA이든 AP이든 또는 MP이든 상관없이 적용될 수 있다. 예컨대, 본 발명의 실시예에 따른 동적 주파수 선택 절차는, 도 3의 예와 같은 인프라 스트럭쳐 BSS의 비AP STA과 AP 사이는 물론, IBSS 및 MBSS의 비AP STA 사이에서도 진행될 수도 있다.

The authentication process (S20) is completed or the dynamic frequency selection procedure can be progres sed between the first STA (2) and the second STA (4) which thus adds and completes the bonding process (S 30) (S40). In fig. 4, it is illustrated that the position pr ocedure is progressed in the infrastructure BSS betwee n the first STA (2) and the second STA (4) completing the bonding process (S30). However the dynamic frequ ency selection procedure (S40) according to the embo diment of the invention which will be described later is not thus restricted. That is, if it is two STA intervals in which the dynamic frequency selection procedure acco rding to a preferred embodiment of the present inventio n sets the radio link to each other , or that can be irre spective applied as the ratio AP STA or AP as MP. For example, the dynamic frequency selection procedure a ccording to a preferred embodiment of the present inve ntion can be progressed between the ratio AP STA of I BSS as well as the ratio AP STA of the infrastructure B SS like the example of fig. 3 and AP interval, and MBS S.

무선랜 네트워크에서 동적 주파수 선택 절차는 동작 채널(operating channel)을 채널 환경의 변화에 따라 적응적으로 스위칭 할 수 있도록 한다. AP와 STA은 동적 주파수 선택 절차를 통해 동작채널을 유지/변경 할 수 있다. 동작채널을 변경할 것인지 여부에 여부는 AP가 현재 동작채널의 상황에 기반하여 판단할 수 있다. 예를 들어, 현재의 동작채널의 상태가 악화되거나, 동종 또는 이종 통신 시스템으로부터 간섭이 있는 경우 또는 정책적/행정적 규제에 의해 특정한 상황에서 해당 채널의 사용이 더 이상 허용되지 아니하는 경우 등에는 해당 동작채널의 사용을 중지하고 새로운 동작 채널을 설정하여야 하는 것으로 판단할 수 있다.

In the wireless lan network, the dynamic frequency selection procedure switches the working channel (ope rating channel) as the adaptively according to the cha nnel ambient change. AP and STA can the working cha nnel through the dynamic frequency selection procedur e the maintenance / change. As to acceptance and rej ection, AP can determine in acceptance and rejection based on the situation of the current working channel i f the working channel is changed. For example, the sta te of the current working channel gets worse or with t he use of the corresponding operation channel has to b e stopped from the allogenic or the heterogeneous com munication system in the case where the case have th e interference etc. and the use of the corresponding c hannel is not any more allowed with the political / admi nistration regulation in the specific situation the new w orking channel has to be set up it can determine.

이하에서 5GHz 대역에서 동작하는 무선랜 네트워크에 적용되는 사항을 가정하여 설명하기로 한다. 동적 채널 선택 과정을 통해 채널을 스위칭해야 하는 사유로 5GHz 대역을 사용하는 레이더(radar)신호를 보호하기 위한 규제(regulations)를 가정한다. 다만 이는 설명의 편의를 위한 것으로 본 발명이 적용되는 주파수 대역, 동적 주파수 선택 절차에서 검출하는 대상 신호 등에 대한 제한으로 이해 되어서는 안 된다. 또한 이하의 실시예에서 특정 채널에서의 프레임 전송/수신을 제한하는 것은 동적 주파수 선택 절차와 무관하게 이루어질 수 있다.

Hereinafter, the matter applied to the wireless lan network operating in 5GHz band is assumed and it deci des to illustrate. The regulation (regulations) for protec ting the radar signal using 5GHz band as the proprietar y which has to switch the channel through the dynami c channel selection process is assumed. But this is for the convenience of the description and the description should not be understood as the limit including the freq uency band, in which the invention is applied the objec t signal etc. it detects in the dynamic frequency select ion procedure. Moreover, it has no concern with the dy namic frequency selection procedure in an embodiment of less than, it can be made to restrict the frame forwa rding / reception at the special channel.

동적 주파수 선택 절차는 앞서 설명한 AP와 STA들과의 도 4의 결합 절차(S30)를 포함할 수 있다. 동적 주파수 선택 절차는 현재의 채널을 침묵시키는(quieting the current channel) 고, 채널을 측정하여 레이더가 검출(detecting)되면 동작을

The dynamic frequency selection procedure comprises AP which it before illustrates and the bonding process (S30) of fig. 4 with STA. The dynamic frequency select ion procedure mutes the current channel (quieting the

중단하고, 새로운 채널을 선택하고, 선택된 새로운 채널을 STA들에게 알리는 것을 포함할 수 있다.

current channel) and if the channel is measured and radar is the detection (detecting), the operation is discontinued and the new channel is chosen and it may include informing the selected and new channel to STAs.

도 5는 VHT 무선랜 시스템의 동작 대역폭(operating bandwidth)이 될 수 있는 5GHz 대역의 스펙트럼 상세(spectrum detail)를 나타낸 것이다. 도 5에서 DFS (Dynamic Frequency Selection) 대역(band)으로 표시된 대역, 즉, 5.25GHz ~ 5.35GHz 및 5.47GHz ~ 5.725GHz는 레이더 신호(radar signal)가 존재할 수 있어 DFS 절차에 의해 레이더 신호의 존재여부를 탐지하고, 레이더 신호가 검출 될 경우에는 해당 대역의 동작채널을 다른 대역의 채널로 스위칭하여야 하는 대역을 의미한다.

Figure 5 show the spectrum detail of 5GHz band in which it can become the operation bandwidth (operating bandwidth) of the VHT wireless LAN-system. In fig. 5, the radar signal can exist and the band, in other words, 5.25GHz ~ 5.35GHz and 5.47GHz ~ 5.725GHz indicated as the DFS (Dynamic Frequency Selection) band detect the presence of the radar signal with the DFS procedure and the band which has to switch the working channel of the target bandwidth with the channel of the dissimilar band in case the radar signal is detected is meant.

무선랜 네트워크의 어느 BSS가 DFS 대역을 동작채널의 대역, 즉 동작 대역(operating band)으로 할 때, BSS의 AP와 non-AP STA들은 해당 대역을 사용하기 전 및 사용 중 때때로 레이더의 존재여부를 검출하여야 한다. 해당 대역에 레이더가 존재하는지 여부를 검출하기 위한 검사(test)에 앞서 AP는 BSS내의 모든 STA들이 현재의 동작 채널을 통해 프레임을 전송하지 아니하도록 한다. 즉, 모든 STA들을 침묵시키기 (quieting) 위한 침묵 요소를 전송할 수 있다. 침묵 요소는 비콘 프레임에 포함되어 BSS내의 모든 STA들에게 브로드캐스팅되거나 프로브 응답 프레임에 포함되어 개별 STA에게 전송될 수 있다.

When a BSS of the wireless lan network translates the DFS band to the band of the working channel, in other words, the operation band (operating band) the presence of radar has to be from time to time detected among the use before AP and non-AP STA of BSSs use the target bandwidth. As to the AP, all STAs within BSS does not transmit the frame before the inspection (test) for detecting whether radar exists in the target bandwidth or not through the current working channel. That is, the silence element which it is to mute all STA (quieting)s can be transmitted. The silence element is included in the beacon frame and it is broadcasted to all STAs within BSS or it is included in the probe response frame and it can be transmitted to the individual case STA.

AP로부터 침묵 요소를 수신한 STA들은 전송하여 STA들을 침묵 요소에 설정된 값에 따라 프레임의 전송/수신이 금지되는 침묵 기간을 갖는다. AP는 해당 대역에서 다른 STA의 프레임 전송/수신에 따른 간섭을 받지 아니하고 레이더 신호의 존재 여부를 검사할 수 있다.

It has the silent period in which STAs receiving the silence element from AP transmit and the transmission / reception of the frame is STAs banned by law for the sake in the silence element according to the set value. AP can not be interfered in the target bandwidth and dissimilar the presence of the radar signal can be inspected.

해당 대역에서 레이더 신호가 검출되면 동작 대역을 다른 주파수 대역으로 옮길 수 있다. 도 5에서 EIRP는 유효 등방성 복사 전력(Effective Isotropic Radiated Power, EIRP )를 의미하며, DSRC 5.9GHz는 단거리 통신에 사용되는(dedicated) 주파수 대역을 의미한다. DFS(dynamic frequency selection)는 5 GHz 주파수 대역에서 레이더 검출 및 균일한 채널을 사용하기 위한 기법으로서 자동으로 주파수를 할당하는 기법을 의미하고, TPC(transmit power control) 5GHz 주파수 대역에서 간섭의 감소, 도달거리 제어 및 전력 소비 감소를 위해 송출전력을 적절히 조정하도록 802.11h에서 제안된 전력제어기법이다.

In the target bandwidth, if the radar signal is detected, the operation band can be moved to the dissimilar frequency band. In fig. 5, EIRP means the effective isotropic radiation power (Effective Isotropic Radiated Power, EIRP) and the frequency band in which the DSRC 5.9GHz is used for the short-haul communication (dedicated) is meant. The DFS (dynamic frequency selection) is the power controller method which means the technique which automatically assigns frequency and is proposed in the TPC (transmit power control) 5GHz frequency band for the reduction of the interference, and the arrival range control and reduced power consumption in 802.11h in order to appropriately control the transmission power as the technique for detecting in 5 GHz frequency band with radar and using the uniform channel.

도 6은 침묵 정보요소(Quiet Information Element, Quiet IE) 포맷의 일례를 나타낸 블록도이다.

Figure 6 is a block diagram showing an example of the silence information element (Quiet Information Element, Quiet IE) format.

침묵 IE는 요소 식별자(Element ID) 필드, 길이(Length) 필드, 침묵 카운트(Quiet Count) 필드, 침묵 주기(Quiet Period) 필드, 침묵 지속기간(Quiet Duration) 필드, 침묵 오프셋(Quiet Offset) 필드를 포함할 수 있다.

The silence IE may include the element identifier field, length field, the silence count (Quiet Count) field, the quiet period field, the silent duration period (Quiet Duration) field, the silence offset (Quiet Offset) field.

요소 식별자 필드는 요소(element)의 식별정보를 지시하는 값으로 설정되어, 본 요소가 침묵 요소임을 지시한다.

The element identifier field indicates that it is set up as the value indicating the identifying information of the element and this element is the silence element.

길이(Length) 필드는 침묵 카운트(Quiet Count) 필드, 침묵 주기(Quiet Period) 필드, 침묵 지속기간(Quiet Duration) 필드, 침묵 오프셋(Quiet Offset) 필드의 길이를 지시하는 값으로 설정될 수 있다. 일례로 6 옥텟(octet)으로 설정되어 있어 이후에 침묵 카운트 필드(1 octet), 침묵 주기 필드(1 octet), 침묵 지속기간 필드(2 octets), 및 침묵 오프셋 필드(2 octets)이 이어짐을 지시할 수 있다.

The length field can be set up as the value indicating the length of the silence count (Quiet Count) field, the quiet period field, the silent duration period (Quiet Duration) field, the silence offset (Quiet Offset) field. For example, it is set up as 6 octet and thereafter it can indicate that the silence count field (1 octet), the silence period field (1 octet), and the silent duration duration field (2 octets) and silence offset field (2 octets) are connected.

침묵 카운트 필드는 다음 침묵 기간(quiet interval)이 시작되는 시점을 포함하는 비콘 간격까지의 TBTT(target beacon transmission time)의 수로 설정될 수 있다. 즉 침묵 카운트 필드가 1로 설정되면 다음 TBTT에서 시작되는 비콘 간격 동안에 침묵 기간이 시작됨을 지시한다.

The silence count field the next silent period (quiet interval) can be set up as the number of TBTT (target beacon transmission time) to the beacon interval including the start points. That is, it indicates that the silent period is initiated for the beacon interval initiated in the next TBTT if the silence count field is set up as 1.

침묵 주기 필드는 침묵 요소에 의해 정의된 정기적인 침묵 기간들의 시작점간 비콘 인터벌들의 수로 설정된다. 0으로 설정된 값은 침묵 기간이 주기적으로 설정된 것이 아님을 지시한다.

It is set up as the number of the beacon intervals between the initial point of the regular silent periods in which the silence period field is defined with the silence element. 0 the set value indicates that the silent period is not periodically set up.

침묵 지속기간 필드는 타임 유닛(time unit, TUs)으로 표현되고, 침묵 기간의 지속기간으로 설정된다.

The silent duration duration field is expressed as the time unit (time unit, TUs) and it is set up as the duration of the silent period.

침묵 오프셋 필드는 TUs로 표현되고 침묵 카운트 필드에 의해 명시된 TBTT로부터 침묵 기간의 시작시점의 오프셋 값으로 설정된다. 침묵 오프셋 필드의 값은 하나의 비콘 간격보다 적다.

It is set up as the offset value of the start time point of the silent period from TBTT in which the silence offset field is expressed as the TUs and which is clarified by the silence count field. The value of the silence offset field is less than those of one beacon interval.

침묵 요소가 AP에 의해 STA에게 전송될 때, AP와 STA은 다음과 같이 동작할 수 있다.

When the silence element is transmitted with AP to STA , AP and STA can operate like the next.

BSS의 AP는 비콘 프레임 및/또는 프로브 응답 프레임을 통하여 하나 또는 그 이상의 침묵 요소들을 전송하여 침묵 기간들을 스케쥴링할 수 있다. AP는 요청이 있을 경우 침묵 기간들의 스케쥴링을 중단하거나 침묵 요소의 각 필드의 값을 변경할 수 있다. 가장 최근에 전송된 침묵 요소의 각 필드값에 의해 이후 AP와 STA의 동작이 이루어지므로, 침묵 요소의 각 필드의 값이 변경되어 전송되면, 변경 이전에 비콘 프레임 또는 프로브 응답 프레임을 통하여 전송된 침묵 요소는 폐기할 수 있다.

AP of BSS transmits one or more silence elements through the beacon frame and/or the probe response frame and silent periods can be scheduled. In case it has the request AP discontinues the scheduling of the silent periods or the value of each field of the silence element can be changed. Most, recently, then the operation of STA and AP is made with each field data of the transmitted silence element. Therefore if the value of each field of the silence element is changed and the value is transmitted , the beacon frame or the silence element transmitted through the probe response frame previously can discard the change.

IBSS의 경우 DFS 소유자(owner)의 지위를 갖는 STA만이 IBSS를 설립하는 최초의 비콘 프레임을 통하여 하나 또는 이상의 침묵 요소들을 전송하여 침묵 기간들의 일정(schedule)을 규정할 수 있다. IBSS의 모든 STA들은 전송된 비콘 프레임 또는 프로브 응답 프레임에 침묵 요소들을 포함시켜 침묵 기간 스케쥴을 지속할 수 있다.

In case of IBSS, one or the silence elements described in the above is transmitted through the initial beacon frame in which it sets up IBSS only STA having the rung of the DFS owner and the given (schedule) of the silent periods can be prescribed. Silence elements are included in the beacon frame or the probe response frame in which all STA of IBSSs are transmitted and the silent period schedule can be continued.

복수의 독립적인 침묵 기간들이 스케쥴링될 수 있다. 비콘 프레

Multiple independent silent periods can be scheduled.

임 또는 프로브 응답 프레임에 포함되는 복수의 침묵 요소들 각각의 침묵 기간들은 TBTT에 동일한 타이밍 관계를 갖지 아니할 수 있다.

The beacon frame or the multiple silence element each silent periods included in the probe response frame doe s not have the same timing relationship on TBTT.

채널의 제어는 침묵 인터벌의 시작과 함께 잃게 되며, 침묵 인터벌의 길이 동안 BSS의 모든 STA들은 NAV(network allocation vector)를 설정한다. BSS의 STA에 의한 주채널 및 보조 채널에서의 MPDU 및 MPDU와 연관된 확인 메시지의 전송은 침묵 인터벌이 시작되기 전에 완료되어야 한다. 만일 침묵 인터벌이 시작되기 전까지의 기간이 어느 MPDU의 전송에 필요한 시간에 못 미치는 경우 STA은 현재의 경쟁 윈도우를 이용하여 랜덤 백오프 시간을 선택하여 해당 MPDU의 전송을 연기하여야 한다. MPDU 전송의 연기로 인하여 MSDU 또는 A-MSDU를 위한 단기 재시도 카운터(short retry counter) 및 장기 재시도 카운터(long retry counter)는 영향을 받지 아니한다.

The control of the channel is for the establishment of all STAs of BSS for the length of the silence interval is the NAV (network allocation vector) it loses with the b eginning of the silence interval. The transmission of MP DU at the main channel by STA of BSS and the second ary channel and the acknowledgement message related to MPDU have to be completed before the silence inter val starts. STA not chooses the random backoff time in the time required for the transmission of a MPDU in cas e the urogmphus using the current contention window and the period to total has to postpone the transmissio n of the corresponding MPDU that the silence interval s tarts. The short-term restart for MSDU or the A-MSDU the counter (short retry counter) and long-term restart the counter (long retry counter) is not affected due to the smoke of the MPDU transmission.

채널에 레이더 신호가 존재하는지 검사하기 위하여 STA은 규제조건에 따른 레이더의 존재가 검사되지 아니하면 해당 채널에서 전송을 수행하지 아니한다.

If the presence of the radar according to the restriction condition is not tested, STA does not perfor m the transmission in the corresponding channel to insp ect whether radar signal exist in the channel.

만일 레이더 신호가 검출되면, BSS는 새로운 운영 채널로 이전될 수 있다.

If the radar signal is detected BSS can be transferred to the new operation channel.

상술한 침묵 IE 는 BSS내의 다른 STA으로 인한 간섭없이 채널을 측정하기 위해 사용되었다. 상술한 침묵 IE 는 운영채널의 모든 서브 채널을 침묵시킨다. 그런데 운영 채널은 복수의 서브 채널로 구성될 수 있으며, 일부의 서브 채널은 DFS 대역 이외의 대역에 있을 수 있다. DFS 대역 내의 채널에 레이더 신호가 존재하는지 여부를 점검하기 위하여 DFS 대역 이외에 존재하는 서브 채널까지 침묵시키는 것은 무선자원의 효율적인 활용을 저해한다. 이러한 문제점은 넓은 대역의 채널 대역폭을 지원하는 VHT 무선랜 시스템에서 빈번히 발생할 수 있다.

So that the above-described silence IE measure the channel without the interference due to dissimilar STA within BSS the channel was used. The above-described silence IE mutes all sub channels of the operation chan nel. But the operation channel can consist of multiple s ub channels and the partial sub channel can be in the band except the DFS band. The efficient application of the radio resource is hindered to mute to the sub chan nel existing besides the DFS band it checks out whethe r the radar signal exists in the channel within the DFS b and or not. Such problem can be frequently generated i n the VHT wireless LAN-system supporting the channel bandwidth of the wide band.

도 7은 넓은 대역의 동작 채널을 지원하는 무선랜 시스템에서 발생할 수 있는 상술한 문제점을 예시한 것이다.

The above-described problem of being generated in the wireless LAN-system in which fig. 7 supports the workin g channel of the wide band is exemplified.

도 7의 예에서 무선랜 시스템은 80MHz의 대역폭을 갖는 제1 채널과 80MHz의 대역폭을 갖는 제2 채널로 구성된 동작채널을 가진다. 제2 채널은 DFS 대역에 존재하고 제1 채널은 DFS 대역 외의 채널이다. 이와 같은 상황에서 DFS 대역의 제2 채널의 대역에 레이더 신호가 존재하는지 여부를 검사하기 위하여 침묵시키는 경우 제1 채널과 제2 채널 모두 침묵 기간 동안 사용될 수 없다. 그러나 DFS 대역 밖의 채널인 제1 채널을 침묵시키는 것은 무선 자원의 낭비를 초래한다. 본 발명은 이러한 문제점을 해결하기 위한 방법을 제시한다.

The wireless LAN-system in the example of fig. 7 has the primary channel having the bandwidth of 80MHz an d the working channel consisting of the second channel having the bandwidth of 80MHz. The second channel e xists in the DFS band and the primary channel is the ch annel of the DFS out-of-band. In order to examine acc eptance and rejection the radar signal exists in the ban d of the second channel of the DFS band in this kind of the situation, it cannot be altogether used for the silen t period with that case, the primary channel and the se cond channel it mutes. But the waste of the radio reso urce is caused to mute the primary channel which is th e channel of the DFS out-of-band. The invention provi des the method for solving such problem.

도 8은 본 발명의 일 실시예에 따른 채널의 활용 방법을 나타낸 것이다.

Figure 8 shows the utilization method of the channel according to a preferred embodiment of the present inv

ention.

도 7의 예와 같이 각각 80MHz의 대역폭을 갖는 제1 채널과 제2 채널로 구성된 동작채널을 갖는 무선랜 시스템에서의 동작을 가정한다. 제1 채널은 주채널로서 DFS 대역 밖에 위치하며 제2 채널은 부채널로서 DFS 대역에 위치한다. 본 발명의 실시예에 의하면 제2 채널을 침묵시키는 경우에 필요에 따라 제1 채널을 침묵시키지 아니할 수 있다. 즉, 종래와 같이 모든 채널을 침묵시키는 것과 달리 각각의 주파수 대역 또는 서브채널별로 해당 채널을 침묵시킬지 여부를 STA에게 지시할 수 있다.

The operation at the wireless LAN-system having the primary channel having the bandwidth of 80MHz like th e example of fig. 7 and the working channel consisting of the second channel is assumed. The second channel is positioned in the DFS band as the subchannel while t he primary channel is positioned as the main channel a bout the DFS band. According to the embodiment of th e present invention., the primary channel is not muted i n as necessary in case of muting the second channel. That is, it can indicate to STA if the corresponding cha nnel is muted according to each frequency band or the sub channel in the different manner as muting all chann els like the convention.

도 8의 예에서 제2 채널은 침묵시키고 제1 채널은 침묵시키지 아니할 수 있다. 이러한 경우 제2 채널의 침묵 인터벌 동안 제1 채널을 통해 프레임의 전송/수신이 가능하다. 즉, 동작 채널을 구성하는 일부 채널을 이용한 프레임의 전송/수신이 금지되는 경우에도 금지되지 아니한 채널을 통해 프레임을 전송/수신할 수 있도록 하여 무선자원 활용의 효율 향상을 꾀할 수 있다.

In the example of fig. 8, the second channel mutes and the primary channel does not mute. In this case, the tr ansmission / reception of the frame is possible for the s ilence interval of the second channel through the prima ry channel. That is, even in case the transmission / rec eption of the frame using the partial channel comprising the working channel is forbidden the frame is received t hrough the channel which is not prohibited with the tra nsmission / and the efficiency enhancement of the radi o resource application can be sought.

달리 표현하면, 동작채널을 구성하는 각 서브채널별로 특정 기간 동안의 사용 금지여부를 결정하여 STA에게 알려주어 각 서브채널의 상황에 따라 서브채널의 사용 가부를 STA이 알수 있도록 하는 것이다.

Differently, if it expresses prohibition on use acceptance and rejection for the specified period are d etermined according to each sub channel comprising th e working channel and it informs STA of something and STA knows the use right or wrong of the sub channel a ccording to the situation of each sub channel.

제2 채널의 사용이 금지되고 제1 채널의 사용이 허락되는 경우 STA은 사용이 허락된 제1 채널을 이용할 수 있다. 만일 AP가 제1 채널 및 제2 채널 각각에 대해 개별적인 RF 체인(chains)을 가지고 동작하고 있었다면, 해당 침묵 구간 동안 제1 채널을 사용하여 non-AP STA들과 마찬가지로 통상적인 통신을 할 수 있다. 본 발명의 실시예에 의하면 개별 서브 채널 별로 사용 금지 여부를 알리기 위하여 도 6의 침묵 요소에서 정의된 정보 이외의 추가적인 정보가 전송될 수 있다. 본 발명의 실시예에서 STA에게 제공하는 추가 정보는 도 6의 침묵 요소와 함께 전송되거나 또는 독립적으로 전송될 수 있으며, 별개의 정보 요소로 STA에게 전송될 수 있다. 침묵 채널 요소는 별개의 관리/제어 프레임을 통해 전송되거나 비콘 프레임 또는 프로브 응답 프레임에 포함되어 전송될 수도 있다.

STA in which the use of the second channel is forbidden and the use of the primary channel is authori zed can use the primary channel in which the use is au thorized. If it operated AP respectively confronting wit h the primary channel and the second channel and havi ng the individual RF chain (chains) , it can communicat e for the corresponding silent period using the primary channel like non-AP STAs. Normal. According to the em bodiment of the present invention., the additional infor mation except the information defined in the silence ele ment of fig. 6 can be transmitted in order to especially inform prohibition on use acceptance and rejection with the discrete subchannel. In an embodiment of the inve ntion, additional information : provided to STA is trans mitted with the silence element of fig. 6 or it can be in dependently transmitted and it can be transmitted to t he separate information element to STA. The silence c hannel element is transmitted through the separate ad ministration / control frame or it can be contained and transmitted in the beacon frame or the probe response frame.

이하에서는 침묵 요소와 별개의 정보 요소(Information Element, IE)로 STA에게 전송되는 경우를 예로 설명한다. 이하에서 본 발명의 실시예에 따라 제공되는 정보 요소를 도 6의 침묵 요소와 구별하기 위하여 침묵 채널 정보요소(Quiet Channel IE)라고 칭하기로 한다. 이하에서 '침묵 채널 IE'라는 명칭 및 침묵 채널 IE에 포함되는 정보가 설정되는 필드의 명칭은 예시에 불과하며, 침묵 채널 IE에 포함되는 정보는 필요에 따라 생략되거나 다른 정보가 더 추가될 수 있다.

Hereinafter, for example, the silence element and the case of being transmitted to the separate information e lement (Information Element, IE) to STA are illustrated the name of the field in which the information which de cides to call as the silence channel information element (Quiet Channel IE) it distinguishes between the provide d information element and the silence element of fig. 6 according to the embodiment of the invention hereinaft er is included in the name called 'silence channel IE' an

d silence channel IE is established is nothing but the ex ample and the information included in the silence chann el IE is omitted as necessary or the other information c an be added.

도 9는 본 발명의 실시예에 따른 침묵 채널 IE 의 포맷의 일례을 나타낸 블록도이다.

Figure 9 is a block diagram showing an example of the format of the silence channel IE according to a preferre d embodiment of the present invention.

침묵 채널 IE 는 요소 식별자 필드, 길이 필드, 상태 플래그 필드, 침묵 운영 클래스 필드 및 침묵 채널 번호 필드를 포함할 수 있다.

The silence channel IE comprises the element identifier field, the length field, the state flag field, the silence o peration class field and the silence channel number fiel d.

요소 식별자 필드는 본 정보 요소가 침묵 채널 IE 임을 지시하는 값으로 설정될 수 있다. 길이 필드는 길이 필드 이후에 부가되는 필드의 길이를 지시할 수 있다.

It can be set up as the value in which the element identifier field indicates that this information element is the silence channel IE. The length field can indicate th e length of the added field after the length field.

AP 상태 플래그 필드는 동작 채널 중 일부만이 침묵 채널 IE 에 의해 침묵 기간 동안 사용이 금지되는 경우 침묵 채널 IE 에 의해 사용이 금지되지 아니하는 채널에서의 AP 동작에 관한 정보를 제공한다. 즉, 도 8의 예에서 침묵 채널 요소를 통해 제2 채널만 침묵시키는 경우 제1 채널에서의 AP의 동작을 지시할 수 있다. AP가 제1 채널에서 STA과 프레임을 전송/수신할 수 있는지 여부를 지시할 수 있다. 일례로 AP 상태 플래그 필드는 1 비트로 표현되어 필드값이 '1'로 설정되면, AP가 제1 채널에서 STA과의 프레임 전송/수신이 가능하다는 것을 지시할 수 있다. 만일 필드값이 '0'으로 설정되면 AP가 침묵기간 동안 제1 채널을 이용하여 STA과 프레임을 전송/수신할 수 없음을 지시할 수 있다. AP가 단일 RF 체인을 사용하고 있어서 제2 채널에서의 레이더 신호를 검사하는 중에는 제1 채널을 통해서 STA과 프레임을 전송/수신할 수 없다거나, 채널 상황이나 행정적 규제 등으로 AP가 침묵기간 중 제1 채널을 사용할 수 없거나 바람직하지 아니한 경우에는 AP 상태 플래그 필드를 0으로 설정하여 AP가 제1 채널에서 프레임의 전송/수신이 불가능하다는 것을 알려 줄 수 있다.

The AP state flag field provides the information about the AP operation at the channel in which the use is not forbidden by the silence channel IE in which the use is forbidden by the silence channel IE for the silent period among the working channel only the part. That is, in th e example of fig. 8, the operation of AP at the primary channel muted in the second channel can be indicated through the silence channel element. In AP is the prima ry channel, it can indicate whether STA and frame can be received with the transmission / or not. For exampl e, if the AP state flag field is expressed as the single bi t and field data are set up as '1' AP can indicate in the primary channel that the frame forwarding / reception with STA is possible. It can indicate that AP cannot re ceive STA and frame for the silent period using the pri mary channel with the transmission / if field data are s et up as '0'. STA and frame cannot be received in the middle in which AP uses the single RF chain and inspect ing the radar signal at the second channel through the primary channel with the transmission / or in case of A P using the primary channel as the state of channel or the administrative regulation etc. among the silent peri od or doing not the be desirable paper the AP state fla g field is set up as 0 and AP can inform in the primary c hannel that the transmission / reception of the frame is impossible.

침묵 운영 클래스 필드는 특정 지역/국가의 운영 클래스를 지시하는 값으로 설정될 수 있다. 침묵 운영 클래스 필드에 이어지는 침묵 채널 번호 필드는 해당 운영 클래스의 채널 셋 내의 특정 채널을 지시하는 값으로 설정될 수 있다. 즉, 침묵 운영 클래스 필드를 통해 국가별로 정해진 운영 클래스 값을 알려주고, 이어지는 침묵 채널 번호 필드를 통해 구체적으로 침묵시키고자 하는 채널의 번호를 알려줄 수 있다. 일례로 도 8의 예에서 제2 채널을 침묵시키고자 할때, 침묵 운영 클래스 필드를 특정 국가를 지시하는 값으로 설정하고, 침묵 채널 번호 필드에는 채널 번호 116을 설정할 수 있다. 침묵 운영 클래스 필드와 침묵 채널 번호 필드의 쌍은 하나의 20MHz 채널을 침묵시킬 대상 채널로 지시할 수 있다. 따라서 도 8의 예에서 제2 채널을 침묵시키기 위하여 4개의 침묵 운영 클래스 필드, 침묵 채널 번호 필드 쌍이 필요할 수 있다. 이때 4개의 침묵 채널 번호 필드는 각각 채널 번호 116, 채널 번호 120, 채널 번호 124, 채널 번호 128번을 지시하는 값으로 설정될 수 있다.

It can be set up as the value in which the silence operation class field indicates the operation class of th e specific area / country. It can be set up as the value in which the silence channel number field coming in con tinuously at the silence operation class field indicates t he special channel within the channel set of the corres ponding operation class. That is, the determined operat ion class value is informed with each country to the sil ence operation class field and the number of the chann el to mute in the specifically can be informed to the co nnected silence channel number field. In the example o f one example furnace drawing 8, when the second cha nnel tries to be muted the silence operation class field i s set up as the value indicating the specific country an d the channel number 116 can be set up in the silence channel number field. The pair of the silence channel n umber field and silence operation class field can indicat e to the object channel muting one 20MHz channel. Th erefore, in the example of fig. 8, the silence operation

class field of 4, and the silence channel number field pa ir can need in order to mute the second channel. Then, it can be set up as the value in which 4 silence channe l number fields indicate the channel number 116, the ch annel number 120, the channel number 124, the chann el number 128 burn.

STA은 침묵 채널 요소를 AP로부터 수신하여 침묵 기간 동안 사용이 금지되는 대상 채널을 알게 되고, 침묵 기간동안 해당 채널(본 예에서의 제2 채널)에서의 프레임 전송/수신을 하지 아니한다. 이때 침묵 채널 요소를 수신한 STA은 침묵 기간 동안 NAV를 설정할 수 있다.

STA receives the silence channel element from AP and the object channel in which the use is forbidden for the silent period is known and the frame forwarding / recep tion at the corresponding channel (the second channel at this example) is not received for the silent period. T hen, STA receiving the silence channel element is for t he establishment of NAV for the silent period.

AP는 침묵 기간 동안 제2 채널에서는 레이더 신호의 존재 여부를 검사하게 되고, 제1 채널에서는 상술한 AP 상태 플래그 필드의 설정에 따라 STA과 프레임을 전송/수신할 수 있다.

In AP is the second channel for the silent period, the presence of the radar signal is inspected and STA and f rame can be received according to the setting of the A P state flag field describing in detail in the primary chan nel with the transmission /.

도 10 및 도 11은 본 발명의 실시예에 따른 침묵 채널 요소 포맷의 다른 일례이다.

Figures 10 and 11 are an example of the silence channel element format of being different according to the embodiment of the invention.

침묵 채널 요소는 요소 ID(Element ID) 필드, 길이(Length) 필드, BSS 가용 채널 대역폭(BSS Usable Channel Width) 필드, AP 침묵 모드(AP Quiet Mode) 필드, 침묵 카운트(Qui et Count) 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드를 포함한다.

The silence channel element comprises the element ID field, the length field, the BSS available channel bandwi dth (BSS Usable Channel Width) field, the AP quiet mod e field, the silence count (Quiet Count) field, the silenc e period field, and the silent duration duration field, and the silence offset field.

요소 ID 필드 및 길이 필드의 설정 및 해당 필드가 지시하는 바는 도 9의 예에서 설명한 바와 같다.

The thing which the setting of the element ID field and length field and correspond field indicates is the same li ke it illustrates in the example of 9.

BSS 가용 채널 대역폭 필드는 침묵 IE에 의해 지시되는 기간 동안 BSS내 STA들에 의해 사용이 허용되는 채널 대역폭을 지시한다. 예를 들어, 주 80MHz일 경우 이 필드는 0으로 설정된다. 또 다른 예로, 주 20MHz인 경우 0, 주 40MHz인 경우 1, 주 80MHz인 경우 2로 설정된다.

The BSS available channel bandwidth field indicates the channel bandwidth in which the use is allowed by STAs for the period indicated with the silence IE within BSS. For example, this field is set up as 0 in case of being th e main part 80MHz. In case of being the dissimilar main part 20MHz in case of being 0, and the main part 40MH z in case of being 1, and the main part 80MHz also it is set up as 2.

AP 침묵 모드 필드는 침묵 기간들 동안 STA 동작을 특ㅈ경한다. BSS 가용 채널 대역폭에 의해 지시되는 채널상에서 AP로의 통신이 허용되면, AP 침묵 모드 필드는 1로 설정된다. 그렇지 않은 경우 0으로 설정된다.

The AP silence mode field is the STA operation the extra-large ㅈ *** for silent periods. If the communicat ion to AP is allowed on the channel indicated with the BSS available channel bandwidth , the AP silence mode field is set up as 1. Otherwise, it is set up as 0.

침묵 카운트 필드는 다음 침묵 기간이 시작되는 시점을 포함하는 비콘 간격까지의 TBTT의 수로 설정될 수 있다. 즉 침묵 카운트 필드가 1로 설정되면 다음 TBTT에서 시작되는 비콘 간격 동안에 침묵 기간이 시작됨을 지시한다. 0 값은 예비의 값으로 사용된다.

The silence count field the next silent period can be set up as the number of TBTT to the beacon interval in cluding the start points. That is, it indicates that the si lent period is initiated for the beacon interval initiated i n the next TBTT if the silence count field is set up as 1. 0 value is used as the value of the back up.

침묵 주기 필드는 침묵 채널 IE에 의해 정의된 정기적인 침묵 기간들의 시작점간 비콘 인터벌들의 수로 설정된다. 0으로 설정된 값은 침묵 기간이 주기적으로 설정된 것이 아님을 지시한다.

It is set up as the number of the beacon intervals between the initial point of the regular silent periods in which the silence period field is defined with the silence channel IE. 0 the set value indicates that the silent per iod is not periodically set up.

침묵 지속기간 필드는 타임 유닛(time unit, TUs)으로 표현되고, 침묵 기간의 지속기간으로 설정된다.

The silent duration duration field is expressed as the time unit (time unit, TUs) and it is set up as the duration of the silent period.

침묵 오프셋 필드는 TUs로 표현되고 침묵 카운트 필드에 의해 명시된 TBTT로부터 침묵 기간의 시작시점의 오프셋 값으로 설정된다. 침묵 오프셋 필드의 값은 하나의 비콘 간격보다 적다.

It is set up as the offset value of the start time point of the silent period from TBTT in which the silence offset field is expressed as the TUs and which is clarified by the silence count field. The value of the silence offset field is less than those of one beacon interval.

도 10의 침묵 채널 IE가 단독으로 지시 프레임(일례로, 비콘 프레임 또는 프로브 응답 프레임)에 포함되어 전송되면, 이러한 침묵 채널 IE를 해독할 수 있는 VHT STA들과 같은 개량된 장치(enhanced device)들만, BSS 가용 채널 대역폭 필드에 의해 특정되는 비-DFS 대역을 제외한 DFS 대역에서 침묵시킬 수 있다. 침묵 IE없이 침묵 채널 IE가 독립적으로 지시 프레임에 포함되어 전송되면, 침묵 채널 IE를 인식할 수 없는(또는 지원하지 아니하는) 비-VHT STAs와 같은 레거시 장치들은 침묵 채널 IE를 해독하지 못함과 동시에 침묵 IE도 수신하지 않았으므로 전혀 침묵 관련한 동작을 수행하지 않는다.

If the silence channel IE of fig. 10 is independently contained and transmitted in the indication frame (for example, the beacon frame or the probe response frame) apparatus (enhanced device) like VHT STAs can decode can mute such silence channel IE in the DFS band except for the non- DFS band specified with the BSS available channel bandwidth field. Improved. If the silence channel IE is independently contained and transmitted without the silence IE in the indication frame since the legacy device like the non- VHT STAses which could not recognize the silence channel IE (it does not support) were unable to decode the silence channel IE and the silence IE did not receive at the same time the operation relating with silence is not performed at all.

반면 VHT STAs와 같은 개선된 장치들은 도 10의 침묵 채널 IE를 수신하여 해독할 수 있으므로 해당 침묵 기간 동안 BSS 가용 채널 대역폭 필드에서 지시하는 비-DFS 대역을 제외한 DFS 대역에서만 침묵하고, BSS 가용 채널 대역폭 필드에서 지시하는 비-DFS 대역에서는 정상적인 통신을 할 수가 있다. 이때 AP 침묵 모드 필드값에 따라 AP와 STA간의 통신이 해당 비-DFS 대역에서 허용되는지 여부도 추가 지시할 수 있다. 이하에서 침묵 채널 IE를 인식할 수 있는 STA 의 일례로 VHT STA을 들어 설명하나 이는 설명의 편의를 위한 것으로 VHT STA은 침묵 채널 IE를 이용한 채널의 선별적 침묵 방법을 지원하는 STA을 대표하는 것으로 이해되어야 한다.

On the other hand, since it receives the silence channel IE of fig. 10 and the improved apparatus like the VHT STAses can decode it keeps silence for the corresponding silent period in the DFS band except for the non- DFS band indicated in the BSS available channel bandwidth field and the normal communication can be in the non- DFS band indicated in the BSS available channel bandwidth field. Then, according to AP quiet mode field data, also whether the communication between STA and AP are allowed in the corresponding non- DFS band or not can direct the addition. Hereinafter, it has to be understood that STA supporting the selective keeping method of the channel which for example, gives the VHT STA and which it illustrates but in which this is for the convenience of the description and in which the VHT STA uses the silence channel IE of STA recognizing the silence channel IE is represented.

본 발명의 실시예에 따르면, 도 10의 예와 같은 침묵 채널 IE는 침묵 IE의 전송여부와 무관하게 전송될 수 있다. 침묵 채널 IE가 독립적으로 전송될 때, 비-DFS 대역에서 동작하는 non-VHT STAs은 침묵 기간 동안 계속해서 정상적인 통신을 수행할 수 있다는 이점을 가질 수 있다.

According to the embodiment of the invention, it has no concern with the transmission of the silence IE the silence channel IE like the example of fig. 10 can be transmitted. When the silence channel IE is independently transmitted , it can have the advantage that the non-VHT STAs operating in the non- DFS band and then can perform the normal communication for the silent period.

침묵 채널 IE가 항상 도 6의 침묵 IE 함께 전송된다면, 침묵 채널 IE를 인식할 수 없는 STAs들은 침묵 IE만을 인식하여 침묵 기간 동안 비-DFS 대역에서조차 프레임을 전송/수신할 수 없다. 이에 반하여 본 발명이 제안하는 도 10의 침묵 채널 IE는 침묵 IE를 대체하여 지시 프레임에 포함되어 전송되므로, 침묵 채널 IE를 인식하지 못하는 STAs들은 침묵 채널 IE의 전송과 무관하게 동작을 지속할 수 있다. 반면 침묵 채널 IE를 인식하는 VHT STAs들은 침묵 채널 IE의 각 필드값의 설정에 따라 해당 채널에서의 동작을 결정할 수 있다.

If the silence channel IE is always together transmitted with the silence IE of fig. 6 STAses which cannot recognize the silence channel IE recognize only the silence IE and the frame cannot be received by the non- DFS band for the silent period with the transmission /. Thus, the silence channel IE of fig. 10 which the invention which is obvious suggests replaces the silence IE and it is contained and transmitted in the indication frame. Therefore it has no concern with the transmission of the silence channel IE STAses which are unable to recognize the silence channel IE can continue the operation. On the other hand, VHT STAses recognizing the silence channel IE can determine the operation at the correspondi

ng channel according to the setting of each field data of the silence channel IE.

도 11은 도 10의 침묵 채널 IE 포맷에서 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간, 침묵 오프셋 필드가 생략된 형태이다. 도 11의 침묵 채널 IE에서 생략된 필드들은 침묵 기간의 설정에 관련된 정보를 포함하는 필드들이다. 침묵 채널 IE가 침묵 IE와 함께 전송되는 경우 침묵 기간의 설정은 침묵 IE에 의해 이루어질 수 있으므로 중복될 수 있는 해당 정보를 담은 필드는 생략될 수 있다. 또는 AP 침묵 모드 필드가 0으로 설정되는 경우, 즉 침묵 기간 동안 AP가 BSS 가용 채널 대역폭 필드가 지시하는 서브 채널에서 STA들과 프레임을 전송/수신하는 것이 허용되지 아니하는 경우에는 침묵 카운트(Quiet Count) 필드, 침묵 주기 필드, 침묵 지속기간, 침묵 오프셋 필드의 설정이 불필요하다. 따라서, AP 침묵 모드 필드가 0으로 설정되는 경우에는 도 11의 포맷이, AP 침묵 모드 필드가 1로 설정되는 경우에는 도 10의 포맷이 사용될 수 있다.

In fig. 11 is the silence channel IE format of 10, it is the form in which the silence count field, silence period field, silent duration period, silence offset field is omitted. It is fields where fields the silence channel IE of fig. 11 omitted from the silence channel IE of fig. 11 include the related information in the setting of the silent period. The field containing the corresponding information which can be overlapped since the setting of the silent period in which the silence channel IE is transmitted with the silence IE can be made with the silence IE can be omitted. Or in case it is not allowed for the case, where the AP silence mode field is set up as 0 in other words, the silent period that AP receives STAs and frame by the sub channel which the BSS available channel bandwidth field instructs with the transmission / the setting of the silence count (Quiet Count) field, the silence period field, the silent duration period, the silence offset field is unnecessary. Therefore, in case the AP silence mode field of the format of fig. 11 is set up as 1 in case the AP silence mode field is set up as 0 the format of fig. 10 can be used.

도 12 및 도 13은 본 발명의 실시예에 따른 침묵 채널 IE 포맷의 다른 일례를 나타낸 것이다.

Figures 12 and 13 show an example of the silence channel IE format according to a preferred embodiment of the present invention of being different.

도 12의 침묵 채널 IE는 요소 ID 필드와 길이 필드 및 AP 침묵 모드 필드를 포함한다. 요소 ID 필드는 해당 필드를 포함하는 본 IE가 침묵 채널 IE임을 식별할 수 있도록 하는 IE 식별자 정보를 포함한다. 길이 필드는 IE의 길이 정보를 포함한다. 일례로 길이 필드 이후에 포함되는 필드들의 길이의 합이 길이 필드의 값으로 설정될 수 있다.

The silence channel IE of fig. 12 comprises the element ID field, the length field, and the AP silence mode field. The IE identifier information which distinguishes that this IE in which the element ID field includes the corresponding field is the silence channel IE is contained. The length field includes the length information of IE. For example, the sum total of the length of the included fields can be established after the length field as the value of the length field.

AP 침묵 모드 필드의 설정 및 기능은 앞서 도 10, 도11에서 설명한 바와 같다. 즉, 침묵 기간 동안 AP의 동작, AP와 결합되어 있는 STA들의 동작을 지시한다. 일례로, AP 침묵 모드 필드는 침묵 기간 동안 AP가 AP와 결합된 SAT과 프레임을 전송/수신하는 것을 허용하는 경우 1로 설정될 수 있다. 다시 말해서 AP 침묵 모드 필드가 1로 설정되었다 함은 동작 채널을 구성하는 복수의 서브 채널 중 일부 채널은 침묵 기간 동안 침묵되지 아니함을 의미한다. 이때, AP와 STA들은 침묵되지 아니하는 채널을 이용하여 통신(프레임을 전송/수신) 할 수 있다.

The setting and function of the AP silence mode field are same as those of the before illustrates in 10, and fig. 11. That is, the operation of AP, and the operation of STAs combined with AP are indicated for the silent period. For example, the AP silence mode field can be set up for the silent period in case the allowable as 1 that AP receives combined SAT and frame with AP with the transmission /. In other words, it means among multiple sub channels in which it configures the working channel that the AP silence mode field was set up as 1 it does that the partial channel does not become silence for the silent period. Then, it can do using the channel in which AP and STAs does not become silence with the communication (the transmission / reception the frame).

도 12의 침묵 채널 IE는 침묵되지 아니하는 서브채널(침묵 기간 동안AP와 STA이 통신할 수 있는 서브채널 또는 채널 대역폭)을 지시하는 필드를 포함하고 있지 아니하다. 도 12의 침묵 채널 IE가 사용될 때, 도 12의 침묵 채널 IE에 의해 정의되지 아니하는 침묵 기간 및 침묵 기간 동안 AP 침묵 모드 필드의 설정에 따라 AP와 STA간 프레임 전송/수신이 이루어질 수 있는 채널은 다른 IE(e.g. 침묵 IE)에 의해 정의되거나 AP와 STA간 약속되어 있는 기 설정된 값/채널로 정의될 수 있다.

The field indicating sub channel (the sub channel or the channel bandwidth in which the silence during the period AP and STA can communicate) in which the silence channel IE of fig. 12 does not become silence is not comprised. When the silence channel IE of fig. 12 is used it is defined with the IE (E g. silence IE) in which the silent period and the channel in which the frame forwarding / reception can be made for the silent period according to the setting of the AP silence mode field in AP and STA are different is not defined with the silence channel IE of fig. 12 or it can be defined as the predet

ermined value / channel promised between AP and ST A.

일례로 DFS 대역의 80MHz 부 채널이 침묵될 때, AP 침묵 모드 필드값의 설정에 따라 AP와 STA간 프레임 교환이 가능한 채널로 80MHz 주 채널이 사용될 것임을 미리 정의하여 사용될 수 있다. 이러한 경우 AP는 AP 침묵 모드 필드가 1로 설정된 침묵 채널 IE를 수신한 경우 침묵 기간 동안 주 80MHz 채널의 대역폭 내에서(within) STA들과 통신할 수 있다.

For example, when 80MHz subchannel of the DFS band becomes silence it defines in advance being the thing i n which 80MHz main channel is used as the channel in which the frame switching is possible according to the setting of AP quiet mode field data between AP and ST A and it can be used. In this case, in case AP receives the silence channel IE in which the AP silence mode fiel d is set up as 1 it can communicate through the in-ban d (within) of the main part 80MHz channel for the silent period with STAs.

도 12의 침묵 채널 IE 포맷이 사용될 때, 침묵 기간은 도 12의 침묵 채널 IE와 함께 전송되는 침묵 IE에 의해 정의될 수 있다. 즉, 도 6의 침묵 IE가 침묵 채널 IE와 함께 지시 프레임(e.g. 비콘 프레임 또는 프로브 응답 프레임)을 통해 STA에게 전송되면, STA들은 침묵 IE의 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드 및 침묵 오프셋 필드로 정의된 침묵 기간에 의해 동작할 수 있다.

When the silence channel IE format of fig. 12 is used , it can be defined with the silence IE in which the silent period is transmitted with the silence channel IE of 12. That is, if the silence IE of fig. 6 is transmitted with th e silence channel IE through the indication frame (the e g. beacon frame or the probe response frame) to ST A , STAs can operate with the silence count field of th e silence IE, the silence period field, and the silent dura tion duration field and the silent period defined as the s ilence offset field.

도 13의 침묵 채널 IE 포맷은 도 12의 포맷에 비하여 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드 및 침묵 오프셋 필드를 더 포함한다. 즉, 도 13의 포맷은 침묵 기간의 설정에 필요한 정보를 포함하고 있다. 도 13의 포맷은 침묵 IE와 독립적으로 전송될 수 있다. 다시 말해서 침묵 IE 없이 도 13의 포맷의 침묵 채널 IE만을 포함하는 지시 프레임이 전송될 수 있다.

The silence channel IE format of fig. 13 is the format of 12 the silence count field, silence period field, and the silent duration duration field and silence offset field furt her are included. That is, the format of fig. 13 includes the necessary information in the setting of the silent p eriod. The format of fig. 13 can be independently trans mitted with the silence IE. In other words, the indicatio n frame including only the silence channel IE of the for mat of fig. 13 can be transmitted without the silence I E.

AP 침묵 모드 필드가 0으로 설정되는 경우에는 침묵 채널 IE에서 침묵 기간이 정의되지 아니할 수 있다. AP 침묵 모드 필드가 0으로 설정되는 경우 침묵 기간 동안 동작 채널의 모든 서브채널이 침묵되기 때문이다. 즉, 모든 STA이 인식할 수 있는 침묵 IE를 전송하는 것만으로 동일한 효과를 얻을 수 있으므로 침묵 채널 IE는 AP 침묵 모드 필드외에 침묵 기간 설정과 관련된 필드들의 전송을 생략할 수 있다. 다시 말해서, AP 침묵 모드 필드가 0으로 설정되는 경우 도 12의 포맷이, AP 침묵 모드 필드가 1로 설정되는 경우 도 13의 포맷이 사용될 수 있다.

The silent period is not defined in the silence channel IE in case the AP silence mode field is set up as 0. All s ub channels of the working channel are due to become silence for the silent period in which the AP silence mod e field is set up as 0. That is, since the same effect ca n be obtained only by transmitting the silence IE which all STAs can recognize the silence channel IE can omit the transmission of field associated with the silence fix ation of period in the AP quiet mode ***. In other wor ds, in that case, the format in which the AP silence mo de field of in that case, the format in which the AP sile nce mode field is set up as 0 of fig. 12 is set up as 1 of fig. 13 can be used.

AP가 도 12의 포맷의 침묵 채널 IE가 전송할 때에는 침묵 기간에 대한 정보를 제공하기 위하여 침묵 IE를 함께 전송할 수 있다. 다시 말해서 도 12의 침묵 채널 IE는 적어도 하나의 침묵 IE와 함께 전송될 수 있다.

So that AP provide the information about the silent period when the silence channel IE of the format of fig. 12 transmits, the silence IE can be together transmitte d. Again, the silence channel IE of the word reelability of cocoon drawing 12 can be transmitted with at least one silence IE.

반면 도 13의 포맷의 침묵 채널 IE는 침묵 IE와 함께 전송되거나 침묵 IE 없이 침묵 채널 IE만이 전송될 수 있다.

The other side the silence channel IE of the format of 13 is transmitted with the silence IE or it can be trans mitted without the silence IE only the silence channel I E.

지금까지 광대역의 동작채널을 지원하는 무선랜 시스템에서 동작채널의 일부 대역 또는 동작 채널을구성하는 복수의 서브 채

So far, in the wireless LAN-system supporting the working channel of the broadband, the keeping method

널 중 일부 채널에 대해 선별적인 침묵 방법을 제안하고, 침묵 기간 동안의 AP와 STA들의 동작을 지시하는 AP 상태 플래그 필드 또는 AP 침묵 모드 필드를 설명하였다.

in which the partial band or the working channel Eul-zo ne under the castle wall of the working channel was sel ective among the multiple sub channels about the parti al channel was proposed and the AP state flag field or the AP silence mode field indicating the operation of AP for the silent period and STAs was illustrated.

실시예에 따라 AP 상태 플래그 필드는 비-침묵 채널에서 침묵 기간 동안 STA들과 통신이 가능한지 여부를 지시하는 것 이외에, AP가 자기 간섭(self-interference) 문제 등으로 인해 송신은 불가하고 수신만 할 수 있다는 지시 비트를 상기 AP 상태 플래그 필드 내에 추가로 설정할 수 있다. 이 경우 STA들이 AP로 데이터 전송을 하고자 할 때는 ACK 정책을 AP로부터의 ACK을 받을 필요가 없는 No-ACK 정책을 채택하여 데이터 전송을 할 수 있다.

According to the embodiment, it indicates whether STAs and communication the AP state flag field are pos sible in the non- silence channel for the silent period. B esides the Indication bit that it can be impossible to as to the transmission, and AP can receive due to the sel f-interference problem etc. can be additionally set up within the AP state flag field. In this case, when STAs try to transmit data to AP the No-ACK policy without t he need to receive ACK from AP is adopted and the ack nowledge policy can be data transmitted.

이하에서는 상기 도 12 또는 도 13의 침묵 채널 IE가 지시 프레임(예로, 비콘 프레임 또는 프로브 응답 프레임)에 포함되어 전송된 경우, AP 또는 비-AP STAs의 동작을 설명한다.

Hereinafter, in case in the above, the silence channel IE of 12 or fig. 13 is contained and transmitted in the i ndication frame (for example, the beacon frame or the probe response frame) the operation of AP or the non-A P STAs is illustrated.

AP는 동작 채널의 일부 대역 또는 일부 서브채널을 침묵 시키기 위하여 침묵 채널 IE를 전송할 수 있다. 침묵 채널 IE는 지시 프레임에 포함되어 전송될 수 있는데, 비콘 프레임, 프로브 응답 프레임은 지시 프레임의 일례이다.

AP can transmit the silence channel IE in order to mute the partial band or the part sub channel of the working channel. The silence channel IE is the beacon frame ca n be contained and transmitted in the indication frame, and the probe response frame are an example of the in dication frame.

AP는 침묵 채널 IE를 침묵 IE와 함께 전송될 수 있다. AP는 현재의 동작채널 중 일부의 대역 또는 서브채널을 침묵시키고자 하는 경우 침묵 채널 IE의 AP 침묵 모드 필드를 1로 설정하여 전송할 수 있다.

AP can be the silence channel IE transmitted with the silence IE. The AP silence mode field of the silence cha nnel IE to mute the partial band or the sub channel is s et up as 1 and AP can transmit among the current wor king channel.

AP는 AP 침묵 모드 필드를 1로 설정하는 경우 도 12 또는 도 13의 포맷의 침묵 채널 IE를 전송할 수 있으며, AP 침묵 모드 필드를 0으로 설정하는 경우 도 12의 포맷을 사용할 수 있다. 도 12의 포맷을 사용하여 침묵 채널 IE를 전송하는 경우 침묵 IE를 함께 전송한다.

AP can transmit the silence channel IE of the format of the figures 12 or 13 setting up the AP silence mode fiel d as 1 and in that case, the format setting up the AP s ilence mode field as 0 of fig. 12 can be used. The silen ce channel IE the silence IE is together transmitted usi ng the format of fig. 12 in case the transmission.

DFS 절차에서 침묵 채널 IE를 전송하는 경우 AP는 침묵 기간 동안 침묵된 채널(Quieted channel)에서 레이더 신호의 존재 여부를 검사하고, 레이더 신호가 존재하는 경우 새로운 동작채널을 선택하고 선택된 새로운 동작채널을 STA들에게 알릴 수 있다.

In the DFS procedure, the presence of the radar signal is inspected in the channel (Quieted channel) in which AP becomes the silence channel IE silence in case the transmission for the silent period and the radar signal c an choose the new working channel in case the presen ce and the selected and new working channel can be i nformed STAs of.

AP 침묵 모드 필드가 1로 설정된 경우 AP는 침묵 기간 동안 비-침묵 채널(non-quieted channel)에서 STA들과 통신할 수 있다.

AP can communicate through the non- silence channel (non-quieted channel) for the silent period with STAs i n case the AP silence mode field is set up as 1.

BSS내의 STA들은 침묵 채널 IE를 인식할 수 있는 VHT STA들과 인식할 수 없는 레거시 STA으로 나뉠 수 있다. 레거시 STA들은 침묵 IE만 해독 가능하며 침묵 IE의 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드의 설정값에 의해 정의되는 침묵 기간동안 자신의 운영 채널에서 프레임의 전송/수신을 하지 아니하고 NAV를 설정하여 채널 접근을 연기한다.

It can be classified into VHT STAs in which STA within BSSs can recognize the silence channel IE and the lega cy STA which it cannot recognize. The transmission / r eception of the frame is not received in its own operati on channel for the silent period which enables to decip her and in which legacy STAs the silence IE is defined with the set value of the silence count, quiet period, sil ent duration period, silence offset field of the silence IE

and NAV is set up and the channel access is postpone d.

VHT STA들은 침묵 채널 IE의 AP 침묵 모드 필드로부터 침묵 기간 동안의 자신의 동작정보를 획득한다. AP 침묵 모드 필드가 0으로 설정된 경우 침묵 기간에 관한 정보는 침묵 채널 IE와 함께 전송되는 침묵 IE의 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드를 통해 획득한다. AP 침묵 모드 필드가 0으로 설정된 경우 침묵 기간 동안 NAV를 설정하고 채널 접근을 연기한다.

VHT STAs obtain its own operation information for the silent period from the AP silence mode field of the silen ce channel IE. It obtains through the silence count, qui et period, silent duration period, silence offset field of t he silence IE in which the information about the silent period is transmitted with the silence channel IE in cas e the AP silence mode field is set up as 0. In case the AP silence mode field is set up as 0 NAV is set up and t he channel access is postponed for the silent period.

AP 침묵 모드 필드가 1로 설정된 경우 침묵 채널 IE가 도 13의 포맷과 같이 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드를 포함하는 경우 해당 필드들로부터 침묵 기간을 획득하고 침묵 기간 동안 부 80MHz 채널에서는 NAV를 설정하고, 주 80MHz 채널 내에서 AP와 프레임을 교환할 수 있다. 만일 침묵 채널 IE가 도 12의 포맷과 같이 침묵 기간을 정의하는데 필요한 정보를 포함하는 필드를 포함하지 아니하는 경우에는 침묵 채널 IE와 함께 전송되는 침묵 IE로부터 침묵 기간 정보를 획득할 수 있다.

In case the AP silence mode field is set up as 1 the silence channel IE obtains the silent period the silence count, quiet period, silent duration period, silence offse t field like the format of fig. 13 in case the includes fro m correspond fields and NAV is set up for the silent peri od in the part 80MHz channel and AP and frame can be exchanged in the main part 80MHz channel. In case of not comprising the field where the silence channel IE d efines the silent period like the format of fig. 12 but inc luding the necessary information the silent period infor mation can be obtained from the silence IE transmitted with the silence channel IE.

AP는 침묵 기간을 폐지/갱신하기 위하여 침묵 IE 및/또는 침묵 채널 IE를 전송할 수 있으며, STA은 자신이 수신한 최신 침묵 IE 또는 침묵 채널 IE를 통해 획득한 침묵 기간 및 침묵 기간 동안의 동작정보를 기반으로 동작한다.

AP can transmit the silence IE and/or the silence channel IE in order to renew the silent period with the waste paper / and STA operates based on the operatio n information for the latest silence IE which oneself rec eives or the silent period obtained through the silence channel IE and silent period.

본 발명의 다른 실시예에 의하면, 특정 주파수 대역을 침묵시키기 위한 방법으로 관리 프레임을 이용할 수 있다. 관리 프레임의 일례로 VHT 운영 모드 알림 프레임이 사용될 수 있다.

According to the other embodiment of the present invention., the management frame can be used as the method for muting the specific frequency band. For exa mple, it informs of the management frame with the VHT operational mode the frame can be used.

VHT 운영 모드 알림 프레임은 전송 STA이 운영 채널 대역폭, 수신 가능한 최대 공간 스트림 개수 중 적어도 하나를 변경하는 것을 STA들에게 알리기 위하여 사용될 수 있다. 이 프레임은 비-AP STA 및 AP 모두에 의해 전송될 수 있다. AP가 운영 모드를 변경하고자 하는 경우, AP는 이 액션 프레임을 BSS내 모든 STA으로 브로드캐스트한다. VHT 운영 모드 알림 프레임에는 표1의 정보가 포함될 수 있다.

It informs with the VHT operational mode so that the transmission STA inform STAs among the operation cha nnel bandwidth, and the maximum space number of str eam enabling to receive changing at least one, the fra me can be used. This frame can be transmitted with th e non-A P STA and AP everyone. The case , and AP in which AP changes the operational mode broadcast this action frame to all STAs within BSS. The frame it infor ms with the VHT operational mode includes the informa tion of the table 1.

| 순서 | 정보 |
|---|---|
| 1 | 카테고리(Category) |
| 2 | VHT 액션(VHT Action) |
| 3 | VHT 운영 모드(VHT Operating mode) |

| Order | Information |
|---|---|
| 1 | Category(Category) |
| 2 | VHT action(VHT Action) |
| 3 | VHT operational mode(VHT Operating mode) |

카테고리 필드는 VHT를 위한 값으로 설정된다. VHT 액션 필드는 VHT 운영 모드 알림을 위한 값으로 설정된다.

The category field is set up as the value for VHT. It is set up as the value which is that the VHT action field i nforms.

VHT 운영 모드 필드는 전송 STA이 수신 가능한 운영 채널 대역폭 및 Nss를 지시하기 위하여 VHT 운영 모드 알림 프레임 내에서 사용될 수 있다.

The VHT operation mode field may be used in the operation channel bandwidth in which the transmission STA is receivable and in-frame it informs with the VHT operational mode the Nss is indicated.

도 14는 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

Figure 14 is a block diagram showing the format of the VHT operation mode field.

이 필드를 전송하는 STA은 현재 운영 채널 대역폭 및 공간 스트림 개수를 지시한다. VHT 운영 모드 필드는 채널 대역폭(Channel width) 서브 필드, Rx Nss 서브필드, Max Nss For SU Present 서브필드를 포함할 수 있다. 표 2는 VHT 운영 모드 필드에 포함되는 각 서브필드의 설정 및 기능을 설명한다.

STA transmitting this field indicates the current operation channel bandwidth and space number of stream. The VHT operation mode field may include the channel bandwidth (Channel width) subfield, the Rx Nss subfield, and the Max Nss For SU Present subfield. The table 2 illustrates the setting and function of each subfield included in the VHT operation mode field.

| 서브필드 | 설 명 |
|---|---|
| 채널 대역폭 (Channel Width) | Rx Nss Type 서브필드가 0이면, 지원 채널 대역폭을 지시함:<br>20 MHz의 경우 0,<br>40 MHz의 경우 1<br>80 MHz의 경우 2<br>160 MHz 또는 80+80 MHz의 경우 3. |
| Rx Nss | Rx Nss subfield is 1이면 예비(reserved)<br>Rx Nss Type 서브필드가 0이면, STA이 수신할 수 있는 최대 공간스트림 개수를 지시함<br><br>Rx Nss Type 서브필드가 1이면, VHT 압축 빔포밍 프레임(VHT Compressed Beamforming frame)내에서 MU를 지시하는 피드백 타입(Feedback Type) 서브 필드를 포함하는 VHT 압축 빔포밍 보보고부터 전달된 빔포밍 조정 매트릭스(beamforming steering matrix)를 사용하는 SU PPDU에 대한 빔포미(beamformee)로서 STA이 수신할 수 있는 최대 공간 스트림 개수를 지시함.<br><br>Nss = 1의 경우 0<br><br>Nss = 2의 경우 1<br><br>…<br><br>Nss = 8의 경우 7<br>0이면, STA이 수신할 수 있는 최대 공간 스트림 개수를 담고 있음을 지시함. |
| Rx Nss Type | 1이면, Rx Nss 서브필드가 VHT 압축 빔포밍 프레임(VHT Compressed Beamforming frame)내에서 MU를 지시하는 피드백 타입(Feedback Type) 서브 필드를 포함하는 VHT 압축 빔포밍 보보고부터 전달된 빔포밍 조정 매트릭스(beamforming steering matrix)를 사용하는 SU PPDU에 대한 빔포미(beamformee)로서 STA이 수신할 수 있는 최대 공간 스트림 개수를 담고 있음을 지시함. |

| **Subfield** | **The description** |
|---|---|
| Channel bandwidth (Channel width) | It is the Rx Nss Type subfield 0,The supported channel bandwidth is indicated :<br>0 in the case of 20 MHz,<br>1 in the case of 40 MHz<br>2 in the case of 80 MHz<br>160 MHz or 80+3 in the case of 80 MHz |
| Rx Nss | It provides if it is the Rx Nss subfield is 1(reserved)<br>It is the Rx Nss Type subfield 0,The maximum space stream number which STA can receive is indicated<br><br>It is the Rx Nss Type subfield 1,VHT compression beam forming frame(VHT Compressed Beamforming frame)The feedback type indicating MU in in(Feedback Type)The beam forming control matrix delivered from the VHT compression beam forming steps including the subfield(beamforming steering matrix)The beam breech about the SU PPDU using (beamformee)The maximum space number of stream which STA can receive is indicated<br><br>Nss=0 in the case of 1<br><br>Nss=1 in the case of 2<br><br>…<br><br>Nss=7 in the case of 8<br>It is 0,It indicates putting in the maximum space number of stream which STA can receive |
| Rx Nss Type | It is 1,The Rx Nss subfield is the VHT compression beam forming frame(VHT Compressed Beamforming frame)The feedback type indicating MU in in(Feedback Type)The beam forming control matrix delivered from the VHT compression beam forming steps including the subfield(beamforming steering matrix)The beam breech about the SU PPDU using (beamformee)It indicates putting in the maximum space number of stream which STA can receive |

VHT 운영 모드 필드는 VHT 운영 모드 알림 액션 관리 프레임을 통해서 전송될 수 있다. AP가 만일 현재의 BSS 운영 채널 대역폭을 변경하고자 한다면 VHT 운영 모드 알림 액션 관리 프레임을 브로드캐스트할 수 있다.

The VHT operation mode field informs with the VHT operational mode it can be transmitted through the action management frame. If AP tries to change the current BSS operation channel bandwidth it informs with the VHT operational mode the action management frame can be.

본 발명의 실시예에 따르면, VHT 운영 모드 필드를 이용하여 특정 주파수 대역을 침묵시킬 수 있도록 하기 위하여 침묵 타입 정보와 AP 침묵 모드 정보를 더 포함한 수정된 VHT 운영 모드 필드를 전송할 수 있다.

According to the embodiment of the invention, in order to mute the specific frequency band using the VHT operation mode field, the silence type information and the modified VHT operation mode field which further includes the AP quiet mode information can be transmitted.

도 15는 본 발명의 실시예에 따른 수정된 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

Figure 15 is a block diagram showing the format of the modified VHT operation mode field according to a prefer

red embodiment of the present invention.

본 발명의 실시예에 의하면 수정된 VHT 운영 모드 필드는 비콘 프레임 또는 프로브 응답 프레임을 통해 전송될 수 있다. 비콘 프레임을 통해 전송될 수 있도록 하여 기존에 액션 프레임 형태로만 VHT 운영 모드 필드를 전송할 수 있었던 방식에 비해 BSS내에 더 많은 수의 STA들이 이 메시지를 수신할 수 있도록 하는 효과가 있다. 액션 프레임 전송의 경우 비콘 프레임 전송에 비해, 해당 시간에 취침 상태에 있어서 이를 수신하지 않는 STA들이 상대적으로 더 많을 수 있기 때문이다.

According to the embodiment of the present invention., the modified VHT operation mode field can be transmitted through the beacon frame or the probe response frame. It has the effect that the greater number of STAs receives this message in comparison with the mode which was transmitted through the beacon frame and could transmit the VHT operation mode field in the existing in the form of the action frame within BSS. In case of the action frame transmission, relatively there be more many STAs which does not receive this in the corresponding time as to the sleep status compared to the beacon frame transmission.

표 3은 수정된 VHT 운영 모드 필드에 새롭게 추가된 침묵 타입 서브필드 및 AP 침묵 모드 서브필드의 설정 및 기능을 간략히 설명한 것이다.

The setting of the silence type subfield freshly added to the VHT operation mode field in which the table 3 is modified and AP quiet mode subfield and function is briefly illustrated.

| 서브필드 | 설 명 |
|---|---|
| 침묵 타입 (Quiet Type) | 현재 운영 채널 대역폭이 80+80MHz일 때, VHT 운영 모드 필드가 침묵 IE에 의해 지시된 침묵 지속기간동안만 유효하면, 1로 설정됨. 이는 VHT STA이 침묵 지속기간동안 부80MHz 상에서 침묵해야함을 지시함.<br>VHT 운영 모드 필드가 모든 시간에 대해 유효하면 0으로 설정됨. |
| AP 침묵 모드 | 현재 운영 채널 대역폭이 80+80MHz일 때, 침묵 지속기간동안 주 80MHz상에서 AP-STA간 통신이 허용되면, 1로 설정됨, 그렇지 않으면 0으로 설정됨. |
| (AP Quiet Mode) | 현재 운영 채널 대역폭이 20/40/80/160MHz일 때, 예비인 0 값으로 설정됨 |

| **Subfield** | **The description** |
|---|---|
| Silence type (Quiet Type) | The current operation channel bandwidth is 80+It is 80MHz,It is available the silent duration period when the VHT operation mode field is indicated with the silence IE,It is set up as 1. This indicates that the VHT STA has to keep silence for the silent duration period on the part 80MHz<br>The VHT operation mode field is set up as 0 if it is effective about every the times |
| AP quiet mode | The current operation channel bandwidth is 80+It is 80MHz,The communication is allowed for the silent duration period on the main part 80MHz between the AP-STA,It is set up as 1,It is set up as 0 if it is not so |
| (AP Quiet Mode) | The current operation channel bandwidth is 20/40/80/160MHz,It is set up as 0 value which is the back up |

침묵 타입 필드가 0으로 설정될 때는 VHT 운영 모드 필드의 동작과 동일하다. 즉, 침묵 타입 필드가 0으로 설정된 수정된 VHT 운영 모드 필드를 수신한 BSS내의 STA들은 즉시 BSS 운영 채널 대역폭을 변경한다. 이 경우는 BSS 운영 채널 대역폭이 완전히 변경된 것이므로 이후 침묵 지속기간이 도래하면 상기 변경된 운영 채널 대역폭을 전체 operating band로 해석하고 해당 동작을 수행한다.

It is identical with the operation of the VHT operation mode field when the silence type field is set up as 0. That is, immediately STA within BSSs receiving the modified VHT operation mode field in which the silence type field is set up as 0 change the BSS operation channel bandwidth. Then if the silent duration period comes since the BSS operation channel bandwidth is completely changed the above-mentioned changed operation channel bandwidth is interpreted as the whole operating band and this case performs the corresponding operation.

반면, 침묵 타입 필드가 1로 설정되는 경우, 동작 채널 대역폭의 변경은 침묵 지속기간 구간들에만 한정하여 적용되는 것을 의미한다. 따라서, VHT STAs는 침묵 지속기간 동안 부 80MHz에서만 침묵하고 주80MHz에서는 프레임을 송수신할 수 있다.

On the other hand, it means that it limits to the case where the silence type field is set up as 1, and change silver silent duration period sections of the working channel bandwidth and the case are applied. Therefore, the VHT STAs can keep silence for the silent duration period in the part 80MHz and the frame can be sent and can be received in the main part 80MHz.

AP 침묵 모드 필드는 앞선 실시예에서 기술한 바 있는 AP 상태 플래그 필드, AP 침묵 모드 필드와 동일한 기능을 한다. 즉, 현재 운영 채널 대역폭이 비연속(non-contiguous) 80+80MHz 채널인 경우, 이 값이 1로 설정되면 이후 침묵 지속기간 구간마다 AP-STA 통신이 주 80MHz에서 허락됨을 의미한다. AP 침묵 모드 필드가 0으로 설정된 경우 이후 침묵 지속기간 구간마다 AP-STA 채널이 주 80MHz에서 허용되지 않으며, STA-STA 통신만 허용될 수 있음을 의미한다.

The AP state flag field which the AP silence mode field describes in the anterior embodiment, and the same function as the AP silence mode field are done. That is, in case the current operation channel bandwidth is the non-successive (non-contiguous) 80+80MHz channel it means then that the AP-STA communication is authorized at the silent duration period section in the main part 80MHz if this value is set up as 1. Then the silent duration period section the AP-STA channel is not allowed in

the main part 80MHz in case the AP silence mode field i s set up as 0 and it means the STA-STA communicatio n being allowed.

도 16은 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다. 무선 장치(70)는 상술한 실시예를 구현할 수 있는 단말로서, 광대역 채널을 지원하는 AP 또는 비AP 스테이션(non-AP station)일 수 있다.

Figure 16 is a block diagram showing the wireless device the embodiment of the invention can be applied. It is the terminal in which the wireless device (70) can implement the above-described embodiment and it may be AP or the non-AP station supporting the broadband channel.

무선장치(70)은 프로세서(72), 메모리(74) 및 트랜시버(transceiver, 76)를 포함한다. 트랜시버(76)는 무선신호를 송신/수신하되, IEEE 802.11의 물리계층이 구현된다. 프로세서(72)는 트랜시버(76)와 기능적으로 연결되어, IEEE 802.11의 MAC 계층 및 물리계층을 구현한다. 프로세서(72)는 본 발명이 제안하는 침묵 채널 요소를 포함하는 프레임을 생성하고 전송하거나, 수신한 프레임에 포함된 침묵 채널 요소 필드의 값을 해석하여 제어 정보를 획득할 수 있도록 설정될 수 있다. 프로세서(72)는 상술한 본 발명의 실시예를 구현하도록 설정될 수 있다.

The wireless device (70) comprises the processor (72), the memory (74), and transceivers (transceiver, 76). T he transceiver (76) receives the radio signal with the tr ansmission /. The physical layer of the IEEE 802.11 is i mplemented. The processor (72) is functionally connec ted to the transceiver (76) and the MAC layer of the IE EE 802.11 and physical layer is implemented. The proce ssor (72) produces the frame including the silence chan nel element which the invention suggests and it transm its or the value can be set up in order to interpret the value of the silence channel element field included in th e frame received and obtain the control information. It can be set up so that the processor (72) implements t he embodiment of the invention.

프로세서(72) 및/또는 트랜시버(76)는 ASIC(application-specific integrated circuit), 다른 칩셋, 논리 회로 및/또는 데이터 처리 장치를 포함할 수 있다. 메모리(74)는 ROM(read-only memory), RAM(random access memory), 플래쉬 메모리, 메모리 카드, 저장 매체 및/또는 다른 저장 장치를 포함할 수 있다. 실시예가 소프트웨어로 구현될 때, 상술한 기법은 상술한 기능을 수행하는 모듈(과정, 기능 등)로 구현될 수 있다. 모듈은 메모리(74)에 저장되고, 프로세서(72)에 의해 실행될 수 있다. 메모리(74)는 프로세서(72) 내부 또는 외부에 있을 수 있고, 잘 알려진 다양한 수단으로 프로세서(72)와 연결될 수 있다.

The processor (72) and/or the transceiver (76) may include the ASIC (application-specific integrated circui t), the dissimilar chip set, and the logic circuit and/or t he data processing unit. The memory (74) may include the ROM (read-only memory), the RAM (random access memory), flash memory, memory card, storage medium and/or the dissimilar storage unit. When the embodimen t is implemented as software , the above-described tec hnique can be implemented as the module (the proces s, the function etc) performing the above-described fu nction. The module is stored in the memory (74) and th e module can be carried out by the processor (72). Th e memory (74) can be in the processor (72) inside or t he outside and it can be connected to the processor (72) by the various means which is well known.

이상에서 상세하게 설명한 본 발명의 실시예는 단지 본 발명의 기술 사상을 보여주기 위한 예시적인 것으로서, 상기 실시예에 의 의하여 본 발명의 기술 사상이 한정되는 것으로 해석되어서는 안된다. 본 발명의 보호 범위는 후술하는 본 발명의 특허청구범위에 의하여 특정된다.

In the above, specifically, the embodiment of the invention illustrated only shows the technical spirit of t he invention the technical spirit of the invention which is according to of the embodiment is restricted and the invention should not be interpreted. The scope of prote ction of the invention is specified with the patent claim of the invention which will be described later.

## 도면에 대한 간단한 설명

도 1 및 도 2는 각각 본 발명의 실시예가 적용될 수 있는 무선랜 시스템의 일례에 대한 구성을 간략히 도시한 것이다.

도 3은 무선랜 시스템의 BSS에서 동작채널로 설정될 수 있는 채널을 그 대역폭과 함께 예시한 것이다.

도 4는 무선랜 시스템 또는 이를 포함하거나 이와 실질적으로 균등한 무선 통신 시스템에서의 본 발명의 일 실시예에 따른 무선 네트워크의 관리 절차를 보여 주기 위한 동작 절차도이다.

## Brief explanation of the drawing

As to figures 1 and 2, the embodiment of the invention briefly shows the configuration about an example of th e wireless LAN-system which can be applied.

In fig. 3 is BSS of the wireless LAN-system, the channe l which can be set up as the working channel is exempli fied with the bandwidth.

Figure 4 is an operation procedure drawing for showing the management process of the wireless network accor

도 5는 VHT 무선랜 시스템의 동작 대역폭(operating bandwidth)이 될 수 있는 5GHz 대역의 스펙트럼 상세(spectrum detail)를 나타낸 것이다.

도 6은 침묵 정보요소(Quiet Information Element, Quiet IE) 포맷의 일례를 나타낸 블록도이다.

도 7은 넓은 대역의 동작 채널을 지원하는 무선랜 시스템에서 발생할 수 있는 상술한 문제점을 예시한 것이다.

도 8은 본 발명의 일 실시예에 따른 채널의 활용 방법을 나타낸 것이다.

도 9는 본 발명의 실시예에 따른 침묵 채널 IE 의 포맷의 일례을 나타낸 블록도이다.

도 10 및 도 11은 본 발명의 실시예에 따른 침묵 채널 요소 포맷의 다른 일례이다.

도 12 및 도 13은 본 발명의 실시예에 따른 침묵 채널 IE 포맷의 다른 일례를 나타낸 것이다.

도 14는 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

도 15는 본 발명의 실시예에 따른 수정된 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

도 16은 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다.

ding to a preferred embodiment of the present invention at the wireless LAN-system or the radio communication system including the same or this is substantially on a parity.

Figure 5 show the spectrum detail of 5GHz band in which it can become the operation bandwidth (operating bandwidth) of the VHT wireless LAN-system.

Figure 6 is a block diagram showing an example of the silence information element (Quiet Information Element, Quiet IE) format.

The above-described problem of being generated in the wireless LAN-system in which fig. 7 supports the working channel of the wide band is exemplified.

Figure 8 shows the utilization method of the channel according to a preferred embodiment of the present invention.

Figure 9 is a block diagram showing an example of the format of the silence channel IE according to a preferred embodiment of the present invention.

Figures 10 and 11 are an example of the silence channel element format of being different according to the embodiment of the invention.

Figures 12 and 13 show an example of the silence channel IE format according to a preferred embodiment of the present invention of being different.

Figure 14 is a block diagram showing the format of the VHT operation mode field.

Figure 15 is a block diagram showing the format of the modified VHT operation mode field according to a preferred embodiment of the present invention.

Figure 16 is a block diagram showing wireless device the embodiment of the invention can be applied.


## Disclaimer

본 문서는 특허 및 과학기술문헌 전용의 첨단 자동번역 시스템을 이용해 생성되었습니다. 따라서 부분적으로 오역의 가능성이 있으며, 본 문서를 자격을 갖춘 전문 번역가에 의한 번역물을 대신하는 것으로 이용되어서는 안 됩니다. 시스템 및 네트워크의 특성때문에 발생한 오역과 부분 누락, 데이터의 불일치등에 대하여 본원은 법적인 책임을 지지 않습니다. 본 문서는 당사의 사전 동의 없이 권한이 없는 일반 대중을 위해 DB 및 시스템에 저장되어 재생, 복사, 배포될 수 없음을 알려드립니다.
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(54) 발명의 명칭 **무선랜 시스템에서 동적 주파수 선택 방법 및 장치**

## (57) 요 약

무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법이 제공된다. 상기 방법은 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고 및 상기 침묵 기간동안 채널 측정을 수행하는 것을 포함한다.

## 대 표 도

| | 요소 ID | 길이 | AP 침묵 모드 | 침묵 카운트 | 침묵 주기 | 침묵 지속기간 | 침묵 오프셋 |
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## 특허청구의 범위

### 청구항 1

무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법에 있어서,

침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고; 및

상기 침묵 기간동안 채널 측정을 수행하는 것;을 포함함을 특징으로 하는 방법.

### 청구항 2

제 1항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들인 것을 특징으로 하는 방법.

### 청구항 3

제 2항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가짐을 특징으로 하는 방법.

### 청구항 4

제 1항에 있어서, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함함을 특징으로 하는 방법.

### 청구항 5

제 4항에 있어서,

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정되고, 및

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정됨을 특징으로 하는 방법.

### 청구항 6

제 1항에 있어서, 상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함함을 특징으로 하는 방법.

### 청구항 7

제 6항에 있어서, 상기 방법은,

상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하는 것을 더 포함함을 특징으로 하는 방법.

### 청구항 8

제 1항에 있어서, 상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함함을 특징으로 하는 방법.

### 청구항 9

무선랜에서 BSS(Basic Service Set)내 액세스 포인트(Access Point; AP)에 있어서, 상기 AP는 주 서브채널 및 부 서브채널 중 하나에서 동적 주파수 선택을 수행하도록 설정되되, 상기 AP는,

트랜시버; 및

상기 트랜시버와 기능적으로 결합된 컨트롤러를 포함하되, 상기 컨트롤러는,

침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고, 및

상기 침묵 기간동안 채널 측정을 수행하도록 설정된 것을 특징으로 하는 AP.

**청구항 10**

제 9항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들인 것을 특징으로 하는 AP.

**청구항 11**

제 2항에 있어서, 상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가짐을 특징으로 하는 AP.

**청구항 12**

제 9항에 있어서, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함함을 특징으로 하는 AP.

**청구항 13**

제 12항에 있어서,

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정되고, 및

상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정됨을 특징으로 하는 AP.

**청구항 14**

제 9항에 있어서, 상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함함을 특징으로 하는 AP.

**청구항 15**

제 14항에 있어서, 상기 컨트롤러는,

상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하도록 설정된 것을 특징으로 하는 AP.

**청구항 16**

제 9항에 있어서, 상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함함을 특징으로 하는 AP.

## 명 세 서

### 기 술 분 야

[0001] 본 발명은 무선통신에 관한 것으로, 보다 상세하게는 무선랜 시스템에서의 동적 주파수 선택 방법 및 이를 지원하는 장치에 관한 것이다.

### 배 경 기 술

[0002] 최근 정보통신 기술의 발전과 더불어 다양한 무선 통신 기술이 개발되고 있다. 이 중에서 무선랜(WLAN)은 무선

주파수 기술을 바탕으로 개인 휴대용 정보 단말기(Personal Digital Assistant, PDA), 랩탑 컴퓨터, 휴대형 멀티미디어 플레이어(Portable Multimedia Player, PMP) 등과 같은 휴대형 단말기를 이용하여 가정이나 기업 또는 특정 서비스 제공지역에서 무선으로 인터넷에 접속할 수 있도록 하는 기술이다.

[0003] WLAN 기술의 표준화 기구인 IEEE(Institute of Electrical and Electronics Engineers) 802가 1980년 2월에 설립된 이래, 많은 표준화 작업이 수행되고 있다. 초기의 WLAN 기술은 IEEE 802.11을 통해 2.4GHz 주파수를 사용하여 주파수 호핑, 대역 확산, 적외선 통신 등으로 1~2Mbps의 속도를 지원한 이래, 최근에는 OFDM(Orthogonal Frequency Division Multiplex)을 적용하여 최대 54Mbps의 속도를 지원할 수 있다. 이외에도 IEEE 802.11에서는 QoS(Quality for Service)의 향상, 액세스 포인트(Access Point) 프로토콜 호환, 보안 강화(Security Enhancement), 무선 자원 측정(Radio Resource measurement), 차량 환경을 위한 무선 접속(Wireless Access Vehicular Environment), 빠른 로밍(Fast Roaming), 메쉬 네트워크(Mesh Network), 외부 네트워크와의 상호작용(Interworking with External Network), 무선 네트워크 관리(Wireless network Management) 등 다양한 기술의 표준을 실용화 또는 개발 중에 있다.

[0004] IEEE 802.11 중에서 IEEE 802.11b는 2.4GHz 대역의 주파수를 사용하면서 최고 11Mbs의 통신 속도를 지원한다. IEEE 802.11b 이후에 상용화된 IEEE 802.11a는 2.4GHz 대역이 아닌 5GHz 대역의 주파수를 사용함으로써 상당히 혼잡한 2.4GHz 대역의 주파수에 비해 간섭에 대한 영향을 줄였으며, OFDM 기술을 사용하여 통신 속도를 최대 54Mbps까지 향상시켰다. 그러나 IEEE 802.11a는 IEEE 802.11b에 비해 통신 거리가 짧은 단점이 있다. 그리고 IEEE 802.11g는 IEEE 802.11b와 마찬가지로 2.4GHz 대역의 주파수를 사용하여 최대 54Mbps의 통신속도를 구현하며, 후방 호환성(Backward Compatibility)을 만족하고 있어 상당한 주목을 받고 있는데, 통신 거리에 있어서도 IEEE 802.11a보다 우위에 있다.

[0005] 또한, 무선랜에서 취약점으로 지적되어온 통신 속도에 대한 한계를 극복하기 위하여 비교적 최근에 제정된 기술 규격으로서 IEEE 802.11n이 있다. IEEE 802.11n은 네트워크의 속도와 신뢰성을 증가시키고, 무선 네트워크의 운영 거리를 확장하는데 목적을 두고 있다. 보다 구체적으로, IEEE 802.11n에서는 데이터 처리 속도가 최대 540Mbps 이상인 고처리율(High Throughput, HT)을 지원하며, 또한 전송 에러를 최소화하고 데이터 속도를 최적화하기 위해 송신부와 수신부 양단 모두에 다중 안테나를 사용하는 MIMO(Multiple Inputs and Multiple Outputs) 기술에 기반을 두고 있다. 또한, 이 규격은 데이터 신뢰성을 높이기 위해 중복되는 사본을 여러 개 전송하는 코딩 방식을 사용할 뿐만 아니라, 속도를 증가시키기 위해 직교 주파수 분할 다중(Orthogonal Frequency Division Multiplex, OFDM)을 사용할 수도 있다.

[0006] WLAN의 보급이 활성화되고 또한 이를 이용한 어플리케이션이 다양화됨에 따라, 최근에는 IEEE 802.11n이 지원하는 데이터 처리 속도보다 더 높은 처리율을 지원하기 위한 새로운 WLAN 시스템에 대한 필요성이 대두되고 있다. 초고처리율(Very High Throughput, VHT) 무선랜 시스템은 1Gbps 이상의 데이터 처리 속도를 지원하기 위하여 최근에 새롭게 제안되고 있는 IEEE 802.11 무선랜 시스템 중의 하나이다.

[0007] VHT 무선랜 시스템의 표준화를 진행하고 있는 IEEE 802.11 TGac에서는 1Gbps 이상의 쓰루풋을 제공하기 위하여 8X8 MIMO 및 80MHz 또는 그 이상의 채널 대역폭을 사용하는 방안에 대한 연구가 활발하게 진행되고 있다.

[0008] 80MHz 또는 그 이상의 채널 대역폭을 사용하는 경우 해당 대역을 사용하고 있는 다른 사용자와의 간섭 문제가 심각해 질 수 있다. 경우에 따라서는 해당 대역을 사용하고 있는 사용자가 우선적으로 보호되어야 하거나, 해당 주파수 대역을 사용함에 있어 준수되어야 할 규제사항에 의해 해당 주파수 대역의 상황에 따라 해당 주파수 대역의 사용이 제한될 수 있다.

[0009] 이러한 환경에서 해당 주파수 대역을 사용하기 위하여 해당 주파수 대역에 대해 우선순위를 가지고 있는 사용자를 보호하기 위하여 또는 행정적/정책적 규제사항을 만족시키기 위하여 대상 주파수 대역을 검사하는 절차가 필요하다. 검사 결과에 따라 적응적으로 채널의 대역폭을 조정하거나 채널을 스위칭하는 동적 주파수 선택 방법이 적용될 수 있다. 동적 주파수 선택 절차의 한 전제가 되는 채널을 상태를 검사하는 방법에 있어, 넓은 대역폭을 갖는 채널을 대상으로 함에 따라 발생할 수 있는 무선 자원의 낭비를 최소화하는 효율적인 방법에 대한 고려가 필요하다.

## 발명의 내용

### 해결하려는 과제

[0010] 본 발명이 해결하고자 하는 과제는 광대역의 동작 채널을 지원하는 무선랜 시스템에서의 동적 주파수 선택

(Dynamic Frequency Selection; DFS) 절차를 지원하는 관리 정보를 전송하는 방법을 제공하는 것이다.

[0011] 본 발명이 해결하고자 하는 다른 과제는 복수의 서브 채널을 포함하는 동작채널을 지원하는 무선랜 시스템에서 특정 서브 채널을 선택적으로 침묵시키는 방법을 제공하는 것이다.

## 과제의 해결 수단

[0012] 일 양태에서, 무선랜에서 BSS(Basic Service Set)내 주 서브채널 및 부 서브채널 상에서 통신하도록 설정된 액세스 포인트(Access Point; AP)에 의한 동적 주파수 선택(dynamic frequency selection) 방법이 제공된다. 상기 방법은 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고 및 상기 침묵 기간동안 채널 측정을 수행하는 것을 포함한다.

[0013] 상기 제1 서브 채널 및 상기 제2 서브 채널은 비연속 서브채널들일 수 있다.

[0014] 상기 제1 서브 채널 및 상기 제2 서브 채널은 각각 80MHz 대역폭을 가질 수 있다.

[0015] 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되는지 여부를 지시하는 AP 침묵 모드 필드를 포함할 수 있다.

[0016] 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 상기 AP 침묵 모드 필드는 1로 설정될 수 있다. 상기 침묵 기간동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용되지 않음을 지시하기 위해 상기 AP 침묵 모드 필드는 0으로 설정될 수 있다.

[0017] 상기 채널 측정을 수행하는 것은 상기 부 채널에 레이더의 존재를 감지하는 것을 포함할 수 있다.

[0018] 상기 방법은 상기 부 채널에서 상기 레이더의 존재가 감지되면, 채널 이동을 위한 상기 BSS의 새로운 채널을 선택 및 광고하는 것을 더 포함할 수 있다.

[0019] 상기 침묵 채널 요소가 상기 침묵 기간 동안 상기 주 서브채널에서 상기 AP에 대한 통신이 허용됨을 지시하기 위해 1로 설정된 AP 침묵 필드를 포함하면, 상기 침묵 채널 요소는 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드 중 하나를 더 포함할 수 있다.

[0020] 다른 양태에 있어서, 무선랜에서 BSS(Basic Service Set)내 액세스 포인트(Access Point; AP)가 제공된다. 상기 AP는 주 서브채널 및 부 서브채널 중 하나에서 동적 주파수 선택을 수행하도록 설정된다. 상기 AP는 트랜시버 및 상기 트랜시버와 기능적으로 결합된 컨트롤러를 포함한다. 상기 컨트롤러는 침묵 요소(quiet element) 및 침묵 채널 요소(quiet channel element)를 포함하는 프레임을 전송하되, 상기 침묵 요소는 전송이 발생하지 않는 침묵 기간(quiet interval)을 정의하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 부 서브채널이 침묵될 것을 지시하고, 상기 침묵 채널 요소는 상기 침묵 기간동안 상기 주 서브채널이 사용될 수 있는 조건을 지시하고, 및 상기 침묵 기간동안 채널 측정을 수행하도록 설정된다.

## 발명의 효과

[0021] 광대역의 동작채널을 지원하는 무선랜 시스템에서 동작채널을 구성하는 일부 채널의 환경 변화에 능동적으로 대응하여 채널의 환경 변화에 따른 채널 활용도의 저하을 최소화 할 수 있다.

## 도면의 간단한 설명

[0022] 도 1 및 도 2는 각각 본 발명의 실시예가 적용될 수 있는 무선랜 시스템의 일례에 대한 구성을 간략히 도시한 것이다.

도 3은 무선랜 시스템의 BSS에서 동작채널로 설정될 수 있는 채널을 그 대역폭과 함께 예시한 것이다.

도 4는 무선랜 시스템 또는 이를 포함하거나 이와 실질적으로 균등한 무선 통신 시스템에서의 본 발명의 일 실시예에 따른 무선 네트워크의 관리 절차를 보여 주기 위한 동작 절차도이다.

도 5는 VHT 무선랜 시스템의 동작 대역폭(operating bandwidth)이 될 수 있는 5GHz 대역의 스펙트럼 상세(spectrum detail)를 나타낸 것이다.

도 6은 침묵 정보요소(Quiet Information Element, Quiet IE) 포맷의 일례를 나타낸 블록도이다.

도 7은 넓은 대역의 동작 채널을 지원하는 무선랜 시스템에서 발생할 수 있는 상술한 문제점을 예시한 것이다.

도 8은 본 발명의 일 실시예에 따른 채널의 활용 방법을 나타낸 것이다.

도 9는 본 발명의 실시예에 따른 침묵 채널 IE 의 포맷의 일례을 나타낸 블록도이다.

도 10 및 도 11은 본 발명의 실시예에 따른 침묵 채널 요소 포맷의 다른 일례이다.

도 12 및 도 13은 본 발명의 실시예에 따른 침묵 채널 IE 포맷의 다른 일례를 나타낸 것이다.

도 14는 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

도 15는 본 발명의 실시예에 따른 수정된 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

도 16은 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다.

## 발명을 실시하기 위한 구체적인 내용

[0023] 이하, 첨부 도면을 참조하여 본 발명의 실시예에 따른 무선 통신 시스템에서의 관리 절차 및 이를 지원하는 장치에 대하여 상세히 설명한다. 이하의 실시예에서는 무선 통신 시스템 중에서 무선랜(wireless local area network, WLAN) 시스템을 예를 들어 설명하지만 이것은 단지 예시적인 것이다. 따라서 후술하는 본 발명의 실시예는 그 성질상 허용되지 않는 경우를 제외하고 무선랜 시스템 이외의 다른 무선 통신 시스템에서도 동일하게 적용될 수 있을 것이다. 이 경우 후술하는 본 발명의 실시예에서 사용되는 무선랜 시스템에 고유한 용어들이나 단어들은 해당 무선 통신 시스템에서 관용적으로 사용되는 다른 용어들이나 단어들로 적절하게 변형될 수 있을 것이다.

[0024] 도 1 및 도 2는 각각 본 발명의 실시예가 적용될 수 있는 무선랜 시스템의 일례에 대한 구성을 간략히 도시한 것이다.

[0025] 도 1 및 도 2를 참조하면, 무선랜 시스템은 하나 또는 그 이상의 기본 서비스 세트(Basic Service Set, BSS)를 포함한다. BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 스테이션(Station, STA)의 집합으로서, 특정 영역을 가리키는 개념은 아니다. BSS는 인프라스트럭처 BSS(infrastructure BSS), 독립 BSS(Independent BSS, IBSS) 및 메쉬 BSS(mesh BSS, MBSS) 등으로 구분할 수 있다. 도 1은 인프라스트럭처 BSS를, 도 2는 IBSS를 나타낸 것이다. 인프라스트럭처 BSS(BSS1, BSS2)는 하나 또는 그 이상의 STA(STA1, STA3, STA4), 분배 서비스(Distribution Service)를 제공하는 STA인 액세스 포인트(Access Point, AP), 및 다수의 AP(AP1, AP2)를 연결시키는 분배 시스템(Distribution System, DS)을 포함한다. 반면, IBSS는 AP를 포함하지 않기 때문에 모든 STA이 이동 스테이션(STA6, STA7, STA8))으로 이루어져 있으며, DS에로의 접속이 허용되지 않아서 자기 완비적 네트워크(self-contained network)를 이룬다. MBSS는 메쉬 포인트(mesh point, MP)들로 구성된 네트워크로서 자기 완비적 네트워크의 다른 일례이다.

[0026] STA은 IEEE 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리층(Physical Layer) 인터페이스를 포함하는 임의의 기능 매체로서, 광의로는 AP와 비AP 스테이션(Non-AP Station)을 모두 포함한다. 무선 통신을 위한 STA은 프로세서(Processor)와 트랜시버(transceiver)를 포함하고 사용자 인터페이서와 디스플레이 수단 등을 포함할 수 있다. 프로세서는 무선 네트워크를 통해 전송할 프레임을 생성하거나 또는 상기 무선 네트워크를 통해 수신된 프레임을 처리하도록 고안된 기능 유닛으로서, 스테이션을 제어하기 위한 여러 가지 기능을 수행한다. 그리고 트랜시버는 상기 프로세서와 기능적으로 연결되어 있으며 스테이션을 위하여 무선 네트워크를 통해 프레임을 송수신하도록 고안된 유닛이다.

[0027] STA 중에서 사용자가 조작하는 휴대용 단말은 비AP STA(STA1, STA3, STA4, STA6, STA7, STA8)으로서, 단순히 STA이라고 할 때는 비AP STA(non-AP STA)을 가리키기도 한다. 비AP STA은 무선 송수신 유닛(Wireless Transmit/Receive Unit, WTRU), 사용자 장비(User Equipment, UE), (Mobile Station, MS), 휴대용 단말(Mobile Terminal), 또는 이동 가입자 유닛(Mobile Subscriber Unit) 등의 다른 명칭으로도 불릴 수 있다.

[0028] 그리고 AP(AP1, AP2)는 자신에게 결합된 STA(Associated Station)을 위하여 무선 매체를 경유하여 DS에 대한 접속을 제공하는 기능 개체이다. AP를 포함하는 인프라스트럭처 BSS에서 비AP STA들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이나, 비AP STA들간 다이렉트 링크가 설정된 경우에는 비AP STA들 사이에서도 직접 통신이 가능하다. AP는 엑세스 포인트라는 명칭 외에 집중 제어기, 기지국(Base Station, BS), 노드-B, BTS(Base

Transceiver System), 또는 사이트 제어기 등으로 불릴 수도 있다.

[0029] 복수의 인프라스트럭처 BSS는 분배 시스템(Distribution System, DS)을 통해 상호 연결될 수 있다. DS를 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다. ESS에 포함되는 STA들은 서로 통신할 수 있으며, 동일한 ESS 내에서 비AP STA은 끊김 없이 통신하면서 하나의 BSS에서 다른 BSS로 이동할 수 있다.

[0030] DS는 하나의 AP가 다른 AP와 통신하기 위한 메커니즘으로서, 이에 의하면 AP가 자신이 관리하는 BSS에 결합되어 있는 STA들을 위해 프레임을 전송하거나 또는 어느 하나의 STA이 다른 BSS로 이동한 경우에 프레임을 전달하거나 유선 네트워크 등과 같은 외부 네트워크와 프레임을 전달할 수가 있다. 이러한 DS는 반드시 네트워크일 필요는 없으며, IEEE 802.11에 규정된 소정의 분배 서비스를 제공할 수 있다면 그 형태에 대해서는 아무런 제한이 없다. 예컨대, DS는 메쉬 네트워크와 같은 무선 네트워크이거나 또는 AP들을 서로 연결시켜 주는 물리적인 구조물일 수도 있다.

[0031] 도 3은 무선랜 시스템의 BSS에서 동작채널로 설정될 수 있는 채널을 그 대역폭과 함께 예시한 것이다.

[0032] BSS의 동작채널이라 함은 AP가 자신과 결합된(associated) STA들에게 제어 정보 및/또는 관리 정보를 제공하기 위하여 전송하는 프레임을 전송하기 위하여 사용하는 채널을 의미한다. 비콘 프레임은 제어 정보 및/또는 관리 정보를 제공하기 위하여 AP가 전송하는 프레임의 일례이다. IBSS에서는 동작채널은 DFS owner가 비콘 프레임을 전송하는 채널을 의미할 수 있다. DFS owner는 IBSS에서 동작채널의 변경이 필요할 경우 스위칭할 대상 채널을 선택할 책임이 있는 STA을 의미한다.

[0033] 도 3의 예에서 채널 대역폭의 기본 단위는 20MHz로 설정되어 있고, 이하 이를 기준으로 설명하나 이는 예시에 불과하며, 채널 대역폭의 기본 단위은 20MHz에 한정되지 아니하고 사용 대역의 주파수 상황 등을 고려하여 다양하게 설정될 수 있다. VHT 무선랜 시스템은 광대역폭(wide band)의 동작채널을 지원할 수 있다. VHT BSS는 VHT 무선랜 시스템의 BSS로서 VHT BSS에서는 VHT 동작 요소(VHT Operation element)를 포함하는 비콘 프레임이 브로드캐스팅(broadcasting) 된다. VHT 동작 요소는 광대역폭의 동작채널을 지원하기 위한 정보를 포함한다. 보다 구체적으로 VHT 동작 요소는 채널 대역폭(channel width) 정보, 채널 중심 주파수(channel center frequency) 정보를 포함할 수 있다. 비인접한 복수의 주파수 대역을 동작채널로 사용하는 경우 비인접한(non-contiguous) 각각의 주파수 부분(segment)별 중심 주파수를 지시하는 정보가 포함될 수 있다.

[0034] 도 3의 예는 20MHz, 40MHz, 80MHz, 160MHz, 80MHz+80MHz의 채널 대역폭(channel bandwidth)을 갖는 동작채널이 설정될 수 있음을 예시하고 있다. 여기에서 80MHz+80MHz의 동작채널이라 함은 서로 비인접한 2개의 80MHz 채널로 구성된 동작 채널을 의미한다.

[0035] 주 채널(primary channel)은 BSS의 멤버인 모든 STA들을 위한 공통 채널이다. 부 채널(secondary channel)은 주 채널과 연관된 채널(associated channel)로 동작 채널의 대역폭 확장을 위해 사용될 수 있다.

[0036] 주 40MHz 채널(primary 40 MHz channel)은 80MHz, 160MHz 또는 80MHz+80MHz VHT BSS에서 40MHz PPDUs(PLCP(physical layer convergence procedure) protocol data units)를 전송하는데 사용되는 서브채널을 의미한다. 주 80MHz 채널(primary 80 MHz channel)은 160MHz 또는 80MHz+80MHz VHT BSS에서 80MHz PPDUs를 전송하는데 사용되는 서브채널을 의미한다. 여기에서 'n' MHz PPDU라 함은 해당 PPDU의 전송벡터 파라미터(TXVECTOR parameter) CH_BANDWIDTH가 CBW 'n'으로 설정된 PPDU를 의미한다.

[0037] 부 40MHz 채널(secondary 40MHz channel)은 80MHz VHT BSS에서 인접한 주 40MHz 채널에 인접한 서브채널이며, 주 40MHz 채널과 함께 80MHz 채널을 구성한다. 160 또는 80+80MHz VHT BSS에서 부 40MHz 채널은 인접한 주 40MHz 채널과 함께 주 80MHz 채널을 구성한다.

[0038] 부 80MHz 채널(secondary 80MHz channel)은 160 또는 80+80MHz VHT BSS에서 주 20MHz 채널을 포함하지 아니하는 80MHz 서브채널이며, 주 80MHz 채널과 함께 160MHz 또는 80+80 MHz 채널을 구성한다.

[0039] 40, 80, 160 또는 80+80 MHz VHT BSS에서 주 20MHz 채널을 포함하지 아니하는 채널을 보조채널(non-primary channel)이라 한다.

[0040] 도 4는 도 1 또는 도 2에 도시된 것과 같은 무선랜 시스템 또는 이를 포함하거나 이와 실질적으로 균등한 무선통신 시스템에서의 본 발명의 일 실시예에 따른 무선 네트워크의 관리 절차를 보여 주기 위한 동작 절차도이다. 도 4에 도시되어 있는 제1 STA(2)과 제2 STA(4) 사이에서의 동작 절차도는 인프라스트럭처 BSS를 구성하는 비AP STA과 AP 사이에 진행되는 절차일 수 있지만, 본 실시예가 여기에만 한정되는 것이 아니라는 것은 자명하다. 예

를 들어, IBSS를 구성하는 비AP STA들 사이에서의 동작이나 메쉬 네트워크 시스템을 구성하는 MP들 사이의 동작, 또는 다른 무선 통신 시스템을 구성하는 단말들 또는 단말과 기지국 사이의 동작에서도, 그 본질상 적용이 불가능 것을 제외하고는, 본 실시예는 동일 또는 균등한 방식으로 적용이 될 수 있다.

[0041] 도 4를 참조하면, 본 발명의 실시예에 따른 무선 통신 시스템에서의 라디오 측정 절차는 그 예비 과정으로서 탐색 절차(Scanning Procedure, S10), 인증 절차(Authentication Procedure, S20), 및/또는 결합 절차(Association Procedure, S30)를 포함하며, 상기 예비 과정(S10 내지 S30) 이후에 수행되는 동적 주파수 선택 절차(Dynamic Frequency Selection Procedure, S40)를 더 포함한다. 본 발명의 실시예의 일 측면에 의하면, 상기 예비 과정들 중에서 적어도 일부 절차는 필수적인 절차가 아닌 임의적인 절차일 수 있다.

[0042] 도 4를 참조하면, 제1 STA(1)과 제2 STA(4) 사이에는 탐색(scanning) 절차(S10)가 먼저 수행된다. 탐색 절차(S10)는 제1 STA(2)이 결합 절차(S30)에서 결합할 대상이 되는 후보 스테이션을 찾는 과정인데, 예컨대 인프라스트럭처 BSS에서 비AP STA이 AP를 찾는 과정이라고 볼 수 있다. 하지만, 보다 넓은 의미의 탐색 절차(S10)는 IBSS인 경우에는 비AP STA이 이웃 비AP STA을 찾는 과정이나 메쉬 네트워크인 경우는 이웃 MP를 찾는 과정도 포함한다고 볼 수 있다.

[0043] 이러한 탐색 절차는 두 가지 유형이 있다. 첫 번째 유형은 수동 스캔(Passive Scan) 방법으로서, 제2 STA(4) 등으로부터 전송되는 비콘 프레임(Beacon Frame)을 이용하는 방법이다. 이에 의하면, 무선랜에 접속하고자 하는 제1 STA(2)은 해당 BSS(또는 IBSS)를 관리하는 AP인 제2 STA(4) 등으로부터 주기적으로 전송되는 비콘 프레임을 수신하여, 접속 가능한 BSS를 찾을 수 있다.

[0044] 다른 탐색 절차 유형으로 능동 스캔(Active Scan) 방법이 적용될 수 있다. 능동 스캔 절차에 의하면, 무선랜 시스템에 접속하고자 하는 제1 STA(2)이 먼저 프로브 요청 프레임(Probe Request Frame)을 전송한다. 그리고 상기 프로브 요청 프레임을 수신한 제2 STA(4), 예컨대 AP는 자신이 관리하는 BSS의 서비스 세트 아이디(Service Set ID, SSID)와 자신이 지원하는 능력치(Capability) 등의 정보가 포함된 프로브 응답 프레임(Probe Response Frame)을 제1 STA(2)에게 전송한다. 따라서 제1 STA(2)은 수신된 프로브 응답 프레임을 통해 후보 AP의 존재와 함께 상기 후보 AP에 관한 여러 가지 정보를 알 수가 있다.

[0045] 탐색 과정(S10)에서 비콘 프레임이나 프로브 응답 프레임을 전송하는 제2 STA(4)은 동적 주파수 선택(Dynamic Frequency Selection, DFS) 절차에서 사용될 수 있는 정보를 비콘 프레임이나 프로브 응답 프레임을 통해 전송할 수 있다. DFS 절차에서 사용될 수 있는 정보의 일례로 침묵 요소(Quiet element) 및/또는 침묵 채널 요소(Quiet channel element)가 비콘 프레임 또는 프로브 응답 프레임에 포함될 수 있다. 비콘 프레임이나 프로브 응답 프레임에 포함될 수 있는 DFS 절차에서 활용되는 정보는 이후 다시 구체적으로 설명하기로 한다.

[0046] 계속해서 도 4를 참조하면, 제1 STA(2)과 제2 STA(4) 사이에 인증 절차(S20)가 진행된다. 인증 절차(S20)는 무선 통신에 참여하는 개체들 사이에 인증 절차와 암호화 방식 등을 협상하는 과정이다. 예를 들어, 제1 STA(2)이 탐색 절차(S10)에서 찾은 하나 이상의 AP들 중에서 결합하고자 하는 제2 STA, 예컨대 AP와 인증 절차(S20)를 수행할 수 있다. WLAN에서는 대부분의 경우에 오픈 시스템(Open System) 인증방식을 사용하기 때문에, AP인 제2 STA(4)은 제1 STA(2)으로부터의 인증 요청에 대하여 아무런 조건 없이 인증 과정을 수행한다. 보다 강화된 인증 방식으로 IEEE 802.1x 기반 EAP-TLS(Extensible Authentication Protocol-Transport Layer Security), EAP-TTLS(Extensible Authentication Protocol-Tunneled Transport Layer Security), EAP-FAST(Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling), PEAP (Protected Extensible Authentication Protocol) 등이 있다.

[0047] 인증 절차(S20)에서 성공적으로 인증을 완료하고 나면 제1 STA(2)은 결합 절차를 수행한다(S30). 본 단계의 결합 절차는 제1 STA(2)이 비AP STA이고 제2 STA(4)이 AP인 경우 등에 수행되는 임의적인 절차일 수 있다. 결합 절차(S30)는 제1 STA(2)과 제2 STA(4) 사이에 식별 가능한 연결, 즉 무선 링크를 설정하는 것을 의미한다. 결합 절차(S30)를 위해, 제1 STA(2)은 우선 인증 절차(S20)를 성공적으로 완료한 제2 STA(4)에게 결합 요청 프레임(Association Request Frame)을 전송하고, 제2 STA(4)는 이에 대한 응답으로 '성공(Successful)'이라는 상태값을 갖는 결합 응답 프레임(Association Response Frame)을 제1 STA(2)에게 전송한다. 상기 결합 응답 프레임에는 제1 STA(2)과의 결합을 식별할 수 있는 식별자, 예컨대 결합 아이디(Association ID, AID)가 포함된다.

[0048] 결합 절차(S30)가 성공적으로 완료된 후라도 가변적인 채널 상황으로 인하여 제1 STA(2)과 AP인 제2 STA(4)과의 연결 상태가 나빠지는 경우에, 제1 STA(2)은 접속 가능한 다른 AP와 다시 결합 과정을 수행할 수 있는데, 이를 재결합 절차(Re-association Procedure)라고 한다. 이러한 재결합 절차는 전술한 결합 절차(S30)와 상당히 유사

하다. 보다 구체적으로, 재결합 절차에서는 제1 STA(2)은 현재 결합되어 있는 AP가 아닌 다른 AP(전술한 탐색 과정(S10)에서 찾은 후보 AP들 중에서 인증 절차(S20)를 성공적으로 완료한 AP)에게 재결합 요청 프레임을 전송하고, 상기 다른 AP는 재결합 응답 프레임을 제1 STA(2)에게 전송한다. 다만, 재결합 요청 프레임에는 이전에 결합한 AP에 관한 정보가 더 포함되며, 이 정보를 통하여 재결합 AP는 기존 AP인 제2 STA(4)에 버퍼링되어 있는 데이터를 제1 STA(2)에게 전달할 수가 있다.

[0049] 상술한 결합 및 재결합 절차에서 제1 STA(2)은 제2 STA(4)에게 제1 STA(2)이 동작 가능한 채널들의 목록(list)을 제공할 수 있다. 채널들의 목록은 결합 요청 프레임 또는 재결합 요청 프레임에 포함되어 전송될 수 있다.

[0050] 인증 절차(S20)를 완료하거나 또는 이에 추가하여 결합 절차(S30)를 완료한 제1 STA(2)과 제2 STA(4) 사이에 동적 주파수 선택 절차가 진행될 수 있다(S40). 도 4에서는 인프라스트럭처 BSS에서 결합 절차(S30)를 완료한 제1 STA(2)과 제2 STA(4) 사이에서 위치 절차가 진행되는 것으로 도시되어 있지만, 후술하는 본 발명의 실시예에 따른 동적 주파수 선택 절차(S40)는 이에 한정되는 것은 아니다. 즉, 본 발명의 실시예에 따른 동적 주파수 선택 절차는 서로간에 무선 링크를 설정하고 있는 두 개의 STA 사이이면, 그것이 비AP STA이든 AP이든 또는 MP이든 상관없이 적용될 수 있다. 예컨대, 본 발명의 실시예에 따른 동적 주파수 선택 절차는, 도 3의 예와 같은 인프라 스트럭처 BSS의 비AP STA과 AP 사이는 물론, IBSS 및 MBSS의 비AP STA 사이에서도 진행될 수도 있다.

[0051] 무선랜 네트워크에서 동적 주파수 선택 절차는 동작 채널(operating channel)을 채널 환경의 변화에 따라 적응적으로 스위칭 할 수 있도록 한다. AP와 STA은 동적 주파수 선택 절차를 통해 동작채널을 유지/변경 할 수 있다. 동작채널을 변경할 것인지 여부에 여부는 AP가 현재 동작채널의 상황에 기반하여 판단할 수 있다. 예를 들어, 현재의 동작채널의 상태가 악화되거나, 동종 또는 이종 통신 시스템으로부터 간섭이 있는 경우 또는 정책적/행정적 규제에 의해 특정한 상황에서 해당 채널의 사용이 더 이상 허용되지 아니하는 경우 등에는 해당 동작채널의 사용을 중지하고 새로운 동작 채널을 설정하여야 하는 것으로 판단할 수 있다.

[0052] 이하에서 5GHz 대역에서 동작하는 무선랜 네트워크에 적용되는 사항을 가정하여 설명하기로 한다. 동적 채널 선택 과정을 통해 채널을 스위칭해야 하는 사유로 5GHz 대역을 사용하는 레이더(radar)신호를 보호하기 위한 규제(regulations)를 가정한다. 다만 이는 설명의 편의를 위한 것으로 본 발명이 적용되는 주파수 대역, 동적 주파수 선택 절차에서 검출하는 대상 신호 등에 대한 제한으로 이해 되어서는 안 된다. 또한 이하의 실시예에서 특정 채널에서의 프레임 전송/수신을 제한하는 것은 동적 주파수 선택 절차와 무관하게 이루어질 수 있다.

[0053] 동적 주파수 선택 절차는 앞서 설명한 AP와 STA들과의 도 4의 결합 절차(S30)를 포함할 수 있다. 동적 주파수 선택 절차는 현재의 채널을 침묵시키는(quieting the current channel)고, 채널을 측정하여 레이더가 검출(detecting)되면 동작을 중단하고, 새로운 채널을 선택하고, 선택된 새로운 채널을 STA들에게 알리는 것을 포함할 수 있다.

[0054] 도 5는 VHT 무선랜 시스템의 동작 대역폭(operating bandwidth)이 될 수 있는 5GHz 대역의 스펙트럼 상세(spectrum detail)를 나타낸 것이다. 도 5에서 DFS (Dynamic Frequency Selection) 대역(band)으로 표시된 대역, 즉, 5.25GHz ~ 5.35GHz 및 5.47GHz ~ 5.725GHz는 레이더 신호(radar signal)가 존재할 수 있어 DFS 절차에 의해 레이더 신호의 존재여부를 탐지하고, 레이더 신호가 검출 될 경우에는 해당 대역의 동작채널을 다른 대역의 채널로 스위칭하여야 하는 대역을 의미한다.

[0055] 무선랜 네트워크의 어느 BSS가 DFS 대역을 동작채널의 대역, 즉 동작 대역(operating band)으로 할 때, BSS의 AP와 non-AP STA들은 해당 대역을 사용하기 전 및 사용 중 때때로 레이더의 존재여부를 검출하여야 한다. 해당 대역에 레이더가 존재하는지 여부를 검출하기 위한 검사(test)에 앞서 AP는 BSS내의 모든 STA들이 현재의 동작채널을 통해 프레임을 전송하지 아니하도록 한다. 즉, 모든 STA들을 침묵시키기 (quieting) 위한 침묵 요소를 전송할 수 있다. 침묵 요소는 비콘 프레임에 포함되어 BSS내의 모든 STA들에게 브로드캐스팅되거나 프로브 응답 프레임에 포함되어 개별 STA에게 전송될 수 있다.

[0056] AP로부터 침묵 요소를 수신한 STA들은 전송하여 STA들을 침묵 요소에 설정된 값에 따라 프레임의 전송/수신이 금지되는 침묵 기간을 갖는다. AP는 해당 대역에서 다른 STA의 프레임 전송/수신에 따른 간섭을 받지 아니하고 레이더 신호의 존재 여부를 검사할 수 있다.

[0057] 해당 대역에서 레이더 신호가 검출되면 동작 대역을 다른 주파수 대역으로 옮길 수 있다. 도 5에서 EIRP는 유효 등방성 복사전력(Effective Isotropic Radiated Power, EIRP )를 의미하며, DSRC 5.9GHz는 단거리 통신에 사용되는(dedicated) 주파수 대역을 의미한다. DFS(dynamic frequency selection)는 5 GHz 주파수 대역에서 레이더 검출 및 균일한 채널을 사용하기 위한 기법으로서 자동으로 주파수를 할당하는 기법을 의미하고, TPC(transmit

power control) 5GHz 주파수 대역에서 간섭의 감소, 도달거리 제어 및 전력 소비 감소를 위해 송출전력을 적절히 조정하도록 802.11h에서 제안된 전력제어기법이다.

[0058] 도 6은 침묵 정보요소(Quiet Information Element, Quiet IE) 포맷의 일례를 나타낸 블록도이다.

[0059] 침묵 IE는 요소 식별자(Element ID) 필드, 길이(Length) 필드, 침묵 카운트(Quiet Count) 필드, 침묵 주기(Quiet Period) 필드, 침묵 지속기간(Quiet Duration) 필드, 침묵 오프셋(Quiet Offset) 필드를 포함할 수 있다.

[0060] 요소 식별자 필드는 요소(element)의 식별정보를 지시하는 값으로 설정되어, 본 요소가 침묵 요소임을 지시한다.

[0061] 길이(Length) 필드는 침묵 카운트(Quiet Count) 필드, 침묵 주기(Quiet Period) 필드, 침묵 지속기간(Quiet Duration) 필드, 침묵 오프셋(Quiet Offset) 필드의 길이를 지시하는 값으로 설정될 수 있다. 일례로 6 옥텟(octet)으로 설정되어 있어 이후에 침묵 카운트 필드(1 octet), 침묵 주기 필드(1 octet), 침묵 지속기간 필드(2 octets), 및 침묵 오프셋 필드(2 octets)이 이어짐을 지시할 수 있다.

[0062] 침묵 카운트 필드는 다음 침묵 기간(quiet interval)이 시작되는 시점을 포함하는 비콘 간격까지의 TBTT(target beacon transmission time)의 수로 설정될 수 있다. 즉 침묵 카운트 필드가 1로 설정되면 다음 TBTT에서 시작되는 비콘 간격 동안에 침묵 기간이 시작됨을 지시한다.

[0063] 침묵 주기 필드는 침묵 요소에 의해 정의된 정기적인 침묵 기간들의 시작점간 비콘 인터벌들의 수로 설정된다. 0으로 설정된 값은 침묵 기간이 주기적으로 설정된 것이 아님을 지시한다.

[0064] 침묵 지속기간 필드는 타임 유닛(time unit, TUs)으로 표현되고, 침묵 기간의 지속기간으로 설정된다.

[0065] 침묵 오프셋 필드는 TUs로 표현되고 침묵 카운트 필드에 의해 명시된 TBTT로부터 침묵 기간의 시작시점의 오프셋 값으로 설정된다. 침묵 오프셋 필드의 값은 하나의 비콘 간격보다 적다.

[0066] 침묵 요소가 AP에 의해 STA에게 전송될 때, AP와 STA은 다음과 같이 동작할 수 있다.

[0067] BSS의 AP는 비콘 프레임 및/또는 프로브 응답 프레임을 통하여 하나 또는 그 이상의 침묵 요소들을 전송하여 침묵 기간들을 스케쥴링할 수 있다. AP는 요청이 있을 경우 침묵 기간들의 스케쥴링을 중단하거나 침묵 요소의 각 필드의 값을 변경할 수 있다. 가장 최근에 전송된 침묵 요소의 각 필드값에 의해 이후 AP와 STA의 동작이 이루어지므로, 침묵 요소의 각 필드의 값이 변경되어 전송되면, 변경 이전에 비콘 프레임 또는 프로브 응답 프레임을 통하여 전송된 침묵 요소는 폐기할 수 있다.

[0068] IBSS의 경우 DFS 소유자(owner)의 지위를 갖는 STA만이 IBSS를 설립하는 최초의 비콘 프레임을 통하여 하나 또는 이상의 침묵 요소들을 전송하여 침묵 기간들의 일정(schedule)을 규정할 수 있다. IBSS의 모든 STA들은 전송된 비콘 프레임 또는 프로브 응답 프레임에 침묵 요소들을 포함시켜 침묵 기간 스케쥴을 지속할 수 있다.

[0069] 복수의 독립적인 침묵 기간들이 스케쥴링될 수 있다. 비콘 프레임 또는 프로브 응답 프레임에 포함되는 복수의 침묵 요소들 각각의 침묵 기간들은 TBTT에 동일한 타이밍 관계를 갖지 아니할 수 있다.

[0070] 채널의 제어는 침묵 인터벌의 시작과 함께 잃게 되며, 침묵 인터벌의 길이 동안 BSS의 모든 STA들은 NAV(network allocation vector)를 설정한다. BSS의 STA에 의한 주채널 및 보조채널에서의 MPDU 및 MPDU와 연관된 확인 메시지의 전송은 침묵 인터벌이 시작되기 전에 완료되어야 한다. 만일 침묵 인터벌이 시작되기 전까지의 기간이 어느 MPDU의 전송에 필요한 시간에 못 미치는 경우 STA은 현재의 경쟁 윈도우를 이용하여 랜덤 백오프 시간을 선택하여 해당 MPDU의 전송을 연기하여야 한다. MPDU 전송의 연기로 인하여 MSDU 또는 A-MSDU를 위한 단기 재시도 카운터(short retry counter) 및 장기 재시도 카운터(long retry counter)는 영향을 받지 아니한다.

[0071] 채널에 레이더 신호가 존재하는지 검사하기 위하여 STA은 규제조건에 따른 레이더의 존재가 검사되지 아니하면 해당 채널에서 전송을 수행하지 아니한다.

[0072] 만일 레이더 신호가 검출되면, BSS는 새로운 운영 채널로 이전될 수 있다.

[0073] 상술한 침묵 IE 는 BSS내의 다른 STA으로 인한 간섭없이 채널을 측정하기 위해 사용되었다. 상술한 침묵 IE 는 운영채널의 모든 서브 채널을 침묵시킨다. 그런데 운영 채널은 복수의 서브 채널로 구성될 수 있으며, 일부의 서브 채널은 DFS 대역 이외의 대역에 있을 수 있다. DFS 대역 내의 채널에 레이더 신호가 존재하는지 여부를 점

검하기 위하여 DFS 대역 이외에 존재하는 서브 채널까지 침묵시키는 것은 무선자원의 효율적인 활용을 저해한다. 이러한 문제점은 넓은 대역의 채널 대역폭을 지원하는 VHT 무선랜 시스템에서 빈번히 발생할 수 있다.

[0074] 도 7은 넓은 대역의 동작 채널을 지원하는 무선랜 시스템에서 발생할 수 있는 상술한 문제점을 예시한 것이다.

[0075] 도 7의 예에서 무선랜 시스템은 80MHz의 대역폭을 갖는 제1 채널과 80MHz의 대역폭을 갖는 제2 채널로 구성된 동작채널을 가진다. 제2 채널은 DFS 대역에 존재하고 제1 채널은 DFS 대역 외의 채널이다. 이와 같은 상황에서 DFS 대역의 제2 채널의 대역에 레이더 신호가 존재하는지 여부를 검사하기 위하여 침묵시키는 경우 제1 채널과 제2 채널 모두 침묵 기간 동안 사용될 수 없다. 그러나 DFS 대역 밖의 채널인 제1 채널을 침묵시키는 것은 무선자원의 낭비를 초래한다. 본 발명은 이러한 문제점을 해결하기 위한 방법을 제시한다.

[0076] 도 8은 본 발명의 일 실시예에 따른 채널의 활용 방법을 나타낸 것이다.

[0077] 도 7의 예와 같이 각각 80MHz의 대역폭을 갖는 제1 채널과 제2 채널로 구성된 동작채널을 갖는 무선랜 시스템에서의 동작을 가정한다. 제1 채널은 주채널로서 DFS 대역 밖에 위치하며 제2 채널은 부채널로서 DFS 대역에 위치한다. 본 발명의 실시예에 의하면 제2 채널을 침묵시키는 경우에 필요에 따라 제1 채널을 침묵시키지 아니할 수 있다. 즉, 종래와 같이 모든 채널을 침묵시키는 것과 달리 각각의 주파수 대역 또는 서브채널별로 해당 채널을 침묵시킬지 여부를 STA에게 지시할 수 있다.

[0078] 도 8의 예에서 제2 채널은 침묵시키고 제1 채널은 침묵시키지 아니할 수 있다. 이러한 경우 제2 채널의 침묵 인터벌 동안 제1 채널을 통해 프레임의 전송/수신이 가능하다. 즉, 동작 채널을 구성하는 일부 채널을 이용한 프레임의 전송/수신이 금지되는 경우에도 금지되지 아니한 채널을 통해 프레임을 전송/수신할 수 있도록 하여 무선자원 활용의 효율 향상을 꾀할 수 있다.

[0079] 달리 표현하면, 동작채널을 구성하는 각 서브채널별로 특정 기간 동안의 사용 금지여부를 결정하여 STA에게 알려주어 각 서브채널의 상황에 따라 서브채널의 사용 가부를 STA이 알수 있도록 하는 것이다.

[0080] 제2 채널의 사용이 금지되고 제1 채널의 사용이 허락되는 경우 STA은 사용이 허락된 제1 채널을 이용할 수 있다. 만일 AP가 제1 채널 및 제2 채널 각각에 대해 개별적인 RF 체인(chains)을 가지고 동작하고 있었다면, 해당 침묵 구간 동안 제1 채널을 사용하여 non-AP STA들과 마찬가지로 통상적인 통신을 할 수 있다. 본 발명의 실시예에 의하면 개별 서브 채널 별로 사용 금지 여부를 알리기 위하여 도 6의 침묵 요소에서 정의된 정보 이외의 추가적인 정보가 전송될 수 있다. 본 발명의 실시예에서 STA에게 제공하는 추가 정보는 도 6의 침묵 요소와 함께 전송되거나 또는 독립적으로 전송될 수 있으며, 별개의 정보 요소로 STA에게 전송될 수 있다. 침묵 채널 요소는 별개의 관리/제어 프레임을 통해 전송되거나 비콘 프레임 또는 프로브 응답 프레임에 포함되어 전송될 수도 있다.

[0081] 이하에서는 침묵 요소와 별개의 정보 요소(Information Element, IE)로 STA에게 전송되는 경우를 예로 설명한다. 이하에서 본 발명의 실시예에 따라 제공되는 정보 요소를 도 6의 침묵 요소와 구별하기 위하여 침묵 채널 정보요소(Quiet Channel IE)라고 칭하기로 한다. 이하에서 '침묵 채널 IE' 라는 명칭 및 침묵 채널 IE에 포함되는 정보가 설정되는 필드의 명칭은 예시에 불과하며, 침묵 채널 IE에 포함되는 정보는 필요에 따라 생략되거나 다른 정보가 더 추가될 수 있다.

[0082] 도 9는 본 발명의 실시예에 따른 침묵 채널 IE 의 포맷의 일례을 나타낸 블록도이다.

[0083] 침묵 채널 IE 는 요소 식별자 필드, 길이 필드, 상태 플래그 필드, 침묵 운영 클래스 필드 및 침묵 채널 번호 필드를 포함할 수 있다.

[0084] 요소 식별자 필드는 본 정보 요소가 침묵 채널 IE 임을 지시하는 값으로 설정될 수 있다. 길이 필드는 길이 필드 이후에 부가되는 필드의 길이를 지시할 수 있다.

[0085] AP 상태 플래그 필드는 동작 채널 중 일부만이 침묵 채널 IE 에 의해 침묵 기간 동안 사용이 금지되는 경우 침묵 채널 IE 에 의해 사용이 금지되지 아니하는 채널에서의 AP 동작에 관한 정보를 제공한다. 즉, 도 8의 예에서 침묵 채널 요소를 통해 제2 채널만 침묵시키는 경우 제1 채널에서의 AP의 동작을 지시할 수 있다. AP가 제1 채널에서 STA과 프레임을 전송/수신할 수 있는지 여부를 지시할 수 있다. 일례로 AP 상태 플래그 필드는 1비트로 표현되어 필드값이 '1' 로 설정되면, AP가 제1 채널에서 STA과의 프레임 전송/수신이 가능하다는 것을 지시할 수 있다. 만일 필드값이 '0' 으로 설정되면 AP가 침묵기간 동안 제1 채널을 이용하여 STA과 프레임을 전송/수신할 수 없음을 지시할 수 있다. AP가 단일 RF 체인을 사용하고 있어서 제2 채널에서의 레이더 신호를 검사하는

중에는 제1 채널을 통해서 STA과 프레임을 전송/수신할 수 없다거나, 채널 상황이나 행정적 규제 등으로 AP가 침묵기간 중 제1 채널을 사용할 수 없거나 바람직하지 아니한 경우에는 AP 상태 플래그 필드를 0으로 설정하여 AP가 제1 채널에서 프레임의 전송/수신이 불가능하다는 것을 알려 줄 수 있다.

[0086] 침묵 운영 클래스 필드는 특정 지역/국가의 운영 클래스를 지시하는 값으로 설정될 수 있다. 침묵 운영 클래스 필드에 이어지는 침묵 채널 번호 필드는 해당 운영 클래스의 채널 셋 내의 특정 채널을 지시하는 값으로 설정될 수 있다. 즉, 침묵 운영 클래스 필드를 통해 국가별로 정해진 운영 클래스 값을 알려주고, 이어지는 침묵 채널 번호 필드를 통해 구체적으로 침묵시키고자 하는 채널의 번호를 알려줄 수 있다. 일례로 도 8의 예에서 제2 채널을 침묵시키고자 할때, 침묵 운영 클래스 필드를 특정 국가를 지시하는 값으로 설정하고, 침묵 채널 번호 필드에는 채널 번호 116을 설정할 수 있다. 침묵 운영 클래스 필드와 침묵 채널 번호 필드의 쌍은 하나의 20MHz 채널을 침묵시킬 대상 채널로 지시할 수 있다. 따라서 도 8의 예에서 제2 채널을 침묵시키기 위하여 4개의 침묵 운영 클래스 필드, 침묵 채널 번호 필드 쌍이 필요할 수 있다. 이때 4개의 침묵 채널 번호 필드는 각각 채널 번호 116, 채널 번호 120, 채널 번호 124, 채널 번호 128번을 지시하는 값으로 설정될 수 있다.

[0087] STA은 침묵 채널 요소를 AP로부터 수신하여 침묵 기간 동안 사용이 금지되는 대상 채널을 알게 되고, 침묵 기간 동안 해당 채널(본 예에서의 제2 채널)에서의 프레임 전송/수신을 하지 아니한다. 이때 침묵 채널 요소를 수신한 STA은 침묵 기간 동안 NAV를 설정할 수 있다.

[0088] AP는 침묵 기간 동안 제2 채널에서는 레이더 신호의 존재 여부를 검사하게 되고, 제1 채널에서는 상술한 AP 상태 플래그 필드의 설정에 따라 STA과 프레임을 전송/수신할 수 있다.

[0089] 도 10 및 도 11은 본 발명의 실시예에 따른 침묵 채널 요소 포맷의 다른 일례이다.

[0090] 침묵 채널 요소는 요소 ID(Element ID) 필드, 길이(Length) 필드, BSS 가용 채널 대역폭(BSS Usable Channel Width) 필드, AP 침묵 모드(AP Quiet Mode) 필드, 침묵 카운트(Quiet Count) 필드, 침묵 주기 필드, 침묵 지속기간 필드, 및 침묵 오프셋 필드를 포함한다.

[0091] 요소 ID 필드 및 길이 필드의 설정 및 해당 필드가 지시하는 바는 도 9의 예에서 설명한 바와 같다.

[0092] BSS 가용 채널 대역폭 필드는 침묵 IE에 의해 지시되는 기간 동안 BSS내 STA들에 의해 사용이 허용되는 채널 대역폭을 지시한다. 예를 들어, 주 80MHz일 경우 이 필드는 0으로 설정된다. 또 다른 예로, 주 20MHz인 경우 0, 주 40MHz인 경우 1, 주 80MHz인 경우 2로 설정된다.

[0093] AP 침묵 모드 필드는 침묵 기간들 동안 STA 동작을 특정한다. BSS 가용 채널 대역폭에 의해 지시되는 채널상에서 AP로의 통신이 허용되면, AP 침묵 모드 필드는 1로 설정된다. 그렇지 않은 경우 0으로 설정된다.

[0094] 침묵 카운트 필드는 다음 침묵 기간이 시작되는 시점을 포함하는 비콘 간격까지의 TBTT의 수로 설정될 수 있다. 즉 침묵 카운트 필드가 1로 설정되면 다음 TBTT에서 시작되는 비콘 간격 동안에 침묵 기간이 시작됨을 지시한다. 0 값은 예비의 값으로 사용된다.

[0095] 침묵 주기 필드는 침묵 채널 IE에 의해 정의된 정기적인 침묵 기간들의 시작점간 비콘 인터벌들의 수로 설정된다. 0으로 설정된 값은 침묵 기간이 주기적으로 설정된 것이 아님을 지시한다.

[0096] 침묵 지속기간 필드는 타임 유닛(time unit, TUs)으로 표현되고, 침묵 기간의 지속기간으로 설정된다.

[0097] 침묵 오프셋 필드는 TUs로 표현되고 침묵 카운트 필드에 의해 명시된 TBTT로부터 침묵 기간의 시작시점의 오프셋 값으로 설정된다. 침묵 오프셋 필드의 값은 하나의 비콘 간격보다 적다.

[0098] 도 10의 침묵 채널 IE가 단독으로 지시 프레임(일례로, 비콘 프레임 또는 프로브 응답 프레임)에 포함되어 전송되면, 이러한 침묵 채널 IE를 해독할 수 있는 VHT STA들과 같은 개량된 장치(enhanced device)들만, BSS 가용 채널 대역폭 필드에 의해 특정되는 비-DFS 대역을 제외한 DFS 대역에서 침묵시킬 수 있다. 침묵 IE없이 침묵 채널 IE가 독립적으로 지시 프레임에 포함되어 전송되면, 침묵 채널 IE를 인식할 수 없는(또는 지원하지 아니하는) 비-VHT STAs와 같은 레거시 장치들은 침묵 채널 IE를 해독하지 못함과 동시에 침묵 IE도 수신하지 않았으므로 전혀 침묵 관련한 동작을 수행하지 않는다.

[0099] 반면 VHT STAs와 같은 개선된 장치들은 도 10의 침묵 채널 IE를 수신하여 해독할 수 있으므로 해당 침묵 기간 동안 BSS 가용 채널 대역폭 필드에서 지시하는 비-DFS 대역을 제외한 DFS 대역에서만 침묵하고, BSS 가용 채널 대역폭 필드에서 지시하는 비-DFS 대역에서는 정상적인 통신을 할 수가 있다. 이 때 AP 침묵 모드 필드값에 따라 AP와 STA간의 통신이 해당 비-DFS 대역에서 허용되는지 여부도 추가 지시할 수 있다. 이하에서 침묵 채널 IE

를 인식할 수 있는 STA 의 일례로 VHT STA을 들어 설명하나 이는 설명의 편의를 위한 것으로 VHT STA은 침묵 채널 IE를 이용한 채널의 선별적 침묵 방법을 지원하는 STA을 대표하는 것으로 이해되어야 한다.

[0100] 본 발명의 실시예에 따르면, 도 10의 예와 같은 침묵 채널 IE는 침묵 IE의 전송여부와 무관하게 전송될 수 있다. 침묵 채널 IE가 독립적으로 전송될 때, 비-DFS 대역에서 동작하는 non-VHT STAs은 침묵 기간 동안 계속해서 정상적인 통신을 수행할 수 있다는 이점을 가질 수 있다.

[0101] 침묵 채널 IE가 항상 도 6의 침묵 IE 함께 전송된다면, 침묵 채널 IE를 인식할 수 없는 STAs들은 침묵 IE만을 인식하여 침묵 기간 동안 비-DFS 대역에서조차 프레임을 전송/수신할 수 없다. 이에 반하여 본 발명이 제안하는 도 10의 침묵 채널 IE는 침묵 IE를 대체하여 지시 프레임에 포함되어 전송되므로, 침묵 채널 IE를 인식하지 못하는 STAs들은 침묵 채널 IE의 전송과 무관하게 동작을 지속할 수 있다. 반면 침묵 채널 IE를 인식하는 VHT STAs들은 침묵 채널 IE의 각 필드값의 설정에 따라 해당 채널에서의 동작을 결정할 수 있다.

[0102] 도 11은 도 10의 침묵 채널 IE 포맷에서 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간, 침묵 오프셋 필드가 생략된 형태이다. 도 11의 침묵 채널 IE에서 생략된 필드들은 침묵 기간의 설정에 관련된 정보를 포함하는 필드들이다. 침묵 채널 IE가 침묵 IE와 함께 전송되는 경우 침묵 기간의 설정은 침묵 IE에 의해 이루어질 수 있으므로 중복될 수 있는 해당 정보를 담은 필드는 생략될 수 있다. 또는 AP 침묵 모드 필드가 0으로 설정되는 경우, 즉 침묵 기간 동안 AP가 BSS 가용 채널 대역폭 필드가 지시하는 서브 채널에서 STA들과 프레임을 전송/수신하는 것이 허용되지 아니하는 경우에는 침묵 카운트(Quiet Count) 필드, 침묵 주기 필드, 침묵 지속기간, 침묵 오프셋 필드의 설정이 불필요하다. 따라서, AP 침묵 모드 필드가 0으로 설정되는 경우에는 도 11의 포맷이, AP 침묵 모드 필드가 1로 설정되는 경우에는 도 10의 포맷이 사용될 수 있다.

[0103] 도 12 및 도 13은 본 발명의 실시예에 따른 침묵 채널 IE 포맷의 다른 일례를 나타낸 것이다.

[0104] 도 12의 침묵 채널 IE는 요소 ID 필드와 길이 필드 및 AP 침묵 모드 필드를 포함한다. 요소 ID 필드는 해당 필드를 포함하는 본 IE가 침묵 채널 IE임을 식별할 수 있도록 하는 IE 식별자 정보를 포함한다. 길이 필드는 IE의 길이 정보를 포함한다. 일례로 길이 필드 이후에 포함되는 필드들의 길이의 합이 길이 필드의 값으로 설정될 수 있다.

[0105] AP 침묵 모드 필드의 설정 및 기능은 앞서 도 10, 도11에서 설명한 바와 같다. 즉, 침묵 기간 동안 AP의 동작, AP와 결합되어 있는 STA들의 동작을 지시한다. 일례로, AP 침묵 모드 필드는 침묵 기간 동안 AP가 AP와 결합된 SAT과 프레임을 전송/수신하는 것을 허용하는 경우 1로 설정될 수 있다. 다시 말해서 AP 침묵 모드 필드가 1로 설정되었다 함은 동작 채널을 구성하는 복수의 서브 채널 중 일부 채널은 침묵 기간 동안 침묵되지 아니함을 의미한다. 이때, AP와 STA들은 침묵되지 아니하는 채널을 이용하여 통신(프레임을 전송/수신) 할 수 있다.

[0106] 도 12의 침묵 채널 IE는 침묵되지 아니하는 서브채널(침묵 기간 동안AP와 STA이 통신할 수 있는 서브채널 또는 채널 대역폭)을 지시하는 필드를 포함하고 있지 아니하다. 도 12의 침묵 채널 IE가 사용될 때, 도 12의 침묵 채널 IE에 의해 정의되지 아니하는 침묵 기간 및 침묵 기간 동안 AP 침묵 모드 필드의 설정에 따라 AP와 STA간 프레임 전송/수신이 이루어질 수 있는 채널은 다른 IE(e.g. 침묵 IE)에 의해 정의되거나 AP와 STA간 약속되어 있는 기 설정된 값/채널로 정의될 수 있다.

[0107] 일례로 DFS 대역의 80MHz 부 채널이 침묵될 때, AP 침묵 모드 필드값의 설정에 따라 AP와 STA간 프레임 교환이 가능한 채널로 80MHz 주 채널이 사용될 것임을 미리 정의하여 사용될 수 있다. 이러한 경우 AP는 AP 침묵 모드 필드가 1로 설정된 침묵 채널 IE를 수신한 경우 침묵 기간 동안 주 80MHz 채널의 대역폭 내에서(within) STA들과 통신할 수 있다.

[0108] 도 12의 침묵 채널 IE 포맷이 사용될 때, 침묵 기간은 도 12의 침묵 채널 IE와 함께 전송되는 침묵 IE에 의해 정의될 수 있다. 즉, 도 6의 침묵 IE가 침묵 채널 IE와 함께 지시 프레임(e.g. 비콘 프레임 또는 프로브 응답 프레임)을 통해 STA에게 전송되면, STA들은 침묵 IE의 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드 및 침묵 오프셋 필드로 정의된 침묵 기간에 의해 동작할 수 있다.

[0109] 도 13의 침묵 채널 IE 포맷은 도 12의 포맷에 비하여 침묵 카운트 필드, 침묵 주기 필드, 침묵 지속기간 필드 및 침묵 오프셋 필드를 더 포함한다. 즉, 도 13의 포맷은 침묵 기간의 설정에 필요한 정보를 포함하고 있다. 도 13의 포맷은 침묵 IE와 독립적으로 전송될 수 있다. 다시 말해서 침묵 IE 없이 도 13의 포맷의 침묵 채널 IE만을 포함하는 지시 프레임이 전송될 수 있다.

[0110] AP 침묵 모드 필드가 0으로 설정되는 경우에는 침묵 채널 IE에서 침묵 기간이 정의되지 아니할 수 있다. AP 침

묵 모드 필드가 0으로 설정되는 경우 침묵 기간 동안 동작 채널의 모든 서브채널이 침묵되기 때문이다. 즉, 모든 STA이 인식할 수 있는 침묵 IE를 전송하는 것만으로 동일한 효과를 얻을 수 있으므로 침묵 채널 IE는 AP 침묵 모드 필드외에 침묵 기간 설정과 관련된 필드들의 전송을 생략할 수 있다. 다시 말해서, AP 침묵 모드 필드가 0으로 설정되는 경우 도 12의 포맷이, AP 침묵 모드 필드가 1로 설정되는 경우 도 13의 포맷이 사용될 수 있다.

[0111] AP가 도 12의 포맷의 침묵 채널 IE가 전송할 때에는 침묵 기간에 대한 정보를 제공하기 위하여 침묵 IE를 함께 전송할 수 있다. 다시 말해서 도 12의 침묵 채널 IE는 적어도 하나의 침묵 IE와 함께 전송될 수 있다.

[0112] 반면 도 13의 포맷의 침묵 채널 IE는 침묵 IE와 함께 전송되거나 침묵 IE 없이 침묵 채널 IE만이 전송될 수 있다.

[0113] 지금까지 광대역의 동작채널을 지원하는 무선랜 시스템에서 동작채널의 일부 대역 또는 동작 채널을구성하는 복수의 서브 채널 중 일부 채널에 대해 선별적인 침묵 방법을 제안하고, 침묵 기간 동안의 AP와 STA들의 동작을 지시하는 AP 상태 플래그 필드 또는 AP 침묵 모드 필드를 설명하였다.

[0114] 실시예에 따라 AP 상태 플래그 필드는 비-침묵 채널에서 침묵 기간 동안 STA들과 통신이 가능한지 여부를 지시하는 것 이외에, AP가 자기 간섭(self-interference) 문제 등으로 인해 송신은 불가하고 수신만 할 수 있다는 지시 비트를 상기 AP 상태 플래그 필드 내에 추가로 설정할 수 있다. 이 경우 STA들이 AP로 데이터 전송을 하고자 할 때는 ACK 정책을 AP로부터의 ACK을 받을 필요가 없는 No-ACK 정책을 채택하여 데이터 전송을 할 수 있다.

[0115] 이하에서는 상기 도 12 또는 도 13의 침묵 채널 IE가 지시 프레임(예로, 비콘 프레임 또는 프로브 응답 프레임)에 포함되어 전송된 경우, AP 또는 비-AP STAs의 동작을 설명한다.

[0116] AP는 동작 채널의 일부 대역 또는 일부 서브채널을 침묵 시키기 위하여 침묵 채널 IE를 전송할 수 있다. 침묵 채널 IE는 지시 프레임에 포함되어 전송될 수 있는데, 비콘 프레임, 프로브 응답 프레임은 지시 프레임의 일례이다.

[0117] AP는 침묵 채널 IE를 침묵 IE와 함께 전송될 수 있다. AP는 현재의 동작채널 중 일부의 대역 또는 서브채널을 침묵시키고자 하는 경우 침묵 채널 IE의 AP 침묵 모드 필드를 1로 설정하여 전송할 수 있다.

[0118] AP는 AP 침묵 모드 필드를 1로 설정하는 경우 도 12 또는 도 13의 포맷의 침묵 채널 IE를 전송할 수 있으며, AP 침묵 모드 필드를 0으로 설정하는 경우 도 12의 포맷을 사용할 수 있다. 도 12의 포맷을 사용하여 침묵 채널 IE를 전송하는 경우 침묵 IE를 함께 전송한다.

[0119] DFS 절차에서 침묵 채널 IE를 전송하는 경우 AP는 침묵 기간 동안 침묵된 채널(Quieted channel)에서 레이더 신호의 존재여부를 검사하고, 레이더 신호가 존재하는 경우 새로운 동작채널을 선택하고 선택된 새로운 동작채널을 STA들에게 알릴 수 있다.

[0120] AP 침묵 모드 필드가 1로 설정된 경우 AP는 침묵 기간 동안 비-침묵 채널(non-quieted channel)에서 STA들과 통신할 수 있다.

[0121] BSS내의 STA들은 침묵 채널 IE를 인식할 수 있는 VHT STA들과 인식할 수 없는 레거시 STA으로 나뉠 수 있다. 레거시 STA들은 침묵 IE만 해독 가능하며 침묵 IE의 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드의 설정값에 의해 정의되는 침묵 기간동안 자신의 운영 채널에서 프레임의 전송/수신을 하지 아니하고 NAV를 설정하여 채널 접근을 연기한다.

[0122] VHT STA들은 침묵 채널 IE의 AP 침묵 모드 필드로부터 침묵 기간 동안의 자신의 동작정보를 획득한다. AP 침묵 모드 필드가 0으로 설정된 경우 침묵 기간에 관한 정보는 침묵 채널 IE와 함께 전송되는 침묵 IE의 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드를 통해 획득한다. AP 침묵 모드 필드가 0으로 설정된 경우 침묵 기간 동안 NAV를 설정하고 채널 접근을 연기한다.

[0123] AP 침묵 모드 필드가 1로 설정된 경우 침묵 채널 IE가 도 13의 포맷과 같이 침묵 카운트, 침묵 주기, 침묵 지속기간, 침묵 오프셋 필드를 포함하는 경우 해당 필드들로부터 침묵 기간을 획득하고 침묵 기간 동안 부 80MHz 채널에서는 NAV를 설정하고, 주 80MHz 채널 내에서 AP와 프레임을 교환할 수 있다. 만일 침묵 채널 IE가 도 12의 포맷과 같이 침묵 기간을 정의하는데 필요한 정보를 포함하는 필드를 포함하지 아니하는 경우에는 침묵 채널 IE와 함께 전송되는 침묵 IE로부터 침묵 기간 정보를 획득할 수 있다.

[0124] AP는 침묵 기간을 폐지/갱신하기 위하여 침묵 IE 및/또는 침묵 채널 IE를 전송할 수 있으며, STA은 자신이 수신

한 최신 침묵 IE 또는 침묵 채널 IE를 통해 획득한 침묵 기간 및 침묵 기간 동안의 동작정보를 기반으로 동작한다.

[0125] 본 발명의 다른 실시예에 의하면, 특정 주파수 대역을 침묵시키기 위한 방법으로 관리 프레임을 이용할 수 있다. 관리 프레임의 일례로 VHT 운영 모드 알림 프레임이 사용될 수 있다.

[0126] VHT 운영 모드 알림 프레임은 전송 STA이 운영 채널 대역폭, 수신 가능한 최대 공간 스트림 개수 중 적어도 하나를 변경하는 것을 STA들에게 알리기 위하여 사용될 수 있다. 이 프레임은 비-AP STA 및 AP 모두에 의해 전송될 수 있다. AP가 운영 모드를 변경하고자 하는 경우, AP는 이 액션 프레임을 BSS내 모든 STA으로 브로드캐스트한다. VHT 운영 모드 알림 프레임에는 표1의 정보가 포함될 수 있다.

표 1

[0127]

| 순서 | 정보 |
|---|---|
| 1 | 카테고리(Category) |
| 2 | VHT 액션(VHT Action) |
| 3 | VHT 운영 모드(VHT Operating mode) |

[0128] 카테고리 필드는 VHT를 위한 값으로 설정된다. VHT 액션 필드는 VHT 운영 모드 알림을 위한 값으로 설정된다.

[0129] VHT 운영 모드 필드는 전송 STA이 수신 가능한 운영 채널 대역폭 및 Nss를 지시하기 위하여 VHT 운영 모드 알림 프레임 내에서 사용될 수 있다.

[0130] 도 14는 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

[0131] 이 필드를 전송하는 STA은 현재 운영 채널 대역폭 및 공간 스트림 개수를 지시한다. VHT 운영 모드 필드는 채널 대역폭(Channel width) 서브 필드, Rx Nss 서브필드, Max Nss For SU Present 서브필드를 포함할 수 있다. 표2는 VHT 운영 모드 필드에 포함되는 각 서브필드의 설정 및 기능을 설명한다.

표 2

[0132]

| **서브 필드** | **설 명** |
|---|---|
| 채널 대역폭 (Channel Width) | Rx Nss Type 서브필드가 0이면, 지원 채널 대역폭을 지시함:<br>20 MHz의 경우 0,<br>40 MHz의 경우 1<br>80 MHz의 경우 2<br>160 MHz 또는 80+80 MHz의 경우 3.<br>Rx Nss subfield is 1이면 예비(reserved) |
| Rx Nss | Rx Nss Type 서브필드가 0이면, STA이 수신할 수 있는 최대공간스트림 개수를 지시함<br>Rx Nss Type 서브필드가 1이면, VHT 압축 빔포밍 프레임(VHT Compressed Beamforming frame)내에서 MU를 지시하는 피드백 타입(Feedback Type) 서브 필드를 포함하는 VHT 압축 빔포밍 보보고부터 전달된 빔포밍 조정 매트릭스(beamforming steering matrix)를 사용하는 SU PPDU에 대한 빔포미(beamformee)로서 STA이 수신할 수 있는 최대 공간 스트림 개수를 지시함.<br>Nss = 1의 경우 0<br>Nss = 2의 경우 1<br>…<br>Nss = 8의 경우 7 |

| | |
|---|---|
| Rx Nss Type | 0이면, STA이 수신할 수 있는 최대 공간 스트림 개수를 담고 있음을 지시함.<br>1이면, Rx Nss 서브필드가 VHT 압축 빔포밍 프레임(VHT Compressed Beamforming frame)내에서 MU를 지시하는 피드백 타입(Feedback Type) 서브 필드를 포함하는 VHT 압축 빔포밍 보보고부터 전달된 빔포밍 조정 매트릭스(beamforming steering matrix)를 사용하는 SU PPDU에 대한 빔포미(beamformee)로서 STA이 수신할 수 있는 최대 공간 스트림 개수를 담고 있음을 지시함. |

[0133] VHT 운영 모드 필드는 VHT 운영 모드 알림 액션 관리 프레임을 통해서 전송될 수 있다. AP가 만일 현재의 BSS 운영 채널 대역폭을 변경하고자 한다면 VHT 운영 모드 알림 액션 관리 프레임을 브로드캐스트할 수 있다.

[0134] 본 발명의 실시예에 따르면, VHT 운영 모드 필드를 이용하여 특정 주파수 대역을 침묵시킬 수 있도록 하기 위하여 침묵 타입 정보와 AP 침묵 모드 정보를 더 포함한 수정된 VHT 운영 모드 필드를 전송할 수 있다.

[0135] 도 15는 본 발명의 실시예에 따른 수정된 VHT 운영 모드 필드의 포맷을 나타낸 블록도이다.

[0136] 본 발명의 실시예에 의하면 수정된 VHT 운영 모드 필드는 비콘 프레임 또는 프로브 응답 프레임을 통해 전송될 수 있다. 비콘 프레임을 통해 전송될 수 있도록 하여 기존에 액션 프레임 형태로만 VHT 운영 모드 필드를 전송할 수 있었던 방식에 비해 BSS내에 더 많은 수의 STA들이 이 메시지를 수신할 수 있도록 하는 효과가 있다. 액션 프레임 전송의 경우 비콘 프레임 전송에 비해, 해당 시간에 취침 상태에 있어서 이를 수신하지 않는 STA들이 상대적으로 더 많을 수 있기 때문이다.

[0137] 표 3은 수정된 VHT 운영 모드 필드에 새롭게 추가된 침묵 타입 서브필드 및 AP 침묵 모드 서브필드의 설정 및 기능을 간략히 설명한 것이다.

표 3

[0138]

| **서브 필드** | **설 명** |
|---|---|
| 침묵 타입<br>(Quiet Type) | 현재 운영 채널 대역폭이 80+80MHz일 때, VHT 운영 모드 필드가 침묵 IE에 의해 지시된 침묵 지속기간동안만 유효하면, 1로 설정됨. 이는 VHT STA이 침묵 지속기간동안 부80MHz 상에서 침묵해야함을 지시함.<br>VHT 운영 모드 필드가 모든 시간에 대해 유효하면 0으로 설정됨. |
| AP 침묵 모드<br>(AP Quiet Mode) | 현재 운영 채널 대역폭이 80+80MHz일 때, 침묵 지속기간동안 주 80MHz상에서 AP-STA간 통신이 허용되면, 1로 설정됨, 그렇지 않으면 0으로 설정됨.<br>현재 운영 채널 대역폭이 20/40/80/160MHz일 때, 예비인 0 값으로 설정됨 |

[0139] 침묵 타입 필드가 0으로 설정될 때는 VHT 운영 모드 필드의 동작과 동일하다. 즉, 침묵 타입 필드가 0으로 설정된 수정된 VHT 운영 모드 필드를 수신한 BSS내의 STA들은 즉시 BSS 운영 채널 대역폭을 변경한다. 이 경우는 BSS 운영 채널 대역폭이 완전히 변경된 것이므로 이후 침묵 지속기간이 도래하면 상기 변경된 운영 채널 대역폭을 전체 operating band로 해석하고 해당 동작을 수행한다.

[0140] 반면, 침묵 타입 필드가 1로 설정되는 경우, 동작 채널 대역폭의 변경은 침묵 지속기간 구간들에만 한정하여 적용되는 것을 의미한다. 따라서, VHT STAs는 침묵 지속기간 동안 부 80MHz에서만 침묵하고 주80MHz에서는 프레임을 송수신할 수 있다.

[0141] AP 침묵 모드 필드는 앞선 실시예에서 기술한 바 있는 AP 상태 플래그 필드, AP 침묵 모드 필드와 동일한 기능을 한다. 즉, 현재 운영 채널 대역폭이 비연속(non-contiguous) 80+80MHz 채널인 경우, 이 값이 1로 설정되면 이후 침묵 지속기간 구간마다 AP-STA 통신이 주 80MHz에서 허락됨을 의미한다. AP 침묵 모드 필드가 0으로 설정된 경우 이후 침묵 지속기간 구간마다 AP-STA 채널이 주 80MHz에서 허용되지 않으며, STA-STA 통신만 허용될 수 있음을 의미한다.

[0142] 도 16은 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다. 무선 장치(70)는 상술한 실시예

를 구현할 수 있는 단말로서, 광대역 채널을 지원하는 AP 또는 비AP 스테이션(non-AP station)일 수 있다.

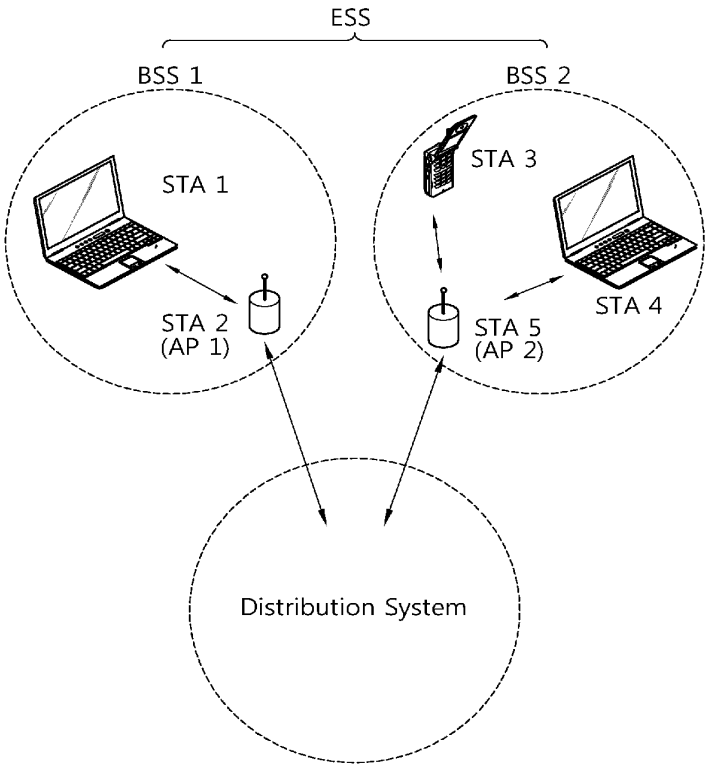
[0143] 무선장치(70)은 프로세서(72), 메모리(74) 및 트랜시버(transceiver, 76)를 포함한다. 트랜시버(76)는 무선신호를 송신/수신하되, IEEE 802.11의 물리계층이 구현된다. 프로세서(72)는 트랜시버(76)와 기능적으로 연결되어, IEEE 802.11의 MAC 계층 및 물리계층을 구현한다. 프로세서(72)는 본 발명이 제안하는 침묵 채널 요소를 포함하는 프레임을 생성하고 전송하거나, 수신한 프레임에 포함된 침묵 채널 요소 필드의 값을 해석하여 제어 정보를 획득할 수 있도록 설정될 수 있다. 프로세서(72)는 상술한 본 발명의 실시예를 구현하도록 설정될 수 있다.

[0144] 프로세서(72) 및/또는 트랜시버(76)는 ASIC(application-specific integrated circuit), 다른 칩셋, 논리 회로 및/또는 데이터 처리 장치를 포함할 수 있다. 메모리(74)는 ROM(read-only memory), RAM(random access memory), 플래쉬 메모리, 메모리 카드, 저장 매체 및/또는 다른 저장 장치를 포함할 수 있다. 실시예가 소프트웨어로 구현될 때, 상술한 기법은 상술한 기능을 수행하는 모듈(과정, 기능 등)로 구현될 수 있다. 모듈은 메모리(74)에 저장되고, 프로세서(72)에 의해 실행될 수 있다. 메모리(74)는 프로세서(72) 내부 또는 외부에 있을 수 있고, 잘 알려진 다양한 수단으로 프로세서(72)와 연결될 수 있다.

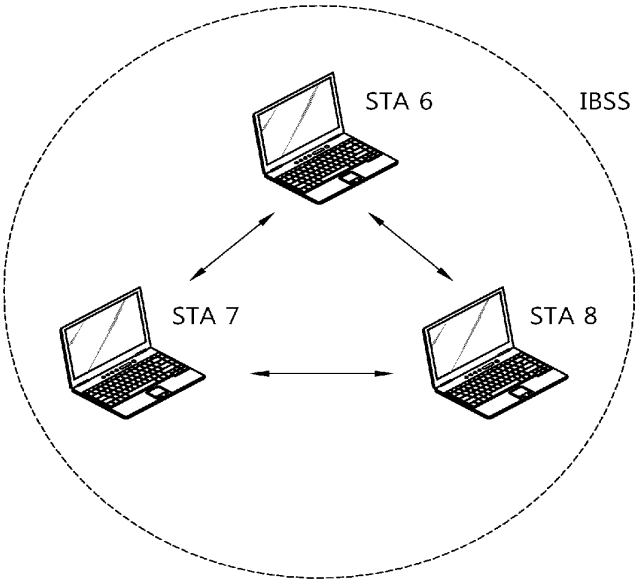
[0145] 이상에서 상세하게 설명한 본 발명의 실시예는 단지 본 발명의 기술 사상을 보여주기 위한 예시적인 것으로서, 상기 실시예에의 의하여 본 발명의 기술 사상이 한정되는 것으로 해석되어서는 안된다. 본 발명의 보호 범위는 후술하는 본 발명의 특허청구범위에 의하여 특정된다.

도면

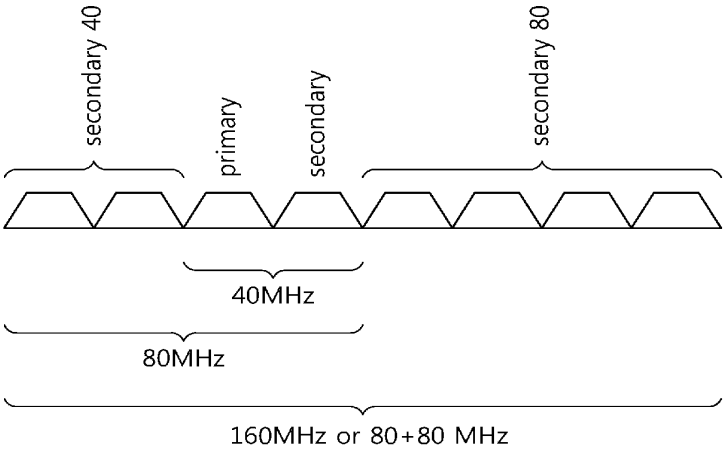
도면1



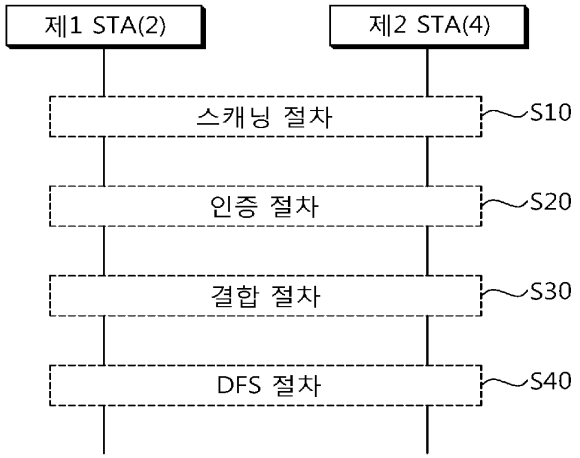
도면2


STA 6
IBSS
STA 7
STA 8

도면3


secondary 40
primary
secondary
secondary 80
40MHz
80MHz
160MHz or 80+80 MHz

도면4



도면25

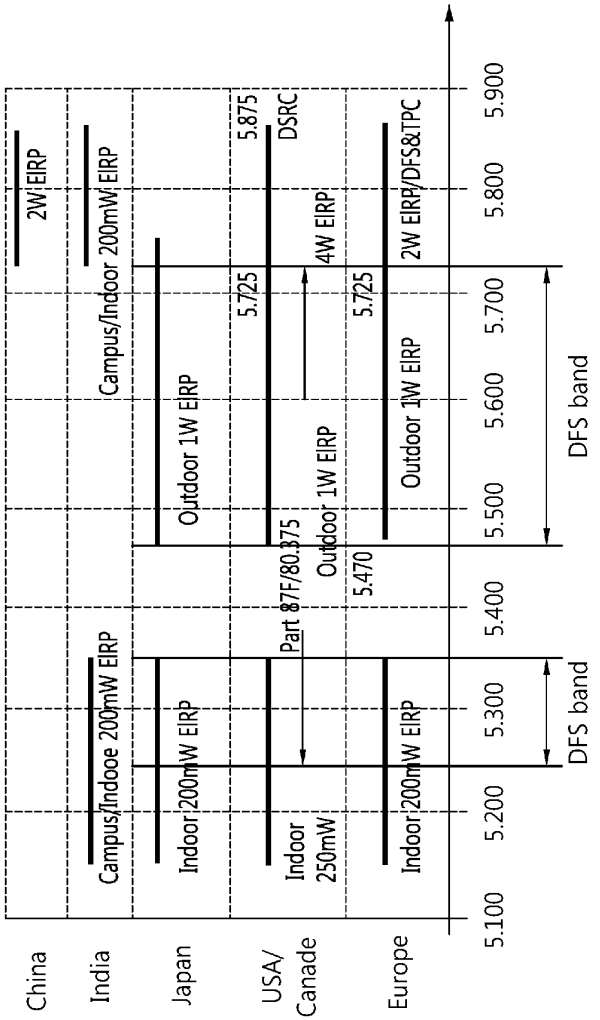
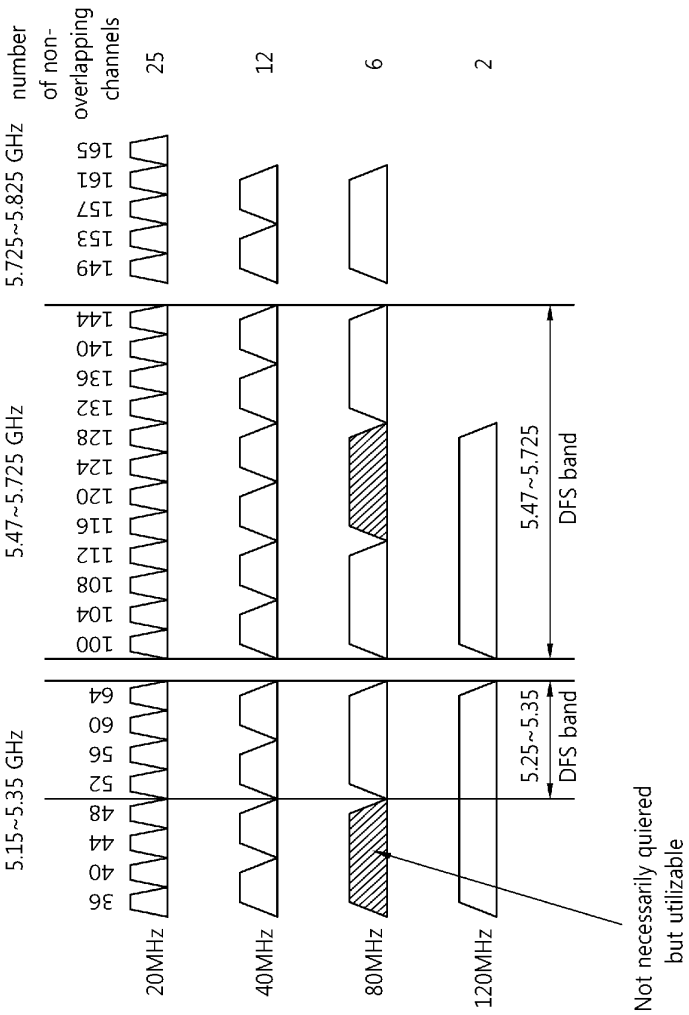

China
India
Japan
USA/
Canade
Europe
2W EIRP
Campus/Indooe 200mW EIRP
Campus/Indoor 200mW EIRP
Indoor 200mW EIRP
Outdoor 1W EIRP
Indoor
250mW
Part 87F/80.375
Outdoor 1W EIRP
4W EIRP
DSRC
Indoor 200mW EIRP
Outdoor 1W EIRP
2W EIRP/DFS&TPC
DFS band
DFS band
5.100
5.200
5.300
5.400
5.470
5.500
5.600
5.700
5.725
5.725
5.800
5.875
5.900

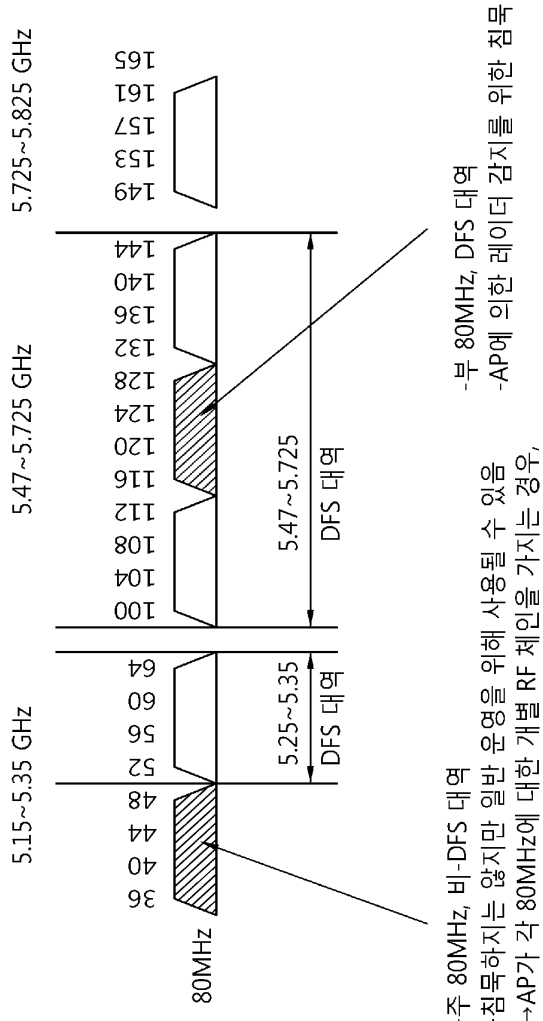
표 96

| 요소 ID | 길이 | 침묵 카운트 | 침묵 주기 | 침묵 지속기간 | 침묵 오프셋 (Quiet Offset) |
|---|---|---|---|---|---|
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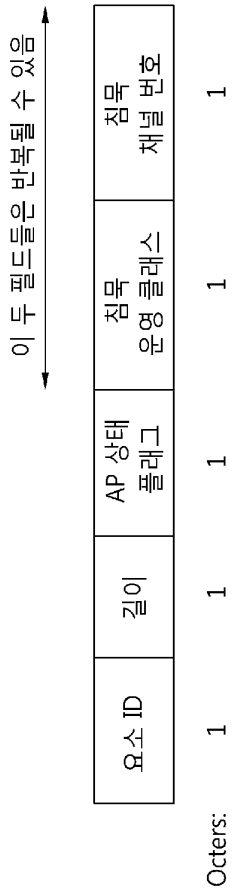
도면7


5.15~5.35 GHz
5.47~5.725 GHz
5.725~5.825 GHz
number of non-overlapping channels
36 40 44 48 52 56 60 64
100 104 108 112 116 120 124 128 132 136 140 144
149 153 157 161 165
20MHz
40MHz
80MHz
120MHz
25
12
6
2
5.25~5.35 DFS band
5.47~5.725 DFS band
Not necessarily quiered but utilizable

도면8


5.15~5.35 GHz
5.47~5.725 GHz
5.725~5.825 GHz
36
40
44
48
52
56
60
64
100
104
108
112
116
120
124
128
132
136
140
144
149
153
157
161
165
80MHz
5.25~5.35
DFS 대역
5.47~5.725
DFS 대역
-주 80MHz, 비-DFS 대역
-침묵하지는 않지만 일반 운영을 위해 사용될 수 있음
→AP가 각 80MHz에 대한 개별 RF 체인을 가지는 경우,
AP뿐 아니라 모든 STA도 송신할 수 있음
→단말이 전체 대역에 대하여 단일 RF 체인을 가지는 경우,
AP는 전송하지 못할 수 있음
-부 80MHz, DFS 대역
-AP에 의한 레이더 감지를 위한 침묵

도면9



도면10




도면11




도면12



도면13



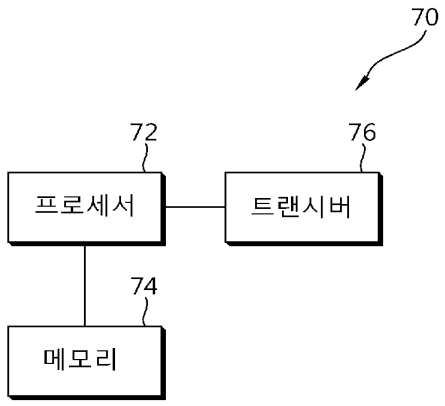

도면14

| B0-B1 | B2-B3 | B4-B6 | B7 |
|---|---|---|---|
| 채널 대역폭 | 예비 | Rx Nss | Max Nss For SU Present |

도면15

| B0-B1 | B2 | B3 | B4-B6 | B7 |
|---|---|---|---|---|
| 채널 대역폭 | 침묵 타입 | AP 침묵 모드 | Rx Nss | Max Nss For SU Present |

도면16



KIPO

Unexamined Patent Publication(A)

## Bibliographic Data


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|---|---|
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| **Application Date** | 20130812 |
| **Unexamined Publication No.** | 1020150044875 |
| **Unexamined Publication Date** | 20150427 |
| **Priority Claims** | 61/682,323 \| 20120813 \| US |
| **Agent.** | KIM, Yong In \| Bang Hae Cheol |
| **Inventor** | LEE,Wookbong \| KIM,Jeongki \| KWAK,Jinsam \| PARK,Giwon \| SEOK,Yongho \| CHUN,Jinyoung \| CHOI,Jinsoo |
| **Applicant** | LG Electronics Inc. |


## 발명의 명칭

화이트 스페이스 대역에서 채널화 방법 및 이를 위한 장치

## Title of Invention

CHANNELIZATION METHOD IN WHITESPACE BAND AND APPARATUS FOR THE SAME

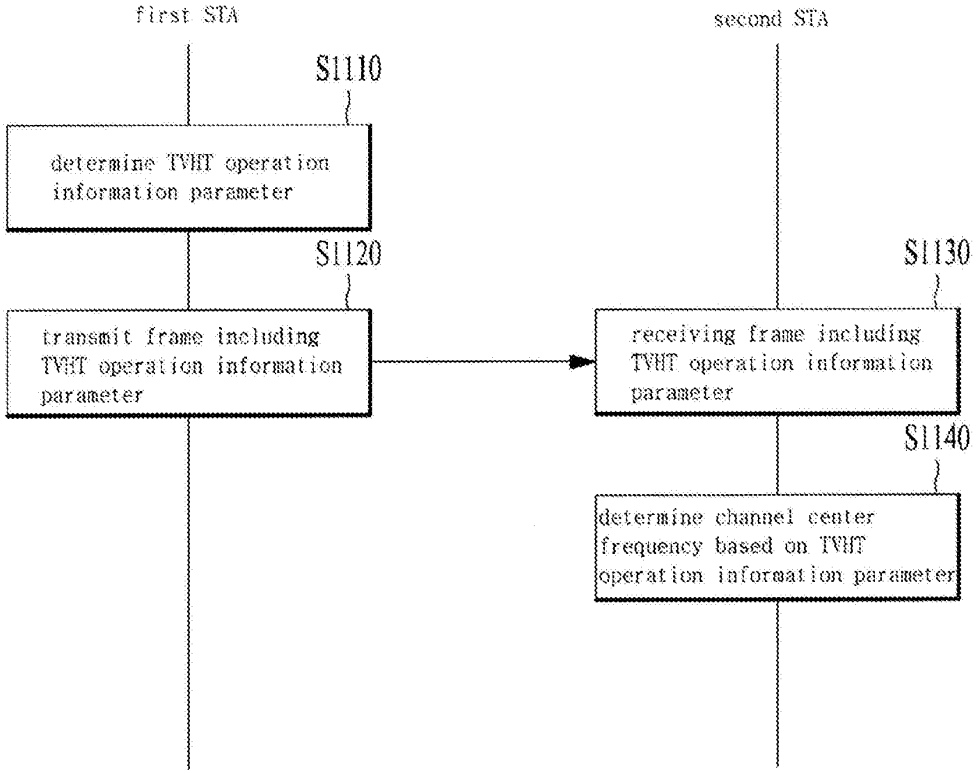
## 요약

본 발명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 화이트스페이스 대역에서의 채널화 방법 및 이를 위한 장치가 개시된다. 본 발명의 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 방법은, 제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

## Abstract

The invention relates to the radio communication system, and more specifically, the channelizing method at the white space band and the apparatus therefor are disclosed. The method, for providing the white space operation information according to a preferred embodiment of the present invention is the primary station (STA) may include the step of transmitting the frame including the TV white space high yield (TVHT) operation information field to the second STA. The TVHT operation information field comprises the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 sub fields. Here, the channel center frequency of the frequency segment 0 or the frequency segment 1 can be determined based on the channel starting frequency. Moreover, the channel starting frequency can be determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

## 대표도면(Representative drawing)




## 청구의 범위

청구 **1**항:

화이트스페이스 동작 정보를 제공하는 방법에 있어서,

제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함하고,

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 제공 방법.

청구 **2**항:

제 1 항에 있어서,

상기 채널 시작 주파수는,

## Scope of Claims

**Claim 1:**

An operation information providing method comprising the steps of: as to the method for providing the white space operation information,

primary station (STA) includes the step of transmitting the frame including the TV white space high yield (TVHT) operation information field to the second STA;

TVHT operation information field including the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields; the channel center frequency of

frequency segment 0 or the frequency segment 1 is determined based on the channel starting frequency; and

channel starting frequency is determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

**Claim 2:**

As for claim 1, the operation information providing method for being set up as the central frequency value of the TV channel corresponding to 0 the TV channel index based on the TV channel index where

상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스를 기준으로, 0번째 TV 채널 인덱스에 해당하는 TV 채널의 중심 주파수 값으로 설정되는, 동작 정보 제공 방법.

channel starting frequency corresponds to

frequency segment 0 or the TV channel index correspo nding to the frequency segment 1.

**청구 3항:**

**Claim 3:**

제 1 항에 있어서,

As for claim 1, the index phosphorus of the TV channel in which the TV channel index or the TV channel index corresponding to the frequency segment 1 is most low i n the frequency segment 0 or the frequency segment 1 corresponding to

상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스는, 상기 주파수 세그먼트 0 또는 상기 주파수 세그먼트 1에서 가장 낮은 TV 채널의 인덱스인, 동작 정보 제공 방법.

frequency segment 0, and the operation information pr oviding method.

**청구 4항:**

**Claim 4:**

제 1 항에 있어서,

As for claim 1, the operation information providing method for being set up as the value wherein

상기 채널 폭이 하나의 기본채널유닛(BCU), 2개의 연속된(co ntiguous) BCU들 또는 4개의 연속된 BCU들 중의 하나에 대응하는 경우에,

channel center frequency segment 0 subfield

channel width corresponds to one fundamental channel unit (BCU), and one among 2 consecutive BCUs or 4 co nsecutive BCUs shows the channel, most, the day (low est) TV channel index that includes one BCU in which t he TVHT basic service set (BSS) operates, and 2 cons ecutive BCUs or 4 consecutive BCUs.

상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT 기본 서비스 세트(BSS)가 동작하는 상기 하나의 BCU, 상기 2개의 연속된 BCU들 또는 상기 4개의 연속된 BCU들을 포함하는 채널에 대한 가장 낮은(lowest) TV 채널 인덱스를 나타내는 값으로 설정되는, 동작 정보 제공 방법.

**청구 5항:**

**Claim 5:**

제 4 항에 있어서,

As for claim 4, the operation information providing method wherein

상기 채널 폭이 2 개의 불연속적인(non-contiguous) BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에,

channel center frequency segment 0 subfield it corresp onds to one of

channel width is discontinuous frequency segments of noncontinuous (non-contiguous) BCUs of 2 or 2 is set u p as the value which shows the index of the TV chann el which is most low about the channel that includes o ne BCU of the frequency segment 0 or 2 successive BC Us in which the TVHT BSS operates, and each of

상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 0의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정되며,

상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함하는, 동작 정보 제공 방법.

frequency segments 2 successive BCUs is included.

**청구 6항:**

**Claim 6:**

제 5 항에 있어서,

The frequency segment phosphorus, and the operation information providing method of claim 5, wherein

상기 주파수 세그먼트 0는 프라이머리 채널을 포함하는 주파수 세그먼트인, 동작 정보 제공 방법.

frequency segment 0 comprise the primary channel.

**청구 7항:**

**Claim 7:**

제 5 항에 있어서,

As for claim 5, the operation information providing method for being set up as the value wherein

상기 채널 폭이 2 개의 불연속적인 BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에,

channel center frequency segment 1 subfield it corresp onds to one of

상기 채널 중심 주파수 세그먼트 1 서브필드는, TVHT BSS가

동작하는 상기 주파수 세그먼트 1의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정되는, 동작 정보 제공 방법.

channel width is discontinuous frequency segments of discontinuous BCUs of 2 or 2 shows the index of the TV channel which is most low about the channel that includes one BCU of the frequency segment 1 or 2 successive BCUs in which the TVHT BSS operates.

청구 **8**항:

제 7 항에 있어서,

상기 주파수 세그먼트 1은 프라이머리 채널을 포함하지 않는 주파수 세그먼트인, 동작 정보 제공 방법.

**Claim 8:**

As for claim 7, the frequency segment phosphorus in which

frequency segment 1 does not include the primary channel, and the operation information providing method.

청구 **9**항:

제 1 항에 있어서,

Channel center frequency = Channel starting frequency + TVHT_W #215# dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection이고,

Channel center frequency는 채널의 중심 주파수이고,

Channel starting frequency는 상기 채널 시작 주파수이고,

TVHT_W는 하나의 BCU이고,

dot11CurrentChannelCenterFrequencyIndex는 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스이며,

ChannelCenterFrequencyCorrection은 소정의 교정 값인, 동작 정보 제공 방법.

**Claim 9:**

As for claim 1,

ChannelCenterFrequencyCorrection is the predetermined correcting value phosphorus, and the operation information providing method it is the TV channel index where

dot11CurrentChannelCenterFrequencyIndex corresponds to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1 it is

Channel center frequency = Channel starting frequency + TVHT W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection ;

Channel center frequency is the center frequency of the channel ;

Channel starting frequency is the channel starting frequency ; and

TVHT W is one BCU.

청구 **10**항:

제 9 항에 있어서,

PPDU((Physical layer convergence procedure (PLCP) Protocol Data Unit))가 하나의 BCU를 이용하여 전송되거나 또는 2 개의 불연속적인 BCU들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0이고,

PPDU가 2 개의 연속적인 BCU들을 이용하여 전송되거나 또는 2 개의 불연속적인 주파수 세그먼트들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0.5 #215# TVHT_W이고,

PPDU가 4 개의 연속적인 BCU들을 이용하여 전송되는 경우에 상기 소정의 교정 값은 1.5 #215# TVHT_W이며,

상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함하는, 동작 정보 제공 방법.

**Claim 10:**

The operation information providing method of claim 9, wherein the predetermined correcting value

PPDU ((Physical layer convergence procedure (PLCP) Protocol Data Unit)) is transmitted using one BCU comprises each of

frequency segments is successive BCUs of 2 the predetermined correcting value is 1.5 × TVHT W

PPDU is transmitted using successive BCUs of 4 the predetermined correcting value is 0.5 × TVHT W or it is transmitted using discontinuous frequency segments of 2

PPDU is transmitted using successive BCUs of 2 it is 0.

청구 **11**항:

제 1 항에 있어서,

상기 TVHT 동작 정보 필드는 4 옥텟 크기를 가지고,

**Claim 11:**

As for claim 1, the operation information providing method

TVHT operation information field

상기 프라이머리 채널 번호, 상기 채널 폭, 상기 채널 중심 주파수 세그먼트 0 및 상기 채널 중심 주파수 세그먼트 1 서브필드들의 각각은 1 옥텟 크기를 가지는, 동작 정보 제공 방법.

primary channel number, the channel width , and each of the channel center frequency segment 0 and channel center frequency segment 1 subfields go to 1 octet size with 4 octet size.

**청구 12항:**

**Claim 12:**

제 1 항에 있어서,

As for claim 1,

상기 제 1 STA는 액세스 포인트(AP) STA이고,

second STA is the non- access point (non-AP) STA phosphorus, and the operation information providing method

상기 제 2 STA는 비-액세스 포인트(non-AP) STA인, 동작 정보 제공 방법.

first STA is the access point (AP) STA.

**청구 13항:**

**Claim 13:**

화이트스페이스 동작 정보를 수신하는 방법에 있어서,

An operation information reception comprising the steps of: as to the method for receiving the white space operation information,

제 2 STA이 제 1 STA으로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하는 단계를 포함하고,

second STA includes the step of receiving the frame including the TV white space high yield (TVHT) operation information field from the first STA;

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

TVHT operation information field including the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields; the channel center frequency of

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

frequency segment 0 or the frequency segment 1 is determined based on the channel starting frequency; and

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 수신 방법.

channel starting frequency is determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

**청구 14항:**

**Claim 14:**

화이트스페이스 동작 정보를 제공하는 스테이션(STA) 장치에 있어서,

The operation information provision STA apparatus it includes

송수신기; 및

transceiver :

프로세서를 포함하고,

and processor as to the station (STA) apparatus for providing the white space operation information ; the including the TV white space high yield (TVHT) operation information field frame is set up so that

상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하도록 설정되고,

processor transmits the frame using the transceiver to the STA apparatus in which the STA apparatus is different ;

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

TVHT operation information field includes the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields ; the channel center frequency of

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

frequency segment 0 or the frequency segment 1 is determined based on the channel starting frequency ; an

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는

TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 제공 STA 장치.

d for being determined as the function of the TV chann el index where

channel starting frequency corresponds to the frequen cy segment 0 or the TV channel index corresponding to the frequency segment 1.

청구 **15**항:

**Claim 15:**

화이트스페이스 동작 정보를 수신하는 스테이션(STA) 장치에 있어서,

The operation information reception STA apparatus it includes

송수신기; 및

transceiver :

프로세서를 포함하고,

and processor as to the station (STA) apparatus for re ceiving the white space operation information ; the incl uding the TV white space high yield (TVHT) operation i nformation field frame is set up so that

상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하도록 설정되고,

processor receives the frame using the transceiver fro m the STA apparatus in which the STA apparatus is dif ferent ;

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

TVHT operation information field includes the primary c hannel number, the channel width, and the channel ce nter frequency segment 0 and channel center frequenc y segment 1 subfields ; the channel center frequency o f

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

frequency segment 0 or the frequency segment 1 is de termined based on the channel starting frequency ; an d for being determined as the function of the TV chann el index where

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 수신 STA 장치.

channel starting frequency corresponds to the frequen cy segment 0 or the TV channel index corresponding to the frequency segment 1.

## 기술분야

## Technical Field

이하의 설명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 화이트 스페이스 대역에서의 채널화 방법 및 이를 위한 장치에 대한 것이다.

The description of less than relates to the radio communication system, more specifically, the channelizi ng method at the white space band and the apparatus therefor.

## 배경기술

## Background Art

무선랜(wireless local area network; WLAN) 기술에 대한 표준은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준으로서 개발되고 있다. IEEE 802.11a 및 b는 2.4. GHz 또는 5 GHz에서 비면허 대역(unlicensed band)을 이용하고, IEEE 802.11b는 11 Mbps의 전송 속도를 제공하고, IEEE 802.11a는 54 Mbps의 전송 속도를 제공한다. IEEE 802.11g는 2.4GHz에서 직교 주파수 분할 다중화(Orthogonal Frequency Division Multiplexing; OFDM)를 적용하여, 54 Mbps의 전송 속도를 제공한다. IEEE 802.11n은 다중 입출력 OFDM(Multiple Input Multiple Output-OFDM; MIMO-OFDM)을 적용하여, 4 개의 공간적인 스트림(spatial stream)에 대해서 300 Mbps의 전송 속도를 제공한다. IEEE 802.11n에서는 채널 대역폭(channel bandwidth)을 40 MHz까지 지원하며, 이 경우에는 600 Mbps의 전송 속도를 제공한다.

The standard about the wireless LAN (wireless local area network: WLAN) technology is developed as IEEE (Institute of Electrical and Electronics Engineers) 802.1 1 standard. In the IEEE 802.11a and b is 2.4. GHz or 5 GHz, the non-licensed band (unlicensed band) is used a nd the IEEE 802.11b provides the transfer rate of 11 M bps and the IEEE 802.11a provides the transfer rate of 54 Mbps. In the IEEE 802.11g is 2.4GHz, the orthogonal frequency division multiplex (Orthogonal Frequency Divi sion Multiplexing: OFDM) is applied and the transfer rat e of 54 Mbps is provided. The IEEE 802.11n applies ** * OFDM (Multiple Input Multiple Output-OFDM: MIMO-O FDM) and the transfer rate of 300 Mbps is provided con cerning the spacious stream (spatial stream) of 4. In th e IEEE 802.11n, the channel bandwidth is supported to 40 MHz and the transfer rate of 600 Mbps is provided i n this case.

현재, TV 화이트 스페이스(TV whitespace, TVWS) 대역에서 비면허 기기(unlicensed device)의 동작을 규정하기 위한 IEEE 802.11af 표준이 개발되고 있다.

In the present, and the TV white space (TV whitespace, TVWS) band, the IEEE 802.11af standard for prescribing the operation of the dome emptiness instrument (unlicensed device) is developed.

TVWS는 TV 방송을 위해 할당된 VHF(Very High Frequency) 대역(54~60, 76~88, 174~216MHz)과 UHF (Ultra High Frequency) 대역(470~698MHz)을 포함하며, 해당 주파수 대역에서 동작하는 면허 기기(licensed device; TV방송 및 무선 마이크 등)의 통신을 저해하지 않는다는 조건하에서 비면허 기기(unlicensed device)에 대해 사용이 허가된 주파수 대역을 의미한다.

VHF (Very High Frequency) bands (54~60, 76~88, 174~216MHz) and the UHF (Ultra High Frequency) band (470~698MHz) in which TVWS is allocated for the TV broadcast are included and the frequency band in which the use is permitted about the dome emptiness instrument (unlicensed device) which does not hinder the communication of license instrument (the licensed device: TV broadcast and wireless microphone etc) operating in the target frequency bandwidth is meant.

512~608MHz, 614~698MHz에서는 특수한 몇 가지 경우를 제외하고 모든 비면허 기기들에게 동작이 허용되어 있으나, 54~60MHz, 76~88MHZ, 174~216MHz, 470~512MHz 대역은 고정형 기기(fixed device)간의 통신에만 허용되었다. 고정형 기기란 정해진 위치에서만 전송을 수행하는 기기를 말한다. 이하의 설명에 있어서 화이트 스페이스 대역은 상술한 TVWS를 포함하나, 이에 한정될 필요는 없다.

In 512~608MHz, 614~698MHz, the operation was allowed to all dome emptiness instruments the several kinds case of being special. But 54~60MHz, 76~88MHZ, 174~216MHz, 470~512MHz band was allowed to the communication between the fixed type instrument (fixed device). In the position which the fixed type instrument is determined, the instrument performing the transmission is referred to. The white space band includes above-described TVWS as to the description of less than. But there is no need to be thus restricted.

화이트 스페이스 대역을 사용하기 원하는 비면허 기기는 면허 기기에 대한 보호 기능을 제공해야 한다. 따라서 화이트 스페이스 대역에서 전송을 시작하기 전에 반드시 면허 기기가 해당 대역을 점유하고 있는지 여부를 확인하도록 한다. 즉, 화이트 스페이스 대역에서 면허 기기가 사용 중이지 않은 경우에만 비면허 기기의 허용이 허용될 수 있다.

The dome emptiness instrument which desires to use the white space band has to provide the protective about the license instrument. Therefore, in the white space band, before starting the transmission it confirms whether the license instrument certainly occupies the target bandwidth or not. That is, in the white space band, the allowable of the dome emptiness instrument can be allowed to the case in which the license instrument is not the use.

이를 위하여, 비면허 기기는 인터넷 혹은 전용망을 통해 지리적-위치 데이터베이스(Geo-location DataBase; GDB)에 접속하여 해당 지역에서 사용 가능한 채널 리스트(즉, 사용 가능한 채널(들)의 세트) 정보를 얻어 와야 한다. GDB는 자신에게 등록된 면허 기기의 정보와 해당 면허 기기들의 지리적 위치 및 사용 시간에 따라 동적으로 변화하는 채널 사용 정보를 저장하고 관리하는 데이터베이스이다. 또한, 화이트 스페이스를 사용하는 비면허 기기들 간의 공존(coexistence) 문제를 해결하기 위해서, 공통 비콘 프레임(common beacon frame) 등과 같은 시그널링 프로토콜 및 스펙트럼 센싱 메커니즘(spectrum sensing mechanism) 등이 이용될 수 있다.

For this, the dome emptiness instrument connects to the geo-location database (Geo-location DataBase: GDB) through the internet or the dedicated network and the usable channel list (in other words, the set of the available channel ()) information has been being obtained from the corresponding area. According to the geographic position of the information of the license instrument in which GDB is registered to oneself and corresponding license instruments and life time, it is the database in which the channel use information which dynamically changes is stored and managed. Moreover, to solve the coexistence problem between dome emptiness instruments using the white space, the common beacon frame, including, the signaling protocol and spectrum sensing mechanism etc. can be used.

IEEE 802.11 시스템에서 TVWS 단말은 TVWS 스펙트럼에서 IEEE 802.11 MAC(Medium Access Control) 계층 및 PHY(Physical) 계층을 이용하여 동작하는 비면허 기기를 지칭할 수 있다. 본 문서에서 별도의 설명이 없으면 스테이션(STA)은 TVWS 스펙트럼에서 동작하는 TVWS 단말을 지칭한다.

In the IEEE 802.11 system, the TVWS terminal can name the IEEE 802.11 MAC (Medium Access Control) layer and the dome emptiness instrument operating using the PHY (Physical) layer in the TVWS spectrum. In the document, if there is no separate description, the TVWS terminal in which the station (STA) operates in the TVWS spectrum is named.

STA은 면허 사용자(TV 사용자 및 무선 마이크 등)를 포함하여 우선 접속이 허용되는 사용자인 우선적 사용자(incumbent user) 또는 프라이머리 사용자(primary user)를 보호하는 기능을 제공해야 한다. 즉, 우선적 사용자가 TVWS를 사용중이면

STA includes license user (the TV user and wireless microphone etc) and the preferential user (incumbent user) which is the user in which first the connection is tolerated or the function of protecting the primary user

STA는 해당 채널의 사용을 중단해야 한다. 따라서 STA는 비면허 기기가 사용할 수 있는 가용 채널(즉, 면허 기기가 사용하지 않는 채널)을 알아내서 가용 채널(available channel)에서 동작하여야 한다.

has to be provided. That is, the preferential user as to the STA, has to discontinue the use of the correspondi ng channel TVWS if it is the busy. Therefore, STA finds the available channel (the channel which in other word s, the license instrument does not use) that the dome emptiness instrument can use and it has to operate in the available channel.

STA이 가용 채널을 알아내기 위한 방법에는, 스펙트럼 센싱 메커니즘을 수행하는 방식 및 GDB에 접속하여 TV 채널 스케줄을 알아내는 방식 등이 있다. 스펙트럼 센싱 메커니즘으로 에너지 검출(energy detection) 방식 (수신 신호의 강도가 일정 값 이상이면 우선적 사용자가 사용 중인 것으로 판단하는 방식), 특징부 검출(feature detection) 방식 (디지털 TV 프리엠블(Preamble) 이 검출되면 우선적 사용자가 사용 중인 것으로 판단하는 방식) 등이 활용될 수 있다. 다음으로, STA는 GDB 에 접속하여 자신의 위치 정보에 기반한 GDB 정보를 획득하여 해당 위치에서 면허 기기의 채널 사용 여부를 알아야 하고, GDB로의 접속 및 정보 획득은 면허 기기를 보호하기에 충분한 빈도로 수행되어야 한다.

In the method in which STA finds the available channel, it has the mode performing the spectrum sensi ng mechanism and mode etc. connects to GDB and find s the TV channel schedule. Energy detection (energy d etection) mode (the mode which the preferential user i s the use if the intensity of the reception signal is and determines the constant value or greater), feature det ection (feature detection) mode (the mode which the p referential user is the use if it is detected with the digit al television preamble etc. can be used as the spectru m sensing mechanism. Next, STA connects to GDB and the GDB information based on its own location informati on is acquired and channel use acceptance and rejecti on of the license instrument have to be known at the r elevant position and it has to be performed to the freq uency in which the connection to GDB and information acquisition is sufficient to protect the license instrumen t.

스펙트럼 센싱 방식 또는 GDB를 통하여, 현재 사용 중인 채널과 바로 인접해 있는 채널에서 우선적 사용자가 사용 중인 것으로 판단되면, 단말(또는 STA)과 기지국(또는 Access Point (AP))는 전송 전력을 낮추는 방식으로 우선적 사용자를 보호할 수 있다.

If the preferential user is the use and it is determined in the channel which is in the present use and the adja cent channel through the spectrum sensing mode or GD B the preferential user can be protected to the mode in which the terminal (or, STA) and base station (or, the Access Point (AP)) lower the transmission power.

## 발명의 내용

## Summary of Invention

### 해결하고자 하는 과제

### Problem to be solved

본 발명의 기술적 과제는 화이트 스페이스 대역에서 무선랜 동작을 위한 채널을 올바르고 효율적으로 설정하는 방안이 제공하는 데에 있다.

In the technical problem of the invention is the white space band, it has in the plan right and which efficiently sets up the channel for the wireless LAN operation provides.

본 발명에서 이루고자 하는 기술적 과제들은 이상에서 언급한 기술적 과제들로 제한되지 않으며, 언급하지 않은 또 다른 기술적 과제들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

In the present invention, it is not limited within technical problems which in the above, technical problems to be comprised mention and it will be able to be specifically understood as a person skilled in the art in the technical Field of the Invention which another technical problems which it does not mention looks from the following material.

### 과제해결 수단

### Means to solve the problem

상기의 기술적 과제를 해결하기 위하여 본 발명의 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 방법은, 제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주

The method, to solve the technical problem described in the above, for providing the white space operation information according to a preferred embodiment of the present invention is the primary station (STA) may include the step of transmitting the frame including the TV white space high yield (TVHT) operation information

파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

field to the second STA. The TVHT operation information field comprises the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields. Here, the channel center frequency of the frequency segment 0 or the frequency segment 1 can be determined based on the channel starting frequency. Moreover, the channel starting frequency can be determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

상기의 기술적 과제를 해결하기 위하여 본 발명의 다른 일 실시예에 따른 화이트스페이스 동작 정보를 수신하는 방법은, 제 2 STA이 제 1 STA으로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

The method, to solve the technical problem described in the above, for receiving the white space operation information according to the dissimilar embodiment of the invention is the second STA may include the step of receiving the frame including the TV white space high yield (TVHT) operation information field from the first STA. The TVHT operation information field comprises the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields. Here, the channel center frequency of the frequency segment 0 or the frequency segment 1 can be determined based on the channel starting frequency. Moreover, the channel starting frequency can be determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 스테이션 (STA) 장치는, 송수신기; 및 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보(Operation Information) 필드를 포함하는 프레임을 전송하도록 설정될 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

The station (STA) apparatus, to solve the technical problem described in the above, for providing the white space operation information according to another embodiment of the invention is the transceiver, and processor are included and the including the TV white space high yield (TVHT) operation information field frame can be set up so that the processor transmits the frame using the transceiver to the STA apparatus in which the STA apparatus is different. The TVHT operation information field comprises the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields. Here, the channel center frequency of the frequency segment 0 or the frequency segment 1 can be determined based on the channel starting frequency. Moreover, the channel starting frequency can be determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 동작 정보를 수신하는 스테이션 (STA) 장치는, 송수신기; 및 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보(Operation Information) 필드를 포함하는 프레임을 수신하도록 설정될 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및

The station (STA) apparatus, to solve the technical problem described in the above, for receiving the white space operation information according to another embodiment of the invention is the transceiver, and processor are included and the including the TV white space high yield (TVHT) operation information field frame can be set up so that the processor receives the frame using the transceiver from the STA apparatus in

채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

which the STA apparatus is different. The TVHT operation information field comprises the primary channel number, the channel width, and the channel center frequency segment 0 and channel center frequency segment 1 subfields. Here, the channel center frequency of the frequency segment 0 or the frequency segment 1 can be determined based on the channel starting frequency. Moreover, the channel starting frequency can be determined as the function of the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

상기 본 발명에 따른 실시예들에 있어서 이하의 사항이 공통으로 적용될 수 있다.

The matter of less than can be commonly applied as to the embodiments according to the present invention.

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스를 기준으로, 0번째 TV 채널 인덱스에 해당하는 TV 채널의 중심 주파수 값으로 설정될 수 있다.

The channel starting frequency can be set up as the central frequency value of the TV channel corresponding to 0 the TV channel index based on the TV channel index corresponding to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1.

상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스는, 상기 주파수 세그먼트 0 또는 상기 주파수 세그먼트 1에서 가장 낮은 TV 채널의 인덱스일 수 있다.

The TV channel index or the TV channel index corresponding to the frequency segment 1 can be the index of the TV channel which is most low in the frequency segment 0 or the frequency segment 1 corresponding to the frequency segment 0.

상기 채널 폭이 하나의 기본채널유닛(BCU), 2개의 연속된(contiguous) BCU들 또는 4개의 연속된 BCU들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT 기본 서비스 세트(BSS)가 동작하는 상기 하나의 BCU, 상기 2개의 연속된 BCU들 또는 상기 4개의 연속된 BCU들을 포함하는 채널에 대한 가장 낮은(lowest) TV 채널 인덱스를 나타내는 값으로 설정될 수 있다.

It can be set up as the value which most shows the day (lowest) TV channel index about the channel including the channel width is one fundamental channel unit (BCU), one BCU, and 2 consecutive BCUs or 4 consecutive BCUs. As to one BCU, in case it corresponds to one among 2 consecutive BCUs or 4 consecutive BCUs the channel center frequency segment 0 subfield the TVHT basic service set (BSS) operates.

상기 채널 폭이 2 개의 불연속적인(non-contiguous) BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 0의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정될 수 있다. 상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함할 수 있다.

In case it corresponds to one of the channel width is discontinuous frequency segments of noncontinuous (non-contiguous) BCUs of 2 or 2 it can be set up as the value showing the index of the TV channel which is most low about the channel in which the channel center frequency segment 0 subfield includes one BCU of the frequency segment 0 or 2 successive BCUs in which the TVHT BSS operates. Each of frequency segments may include successive BCUs of 2.

상기 주파수 세그먼트 0는 프라이머리 채널을 포함하는 주파수 세그먼트일 수 있다.

It can be the frequency segment in which the frequency segment 0 includes the primary channel.

상기 채널 폭이 2 개의 불연속적인 BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 1 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 1의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정될 수 있다.

In case it corresponds to one of the channel width is discontinuous frequency segments of discontinuous BCUs of 2 or 2 it can be set up as the value showing the index of the TV channel which is most low about the channel in which the channel center frequency segment 1 subfield includes one BCU of the frequency segment 1 or 2 successive BCUs in which the TVHT BSS operates.

상기 주파수 세그먼트 1은 프라이머리 채널을 포함하지 않는 주파수 세그먼트일 수 있다.

It can be the frequency segment in which the frequency segment 1 does not include the primary channel.

Channel center frequency = Channel starting frequency + TVHT_W #215# dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection으로 정의될 수 있다. 여기서, Channel center frequency는 채널의 중심 주파수이고, Channel starting frequency는 채널 시작 주파수이고, TVHT_W는 하나의 BCU이고, dot11CurrentChannelCenterFrequencyIndex는 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스이며, , ChannelCenterFrequencyCorrection은 소정의 교정 값일 수 있다.

It can be defined as the Channel center frequency = Channel starting frequency + TVHT W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection. Here, the Channel center frequency is the center frequency of the channel and the Channel starting frequency is the channel starting frequency and the TVHT W is one BCU and it is the TV channel index where the dot11CurrentChannelCenterFrequencyIndex corresponds to the frequency segment 0 or the TV channel index corresponding to the frequency segment 1 and the , ChannelCenterFrequencyCorrection can be the predetermined correcting value.

PPDU((Physical layer convergence procedure (PLCP) Protocol Data Unit))가 하나의 BCU를 이용하여 전송되거나 또는 2 개의 불연속적인 BCU들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0일 수 있다.

In case the PPDU ((Physical layer convergence procedure (PLCP) Protocol Data Unit)) is transmitted using one BCU or it is transmitted using discontinuous BCUs of 2 the predetermined correcting value can be 0.

PPDU가 2 개의 연속적인 BCU들을 이용하여 전송되거나 또는 2 개의 불연속적인 주파수 세그먼트들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0.5 #215# TVHT_W일 수 있다. 상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함할 수 있다.

In case PPDU is transmitted using successive BCUs of 2 or it is transmitted using discontinuous frequency segments of 2 the predetermined correcting value can be 0.5 × TVHT W. Each of frequency segments may include successive BCUs of 2.

PPDU가 4 개의 연속적인 BCU들을 이용하여 전송되는 경우에 상기 소정의 교정 값은 1.5 #215# TVHT_W일 수 있다.

In case PPDU is transmitted using successive BCUs of 4 the predetermined correcting value can be 1.5 × TVHT W.

상기 TVHT 동작 정보 필드는 4 옥텟 크기를 가질 수 있다. 상기 프라이머리 채널 번호, 상기 채널 폭, 상기 채널 중심 주파수 세그먼트 0 및 상기 채널 중심 주파수 세그먼트 1 서브필드들의 각각은 1 옥텟 크기를 가질 수 있다.

The TVHT operation information field can have 4 octet size. The primary channel number, the channel width , and each of the channel center frequency segment 0 and channel center frequency segment 1 subfields can have 1 octet size.

상기 제 1 STA는 액세스 포인트(AP) STA이고, 상기 제 2 STA는 비-액세스 포인트(non-AP) STA일 수 있다.

The first STA is the access point (AP) STA and the second STA can be the non- access point (non-AP) STA.

본 발명에 대하여 전술한 일반적인 설명과 후술하는 상세한 설명은 예시적인 것이며, 청구항 기재 발명에 대한 추가적인 설명을 위한 것이다.

The detailed explanation which will be described later is illustrative with the general description describing in the above about the invention and it is for the additional description about claim material invention.

발명의 효과

**Effects of the Invention**

본 발명에 따르면 화이트 스페이스 대역에서 무선랜 동작을 위한 채널을 올바르고 효율적으로 설정하는 방안이 제공될 수 있다.

According to the present invention, provided are the plan right and which efficiently sets up the channel for the wireless LAN operation in the white space band.

본 발명에서 얻은 수 있는 효과는 이상에서 언급한 효과들로 제한되지 않으며, 언급하지 않은 또 다른 효과들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

In the present invention, it is not limited within effects which in the above, the effect having with number it obtains mentions and it will be able to be specifically understood as a person skilled in the art in the technical Field of the Invention which another effects which it does not mention looks from the following material.

## 발명을 실시하기 위한 구체적인 내용

## Description of Embodiments

이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될

Hereinafter, referring to the figure, specifically, the embodiment done with desirable according to the prese

상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다.

nt invention is illustrated it is attached. It is the thing in which the detailed explanation disclosed with attached drawing in less than illustrates the illustrative embodiment of the invention and it is not. To show the embodiment in which the invention can be performed and which ones and only. The concrete detail item is included so that the following detailed description provide the complete understanding of the invention. But the person skilled in the art embraces that the invention can be performed without such concrete detail item.

이하의 실시예들은 본 발명의 구성요소들과 특징들을 소정 형태로 결합한 것들이다. 각 구성요소 또는 특징은 별도의 명시적 언급이 없는 한 선택적인 것으로 고려될 수 있다. 각 구성요소 또는 특징은 다른 구성요소나 특징과 결합되지 않은 형태로 실시될 수 있다. 또한, 일부 구성요소들 및/또는 특징들을 결합하여 본 발명의 실시예를 구성할 수도 있다. 본 발명의 실시예들에서 설명되는 동작들의 순서는 변경될 수 있다. 어느 실시예의 일부 구성이나 특징은 다른 실시예에 포함될 수 있고, 또는 다른 실시예의 대응하는 구성 또는 특징과 교체될 수 있다.

It is the embodiment of less thans the things combining elements and characteristics of the present invention in the form of the predetermined. The characteristic can be considered that each element or the characteristic is selective. It can be performed to the element in which each element or the characteristic is different or the form which does not combine with the characteristic. Moreover, the embodiment of some elements and/or the invention combining characteristics can be configured. The order of the operations explained in the embodiments of the invention can be changed. The part configuration or the characteristic of a embodiment can be included in the other embodiment and or it can be replaced with the configuration or the characteristic corresponding to of the other embodiment.

이하의 설명에서 사용되는 특정 용어들은 본 발명의 이해를 돕기 위해서 제공된 것이며, 이러한 특정 용어의 사용은 본 발명의 기술적 사상을 벗어나지 않는 범위에서 다른 형태로 변경될 수 있다.

In the following description, in order to assist your understanding of the present invention, in order to assist your understanding of the present invention, used specific terms are provided and the use of such specific term can be changed to the dissimilar form in the range that does not do not depart from the technical mapping of the invention.

몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

In the publicly known structure it avoids being vague and apparatus thereof, the some case, and the concept of the invention are illustrated around the core function of the shell structure it is omitted and apparatus thereof to one block diagram type. Moreover, in this specification whole, it illustrates for the same components element using the same reference numeral.

본 발명의 실시예들은 무선 접속 시스템들인 IEEE 802 시스템, 3GPP 시스템, 3GPP LTE 및 LTE-A(LTE-Advanced)시스템 및 3GPP2 시스템 중 적어도 하나에 개시된 표준 문서들에 의해 뒷받침될 수 있다. 즉, 본 발명의 실시예들 중 본 발명의 기술적 사상을 명확히 드러내기 위해 설명하지 않은 단계들 또는 부분들은 상기 문서들에 의해 뒷받침될 수 있다. 또한, 본 문서에서 개시하고 있는 모든 용어들은 상기 표준 문서에 의해 설명될 수 있다.

It can be guaranteed by the disclosed standard documents among the IEEE 802 system, in which the embodiments of the invention is radio access systems 3GPP system, and 3GPP LTE, the LTE- A (LTE-Advanced) system and 3GPP2 system in at least one. That is, in order to specifically show the technical mapping of the invention among the embodiments of the invention the step or the parts which does not illustrate can be guaranteed by documents. Moreover, all terms disclosed in the document can be explained by the standard document.

이하의 기술은 CDMA(Code Division Multiple Access), FDMA(Frequency Division Multiple Access), TDMA(Time Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier Frequency Division Multiple Access) 등과 같은 다양한 무선 접속 시스템에 사용될 수 있다. CDMA는 UTRA(Universal Terrestrial Radio Access)나 CDMA2000과 같은 무선 기술

The technology of less than can be used for the various radio access system like the CDMA (Code Division Multiple Access), the FDMA (Frequency Division Multiple Access), the TDMA (Time Division Multiple Access), the OFDMA (Orthogonal Frequency Division Multiple Access), the SC- FDMA (Single Carrier Frequency Division Multiple Access) etc. CDMA can be implemented as the

(radio technology)로 구현될 수 있다. TDMA는 GSM(Global System for Mobile communications)/GPRS(General Packet Radio Service)/EDGE(Enhanced Data Rates for GSM Evolution)와 같은 무선 기술로 구현될 수 있다. OFDMA는 IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, E-UTRA(Evolved UTRA) 등과 같은 무선 기술로 구현될 수 있다. 명확성을 위하여 이하에서는 IEEE 802.11 시스템을 위주로 설명하지만 본 발명의 기술적 사상이 이에 제한되는 것은 아니다.

wireless technology (radio technology) such as the UTRA (Universal Terrestrial Radio Access) and CDMA2000. TDMA can be implemented as the wireless technology like the GSM (Global System for Mobile communications) / GPRS (General Packet Radio Service) / EDGE (Enhanced Data Rates for GSM Evolution). OFDMA can be implemented as the wireless technology like the IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, the E- UTRA (Evolved UTRA) etc. Hereinafter it illustrates for clarity around the IEEE 802.11 system but the technical mapping of the invention is not limited thereto.

도 1 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

Figure 1 is drawing showing the structure of being illustrative of the IEEE 802.11 system the invention being applied.

IEEE 802.11 구조는 복수개의 구성요소들로 구성될 수 있고, 이들의 상호작용에 의해 상위계층에 대해 트랜스패런트한 STA 이동성을 지원하는 WLAN이 제공될 수 있다. 기본 서비스 세트(Basic Service Set; BSS)는 IEEE 802.11 LAN에서의 기본적인 구성 블록에 해당할 수 있다. 도 1 에서는 2 개의 BSS(BSS1 및 BSS2)가 존재하고 각각의 BSS의 멤버로서 2 개의 STA이 포함되는 것(STA1 및 STA2는 BSS1에 포함되고, STA3 및 STA4는 BSS2에 포함됨)을 예시적으로 도시한다. 도 1 에서 BSS를 나타내는 타원은 해당 BSS에 포함된 STA들이 통신을 유지하는 커버리지 영역을 나타내는 것으로도 이해될 수 있다. 이 영역을 BSA(Basic Service Area)라고 칭할 수 있다. STA가 BSA 밖으로 이동하게 되면 해당 BSA 내의 다른 STA들과 직접적으로 통신할 수 없게 된다.

The IEEE 802.11 structure comprises the multiple elements. And WLAN supporting the STA mobility making be transparent with their interaction about the higher layer can be provided. The basic service set (Basic Service Set: BSS) can correspond to the primary building block at the IEEE 802.11 LAN. In fig. 1, BSS (the BSS1 and BSS2) of 2 exist and STA of 2 is included as the member of each BSS (the STA1 and STA2 are included in the BSS1 and the STA3 and STA4 are included in the BSS2) are illustratively shown. In fig. 1, the oval showing BSS shows the coverage area in which STAs included in the corresponding BSS maintain the communication it can be understood. This domain can be called the BSA (Basic Service Area). It directly cannot communicate with dissimilar STAs within the corresponding BSA if STA moves from BSA.

IEEE 802.11 LAN에서 가장 기본적인 타입의 BSS는 독립적인 BSS(Independent BSS; IBSS)이다. 예를 들어, IBSS는 2 개의 STA만으로 구성된 최소의 형태를 가질 수 있다. 또한, 가장 단순한 형태이고 다른 구성요소들이 생략되어 있는 도 1 의 BSS(BSS1 또는 BSS2)가 IBSS의 대표적인 예시에 해당할 수 있다. 이러한 구성은 STA들이 직접 통신할 수 있는 경우에 가능하다. 또한, 이러한 형태의 LAN은 미리 계획되어서 구성되는 것이 아니라 LAN이 필요한 경우에 구성될 수 있으며, 이를 애드-혹(ad-hoc) 네트워크라고 칭할 수도 있다.

In the IEEE 802.11 LAN, it is the BSS (Independent BSS: IBSS) in which BSS of the primary type is most independent. For example, it can have the minimum form in which IBSS consists of STA of 2. Moreover, the BSS (the BSS1 or the BSS2) in which elements which are the simple form and are most dissimilar are omitted of fig. 1 can correspond to the typical example of IBSS. It is possible in case such configuration STAs directly can communicate. Moreover, LAN of such form is prepared in advance and it is not formed but if necessary, LAN can be formed and this can be called the ad-hoc network.

STA의 켜지거나 꺼짐, STA가 BSS 영역에 들어오거나 나감 등에 의해서, BSS에서의 STA의 멤버십이 동적으로 변경될 수 있다. BSS의 멤버가 되기 위해서는, STA는 동기화 과정을 이용하여 BSS에 조인할 수 있다. BSS 기반구조의 모든 서비스에 액세스하기 위해서는, STA는 BSS에 연관(associated)되어야 한다. 이러한 연관(association)은 동적으로 설정될 수 있고, 분배시스템서비스(Distribution System Service; DSS)의 이용을 포함할 수 있다.

It is turned on of STA or it is put out. STA comes in the BSS region or it goes out the membership of STA at BSS can be dynamically changed by the etc. In order that it becomes the member of BSS STA can put the seal on BSS using the synchronizing process. In order that it accesses in all services of the BSS infrastructure STA has to be in BSS the linkage (associated). Such linkage (association) can be dynamically set up and the usage of the distribution system service (Distribution System Service: DSS) is include might.

도 2 는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다. 도 2 에서는 도 1 의 구조에서 분배시스템(Distribution System; DS), 분배시스템매체(Distribution System Medium; DSM), 액세스 포인트(Access Point; AP) 등의 구성요소가 추가된 형태이다.

Figure 2 is drawing showing the structure of being illustrative of being different of the IEEE 802.11 system the invention being applied. In fig. 2, it is the form in which the element including the dispensing system (Distribution System: DS), the dispensing system media (Distribution System Medium: DSM), the access point (Access Point: AP) etc. is added in the structure of fig. 1.

LAN에서 직접적인 스테이션-대-스테이션의 거리는 PHY 성능

In LAN, the distance of the direct station - large -

에 의해서 제한될 수 있다. 어떠한 경우에는 이러한 거리의 한계가 충분할 수도 있지만, 경우에 따라서는 보다 먼 거리의 스테이션 간의 통신이 필요할 수도 있다. 확장된 커버리지를 지원하기 위해서 분배시스템(DS)이 구성될 수 있다.

station can be limited by the PHY performance. The limit of such distance can be sufficient in case of being. However the communication between the station of the distance distant than the case can be necessary. In order to support the expanded coverage, the dispensing system (DS) can be formed.

DS는 BSS들이 상호연결되는 구조를 의미한다. 구체적으로, 도 1 과 같이 BSS가 독립적으로 존재하는 대신에, 복수개의 BSS들로 구성된 네트워크의 확장된 형태의 구성요소로서 BSS가 존재할 수도 있다.

DS means the structure where BSSs are interconnected. Specifically, as shown in Figure 1, BSS independently exists. BSS can exist as multiple BSSs as the expanded element of the form of the configured network.

DS는 논리적인 개념이며 분배시스템매체(DSM)의 특성에 의해서 특정될 수 있다. 이와 관련하여, IEEE 802.11 표준에서는 무선 매체(Wireless Medium; WM)와 분배시스템매체(DSM)을 논리적으로 구분하고 있다. 각각의 논리적 매체는 상이한 목적을 위해서 사용되며, 상이한 구성요소에 의해서 사용된다. IEEE 802.11 표준의 정의에서는 이러한 매체들이 동일한 것으로 제한하지도 않고 상이한 것으로 제한하지도 않는다. 이와 같이 복수개의 매체들이 논리적으로 상이하다는 점에서, IEEE 802.11 LAN 구조(DS 구조 또는 다른 네트워크 구조)의 유연성이 설명될 수 있다. 즉, IEEE 802.11 LAN 구조는 다양하게 구현될 수 있으며, 각각의 구현예의 물리적인 특성에 의해서 독립적으로 해당 LAN 구조가 특정될 수 있다.

DS is the logical concept and it can be specified with the property of the dispensing system media (DSM). In the IEEE 802.11 standard in connection with the this, the wireless medium (Wireless Medium: WM) and dispensing system media (DSM) are logically classified. It is used for the purpose that each logical media is different and it is used by the different element. In the definition of the IEEE 802.11 standard, it does not limit that it does not limit that it is identical in such medias and it is different. In this way, multiple medias are logically different. Therefore the flexibility of the IEEE 802.11 LAN structure (the DS structure or the network structure of being different) can be explained. That is, the IEEE 802.11 LAN structure can be variously implemented and the corresponding LAN structure can be specified in the independently with the property of being physical of each implementation.

DS는 복수개의 BSS들의 끊김 없는(seamless) 통합을 제공하고 목적지로의 어드레스를 다루는 데에 필요한 논리적 서비스들을 제공함으로써 이동 기기를 지원할 수 있다.

By DS providing the integration which there is no with the disconnection of the multiple BSSs (seamless) and providing necessary logical services to handles the address to the destination location the mobile equipment can be supported.

AP 는, 연관된 STA들에 대해서 WM을 통해서 DS 로의 액세스를 가능하게 하고 STA 기능성을 가지는 개체를 의미한다. AP를 통해서 BSS 및 DS 간의 데이터 이동이 수행될 수 있다. 예를 들어, 도 2 에서 도시하는 STA2 및 STA3 은 STA의 기능성을 가지면서, 연관된 STA들(STA1 및 STA4)가 DS로 액세스하도록 하는 기능을 제공한다. 또한, 모든 AP는 기본적으로 STA에 해당하므로, 모든 AP는 어드레스 가능한 개체이다. WM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스와 DSM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스는 반드시 동일할 필요는 없다.

AP means the entity making the access to DS possible and has the STA functionality through WM about STAs related with. The data movement between DS and BSS can be performed through AP. For example, while the STA2 and the STA3 shown in fig. 2 have the functionality of STA STA (the STA1 and STA4) related with provide the skill accessed to DS. Moreover, the elementarily all APs correspond to STA. Therefore all APs are the entity enabling to address. The need that the certainly the address and the address used for the communication on DSM with AP are identical used for the communication on WM with AP does not have.

AP에 연관된 STA들 중의 하나로부터 그 AP의 STA 어드레스로 전송되는 데이터는, 항상 비제어 포트(uncontrolled port)에서 수신되고 IEEE 802.1X 포트 액세스 개체에 의해서 처리될 수 있다. 또한, 제어 포트(controlled port)가 인증되면 전송 데이터(또는 프레임)는 DS로 전달될 수 있다.

Transmitted to the STA address of the AP from one of STAs related to AP data can be received and data be always processed by the IEEE 802.1X port access entity at the uncontrolled port. Moreover, the transmitted-data (or, the frame) can be delivered to DS if the control port (controlled port) is authenticated.

도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다. 도 3에서는 도 2 의 구조에 추가적으로 넓은 커버리지를 제공하기 위한 확장된 서비스 세트(Extended Service Set; ESS)를 개념적으로 나타낸다.

Figure 3 is drawing showing another structure of being illustrative of the IEEE 802.11 system the invention being applied. In fig. 3, the expanded service set (Extended Service Set: ESS) for providing the coverage which is additionally broad in the structure of fig. 2 is conceptually shown.

임의의(arbitrary) 크기 및 복잡도를 가지는 무선 네트워크가 DS 및 BSS들로 구성될 수 있다. IEEE 802.11 시스템에서는 이러한 방식의 네트워크를 ESS 네트워크라고 칭한다. ESS는 하나의 DS에 연결된 BSS들의 집합에 해당할 수 있다. 그러나, ESS는 DS를 포함하지는 않는다. ESS 네트워크는 LLC(Logical Link Control) 계층에서 IBSS 네트워크로 보이는 점이 특징이다. ESS에 포함되는 STA들은 서로 통신할 수 있고, 이동 STA들은 LLC에 트랜스패런트하게 하나의 BSS에서 다른 BSS로 (동일한 ESS 내에서) 이동할 수 있다.

The wireless network having size and complexity of the arbitrary can consist of DS and BSSs. In the IEEE 802.11 system, the network of such mode is called the ESS network. It can correspond to the gathering of BSSs in which ESS is connected to one DS. But ESS does not include DS. In the ESS network is the LLC (Logical Link Control) layer, it is characterized to show as the IBSS network. STAs included in ESS can communicate and it can move from one BSS to dissimilar BSS with (in the same ESS) so that movement STAs make be transparent in LLC.

IEEE 802.11 에서는 도 3 에서의 BSS들의 상대적인 물리적 위치에 대해서 아무것도 가정하지 않으며, 다음과 같은 형태가 모두 가능하다. BSS들은 부분적으로 중첩될 수 있고, 이는 연속적인 커버리지를 제공하기 위해서 일반적으로 이용되는 형태이다. 또한, BSS들은 물리적으로 연결되어 있지 않을 수 있고, 논리적으로는 BSS들 간의 거리에 제한은 없다. 또한, BSS들은 물리적으로 동일한 위치에 위치할 수 있고, 이는 리던던시를 제공하기 위해서 이용될 수 있다. 또한, 하나 (또는 하나 이상의) IBSS 또는 ESS 네트워크들이 하나 (또는 하나 이상의) ESS 네트워크로서 동일한 공간에 물리적으로 존재할 수 있다. 이는 ESS 네트워크가 존재하는 위치에 애드-혹 네트워크가 동작하는 경우나, 상이한 기관(organizations)에 의해서 물리적으로 중첩되는 IEEE 802.11 네트워크들이 구성되는 경우나, 동일한 위치에서 2 이상의 상이한 액세스 및 보안 정책이 필요한 경우 등에서의 ESS 네트워크 형태에 해당할 수 있다.

In the IEEE 802.11, nothing does not assume about the relative physical location of BSS in fig. 3 and the form as follows can do all. BSSs can be partly overlapped and it is the form which generally is used so that this provide the successive coverage. Moreover, BSSs are not physically connected and the limit is logically not in the distance between BSS. Moreover, BSSs can be positioned at the same position and the same position can be used so that this provide redundancy. Moreover, it physically can exist in the same space as one (more than or, one) IBSS or the ESS network one (more than or, one) ESS network. The ad-hoc network operates in the position in which as to the this, the ESS network exists. The position is formed. Physically overlapped with the different engine (organizations) if necessary, the access more than 2 and the different security policy in the same position can correspond to the ESS network configurations at the etc.

도 4 는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다. 도 4 에서는 DS를 포함하는 기반 구조 BSS 의 일례가 도시된다.

Figure 4 is drawing showing the structure of being illustrative of the WLAN system. An example of the infrastructure BSS including DS in fig. 4 is illustrated.

도 4 의 예시에서 BSS1 및 BSS2가 ESS를 구성한다. WLAN 시스템에서 STA는 IEEE 802.11 의 MAC/PHY 규정에 따라 동작하는 기기이다. STA는 AP STA 및 비-AP(non-AP) STA을 포함한다. Non-AP STA는 랩탑 컴퓨터, 이동 전화기와 같이 일반적으로 사용자가 직접 다루는 기기에 해당한다. 도 4 의 예시에서 STA1, STA3, STA4 는 non-AP STA에 해당하고, STA2 및 STA5 는 AP STA 에 해당한다.

In the example of fig. 4, the BSS1 and BSS2 configure ESS. In the WLAN system, it is the instrument in which STA operates according to the MAC / PHY rules of the IEEE 802.11. STA includes the AP STA and the non-AP (non-AP) STA. Generally the user the Non-AP STA falls under the direct instrument handled like the laptop computer, and the mobile phone. In the example of fig. 4, the STA1, the STA3 , and the STA4 correspond to the non-AP STA and the STA2 and STA5 correspond to the AP STA.

이하의 설명에서 non-AP STA는 단말(terminal), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장치(User Equipment; UE), 이동국(Mobile Station; MS), 이동단말(Mobile Terminal), 이동 가입자국(Mobile Subscriber Station; MSS) 등으로 칭할 수도 있다. 또한, AP는 다른 무선 통신 분야에서의 기지국(Base Station; BS), 노드-B(Node-B), 발전된 노드-B(evolved Node-B; eNB), 기저 송수신 시스템(Base Transceiver System; BTS), 펨토 기지국(Femto BS) 등에 대응하는 개념이다.

In the following description, the non-AP STA can call the terminal, the wireless transmit-receive unit (Wireless Transmit/Receive Unit: WTRU), the user equipment (User Equipment: UE), the mobile station (Mobile Station: MS), the mobile terminal, the mobile subscriber bureau (Mobile Subscriber Station: MSS) etc. Moreover, it is the concept in which AP corresponds to the base station (Base Station: BS) at the dissimilar wireless communication field, the node - B (Node-B), the developed node - B (evolved Node-B: eNB), the base transceiving system (Base Transceiver System: BTS), the femto base station (Femto BS) etc.

화이트 스페이스에서의 가용 채널

The available channel at the white space.

화이트 스페이스에서 STA이 동작하기 위해서는 면허 기기(또는, 우선적 사용자)에 대한 보호 기법이 우선적으로 제공되어야 한다. 따라서, STA는 면허 기기에 의해 사용되지 않아서 비

In the white space, the protection technique about the license instrument (or, the preferential user) has to be preferentially provided so that STA operate. Therefore,

면허 기기가 사용할 수 있는 가용 채널을 알아내서 가용 채널 상에서 동작해야 한다. 만약 STA이 사용중인 채널이 더 이상 가용 채널에 해당하지 않으면 채널 사용을 중단한다.

STA is not used by the license instrument and the available channel which the dome emptiness instrument can use is found and it has to operate on the available channel. If the channel in which STA is the busy any more does not correspond to the available channel the channel use is discontinued.

STA이 화이트 스페이스(예를 들어, TVWS)에서의 채널(예를 들어, TV 채널) 가용성(availability)을 파악하기 위해서, 스펙트럼 센싱을 수행하거나, GDB에 접속하여 TV 채널 스케줄을 알아낼 수 있다. GDB 정보는 특정 위치에서 면허 기기의 특정 채널의 사용 스케줄 (즉, 채널 사용 시간) 등의 정보를 포함할 수 있다. TV 채널의 가용성을 파악하기 원하는 STA은, 인터넷 등을 통하여 GDB에 접속해서 자신의 위치 정보에 기반한 GDB 정보를 얻어와야 하며, 이는 면허 기기를 보호하기에 충분한 시간 단위로 수행되어야 한다.

In order that STA grasps on the channel (for example, the TV channel) solubility (availability) at the white space (for example, TVWS) the spectrum sensing is performed or it connects to GDB and the TV channel schedule can be found. In the GDB information is the specific location, the information including the usage schedule (in other words, the channel use time) of the special channel of the license instrument etc. is include might. STA which desires to grasp on the solubility of the TV channel connects to GDB through the internet etc. and it has been getting the GDB information based on its own location information and it has to be performed by unit of the time when this is sufficient to protect the license instrument.

본 문서에서는 설명의 편의를 위하여 GDB로부터 수신하는 가용 채널 및 주파수에 관한 정보를 화이트 스페이스 맵(White Space Map; WSM)이라 칭할 수 있다. WSM은 STA가 GDB로부터 획득한 채널 및 주파수 정보를 기반으로 TVWS 대역에서 비면허 기기가 사용할 수 있는 채널에 관한 정보를 맵의 형태로 만든 것이다. WSM은 비면허 기기가 사용할 수 있는 가용 채널 리스트 또는 주파수(available channel list or frequencies)에 대한 정보를 포함할 수 있다. 가용 채널 리스트에 포함된 채널들은 법적으로 보호되어야 하는 신호(또는, 사용자)들이 사용하고 있지 않는 채널들이고, 비면허 기기가 GDB에 접속한 시점에서 비면허 기기가 사용 가능한 채널이다. 또는, 비면허 기기가 GDB에 접속한 시점으로부터 특정 시간 이후로부터의 사용 가능 채널에 대한 요청을 했을 경우, 해당 시점으로부터 사용 가능한 채널 및 주파수에 대한 정보를 포함할 수 있다. 다른 실시예로서, 비면허 기기가 GDB에 가용 채널에 대한 요청을 했을 경우, 비면허 기기가 사용할 수 없는 채널을 시그널링 함으로써 사용 가능 채널 및 주파수에 대한 정보를 전달할 수도 있다.

In the document, for the sake of convenience in illustration, the information about the available channel received from GDB and frequency can be called because of being the white space map (White Space Map: WSM). In the TVWS band based on the channel which as to the WSM, STA obtains from GDB and frequency information, the information about the channel which the dome emptiness instrument can use is established in the form of the map. WSM is the dome emptiness instrument may include the information to the available channel list can use or the frequency (available channel list or frequencies). It is channels which signal (or, the user) in which channels included in the available channel list have to be legally protected does not use and the dome emptiness instrument is the available channel in the point of time when the dome emptiness instrument connects to GDB. Or the dome emptiness instrument may include the information about the available channel from the target point of time and frequency it requested from the point of time when connecting to GDB about the use feasibility channel from the specific duration after. As the other embodiment, when the dome emptiness instrument requested in GDB about the available channel by signaling the channel which the dome emptiness instrument cannot use the information for frequency and use feasibility channel can be delivered.

현재 FCC(Federal Communications Commission)의 TVWS에 대한 규정(regulation)에서는 크게 두 가지 종류의 기기 타입을 정의한다. 즉, 소출력의 개인이 휴대할 수 있는 개인용/휴대용 기기(Personal/Portable Device) 및 고정된 위치에서 동작하는 대출력의 고정된 기기(Fixed Device)이 정의된다. 고정된 기기(Fixed Device)는 고정된 STA으로 칭할 수도 있고, 개인용/휴대용(Personal/Portable) 기기는 P/P STA으로 칭할 수도 있다. 고정된 STA 및 P/P SA는 모두 WLAN 시스템에서 일반적인 STA(즉, STA라는 용어는 AP 및 non-AP를 포함한다)에 해당할 수 있다. 이들 두 종류의 기기는 각각 TVWS에서 동작할 때, 각각 다른 동작 규칙(operation rule)이 적용될 수 있다. 고정된 기기는 그 위치가 변하지 않는 특정 위치에서 신호를 송/수신 한다. 물론 고정된 기기 역시 해당 위치에서 신호를 전송하기 위해서는, GDB에 접속하여 가용 채널 정보를 획득해야 한다. 고정된 기기는 GPS와 같은 위치를 확인

In the rules (regulation) toward TVWS of the current FCC (Federal Communications Commission), it can call STA in which the instrument (Fixed Device) which the fixed instrument (Fixed Device) of the high power operating in the position which defines the instrument type of two kinds of kind is fixed with the individual / portable apparatus (Personal/Portable Device) in which in other words, the individual of the low power radio can carry is defined is fixed is fixed and the altogether STA and P / P SA which the individual / portable (Personal/Portable) instrument can call P / P STA is fixed can correspond to general STA (in other words, the term called STA includes AP and non-AP) in the WLAN system. When the instrument of these two typeses operates in TVWS the operation rule which is respectively dissimilar can be applied. It signs in the specific location in which as to t

할 수 있는 장비가 내장되어 있을 수도 있지만, 설치자(installer)에 의해서 그 위치를 사람이 직접 입력함으로써 그 위치 정보를 GDB에 전달할 수 있다. 물론, 위치를 사람이 직접 입력하는 경우에는 한 번 설치되고 위치가 입력되고 나면 그 위치가 바뀌지 않는다는 것을 전제로 하며, 위치가 변경되는 경우에는 그에 따른 위치도 변경/등록되어야 한다. 고정된 기기는 동종의 다른 고정된 기기를 서비스 할 수도 있고, P/P 기기를 서비스 할 수도 있다. 고정된 기기가 가용 채널 정보를 GDB로부터 받아올 때, 반드시 자신의 기기 타입을 전달하여 자신이 직접 사용할 수 있는 자신의 가용 채널 정보를 받아와야 한다. 동시에, P/P 기기를 위한 서비스를 하기 위해서는 P/P 기기가 사용할 수 있는 가용 채널 정보를 GDB로부터 또는 GDB와 연결되어 있는 프록시(proxy) 서버로부터 추가로 받아와야 한다. 고정된 기기와 P/P 기기가 사용할 수 있는 채널 구간이 다르고, 각각의 동작시 최대 허용 전송 전력과 인접 채널에 대한 요구조건이 다르기 때문이다. 예를 들어, 고정된 기기는 54~60 MHz, 76~88 MHz, 174~216 MHz, 470~512 MHz 대역의 주파수 구간 뿐 아니라, 512~608 MHz, 614~698 MHz 대역의 주파수 구간에서도 신호 전송이 허용된다. 그러나, P/P 기기는 512~608 MHz, 614~698 MHz 대역의 주파수 구간 이외의 다른 주파수 대역의 TVWS 대역에서는 신호 전송이 허용되지 않는다. 고정된 기기는 P/P 기기보다 높은 전력으로 신호를 전송할 수 있으며, 실효 등방 방사 전력(Effective Isotropic Radiated Power; EIRP)으로 최대 4 Watt의 전송 전력이 허용된다.

he fixed instrument, the position does not change with transmission/reception. Of course, in the fixed instrument is the relevant position, in order that the signal is transmitted it connects to GDB and the available channel information has to be acquired. The equipment in which the fixed instrument can confirm the position like GPS is embedded. However the location information can be delivered to GDB since human directly inputs the position with the installer. Of course, it bases that the position does not exchange if the position is installed in case human directly inputs the position and the position is inputted and the position according to the same has to be registered in case the position is changed. The fixed instrument can serve the dissimilar and fixed instrument of the allogenic and P / P instrument can be served. When the fixed instrument has been receiving the available channel information from GDB its own instrument type is delivered to the certainly and its own available channel information which oneself directly can use has been being received. Simultaneously, it is to do the service for P / P instrument and or the available channel information which P / P instrument can use has been being additionally received from GDB from the proxy server connected to GDB. The fixed instrument and the channel section which P / P instrument can use are different and the requirement specification for the adjacent channel and maximum permissible transmission power differs in each operation. Therefore each instrument type the available channel list is due to be especially changed. For example, as to the fixed instrument, the signal transmission is allowed in 512~608 MHz not only the frequency section of 54~60 MHz, 76~88 MHz, 174~216 MHz, 470~512 MHz band, and the frequency section of 614~698 MHz band. But in P / P instrument is 512~608 MHz, and the TVWS band of the dissimilar frequency band except the frequency section of 614~698 MHz band, the signal transmission is not allowed. The fixed instrument can transmit the signal with the electricity higher than P / P instrument and the transmission power of the maximum 4 Watt is allowed to the effective isotropically radiated power (Effective Isotropic Radiated Power: EIRP).

P/P 기기는 특정되지 않은 위치에서 신호를 송/수신 할 수 있는 장비이며, 그 위치가 변할 수 있다는 점이 특징이다. 대부분의 경우 사람이 휴대 할 수 있는 장비로서, 그 이동성을 예측할 수 없다. 가용 주파수 대역은 512~608 MHz, 614~698 MHz의 주파수 구간이고, 최대 전송 전력은 100mW (EIRP)이다. 즉, P/P 기기에 대한 허용 전송 전력은 고정형 기기에 비하여 제한된다.

In the position in which P / P instrument is not specified, it is the equipment for signing with transmission/reception and with the point that the position can change is distinct feature. In case of the majority, it is the equipment in which human can carry and the mobility cannot be predicted. The usable frequency zone is 512~608 MHz, and the max transmit power it is the frequency section of 614~698 MHz are 100mW (EIRP). That is, the allowable transmission power about P / P instrument is limited in comparison with the fixed type instrument.

P/P 기기는, 자신의 위치에 대한 식별 능력(identification capability), 즉, 지리적-위치결정 능력(geo-location capability)과 인터넷 액세스를 통한 GDB로의 접속 능력을 갖고 있는지 여부에 따라서, 모드 II 기기(Mode II device)와 모드 I

Whether P / P instrument has the recognizability (identification capability) about its own position, in other words, the access capability to GDB through the geo-location decision-making capability (geo-location cap

기기(Mode I device)의 두 가지 종류로 분류될 수 있다. 즉, 모드 II 기기는 지리적-위치결정 능력과 인터넷 액세스 능력을 가지며, GDB에 접속해서 자신의 위치에서의 가용 채널에 대한 정보를 획득한 후 해당 위치에서 TVWS 상에서 동작할 수 있다. 또한, 모드 II 기기는 가용 채널정보를 GDB로부터 획득한 후, 모드 I 기기에게 통신을 시작할 수 있도록 명령할 수 있는 신호(예를 들어, 인에이블(enable) 신호)를 전송함으로써 네트워크를 시작할 수 있다. 한편, 모드 I 기기에게는 지리적-위치결정 능력이나 GDB 액세스 능력이 요구되지 않으며, GDB에 액세스하여 유효한 가용 채널 정보를 가지고 있는 모드 II 기기 또는 고정된 기기에 의해 제어 받아서 동작하는 것이 요구된다. 모드 I 기기는 모드 II 기기 또는 고정된 기기로부터 가용 채널 정보를 획득할 수 있으며, 주기적으로 가용채널의 유효성을 확인해야 한다. 또한, 모드 I 기기에 대해서는 해당 기기의 식별자(device ID)에 대한 확인을 거친 후 가용 채널에서의 동작이 허용될 수 있다. 여기서, 모드 II 기기 또는 고정된 기기는 인에이블링 STA에 해당하고, 모드 I 기기는 종속(dependent) STA에 해당할 수 있다. 인에이블링 STA이 종속 STA에게 전송하는 인에이블링 신호는 비콘 프레임에 해당할 수 있다.

ability) and internet access or not can be classified as two kinds of kind of the mode I instrument (Mode I device) and mode II instrument (Mode II device) according to acceptance and rejection. That is, the mode II instrument has the geo-location decision-making capability and internet access capability and it connects to GDB and the information about the available channel at its own position can be operated after doing the acquisition in the relevant position on TVWS. Moreover, by transmitting the signal (for example, the enable signal) which it can command in order to start the communication to the mode I instrument after doing the acquisition the mode II instrument can start the network the available channel information from GDB. In the meantime, the geo-location decision-making capability or the GDB access capability is not required to the mode I instrument and the fixed instrument is required that it accesses in GDB and it is controlled with the mode II instrument having with the effective available channel information or the instrument and the instrument operates. The mode I instrument can obtain the available channel information from the mode II instrument or the fixed instrument and the validity of the available channel has to be periodically confirmed. Moreover, the operation at the available channel can be allowed to the mode I instrument after the confirmation toward the identifier (device ID) of the corresponding instrument is gone through. Here, the fixed mode II instrument or the instrument corresponds to the enabling STA and the mode I instrument can correspond to the cascade (dependent) STA. The enabling signal which the enabling STA transmits to the cascade STA can correspond to the beacon frame.

모드 II 기기에 해당하는 P/P 기기가 다른 P/P 기기를 서비스할 수 있고, 또는 모드 II 에 해당하는 P/P 기기가 고정된 기기에게 서비스를 제공할 수도 있다. 이 경우, 모드 II P/P 기기는 고정된 기기를 위한 가용 채널 정보를 GDB로부터 획득하여 고정된 기기에게 전달할 수 있다.

P / P instrument corresponding to the mode II instrument can serve dissimilar P / P instrument and or the service can be provided to the instrument in which P / P instrument corresponding to the mode II is fixed. In this case, it can deliver to the instrument obtaining the available channel information for the instrument in which the mode II P / P instrument is fixed from GDB and is fixed.

한편, GDB는 DTV나 마이크로-폰 등의 우선적 사용자의 채널 사용 스케줄 및 보호 범위(protection contour)를 고려하여, 비면허 기기가 요청하는 위치에서의 가용 채널 정보를 계산하여 비면허 기기에게 전달할 수 있다. GDB에서 가용 채널 정보를 계산할 때 고려하는 파라미터들은 기기 타입, 동작하고자 하는 위치, 전송 전력 그리고 스펙트럼 마스크(spectrum mask) 등이 있다. 기기 타입에 따라서, FCC 규정에서는 인접채널에 대한 사용 여부도 달라지는데, 예를 들어 DTV가 30번 채널에서 사용 중일 때, 29번과 31번 채널이 비어 있더라도 고정된 기기는 29번 및 31번 채널들을 사용할 수 없지만, P/P 기기는 이 두 채널을 사용할 수 있다. 이는, 고정된 기기의 경우에 전송 전력이 높아서 인접 채널에 대한 간섭을 유발할 가능성이 높기 때문이다.

In the meantime, GDB calculates the available channel information at the position which the dome emptiness instrument requests in consideration of the channel usage schedule and scope of protection (protection contour) of the preferential user including DTV or the micro-phone etc. and it can deliver to the dome emptiness instrument. In GDB, the instrument type, the position, to operate the transmission power and spectral mask (spectrum mask) etc. have parameters which it considers when estimating the available channel information. According to the instrument type, the availability about the adjacent channel is changed from the FCC rules. When for example, DTV is the use in 30 burn channel , the instrument which is fixed although 29 burn and 31 burn channel are vacant cannot use 29 burn and 31 burn channels. However P / P instrument can use this two channel. As to this, in case of the fixed instrument, the possibility of the transmission power being high and inducing the interference about the adjacent channel is due to be high.

이하에서는 설명의 편의를 위해서 화이트 스페이스의 일례로서 TVWS를 들어서 본 발명의 예시들에 대해서 설명하지만, 본

Hereinafter, for the sake of convenience in illustration, as an example, TVWS is given of the white space and i

발명의 범위가 이에 제한되는 것은 아니다. 즉, 본 발명의 범위는, 특정 위치에서의 사용 가능한 채널에 대한 정보를 제공하는 DB에 의해서 제어되는 모든 화이트 스페이스에서의 동작에 대해서 적용되는 본 발명의 예시들을 포함한다. 예를 들어, 현재 시점에서는 화이트 스페이스에 해당하지 않지만, 추후 화이트 스페이스에 해당할 것으로 기대되는 다른 주파수 대역에서도 GDB에 의해 제어되는 비면허 장비의 동작이 허용될 것으로 기대되며, 이에 대해서 적용되는 본 발명의 원리에 따른 예시들은 본 발명의 범위에 포함될 수 있다. 또한, 본 발명에서는 설명의 편의를 위해서 현재 최종 규칙이 발표된 TVWS에 대한 FCC 규칙을 기반으로 본 발명의 원리에 대해서 설명하지만, 본 발명의 범위는 FCC 규칙에 따른 화이트 스페이스 대역 상에서의 동작에만 제한되는 것은 아니고, 다른 규칙을 준수하는 화이트 스페이스 대역 상에서의 본 발명의 원리에 따른 예시들을 포함한다.

t illustrates for the examples of the invention. However the scope of the present invention is not limited theret o. That is, the scope of the present invention includes the examples of the invention applied to the operation at all white spaces controlled with DB providing the info rmation about the available channel at the specific loca tion. For example, in at the moment, it does not corres pond to the white space. However the operation of the dome emptiness equipment for being controlled in the d issimilar frequency band corresponding to the afterward white space with GDB be allowed and the example acco rding to the principles of the inventions which with resp ect to this, is applied can be included in the scope of t he present invention. Moreover, in the present inventio n, for the sake of convenience in illustration, it illustrat es for the principles of the invention based on the FCC rule about TVWS in which the current final rule is anno unced. However the scope of the present invention is not limited in the operation on the white space band ac cording to the FCC rule and the examples according to the principles of the invention on the white space band observing the dissimilar rule are included.

이하에서는 화이트 스페이스 대역에서 동작하는 모드 I 기기가 모드 II 기기 또는 고정된 기기로부터 가용 채널 정보를 획득하는 과정의 일례를 설명한다.

Hereinafter, an example of the process where the mode I instrument operating in the white space band obtains the available channel information from the mode II instr ument or the fixed instrument is illustrated.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

Figure 5 is a flowchart for illustrating the link set-up process of being illustrative according to one example o f the invention.

단계 S510에서 모드 II 기기 또는 고정된 기기(이하에서는, 모드 II 기기/고정된 기기로 표현함)는 인터넷 등을 통해 GDB에 액세스하여, 현재 자신의 위치에서 사용가능한 채널 리스트(예를 들어, WSM)을 획득할 수 있다.

In the step S510, the fixed mode II instrument or the instrument (hereinafter it expresses in the instrument fi xed with the mode II instrument /) accesses in GDB thr ough the internet etc. and the usable channel list (for example, WSM) can be obtained in the position of the current oneself.

단계 S520에서, 모드 II 기기/고정된 기기는 비콘을 전송하여 BSS를 구성할 수 있다. 비콘 프레임에는 가용 채널 리스트에 대한 정보 등이 포함될 수 있다. 또한, 비콘 프레임은 주기적으로 전송될 수 있다.

In the step S520, the instrument fixed with the mode II instrument / transmits the beacon and BSS can be con figured. The beacon frame includes the information abo ut the available channel list etc. Moreover, the beacon frame can be periodically transmitted.

단계 S530에서, BSS에 참여하기 원하는 모드 I 기기는 TVWS에 대한 스캐닝 과정을 수행할 수 있다. 만약, 모드 I 기기가 현재 자신의 위치에서 사용 가능한 채널 리스트를 알고 있는 경우에는 사용 가능한 채널 리스트 상의 채널에 대해서만 수동적(passive) 또는 능동적(active) 스캐닝을 수행할 수 있다. 수동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 모드 II 기기/고정된 기기로부터의 비콘 전송을 듣는(listen) 과정을 의미한다. 능동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 프로브 요청 프레임(probe request frame)을 전송하고, 모드 II 기기/고정된 기기로부터 프로브 응답 프레임(probe response frame)을 수신하는 것을 의미한다.

In the step S530, the mode I instrument which desires to participate in BSS can perform the scanning process about TVWS. In case the mode I instrument knows the usable channel list at the position of the current onesel f the passive or the active scanning can be performed about the channel of the available channel list conditio n. The passive scanning means the process of hearing the beacon transmission from the instrument (listen) in which the mode I instrument is fixed on the scanning c hannel with the mode II instrument /. As to the active scanning, the mode I instrument transmits the probe re quest frame on the scanning channel and it means rece iving the probe response frame from the instrument fixe d with the mode II instrument /.

여기서, 모드 I 기기가 BSS에 참여하기 위해서는 모드 II 기기/고정된 기기의 제어를 받아서 동작해야 한다. 따라서, 모드 I 기기는 모드 II 기기/고정된 기기와 링크 셋업을 수행해야 한다.

Here, in order to participate in BSS the control of the instrument fixed with the mode II instrument / is receiv ed and the mode I instrument has to operate. Therefor e, the mode I instrument has to perform the instrument and the link set-up fixed with the mode II instrument /.

단계 S540에서, 모드 I 기기는 스캐닝 과정이 완료된 후에 BSS에 참여하기 위해서 연관(association) 과정을 수행할 수 있다. 이를 위해서, 모드 I 기기는 연관 요청 프레임을 모드 II 기기/고정된 기기에게 전송할 수 있다.

In the step S540, in order to participate in BSS after the scanning process is completed, the mode I instrument can perform the linkage (association) process. For this, the mode I instrument can transmit the linkage request frame to the instrument fixed with the mode II instrument /.

연관 요청/응답 과정이 성공적으로 완료된 후에, 단계 S550에서 보안 셋업(security setup) 과정을 수행하게 된다. 보안 셋업은, 예를 들어, EAPOL(Extensible Authentication Protocol over LAN) 프레임을 통한 4-웨이 핸드쉐이킹을 통해서, 프라이빗 키 셋업(private key setup)을 하는 과정을 포함할 수 있다. 모드 II 기기/고정된 기기와 모드 I 기기 간에는 보안 셋업이 반드시 수행되어야 한다. 이는 모드 II 기기/고정된 기기가 모드 I 기기에게 WSM을 전달할 때에, 무결성 확인(integrity check) 등이 요구되기 때문이다.

After the linkage request / response process is successfully completed the security set up (security setup) process is performed in the step S550. The security set up, for example, can comprise the process of the private key set up (private key setup) through 4- way handshaking through the EAPOL (Extensible Authentication Protocol over LAN) frame. The security set up has to be certainly performed between the instrument and the mode I instrument fixed with the mode II instrument /. When the instrument in which this is fixed with the mode II instrument / delivers WSM to the mode I instrument the integrity checking etc. are due to be required.

단계 S560에서 모드 I 기기는, 보안 셋업이 완료된 후에, 모드 II 기기/고정된 기기에게 채널 가용성(Channel Availability) 요청 프레임(또는 채널 가용성 질의(Channel Availability Query; CAQ) 요청 프레임)을 전송하여 사용가능한 채널의 리스트(예를 들어, WSM)을 요청할 수 있다. 모드 II 기기/고정된 기기는, 채널 가용성 응답 프레임(또는 CAQ 응답 프레임)을 모드 I 기기에게 전송함으로써 가용 채널 리스트(예를 들어, WSM)를 제공할 수 있다. 모드 I 기기가 가용 채널 리스트(예를 들어, WSM)을 수신함으로써, 모드 II 기기/고정된 기기와의 링크 셋업 과정을 완료할 수 있다. 링크 셋업이 완료되면, 모드 I 기기는 모드 II 기기/고정된 기기와 데이터, 제어, 관리 프레임 등에 대한 상호 송수신을 시작할 수 있다.

In the step S560, after the security set up the mode I instrument is finished the channel solubility (Channel Availability) request frame (or, the channel solubility query (Channel Availability Query: CAQ) request frame) is transmitted to the instrument fixed with the mode II instrument / and the list (for example, WSM) of the available channel can be requested. The instrument fixed with the mode II instrument / provides the mode I instrument the channel solubility response frame (or, the CAQ response frame) with the available channel list (for example, WSM) it transmits. The mode I instrument receives the available channel list (for example, WSM). In that way the link set-up process with the instrument fixed with the mode II instrument / can be completed. When the link set-up is completed, the mode I instrument can start the inter transceiver including the instrument and data, fixed with the mode II instrument / the control, the management frame etc.

TVWS 물리계층(PHY) 동작

TVWS physical layer (PHY) operation.

MAC 계층으로부터 PHY으로 제공되는 데이터 유닛(예를 들어, PSDU((Physical layer convergence procedure(PLCP) Service Data Unit))을 무선 매체(wireless medium) 상에서 전송으로 변환(convert)하고 (즉, 데이터 전송 동작), 무선 매체 상에서의 전송을 PSDU로 변환하는 동작 (즉, 데이터 수신 동작)을 수행하기 위한 동작에 대해서 이하에서 설명한다.

Hereinafter it illustrates for the operation for performing the operation (in other words, data receipt action) converting (in other words, the operation of data transmission), and the transmission on the wireless medium data unit (for example, the PSDU ((Physical layer convergence procedure(PLCP) Service Data Unit)) provided from the MAC layer to PHY on the wireless medium into the transmission with the conversion (convert) into PSDU.

특히, TVWS에서 동작하는 통신 시스템(예를 들어, 무선랜)을 위한 채널(이하에서는, TV 채널과 구분하기 위해서, WLAN 채널, WLAN 동작 채널, 또는 동작 채널이라고 칭한다)을 구성하는 방안이 요구된다. TVWS 기기에 의해 사용가능한 TV 채널은 기기의 위치 등에 따라 달라질 수 있다. 특히 주파수 상에서 연속적인 TV 채널을 이용할 수 없는 경우에도 TVWS 기기의 동작을 원활하게 지원하기 위해서, 연속적인 또는 불연속적인(non-contiguous) 동작 채널을 구성하는 방안이 고려될 수 있다.

Especially, the plan comprising channel (hereinafter in order that it classifies from the TV channel it calls the WLAN channel, and the WLAN working channel or the working channel) for the communication system (for example, the wireless LAN) operating in TVWS is required. The usable TV channel can be changed according to the position lamp of the instrument with the TVWS instrument. Especially, in order that taking advantage of the TV channel which is successive in the frequency domain the operation of the TVWS instrument is smoothly supported the consecutive or the plan comprising the non continuous (non-contiguous) working channel can be c

onsidered.

또한, TVWS에서 무선랜의 고수율(High Throughput; HT) 동작을 지원할 수 있으며, 이를 TVHT 동작이라고 칭한다.

Moreover, in TVWS, the high yield (High Throughput: HT) operation of the wireless LAN can be supported an d this is called the TVHT operation.

본 발명에서는 TVHT 동작 채널을 구성하는 기본적인 단위의 대역폭을 W MHz 라고 표현한다. TVHT 동작 채널을 구성하는 기본적인 단위를 기본 채널 유닛(Basic Channel Unit; BCU)이라고 칭할 수 있다. BCU의 대역폭의 크기 W는 TV 채널의 크기에 따라서 정의될 수 있다. 예를 들어, 미국과 한국은 6 MHz 단위의 TV 채널을 정의하고, 호주와 뉴질랜드는 7 MHz 단위의 TV 채널을 정의하며, 유럽은 8 MHz 단위의 TV 채널을 정의하고 있다. 따라서, W MHz의 값은 규제 도메인(regulatory domain)에 따라서 6, 7 또는 8 MHz 중의 어느 하나로 정의될 수 있다.

In the present invention, the bandwidth of the primary unit comprising the TVHT working channel is expressed with W MHz. The primary unit comprising the TVHT wor king channel can be called the basis channel unit (Basi c Channel Unit: BCU). The size W of the bandwidth of BCU can be defined according to the size of the TV ch annel. For example, the U.S. and Korea define the TV c hannel of 6 MHz unit and the Australia and NewZealand define the TV channel of 7 MHz unit and the Europe de fines the TV channel of 8 MHz unit. Therefore, accordin g to the value of W MHz is the regulatory domain, it ca n be defined as 6, and any one among 7 or 8 MHz.

또한, 주파수 세그먼트 또는 주파수 섹션은 하나 이상의 연속적인 주파수 단위를 지칭한다. 예를 들어, TVHT 동작을 위해서 2 개의 BCU가 연속적으로 구성되는 경우에, 2 개의 연속적인 BCU를 하나의 주파수 세그먼트라고 칭할 수 있다.

Moreover, the frequency segment or the frequency section names the successive frequency unit. For exam ple, in case BCU of 2 is consecutively composed for the TVHT operation successive BCU of 2 can be called one frequency segment.

예를 들어, W=6 인 경우에, 하나의 BCU로 구성되는 동작 채널(즉, W = 6 MHz 채널), 2 개의 연속적인 BCU들로 구성되는 동작 채널(즉, 2W = 12 MHz 채널), 4 개의 연속적인 BCU들로 구성되는 동작 채널(즉, 4W = 24 MHz 채널) 등이 정의될 수 있다. 또한, 2 개의 불연속적인 BCU들로 구성되는 동작 채널(즉, W+W = 6+6 MHz 채널), 2 개의 불연속적인 주파수 세그먼트로 구성되며, 각각의 주파수 세그먼트는 연속적인 BCU들을 포함하는 동작 채널(즉, 2W+2W = 12 + 12 MHz 채널) 등이 구성될 수 있다.

For example, in case it is the W=6 the working channel (in other words, W = 6 MHz channel), consisting of one BCU the working channel (in other words, 2W = 12 MHz channel), consisting of successive BCUs of 2 the worki ng channel (in other words, 4W = 24 MHz channel) etc. can be defined. Consisting of successive BCUs of 4. Mo reover, it is made up of the working channel (in other words, the W+W = 6+6 MHz channel) consisting of 2 di scontinuous BCUs, and the discontinuous frequency se gment of 2 and the working channel (in other words, 2 W+2W = 12 + 12 MHz channel) etc. can be formed. Inc luding BCUs in which each frequency segment is succes sive.

또한, 이하의 설명에서 프라이머리 채널(primary channel)은, BSS에 속한 모든 STA들에 대한 공통의 동작 채널을 의미한다. 예를 들어, 프라이머리 채널은 데이터 유닛(예를 들어, PPDU(PLCP Protocol Data Unit))의 전송을 위해서 기본적으로 사용되는 채널이며, 비콘 등의 기본적인 신호 전송을 위하여 사용될 수 있다. 즉, 프라이머리 채널은 STA의 동작의 기본적인 채널에 해당한다.

Moreover, in the following description, the primary channel means the working channel of the common abo ut all STAs belonging to BSS. For example, it is the cha nnel in which the primary channel is elementarily used f or the transmission of the data unit (for example, the P PDU (PLCP Protocol Data Unit)) and the channel can be used for the primary signal transmission including the b eacon etc. That is, the primary channel corresponds to the primary channel of the operation of STA.

한편, 세컨더리 채널(secondary channel)은, 프라이머리 채널에 연관(associate)되는 채널이며, 프라이머리 채널과 합하여 보다 넓은 대역폭 및 높은 수율(high throughput)을 지원하기 위해 사용되는 채널이다.

In the meantime, the secondary channel is the channel which becomes in the primary channel with the linkage (associate) and it sums with the primary channel it is t he wide bandwidth and the channel which is used in or der to support the high yield (high throughput).

예를 들어, 2W MHz 채널을 구성하는 2 개의 W MHz 채널들 중에서 프라이머리 채널의 위치(location)가 결정되어야 한다. 프라이머리 채널의 위치는 2 개의 W MHz 채널 중에서 높은 주파수 부분인지 낮은 주파수 부분인지를 지시(indicate)할 수

For example, the position (location) of the primary channel has to be settled among W MHz channels com prising 2W MHz channel of 2. It can tell about the indic ation (indicate) whether it is the frequency part low w

있다. 본 발명에서의 프라이머리 채널은, 가용 TV 채널이 시간 또는 STA의 위치에 따라 가변하는 TVWS에서 정의되는 것을 특징으로 한다. 구체적으로, 본 발명의 TVWS 동작 채널의 구성에 있어서 정의되는 프라이머리 채널은, TVWS에서의 가용 TV 채널을 고려하여 설정될 수 있다.

hether the position of the primary channel is the freque ncy part high among W MHz channel of 2 or not or not. The availability TV channel is defined in TVWS which th e primary channel at the invention varies according to the position of time or STA. Specifically, the primary ch annel defined as to the configuration of the TVWS wor king channel of the invention can be set up in consider ation of the availability TV channel at TVWS.

도 6은 TVHT 채널-리스트 파라미터 요소 및 채널 대역폭을 설명하기 위한 도면이다.

Figure 6 is a drawing illustrating the TVHT channel - list parameter element and the channel bandwidth.

채널-리스트 파라미터 요소는 STA이 CCA(Clear Channel Assessment) 동작에 관련된 정보이며, CCA는 무선 매체(Wireless Medium)이 사용중(busy)인지 여부를 확인하는 동작이다. STA은 CCA를 수행할 때에 해당 채널이 프라이머리 채널 또는 세컨더리 채널인지 여부를 지시하는 위해서, 채널-리스트 파라미터가 이용될 수 있다.

STA the channel - list parameter element is the related information in the CCA (Clear Channel Assessment) ope ration and it is the operation in which CCA confirms wh ether the wireless medium is the busy or not. When ST A performs CCA, the corresponding channel is whether i t is the primary channel or the secondary channel and the channel - list parameter can be used.

TVHT 채널-리스트 파라미터 요소에는 primaryTVHT_W, primaryTVHT_2W, secondaryTVHT_W, secondaryTVHT_2W 등의 요소가 정의될 수 있다. 여기서 TVHT_W는 하나의 BCU에 해당할 수 있고, TVHT_2W는 연속적인 2개의 BCU 에 해당할 수 있다.

In the TVHT channel - list parameter element, the element of the primaryTVHT W, the primaryTVHT 2W, t he secondaryTVHT W, the secondaryTVHT 2W etc can be defined. Here, the TVHT W can correspond to one B CU and it can correspond to BCU in which the TVHT 2 W is successive of 2.

또한, TVWS에서의 동작하는 시스템을 위한 동작 채널의 정의(즉, 채널화(channelization))는, 가용 TV 채널(즉, 우선적 사용자가 존재하지 않는 TV 채널)에 기초하여 결정될 수 있다. 예를 들어, 연속적인 TV 채널의 사용이 불가능한 경우(즉, TV 채널 n 은 사용가능하지만 TV 채널 n-1과 n+1은 사용가능하지 않은 경우), 또는 연속적인 TV 채널이 사용가능한 경우 몇 개의 연속적인 TV 채널이 사용가능한지를 고려하여, TVWS 시스템을 위한 채널화가 결정될 수 있다.

Moreover, the definition (in other words, the channelizing (channelization)) of the working channel f or the system at TVWS operating can be determined b ased on the availability TV channel (the TV channel in which in other words, the preferential user is nonexiste nt). For example, in case the use of the successive TV channel is impossible (in other words, the TV channel n is usable but the TV channel n-1 and n+1 are not usabl e) in case the successive TV channel is usable it consi ders whether the several successive TV channels is us able and the channelizing for the TVWS system can be determined.

위와 같이 가용 TV 채널에 기초하여 결정되는 동작 채널에 대한 설정 정보는 인에이블링 STA로부터 종속 STA에게, 또는 AP STA으로부터 non-AP STA에게 제공될 수 있다. 예를 들어, 동작 채널에 대한 설정 정보는, 채널 시작 주파수, 채널 폭, 채널 중심 주파수 인덱스(프라이머리 채널을 포함하는 BCU의 중심 주파수 인덱스 및 프라이머리 채널을 포함하지 않는 BCU의 중심 주파수 인덱스), 프라이머리 채널 위치 등을 포함할 수 있다. 여기서, 채널 시작 주파수는 동작 클래스(operating class) 정보에 의해 정의될 수 있다. 또한, 채널 폭(예를 들어, W, 2W, 4W, W+W, 2W+2W 등)에 대한 정보는, 상기 동작 채널 정보 요소 등에 의해 정의될 수 있다. 채널 중심 주파수 인덱스, 프라이머리 채널 위치 등에 대한 파라미터는 PLMEMIB(Physical Layer Management Entity Management Information Base) 등에 의하여 정의될 수 있다.

Or the set up information about the working channel determined like the upper part based on the availability TV channel can be provided for the cascade STA from the enabling STA from the AP STA to the non-AP STA. For example, the set up information about the working channel may include the channel, the channel width, c hannel center frequency index (the center frequency in dex of BCU including the primary channel and center fre quency index of BCU not including the primary channe l), the primary channel position lamp. Here, the channel starting frequency can be defined with the operation cl ass (operating class) information. Moreover, the inform ation about the channel width (for example, the W, 2 W, 4W, the W+W, 2W+2W etc) can be defined with th e working channel information element etc. The channe l center frequency index , and the parameter about the primary channel position lamp can be defined with the PLMEMIB (Physical Layer Management Entity Managem ent Information Base) etc.

이하에서는 본 발명에 따른 TVWS에서의 무선랜 동작을 위한 채널화, 특히 TVHT 동작을 위한 채널화의 실시예들에 대해서 설명한다.

Hereinafter, it illustrates for the channelizing for the wireless LAN operation at the TVWS according to the p resent invention, especially, the embodiments of the ch annelizing for the TVHT operation.

TVHT 동작 요소

TVHT action element.

도 7은 본 발명에 따른 TVHT 동작 요소의 포맷을 설명하기 위한 도면이다.

Figure 7 is a drawing illustrating the format of the TVHT action element according to the present invention.

BSS에서 TVHT STA들의 동작은 TVHT 동작 요소(Operation element)에 의해서 제어될 수 있다. 도 7에서 도시하는 바와 같이, TVHT 동작 요소의 포맷은 요소 ID(Element ID) 필드, 길이(Length) 필드, TVHT 동작 정보(TVHT Operation Information) 필드, 및 TVHT 기본 MCS 세트(TVHT Basic Modulation and Coding Scheme (MCS) Set) 필드를 포함할 수 있다.

In BSS, the operation of TVHT STAs can be controlled with the TVHT action element (Operation element). As shown in Figure 7, the format of the TVHT action element comprises the element ID field, the length field, and the TVHT operation information field and TVHT basis MCS set (TVHT Basic Modulation and Coding Scheme (MCS) Set) field.

도 7의 요소 ID 필드는 해당 정보 요소가 TVHT 동작 요소임을 나타내는 식별자에 해당하는 값을 가질 수 있다.

The element ID field of fig. 7 can have the value which corresponds to the identifier showing that the corresponding information element is the TVHT action element.

도 7의 길이 필드는 길이 필드 이후의 필드들의 크기를 나타내는 값을 가질 수 있으며, 본 예시에서는 6 옥텟을 나타내는 값으로 설정될 수 있다.

It can have the value in which the length field of fig. 7 shows the size of the fields of the length field after and the value can be set up in this example as the value showing 6 octet.

도 7의 TVHT 동작 정보 필드는 TVHT 동작 정보 필드는 프라이머리 채널 번호(Primary Channel Number), 채널 폭(Channel Width), 채널 중심 주파수 세그먼트 0(Channel Center Frequency Segment 0), 채널 중심 주파수 세그먼트 1(Channel Center Frequency Segment 1) 서브필드들을 포함할 수 있다.

As to the TVHT operation information field of fig. 7, the TVHT operation information field may include the primary channel number, the channel width, the channel center frequency segment 0, channel center frequency segment 1 subfields.

도 8은 TVHT 동작 정보 필드의 포맷을 설명하기 위한 도면이다. 본 발명에서 제안하는 TVHT 동작 정보 필드의 서브필드들은 아래 표 1과 같이 정의될 수 있다.

Figure 8 is a drawing illustrating the format of the TVHT operation information field. In the present invention, the subfield of the TVHT operation information field s suggested can be defined like the lower part table 1.

종래 기술에서는 Channel Center Frequency Segment 0가, TVHT_W 또는 TVHT_2W 또는 TVHT_4W의 동작 채널 폭의 경우에는 TVWS BSS가 동작하는 TVHT_W 또는 TVHT_2W 또는 TVHT_4W 채널의 중심 주파수(즉, WLAN 동작 채널의 중심 주파수)를 지시(indicate)하거나, TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭의 경우에는 프라이머리 채널을 포함하는 주파수 세그먼트의 중심 주파수를 지시하는 것으로 정의되어 있다. 또한, Channel Center Frequency Segment 1이, TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭의 경우에는, 프라이머리 채널을 포함하지 않는 주파수 세그먼트의 TVHT_W 또는 TVHT_2W 채널의 중심 주파수를 지시하는 것으로 정의되어 있다.

In the conventional technology, in case of the working channel width of the TVHT W or the TVHT 2W or the TVHT 4W, the Channel Center Frequency Segment 0 tells the center frequency (in other words, the center frequency of the WLAN working channel) of the TVHT W in which the TVWS BSS operates or the TVHT 2W or the TVHT 4W channel about the indication (indicate) or with it indicates the center frequency of the frequency segment including the primary channel in the TVHT W+W or the TVHT 2W+2W working channel width it is defined. Moreover, in case of the TVHT W+W or the TVHT 2W+2W working channel width, the Channel Center Frequency Segment 1 is defined that it indicates the center frequency of the TVHT W of the frequency segment not including the primary channel or the TVHT 2W channel.

WLAN 동작 채널의 중심 주파수는 후술하는 수학식 4에 따라서 표현/계산될 수 있다. 예를 들어, TVHT_2W 또는 TVHT_4W 동작 채널 폭의 경우에, Channel Center Frequency Segment 0 필드의 값이 곧 WLAN 동작 채널의 주파수가 되는 문제가 있다. 이 경우, 수학식 4의 교정값(즉, ChannelCenterFrequencyCorrection)이 적용되는 경우에, 실제 WLAN 동작 채널의 중심 주파수에서 교정 값이 더해진 잘못된 값이 WLAN 동작 채널이 중심 주파수로서 표현되는 문제가 있다.

According to the center frequency of the WLAN working channel is the equation 4 which will be described later, it can be counted with the expression /. For example, there is a problem that in case of the TVHT 2W or the TVHT 4W working channel width, the frequency of the WLAN working channel becomes soon the value of the Channel Center Frequency Segment 0 field. In this case, there is a problem that in case the correcting value (in other words, the ChannelCenterFrequency Correction) of the Equation 4 is applied the WLAN worki

ng channel of the value in which the correcting value is actually added in the center frequency of the WLAN working channel and which becomes wrong is expressed as the center frequency.

유사하게, TVHT_2W+2W 동작 채널 폭의 경우에, Channel Center Frequency Segment 0 필드의 값이 곧 주파수 세그먼트 0(즉, 프라이머리 채널을 포함하는 주파수 세그먼트)의 중심 주파수의 값을 가지게 되므로, 주파수 세그먼트 0의 중심 주파수의 값에 수학식 4의 교정값이 더해진 잘못된 값이 해당 주파수 세그먼트의 중심 주파수로서 표현되는 문제가 있다.

Similarly, there is a problem that in case of the TVHT 2W+2W working channel width, the value of the Channel Center Frequency Segment 0 field soon has the value of the center frequency of the frequency segment 0 (the frequency segment including in other words, the primary channel). Therefore the value in which the correcting value of the Equation 4 is added to the value of the center frequency of the frequency segment 0 and which becomes wrong is expressed as the center frequency of the corresponding frequency segment.

따라서, 본 발명에서는 상기 표 1 및 후술하는 표 4에서 나타내는 바와 같이, Channel Center Frequency Segment(즉, 후술하는 표 4의 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1)을 해당 WLAN 동작 채널에 포함된 TV 채널(들) 중에서 #34 #가장 낮은#34# TV 채널의 중심 주파수를 나타내는 인덱스로서 정의하는 것을 제안한다. 이에 따라, 수학식 4에 따라서 WLAN 동작 채널의 중심 주파수가 올바르게 표현될 수 있다. 구체적인 사항은 후술하는 수학식 4와 관련된 부분에서 설명한다.

Therefore, in the present invention, day most suggests among the TV channel which is the table 1 and the Channel Center Frequency Segment (in other words, the dot11CurrentChannelCenterFrequencyIndex0 or the dot11CurrentChannelCenterFrequencyIndex1 of the table 4 which will be described later) describing later included in the corresponding WLAN working channel with " defining as the index showing the center frequency of the TV channel with 34. Accordingly, according to the Equation 4, the center frequency of the WLAN working channel can be correctly expressed. The detailed matter illustrates in the part associated with the Equation 4 which will be described later.

다음으로, 도 7의 TVHT 기본 MCS 세트 필드는 BSS 내의 모든 TVHT STA들에 의해서 지원되는 TVHT PPDU들의 공간 스트림(spatial stream)의 개수별 MCS를 나타낸다. TVHT 기본 MCS 세트 필드는 8 비트 크기의 비트맵으로 정의될 수 있으며, 상기 비트맵의 8 비트 중에서 각각의 2 비트씩은 Nss (Nss는 공간 스트림의 개수를 의미하고, 1 부터 4 중의 하나의 값을 가질 수 있음)에 대한 지원되는 MCS를 나타낸다. TVHT 기본 MCS 세트 필드는, 수신(Rx) MCS 맵 서브필드(VHT Supported MCS Set 필드의 서브필드 중 하나)의 B0-B7으로서 정의될 수도 있다. 이러한 경우에는, TVHT 기본 MCS 세트 필드는 1 옥텟(즉, 8 비트) 크기로 정의될 수 있다. 그러나, 이에 제한되는 것은 아니고, 상기 8 비트 크기의 비트맵에 추가적인 8 비트를 포함하는 2 옥텟 (즉, 16 비트) 크기로 TVHT 기본 MCS 세트 필드가 정의될 수도 있다.

Next, the TVHT basis MCS set field of fig. 7 shows the number MCS of the space stream (spatial stream) of TVHT PPDUs supported by all TVHT STAs within BSS. The TVHT basis MCS set field can be defined as the bit-map of 8 bit size and each 2 bit-by-bit shows supported MCS about Nss (the number of Nss is the space streams are meant and it can have one value among 4 from 1) among 8-bit of the bit- map. The TVHT basis MCS set field can be defined as the B0-B7 of the reception (Rx) MCS map subfield (one among the subfield of the VHT Supported MCS Set field). In this case, the TVHT basis MCS set field can be defined as 1 octet (in other words, 8-bit) size. But is not limited thereto and the TVHT basis MCS set field can be defined as 2 octet (in other words, 16 bit) size including the additional 8-bit in the bit- map of 8 bit size.

TVHT BSS 동작

TVHT BSS operation.

BSS를 생성하는 STA은 TVHT BSS가 기본적으로 지원하는 MCS의 세트(즉, TVHTBSSBasicMCSSet) 및 TVHT 동작을 위해 지원되는 MCS의 세트(즉, TVHTOperationalMCSSet)에서 정의하는 MCS 값에 따라서 수신 및 전송할 수 있어야 한다.

It can receive and it transmit according to the MCS value defined in the set (in other words, the TVHTOperationalMCSSet) of MCS in which STA producing BSS is supported for the set (in other words, the TVHTBSSBasicMCSSet) and TVHT operation of MCS which the TVHT BSS elementarily supports.

TVHT AP는 TVHT 캐퍼빌리티 요소(TVHT Capabilities element)의 TVHT 캐퍼빌리티 정보(TVHT Capability Info) 필드의 지원되는 채널 폭 세트(Supported Channel Width Set) 서브필드에서, 자신이 지원하는 채널 폭 캐퍼빌리티를 선언한다.

In the TVHT AP is the supported channel width set (Supported Channel Width Set) subfield of the TVHT capability information field of the TVHT capability element (TVHT Capabilities element), the channel width capability which oneself supports is declared.

또한, TVHT AP는 TVHT 동작 요소(TVHT Operation element)의 TVHT 동작 정보(TVHT Operation Informatio

Moreover, the TVHT AP sets up the channel width subfield of the TVHT operation information field of the

n) 필드의 채널 폭(Channel Width) 서브필드를 BSS 동작 채널 폭(BSS operating channel width)을 지시하도록 설정한다. 예를 들어, TVHT AP가 BSS 동작 채널 폭을 W, 2W, W+W, 4W, 2W+2W 중의 하나의 것을 지시할 수 있다.

TVHT action element (TVHT Operation element) in order to indicate the BSS working channel width (BSS operating channel width). For example, the TVHT AP can indicate one among the W, 2W, W+W, 4W, 2W+2W the BSS working channel width.

여기서, BSS에서 전송되는 PPDU(transmitted PPDU)의 대역폭은 BSS 동작 채널 폭의 서브세트일 수 있다. 예를 들어, BSS 동작 대역폭이 2W인 경우에, 지원되는 PPDU 대역폭은 W 또는 2W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 W+W인 경우에, 지원되는 PPDU 대역폭은 W 또는 W+W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 4W인 경우에, 지원되는 PPDU 대역폭은 W, 2W 또는 4W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 2W+2W인 경우에, 지원되는 PPDU 대역폭은 W, 2W 또는 2W+2W 중의 하나일 수 있다.

Here, the bandwidth of the PPDU (transmitted PPDU) transmitted from BSS can be the sub set of the BSS working channel width. For example, it can be one of PPDU bandwidth which in case the BSS operation bandwidth is 2W is supported. Is W or 2W. Moreover, it can be one of PPDU bandwidth which in case the BSS operation bandwidth is the W+W is supported. Is W or the W+W. Moreover, it can be one of PPDU bandwidth which in case the BSS operation bandwidth is 4W is supported. Is W, and 2W or 4W. Moreover, it can be one of PPDU bandwidth which in case the BSS operation bandwidth is 2W+2W is supported. Is W, and 2W or 2W+2W.

따라서, PPDU 대역폭을 정확하게 지시하기 위해서는, BSS 동작 채널 폭 정보 외에 추가적인 추가적인 정보가 필요하다.

Therefore, in order that the PPDU bandwidth is accurately indicated the additional additional information is necessary besides the BSS working channel width information.

여기서, PPDU는 PLCP 프리앰블 필드, PLCP 헤더 필드 및 데이터 필드를 포함할 수 있다. PLCP 프리앰블 필드는 트레이닝 필드(training field) 등을 포함한다. PLCP 헤더 필드는 SIG (Signal) 필드 등을 포함한다. 데이터 필드는 PSDU(PLCP Service Data Unit) 등을 포함한다. PLCP 헤더 필드에 포함되는 SIG 필드는, BW(Bandwidth) 필드 등을 포함한다. BW 필드는 2 비트 크기로 정의된다. 기존의 BW 필드는 X(예를 들어, X=20 MHz), 2X, 4X 또는 8X/4X+4X의 PPDU 대역폭을 지시하는 기능을 한다.

Here, PPDU comprises the PLCP preamble field, and the PLCP header field and data field. The PLCP preamble field includes the training field etc. The PLCP header field includes the SIG (Signal) field etc. The data field includes the PSDU (PLCP Service Data Unit) etc. The SIG field included in the PLCP header field includes the BW (Bandwidth) field etc. The BW field is defined as 2 bit size. The existing BW field functions to indicate X (for example, the X=20 MHz), 2X, and the PPDU bandwidth of 4X or 8X / 4X+4X.

TVHT PPDU에서는 PLCP 헤더의 SIG 필드를 TVHT-SIG-A1 및 TVHT-SIG-A2로 구성될 수 있고, 이 중에서 TVHT-SIG-A1의 처음 2개의 비트(B0 및 B1)이 BW 필드로서 정의될 수 있다.

In the TVHT PPDU, it can be the SIG field of the PLCP header composed of the TVHT-SIG-A1 and TVHT-SIG-A2 and among these, bit (the B0 and B1) of 2 can be defined of the TVHT-SIG-A1 as the BW field for the first time.

본 발명에서는 PPDU 대역폭을 정확하게 지시하기 위해서, 상기 BSS 동작 대역폭 정보와 함께 TVHT-SIG-A1의 BW 필드를 이용하는 것에 대해서 제안한다.

In the present invention, in order that the PPDU bandwidth is accurately indicated it confronts to use the BW field of the TVHT-SIG-A1 with the BSS operation bandwidth information and it suggests.

아래의 표 2는 TVHT BSS 동작 채널 폭을 나타낸다. 표 2에서 나타내는 바와 같이, 전송되는 PPDU의 타입은 BSS 동작 채널 폭 및 TVHT-SIG-A1 필드의 B0-B1의 값에 의존하여 결정될 수 있다.

The following table 2 shows the TVHT BSS working channel width. As shown in table 2, the transmitted type of PPDU depends on the value of the B0-B1 of the BSS working channel width and TVHT-SIG-A1 field and the value can be determined.

상기 표 2에서 TVHT_MODE_1 PPDU는 TVHT_W VHT PPDU 또는 TVHT_W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_W NON_HT PPDU는 하나의 BCU(즉, TVHT_W 대역폭)에서 non-HT PPDU가 2 번 반복(replicate)되는 것을 의미한다.

It corresponds to one of TVHT MODE 1 PPDU is the TVHT W VHT PPDU or the TVHT W NON HT PPDU in the table 2s. Here, in the TVHT W NON HT PPDU is one BCU (in other words, the TVHT W bandwidth), it means that the non-HT PPDU is two times repetition (replicate).

TVHT_MODE_2C PPDU는 TVHT_2W VHT PPDU 또는 TVHT_2W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_2W NON_HT PPDU는 2개의 연속적인 BCU(즉, TVHT 2W 대역폭)에서 non-HT PPDU가 4 번 반복되는 것을 의미

It corresponds to one of TVHT MODE 2C PPDU is the TVHT 2W VHT PPDU or the TVHT 2W NON HT PPDUs. Here, in the TVHT 2W NON HT PPDU is the successive BCU (in other words, the TVHT 2W bandwidth) of 2, it m

한다.

eans that the non-HT PPDU is repeated with four time s.

TVHT_MODE_2N PPDU는 TVHT_W+W VHT PPDU 또는 TVHT_W+W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_W+W NON_HT PPDU는 2 개의 불연속적인 BCU(즉, TVHT_W+W 대역폭)에서 non-HT PPDU가 4 번 반복되는 것을 의미한다.

It corresponds to one of TVHT MODE 2N PPDU is the TVHT W+W VHT PPDU or the TVHT W+W NON HT PPDU s. Here, in the TVHT W+W NON HT PPDU is the disconti nuous BCU (in other words, the TVHT W+W bandwidth) of 2, it means that the non-HT PPDU is repeated with f our times.

TVHT_MODE_4C PPDU는 TVHT_4W VHT PPDU 또는 TVHT_4W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_4W NON_HT PPDU는 4개의 연속적인 BCU(즉, TVHT_4W 대역폭)에서 non-HT PPDU가 8 번 반복되는 것을 의미한다.

It corresponds to one of TVHT MODE 4C PPDU is the TVHT 4W VHT PPDU or the TVHT 4W NON HT PPDUs. H ere, in the TVHT 4W NON HT PPDU is the successive B CU (in other words, the TVHT 4W bandwidth) of 4, it m eans that the non-HT PPDU is repeated with 8 burn.

TVHT_MODE_4N PPDU는 TVHT_2W+2W VHT PPDU 또는 TVHT_2W+2W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_2W+2W NON_HT PPDU는, 하나의 주파수 세그먼트가 2 개의 연속적인 BCU들을 포함하고, 이러한 주파수 세그먼트의 2 개가 불연속적으로 존재하는 대역폭(즉, TVHT_2W+2W 대역폭)에서 non-HT PPDU가 8 번 반복되는 것을 의미한다.

It corresponds to one of TVHT MODE 4N PPDU is the TVHT 2W+2W VHT PPDU or the TVHT 2W+2W NON HT PPDUs. Here, the TVHT 2W+2W NON HT PPDU includes successive BCUs of one frequency segment 2 and it me ans that the non-HT PPDU is repeated in the bandwidt h (in other words, the TVHT 2W+2W bandwidth) in whi ch 2 of such frequency segment discontinuously exists with 8 burn.

TVHT 동작 요소를 포함하는 프레임을 수신한 TVHT non-AP STA은 TVHT 동작 정보 필드(상기 표 1 참조)의 #34#채널 중심 주파수 세그먼트 0#34#, #34#채널 중심 주파수 세그먼트 1#34# 서브필드, 및 #34#프라이머리 채널 오프셋#34# 을 이용하여 채널화(channelization)을 결정할 수 있다. 채널화에 대한 보다 구체적인 설명은 후술한다.

The TVHT non-AP STA receiving the frame including the TVHT action element can determine the channelizin g (channelization) using the " channel center frequency segment 0" of the TVHT operation information field (ref er to table 1), and the " channel center frequency seg ment 1" subfield and " primary channel offset ". The det ailed description more describes later about the channe lizing.

TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접 링크(off-channel Tunneled Direct-Link Setup(TDLS) direct link) 상의 TVHT_MODE_1 PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT_W 채널을 제외한 채널 상에서 TVHT_MODE_1 PPDU를 전송하지 않도록 동작할 수 있다 (즉, BSS의 프라이머리 TVHT_W 채널 상에서만 TVHT_MODE_1 PPDU를 전송하도록 동작할 수 있다). 여기서, 오프-채널은 기본 채널(base channel)이 아닌 다른 채널을 의미하고, 기본 채널은 TDLS 피어(peer) STA이 AP와 연관을 맺은 채널을 의미한다.

The TVHT STA which is the member of the TVHT BSS excludes the TVHT MODE 1 PPDU transmission on the o ff - channel TDLS direct link (off-channel Tunneled Dire ct-Link Setup(TDLS) direct link) and it can operate in o rder not to transmit the TVHT MODE 1 PPDU on the ch annel except for the primary TVHT W channel of BSS (t hat is, it can operate in order to transmit the TVHT MO DE 1 PPDU on the primary TVHT W channel of BSS). He re, the off - channel means the dissimilar channel whic h is not fundamental channel (base channel) and the fu ndamental channel means the channel in which the TDL S peer STA forms AP and linkage.

TVHT_2W, TVHT_4W 또는 TVHT_W+W 동작 채널 폭을 가지는 TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접 링크 상의 TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_2N PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT_W 채널 및 세컨더리 TVHT_W 채널을 사용하지 않는 TVHT_MODE_2C 또는 TVHT_MODE_2N PPDU를 전송하지 않도록 동작할 수 있다.

The TVHT STA which is the member of the TVHT BSS having the TVHT 2W, and the TVHT 4W or the TVHT W +W working channel width excludes the TVHT MODE 2C on the off - channel TDLS direct link, and the TVHT MO DE 4C or the TVHT MODE 2N PPDU transmission and in order not to transmit the primary TVHT W channel of B SS and TVHT MODE 2C or the TVHT MODE 2N PPDU whi ch does not use the secondary TVHT W channel it can operate.

TVHT_4W 또는 TVHT_2W+2W 동작 채널 폭을 가지는 TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접 링크 상의 TVHT_MODE_4C 또는 TVHT_MODE_4N PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT 2W 채널 및 세컨

The TVHT STA which is the member of the TVHT BSS having the TVHT 4W or the TVHT 2W+2W working cha nnel width excludes the TVHT MODE 4C on the off - ch annel TDLS direct link or the TVHT MODE 4N PPDU tran

더리 TVHT_2W 채널을 사용하지 않는 TVHT_MODE_4C 또는 TVHT_MODE_4N PPDU를 전송하지 않도록 동작할 수 있다.

smission and in order not to transmit the primary TVHT 2W channel of BSS and TVHT MODE 4C or the TVHT MODE 4N PPDU which does not use the secondary TVHT 2W channel it can operate.

TVHT STA은 다른 TVHT STA으로부터 최근에 수신된 TVHT 캐퍼빌리티 요소 또는 동작 모드 통지(Operating Mode Notification) 프레임의 지원되는 채널 폭 세트(Supported Channel Width Set) 서브필드에서 지원되는 것으로 지시되지 않는 대역폭을 사용해서는, 상기 다른 TVHT STA으로 전송하지 않도록 동작할 수 있다.

The bandwidth which is not indicated that it is supported in the supported channel width set (Supported Channel Width Set) subfield of the TVHT capability element received from the TVHT STA in which the TVHT STA is different or the operation mode notification (Operating Mode Notification) frame is used and it can operate in order not to transmit with the above-mentioned dissimilar TVHT STA.

TDLS 오프-채널 직접-링크의 경우를 제외하고는, STA은 TXVECTOR의 CH_BANDWIDTH 파라미터가 BSS 동작 채널 폭보다 넓은 채널 대역폭을 지시하는 PPDU를 전송하지 않도록 동작할 수 있다. 여기서, TXVECTOR는 MAC이 PHY에게 PSDU의 전송을 위해서 제공하는 파라미터들의 리스트를 의미하며, 상기 파라미터들 중에서 CH_BANDWIDTH 파라미터는 패킷 전송에 이용되는 채널 폭을 나타낸다.

It excepts the case and it can operate so that STA does not transmit PPDU in which the CH BANDWIDTH parameter of TXVECTOR indicates the channel bandwidth which is broad than the BSS working channel width. Here, TXVECTOR means the list which MAC provides for the transmission of PSDU to PHY of the parameters and the CH BANDWIDTH parameter shows the channel width used for the packet transmission among parameters.

신호의 수학적 표현

The mathematical expression of the signal.

모든 TVHT PPDU 전송 모드에 대해서, 신호는 아래 표 3에서 정의되는 서브캐리어(subcarrier) 상에서 전송된다. 표 3은 톤 위치(tone location)를 나타낸 것이다.

The signal is transmitted about all TVHT PPDU transmission modes on the subcarrier defined in the lower part table 3. The table 3 shows the tone position (tone location).

다음으로, TVHT 채널은 아래의 표 4에서 정의되는 PLME (Physical Layer Management Entity) MIB(Management Information Base) 필드들에 의해서 정의된다. 표 4는 TVHT 채널들을 특정(specify)하는 필드들을 나타낸 것이다.

Next, it is defined with PLME (Physical Layer Management Entity) MIB (Management Information Base) fields where the TVHT channel is defined in the following table 4. The table 4 shows fields TVHT channels the specific (specify).

상기 표 1에서 설명한 바와 같이, 본 발명에서는 Channel Center Frequency Segment(즉, 상기 표 4의 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1)을 해당 WLAN 동작 채널에 포함된 TV 채널(들) 중에서 #34#가장 낮은#34# TV 채널의 중심 주파수를 나타내는 인덱스의 값으로 정의하는 것을 제안한다.

In the table 1, as described above, in the present invention, day most suggests among the TV channel which is the Channel Center Frequency Segment (in other words, the dot11CurrentChannelCenterFrequencyIndex0 of the table 4 or the dot11CurrentChannelCenterFrequencyIndex1) included in the corresponding WLAN working channel with " defining as the value of the index showing the center frequency of the TV channel with 34.

다음으로, 채널 주파수를 수학적으로 표현하기 위해서 다음의 표 5와 같이 각각의 변수를 정의할 수 있다.

Next, each variable can be defined like the following table 5 in order to mathematically express the channel frequency.

상기 표 5에서 채널 시작 주파수($f_{CH,start}$)는 국가 정보 및 동작 클래스(Country information and operating classes) 항목에서 정의되는 값에 따라서 결정된다 (표 9 내지 표 12 참조).

In the table 5, it is determined according to the value in which the channel starting frequency (f(sub)CH,start (/sub)) is defined in the national information and operation class (Country information and operating classes) item ().

상기 표 5와 같이 변수가 정의된 경우에, TVHT_MODE_1, TVHT_MODE_2C, TVHT_MODE_2N, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에서 $f_{c,idx}$ 와 $f_{c,idx0}$ 는 아래의 수학식 1에 의해서 특정되는 관계를 가진다 (또는, dot11CurrentChannelWidth가 TVHT_W, TVHT_2W, TVHT_W+W, TV

In case the variable is defined like the table 5 it has relations in the TVHT MODE 1, the TVHT MODE 2C, the TVHT MODE 2N, the TVHT MODE 4C or the TVHT MODE 4N operation. The $f_{c,idx0}$ is specified with the following equation 1 (or, in case the dot11CurrentChannelWidt

HT_4W 또는 TVHT_2W+2W인 경우에, $f_{PW,idx}$ 와 $f_{c,idx0}$ 는 아래의 수학식 1에 의해서 특정되는 관계를 가진다).

h is the TVHT W, the TVHT 2W, the TVHT W+W, the TVHT 4W or the TVHT 2W+2W it has relations. The $f_{c,idx0}$ is specified with the following equation 1).

상기 수학식 1에서 $0 \le n_{PW} \le N_{PW} - 1$ 이다.

In the equation 1, it is $0 \le n_{PW} \le N_{PW} - 1$.

$N_{PW}$ 의 값은 다음과 같이 결정된다. TVHT_MODE_1 및 TVHT_MODE_2N에서 (또는 TVHT_W 및 TVHT_W+W인 경우에) $N_{PW} = 1$이다. TVHT_MODE_2C 및 TVHT_MODE_4N에서 (또는 TVHT_2W 및 TVHT_2W+2W인 경우에) $N_{PW} = 2$이다. TVHT_MODE_4C에서 (또는 TVHT_4W인 경우에) $N_{PW} = 4$이다.

The value of $N_{PW}$ is decided like the next. In the TVHT MODE 1 and TVHT MODE 2N, it is (it or is the TVHT W and TVHT W+W) $N_{PW} = 1$. In the TVHT MODE 2C and TVHT MODE 4N, it is (it or is the TVHT 2W and TVHT 2W+2W) $N_{PW} = 2$. In the TVHT MODE 4C, it is (it or is the TVHT 4W) $N_{PW} = 4$.

다음으로, TVHT 동작 모드 또는 TVHT 채널 폭에 따라서 프라이머리 채널, 세컨더리 채널의 주파수 특성(예를 들어, 주파수 위치)의 수학적 표현에 대해서 설명한다.

Next, according to the TVHT operation mode or the TVHT channel width, it illustrates for the primary channel, and the mathematical expression of the frequency characteristic (for example, the frequency location) of the secondary channel.

TVHT_MODE_1, TVHT_MODE_2C, TVHT_MODE_2N, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_W, TVHT_2W, TVHT_W+W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 프라이머리 TVHT_W 채널은 $f_{CH,start} + W$ #215# $f_{PW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $f_{PW,idx}$ 는 상기 수학식 1에 따라서 결정된다.

It is the channel having the TVHT W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT W, the TVHT 2W, the TVHT W+W, the TVHT 4W or the TVHT 2W+2W) , and the primary TVHT W channel concentrate on the $f_{CH,start} + W \times f_{PW,idx}$ as to the TVHT MODE 1, the TVHT MODE 2C, the TVHT MODE 2N, the TVHT MODE 4C or the TVHT MODE 4N operation. Here, the $f_{PW,idx}$ is determined according to the equation 1.

TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 세컨더리 TVHT_W 채널은 $f_{CH,start} + W$ #215# $f_{SW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $n_{PW}$ 가 짝수(even)인 경우에 $f_{SW,idx} = f_{PW,idx} + 1$ 이고, $n_{PW}$ 가 홀수(odd)인 경우에 $f_{SW,idx} = f_{PW,idx} - 1$ 이다.

It is the channel having the TVHT W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT 2W, and the TVHT 4W or the TVHT 2W+2W) , and the secondary TVHT W channel concentrate on the $f_{CH,start} + W \times f_{SW,idx}$ as to the TVHT MODE 2C, and the TVHT MODE 4C or the TVHT MODE 4N operation. Here, it is the $f_{SW,idx} = f_{PW,idx} + 1$ in case the $n_{PW}$ is the even number (even) and it is the $f_{SW,idx} = f_{PW,idx} - 1$ in case the $n_{PW}$ is the odd number (odd).

TVHT_MODE_2N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_W+W 인 경우에), 세컨더리 TVHT_W 채널은 $f_{CH,start} + W$ #215# $f_{SW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $f_{SW,idx} = f_{c,idx1}$ 이다(상기 표 5 참조).

It is the channel having the TVHT W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT W+W) , and the secondary TVHT W channel concentrate on the $f_{CH,start} + W \times f_{SW,idx}$ as to the TVHT MODE 2N operation. Here, it is the $f_{SW,idx} = f_{c,idx1}$ (refer to table 5).

TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 프라이머리 TVHT_2W 채널은 $f_{CH,start} + W$ #215# $f_{P2W,idx} + 0.5$ #215# W 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $f_{P2W,idx}$ 는 다음의 수학식 2에 따라서 결정된다.

It is the channel having the TVHT 2W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT 2W, and the TVHT 4W or the TVHT 2W+2W) , and the primary TVHT 2W channel concentrate on the $f_{CH,start} + W \times f_{P2W,idx} + 0.5 \times W$ as to the TVHT MODE 2C, and the TVHT MODE 4C or the TVHT MODE 4N operation. Here, the $f_{P2W,idx}$ is determined according to the following formula 2.

상기 수학식 2에서 $0 \le n_{P2W} \le N_{P2W} - 1$ 이다.

In the equation 2, it is $0 \le n_{P2W} \le N_{P2W} - 1$.

$N_{P2W}$ 의 값은 다음과 같이 결정된다. TVHT_MODE_2C 및 TVHT_MODE_4N에서 (또는 TVHT_2W 및 TVHT_2W+2W 인 경우에) $N_{P2W}$ = 1이다. TVHT_MODE_4C에서 (또는 TVHT_4W인 경우에) $N_{PW}$ = 2이다.

The value of $N_{P2W}$ is decided like the next. In the TVHT MODE 2C and TVHT MODE 4N, it is (it or is the TVHT 2W and TVHT 2W+2W) $N_{P2W}$ = 1. In the TVHT MODE 4C, it is (it or is the TVHT 4W) $N_{PW}$ = 2.

TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start}$ + W #215# $f_{S2W,idx}$ + 0.5 #215# W 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $n_{P2W}$ 가 짝수(even)인 경우에 $f_{S2W,idx} = f_{P2W,idx} + 2$ 이고, $n_{P2W}$ 가 홀수(odd)인 경우에 $f_{S2W,idx} = f_{P2W,idx} - 2$ 이다.

It is the channel having the TVHT 2W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT 2W, and the TVHT 4W or the TVHT 2W+2W) , and the secondary TVHT 2W channel concentrate on the $f_{CH,start} + W \times f_{S2W,idx} + 0.5 \times W$ as to the TVHT MODE 2C, and the TVHT MODE 4C or the TVHT MODE 4N operation. Here, it is the $f_{S2W,idx} = f_{P2W,idx} + 2$ in case the $n_{P2W}$ is the even number (even) and it is the $f_{S2W,idx} = f_{P2W,idx} - 2$ in case the $n_{P2W}$ is the odd number (odd).

TVHT_MODE_4C 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_4W인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start}$ + W #215# $f_{S2W,idx}$ + 0.5 #215# W 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $n_{P2W}$ 가 짝수(even)인 경우에 $f_{S2W,idx} = f_{P2W,idx} + 2$ 이고, $n_{P2W}$ 가 홀수(odd)인 경우에 $f_{S2W,idx} = f_{P2W,idx} - 2$ 이다.

It is the channel having the TVHT 2W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT 4W) , and the secondary TVHT 2W channel concentrate on the $f_{CH,start} + W \times f_{S2W,idx} + 0.5 \times W$ as to the TVHT MODE 4C operation. Here, it is the $f_{S2W,idx} = f_{P2W,idx} + 2$ in case the $n_{P2W}$ is the even number (even) and it is the $f_{S2W,idx} = f_{P2W,idx} - 2$ in case the $n_{P2W}$ is the odd number (odd).

TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W+2W인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start}$ + W #215# $f_{2SW,idx}$ + 0.5 #215# W 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $f_{SW,idx} = f_{c,idx1}$이다(상기 표 5 참조).

It is the channel having the TVHT 2W bandwidth in which (or the dot11CurrentChannelWidth is the TVHT 2W+2W) , and the secondary TVHT 2W channel concentrate on the $f_{CH,start} + W \times f_{2SW,idx} + 0.5 \times W$ as to the TVHT MODE 4N operation. Here, it is the $f_{SW,idx} = f_{c,idx1}$ (refer to table 5).

전송된 신호는 복소 기저대역(complex baseband) 신호 표기법(notation)으로 기술(describe)된다. 실제 전송되는 신호는 아래의 수학식 3에서 정의되는 관계에 따라서 상기 복소 기저대역 신호에 관련된다.

The transmitted signal consists of the complex baseband (complex baseband) signal notation with the technology (describe). The actually transmitted signal relates to the complex baseband signal according to the relation defined in the following equation 3.

는 주파수 세그먼트 $i_{Seg}$에서 전송되는 PPDU의 일부의 중심 주파수를 나타낸다.

The partial center frequency of PPDU transmitted from the increased frequency segment $i_{Seg}$ is shown.

TVHT_MODE_2C 및 TVHT_MODE_4C에서, 인접한 (adjacent) 주파수 세그먼트들의 중심 주파수 간의 갭(gap)은 상기 표 3에서 나타낸 바와 같다.

The gap between the center frequency of frequency segments adjacent in the TVHT MODE 2C and TVHT MODE 4C (adjacent) are same as those of it shows in the table 3.

을 dot11CurrentChannelBandwidth의 함수로서 표현할 수 있다. 표 6은 주파수 세그먼트 $i_{Seg}$ 에서 전송되는 PPDU의 중심 주파수를 나타낸 것이다.

It can express as the function of the dot11CurrentChannelBandwidth. The table 6 shows the center frequency of PPDU transmitted from the frequency segment $i_{Seg}$ .

상기 표 6에서 dot11CurrentChannelBandwidth = TVHT_2W+2W 인 경우에, 채널 대역폭 TVHT_W에서 상기 수학식 1에 따라서 $f_{PW,idx} = f_{c,idx0}$ 이다. 또한, 상기 표 6에서 dot11CurrentChannelBandwidth = TVHT_2W+2W 인 경우에, 채널 대역폭이 TVHT_2W에서 상기 수학식 2에 따라서 $f_{2PW,idx} = f_{c,idx0}$ 이다.

In the table 6, in case it is the dot11CurrentChannelBandwidth = TVHT 2W+2W it is the $f_{PW,idx} = f_{c,idx0}$ in the channel bandwidth TVHT W according to the equation 1. Moreover, in the table 6, in case it is the dot11CurrentChannelBandwidth = TVHT 2W+2W the channel bandwidth is the $f_{2PW,idx} = f_{c,idx}$

$_0$ in the TVHT 2W according to the equation 2.

TVHT_MODE_2N 및 TVHT_MODE_4N 에서 전송되는 신호는, TVHT_MODE_2N 또는 TVHT_MODE_4N에서의 두 개의 주파수 세그먼트 간의 위상 오프셋(phase offset) 또는 위상 잡음과 같은 상이한 특성을 겪을 수 있지만, 명료성을 위해서 이러한 특성은 상기 수학식 3에서 표현되어 있지 않다.

The signal transmitted from the TVHT MODE 2N and TVHT MODE 4N can undergo the property of being different like the phase offset between two frequency segments at the TVHT MODE 2N or the TVHT MODE 4N or the phase noise. However the property of being like that is not expressed for clarity in the equation 3.

값을 정리한 것이다.

The value is readjusted.

상기 표 7에서 NON_HT_DUP_OFDM-Data는 NON_HT_DUP_OFDM 포맷 타입을 가지는 NON_NT PPDU의 데이터 필드를 의미한다.

In the table 7, the data field of the NON NT PPDU in which the NON HT DUP OFDM-Data has the NON HT DUP OFDM format type is meant.

상기 표 7에서 $T_{GI}$ 는 일반적인 가드 인터벌 듀레이션 (마이크로초의 단위로 정의됨)을 의미하고 $T_{GI2}$는 더블 가드 인터벌 값(일반 가드 인터벌 듀레이션의 2배)을 의미한다. 또한, TVHT-Data에서 $T_{GI}$ 는 TXVECTOR 파라미터의 GI_TYPE이 LONG_GI 값을 가지는 경우의 가드 인터벌 듀레이션을 의미하고, $T_{GIS}$는 TXVECTOR 파라미터의 GI_TYPE이 SHORT_GI 값을 가지는 경우의 짧은 가드 인터벌 듀레이션을 의미한다.

In the table 7, $T_{GI}$ means the general guard interval duration (it is defined as the unit of the microsecond) and $T_{GI2}$ means the double guard interval value (two times of the general guard interval duration). Moreover, in the TVHT-Data, $T_{GI}$ the GI TYPE of the TXVECTOR parameter means the guard interval duration of the kinds the LONG GI value and $T_{GIS}$ the GI TYPE of the TXVECTOR parameter means the short guard interval duration of the kinds the SHORT GI value.

또한, 톤 로테이션을 나타내는 $\gamma_{k,M}$ 함수는 다음의 표 8과 같이 정의될 수 있다. 아래의 표 8은 전송 모드와 $\gamma_{k,M}$ 를 정리한 것이다.

Moreover, $\gamma_{k,M}$ function showing the tone rotation can be defined like the following table 8. The following table 8 organizes the transmission mode and $\gamma_{k,M}$.

상기 표 8과 관련하여, TVHT_MODE_1 및 TVHT_MODE_2N PPDU 전송에 대해서, k003c#0 인 경우에 $\gamma_{k,1}=1$ 이고 k≥0 인 경우에 $\gamma_{k,1}=j$ 이다.

In case of being the k003c#0 about the TVHT MODE 1 and TVHT MODE 2N PPDU transmission it is $\gamma_{k,1}=1$ in connection with the table 8 and in case of being the k≥0 it is $\gamma_{k,1}=j$.

TVHT_MODE_2C 및 TVHT_MODE_4N PPDU 전송에 대해서, 6MHz 및 8MHz 채널에 대해서 k003c#-72 인 경우에 $\gamma_{k,2}=1$ 이고 k≥-72 인 경우에 $\gamma_{k,2}=-1$ 이며, 7MHz 채널에 대해서 k003c#-84 인 경우에 $\gamma_{k,2}=1$ 이고 k≥-84 인 경우에 $\gamma_{k,2}=-1$ 이다.

In case of being the k003c#-84 about $\gamma_{k,2}=-1$, 7MHz channel in case of being $\gamma_{k,2}=1$ and the k≥-72 about the TVHT MODE 2C and TVHT MODE 4N PPDU transmission in case of being the k003c#-72 about 6MHz and 8MHz channel it is $\gamma_{k,2}=1$ and in case of being the k≥-84 it is $\gamma_{k,2}=-1$.

TVHT_MODE_4C PPDU 전송에 대해서, 6MHz 및 8MHz 채널에 대해서 k003c#-216 인 경우에 $\gamma_{k,4}=1$ 이고 -216003c#k003c#0 인 경우에 $\gamma_{k,4}=-1$ 이고 0003c#k003c#72 인 경우에 $\gamma_{k,4}=1$ 이고 k≥72 인 경우에 $\gamma_{k,4}=-1$ 이며, 7MHz 채널에 대해서 k003c#-252 인 경우에 $\gamma_{k,4}=1$ 이고 -252003c#k003c#0 인 경우에 $\gamma_{k,4}=-1$ 이고 0003c#k003c#84 인 경우에 $\gamma_{k,4}=1$ 이고 1≥84 인 경우에 $\gamma_{k,4}=-1$ 이다.

In case of being the k003c#-252 about $\gamma_{k,4}=-1$, 7MHz channel in case of being $\gamma_{k,4}=1$ and the k≥72 in case of being $\gamma_{k,4}=-1$ and 0003c#k003c#72 in case of being $\gamma_{k,4}=1$ and -216003c#k003c#0 about the TVHT MODE 4C PPDU transmission in case of being the k003c#-216 about 6MHz and 8MHz channel it is $\gamma_{k,4}=1$ and in case of being -252003c#k003c#0 it is $\gamma_{k,4}=-1$ and in case of being 0003c#k003c#84 it is $\gamma_{k,4}=1$ and in case of being 1≥84 it is $\gamma_{k,4}=-1$.

채널화

Channelizing.

TVHT 채널은 상기 표 4에서와 같이 TVHT 채널을 특정하기 위한 필드들에 의해서 특정될 수 있다.

The TVHT channel can be the TVHT channel specified in as shown in table 4 with fields for specifying.

W 또는 TVHT_W는 MHz 단위의 값으로 주어지며, 규제 도메인(regulatory domain)에 따라서 6, 7 또는 8 MHz 중의 어느 하나로 정의될 수 있다.

W or the TVHT W is given to the value of the MHz unit and the value can be defined according to the regulatory domain as 6, and any one among 7 or 8 MHz.

dot11CurrentChannelCenterFrequencyIndex0 및 dot11CurrentChannelCenterFrequencyIndex1 필드가 주어지면, 각각의 중심 주파수는 아래의 수학식 4에 따라 결정된다.

If the dot11CurrentChannelCenterFrequencyIndex0 and dot11CurrentChannelCenterFrequencyIndex1 field are given , each center frequency is determined according to the following equation 4.

상기 수학식 4에서 Channel starting frequency는 국가 정보 및 동작 클래스(Country information and operating classes) 항목에서 정의되는 값에 따라서 결정된다 (표 9 내지 표 12 참조).

In the Equation 4, it is determined according to the value in which the Channel starting frequency is defined in the national information and operation class (Country information and operating classes) item ().

상기 수학식 4에서 dot11CurrentChannelCenterFrequencyIndex는 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1 이다.

In the Equation 4, the dot11CurrentChannelCenterFrequencyIndex is the dot11CurrentChannelCenterFrequencyIndex0 or the dot11CurrentChannelCenterFrequencyIndex1.

상기 수학식 4에서 ChannelCenterFrequencyCorrection은, TVHT_MODE_1에 대해서 0이고, TVHT_MODE_2C 및 TVHT_MODE_2N에 대해서 0.5 #215# TVHT_W이고, TVHT_MODE_4C 및 TVHT_MODE_4N에 대해서 1.5 #215# TVHT_W으로 정의될 수 있다. 또는, ChannelCenterFrequencyCorrection은, TVHT_MODE_1 및 TVHT_MODE_2N에 대해서 0이고, TVHT_MODE_2C 및 TVHT_MODE_4N에 대해서 0.5 #215# TVHT_W이고, TVHT_MODE_4C에 대해서 1.5 #215# TVHT_W으로 정의될 수도 있다.

In the Equation 4, the ChannelCenterFrequencyCorrection is the TVHT MODE 1 0 and it is 0.5 × TVHT W about the TVHT MODE 2C and TVHT MODE 2N and it can be defined as 1.5 × TVHT W about the TVHT MODE 4C and TVHT MODE 4N. Or the ChannelCenterFrequencyCorrection is 0 about the TVHT MODE 1 and TVHT MODE 2N and it is 0.5 × TVHT W about the TVHT MODE 2C and TVHT MODE 4N and it can be defined as 1.5 × TVHT W about the TVHT MODE 4C.

여기서, Channel starting frequency는, 규제 도메인의 채널 번호가 RLAN(Radio Local Area Network) 채널 번호가 되는 주파수이다. 즉, Channel starting frequency는 첫 번째 채널의 중심 주파수로서 정의된다. 채널 인덱스가 0 부터 시작하는 경우에는 Channel starting frequency는 채널 인덱스 0의 중심 주파수이고, 채널 인덱스가 1 부터 시작하는 경우에는 Channel starting frequency는 채널 인덱스 1의 중심 주파수이다.

Here, the Channel starting frequency is the frequency in which for the channel number of the regulatory domain, the RLAN (Radio Local Area Network) channel number is. That is, the Channel starting frequency is defined as the center frequency of the first channel. The Channel starting frequency is the center frequency of the channel index 0 in case the channel index starts from 0 and the Channel starting frequency is the center frequency of the channel index 1 in case the channel index starts from 1.

예를 들어, 미국 TV 채널 2의 중심 주파수는 57MHz이다. 이는 다음과 같이 상기 수학식 4에 따라서 획득된다. 미국에서 TV 채널 2에 대한 Channel starting frequency는 45MHz이고 (표 9 참조), TVHT_W = 6MHz이며, TVHT_MODE_1에서 ChannelCenterFrequencyCorrection = 0 이다. 따라서, Channel center frequency [MHz] = Channel starting frequency + TVHT_W #215# dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 #215# 2 + 0 = 57 MHz 임을 확인할 수 있다.

For example, the center frequency of the U.S. TV channel 2 is 57MHz. This is obtained like the next according to the Equation 4. In the U.S, the TV channel 2 the Channel starting frequency is 45MHz and it is the TVHT W = 6MHz and it is the ChannelCenterFrequencyCorrection = 0 in the TVHT MODE 1 (refer to table 9). Therefore, it can confirm being the Channel center frequency [MHz] = Channel starting frequency + TVHT W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 × 2 + 0 = 57 MHz.

도 9는 TVHT 채널화를 예시적으로 설명하기 위한 도면이다.

It is drawing in which fig. 9 illustratively illustrates the TVHT channelizing.

TVWS 대역에서 가용 채널 리스트는 TV 채널 번호에 기초하여 주어지고, 가용 채널 리스트를 고려하여 WLAN 채널(또는 WLAN 동작 채널)이 결정될 수 있다. 도 9에서는 가용 채널 리스트에서 TV 채널 인덱스 0 내지 4가 가용한 경우를 가정한다.

In the TVWS band, the available channel list is given based on the TV channel number and the WLAN channel (or, the WLAN working channel) can be determined in consideration of the available channel list. In fig. 9, t

또한, WLAN 채널은 TV 채널 인덱스 2 및 3에 걸쳐서 설정되는 경우를 가정한다. 즉, WLAN 채널은 TVHT_2W의 채널 폭을 가지고, TVHT_MODE_2C 동작에 따라서 PPDU가 전송되는 것으로 가정한다.

he case in which the TV channel index 0 through 4 is available in the available channel list is assumed. Moreover, the case where the WLAN channel is set up with the TV channel index 2 through 3 is assumed. That is, the WLAN channel has the channel width of the TVHT 2W and PPDU is transmitted according to the TVHT MODE 2C operation and it assumes.

이 경우, Channel center frequency 는 전술한 바와 같이 0.045 GHz 즉 45 MHz이다 (표 9 참조). 또한, 상기 표 4에서 설명한 바와 같이, dot11CurrentChannelCenterFrequencyIndex는 주파수 세그먼트(즉, 2 개의 BCU로 구성된 단위)의 가장 낮은 TV 채널의 중심 주파수를 나타낸다. 도 9의 예시에서는 dot11CurrentChannelCenterFrequencyIndex = 2인 경우에, WLAN 채널의 주파수 세그먼트에 포함되는 TV 채널(들) 중에서 가장 낮은 TV 채널의 중심 주파수의 인덱스(즉, TV 채널 번호)가 2 라는 의미이다.

In this case, in case it is 0.045 GHz, in other words, 45 MHz the dot11CurrentChannelCenterFrequencyIndex shows the center frequency of the TV channel which is most low of the frequency segment (the unit consisting of in other words, BCU of 2) as described above, as described above the Channel center frequency is the dot11CurrentChannelCenterFrequencyIndex = 2 in moreover, the table 4 in the example of fig. 9 the index (in other words, the TV channel number) of the center frequency of the TV channel which is most low among the TV channel included in the frequency segment of the WLAN channel is the meaning of 2 (refer to table 9).

도 9의 예시에서 WLAN 채널이 2 개의 연속적인 BCU를 포함하는 주파수 세그먼트로 구성되므로, WLAN 채널의 중심 주파수를 상기 수학식 4에 기초하여 계산할 수 있다. 미국에서 TV 채널 2 및 3에 대한 Channel starting frequency는 45MHz 이고 (표 9 참조), TVHT_W = 6MHz이며, TVHT_MODE_2C 에서 ChannelCenterFrequencyCorrection = 0.5 #215# TVHT_W = 3 이다. 따라서, Channel center frequency [MHz] = Channel starting frequency + TVHT_W #215# dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 #215# 2 + 3 = 60 MHz 임을 확인할 수 있다.

In the example of fig. 9, it is made up of the frequency segment in which the WLAN channel includes successive BCU of 2. Therefore the center frequency of the WLAN channel can be calculated based on the Equation 4. In the U.S, the TV channel 2 and 3 the Channel starting frequency are 45MHz and it is the TVHT W = 6MHz and it is the ChannelCenterFrequencyCorrection = 0.5 × TVHT W = 3 in the TVHT MODE 2C (refer to table 9). Therefore, it can confirm being the Channel center frequency [MHz] = Channel starting frequency + TVHT W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 × 2 + 3 = 60 MHz.

한편, 도 9의 예시에서 WLAN 채널을 위해서, 하나의 TV 채널의 전체 주파수 대역을 사용하지 않고 일부만을 사용하는 것은, 인접 채널 누출 전력 비(Adjacent Channel Leakage power Ratio; ACLR)의 요구조건이 높기 때문이다. 또한, 상이한 BSS의 상이한 대역폭이 공존하는 경우에 STA이 이를 지원하기 위한 복잡도와 비용이 증가하기 때문에, 이를 해결하기 위해서 TV 채널 대역의 중앙(middle)에 WLAN 채널이 위치하도록 한다. 따라서, 도 9의 예시에서 하나의 BCU는 하나의 TV 채널의 중앙에 위치한다. 하나의 TV 채널의 서브캐리어가 144개라고 하면, BCU가 점유하는 서브캐리어의 개수는 128개로 주어질 수 있다.

In the meantime, in the example of fig. 9, the requirement specification of the adjacent channel leak power rate (Adjacent Channel Leakage power Ratio: ACLR) is due to be high not to use the total frequency band of one TV channel and use for the WLAN channel only the part. Moreover, to solve this the different bandwidth of different BSS coexists, the WLAN channel is positioned in the center (middle) of the TV channel band. Therefore, in the example of fig. 9, one BCU is positioned in the center of one TV channel. The number of sub carrier which the lower-side, and BCU of the subcarrier occupies as 144 of one TV channel can be given to 128.

다음으로, 프라이머리 TVHT_W 채널의 중심 주파수는 다음의 수학식 5에 따라서 결정될 수 있다.

Next, the center frequency of the primary TVHT W channel can be determined according to the following formula 5.

한편, TVHT_MODE_2N 동작에 있어서, 임의의(any) 두 개의 동일하지 않은(non-identical) 채널들이 사용될 수 있다.

In the meantime, as to the TVHT MODE 2N operation, two channels which are not identical (non-identical) of the arbitrary (any) can be used.

TVHT_MODE_4N 동작에 있어서는, TVHT_2W 채널로서 허용되는 임의의 2 개의 채널들이 사용될 수 있는데, 상기 2 개의 채널들의 중심 주파수는 TVHT_2W 보다 많이 이격(separated)되어야 한다. 즉, dot11CurrentChannelCenterFrequencyIndex0와 dot11CurrentChannelCenterFrequencyIndex1 사이의 차이가 2 보다 큰 주파수 차이에 대응하여야 한다.

It is in the TVHT MODE 4N operation and the allowed channels of 2 arbitraries can be used as the TVHT 2W channel. It has to become very much the center frequency of the channel of 2 s than TVHT 2W with the space (separated). That is, the difference between the dot11CurrentChannelCenterFrequencyIndex1 and the dot11CurrentChannelCenterFrequencyIndex0 have to correspond to the frequency difference large than 2.

예를 들어, 미국에서 dot11CurrentChannelBandwidth = TVHT_2W (12 MHz)이고, dot11CurrentChannelCenterFrequencyIndex0 = 15 이고, dot11CurrentPrimaryChannel = 16 로 특정되는 채널을 가정한다. 이러한 채널은, 대역폭이 12 MHz이고, 중심 주파수가 482MHz이며, 프라이머리 6 MHz 채널의 중심 주파수는 485 MHz인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

For example, in the U.S, it is the dot11CurrentChannelBandwidth = TVHT 2W (12 MHz) and it is the dot11CurrentChannelCenterFrequencyIndex 0 = 15 and the channel specified in the dot11CurrentPrimaryChannel = 16 is assumed. As to such channel, the bandwidth is 12 MHz and the center frequency is 482MHz and it is the channel in which the center frequency of the primary 6 MHz channel is 485 MHz (the Equation 4, and 5, refer to table 9).

다른 예시로서, 미국에서 dot11CurrentChannelBandwidth = TVHT_4W (24 MHz) 이고, dot11CurrentChannelCenterFrequencyIndex0 = 14 이고, dot11CurrentPrimaryChannel = 17 로 특정되는 채널을 가정한다. 이러한 채널은, 대역폭이 24 MHz 이고, 중심 주파수가 482 MHz이며, 프라이머리 6 MHz 채널의 중심 주파수는 491 MHz 인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

As the dissimilar example, it is the dot11CurrentChannelBandwidth = TVHT 4W (24 MHz) in the U.S. and it is the dot11CurrentChannelCenterFrequencyIndex0 = 14 and the channel specified in the dot11CurrentPrimaryChannel = 17 is assumed. As to such channel, the bandwidth is 24 MHz and the center frequency is 482 MHz and it is the channel in which the center frequency of the primary 6 MHz channel is 491 MHz (the Equation 4, and 5, refer to table 9).

다른 예시로서, 미국에서 dot11CurrentChannelBandwidth = TVHT_2W+2W (12+12 MHz) 이고, dot11CurrentChannelCenterFrequencyIndex0=15 이고, dot11CurrentChannelCenterFrequencyIndex1 = 40 이며, dot11CurrentPrimaryChannel = 16 인 채널을 가정한다. 이러한 채널은, 대역폭이 12+12 MHz 이고, 주파수 세그먼트 0의 대역폭은 12 MHz이고 그 중심 주파수는 482 MHz 이고, 주파수 세그먼트 1의 대역폭은 12 MHz이고 그 중심 주파수는 632 MHz 이며, 프라이머리 6 MHz 채널의 중심 주파수는 485 MHz 인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

As the dissimilar example, it is the dot11CurrentChannelBandwidth = TVHT 2W+2W (12+12 MHz) in the U.S. and it is the dot11CurrentChannelCenterFrequencyIndex0=15 and the dot11CurrentChannelCenterFrequencyIndex1 = 40, the channel which is the dot11CurrentPrimaryChannel = 16 is assumed. As to such channel, the bandwidth is 12+12 MHz and the bandwidth of the frequency segment 0 is 12 MHz and the center frequency is 482 MHz and the bandwidth of the frequency segment 1 is 12 MHz and the center frequency is 632 MHz and it is the channel in which the center frequency of the primary 6 MHz channel is 485 MHz (the Equation 4, and 5, refer to table 9).

국가 정보 및 동작 클래스

The national information and operation class.

국가 요소(Country element)는 STA이 동작 트리플렛(Operating triplet)이 존재하는 경우에 자신의 PHY 및 MAC이 동작하도록 설정하기 위한 정보를 포함한다. 동작 트리플렛은 동작 확장 식별자(Operating Extension Identifier), 동작 클래스(Operating Class) 및 커버리지 클래스(Coverage Class) 필드를 포함할 수 있다.

The country element includes its own PHY the operation triplet (Operating triplet) of STA exists and the information for setting up so that MAC operates. The operation triplet comprises the operation extension identifier (Operating Extension Identifier), and the operation class (Operating Class) and the coverage class field.

동작 클래스는 규제 도메인에서의 무선 동작(radio operation)을 위한 값들의 세트를 지시하는 인덱스이다. 이하에서 예시하는 동작 클래스를 나타내는 표(표 9 내지 표 12)는, 또한 행동 및 신호 검출 제한(behaviors and signal detection limits)에 대한 추가적인 동작 요구조건을 지시하는 정보를 포함한다. 즉, 동작 클래스는 채널 시작 주파수(Channel Starting Frequency), 채널 간격(Channel Spacing), 채널 세트(Channel Set), 행동 제한 세트(Behavior Limit Set)으로 구성될 수 있다.

It is the index where the operation class indicates the set of the values for the radio operation at the regulatory domain. Hereinafter, the table (the table 9 through the table 12) marking the operation class exemplified include moreover, the action and the information indicating the additional operation requirement specification about signal detection limit (behaviors and signal detection limits). That is, the operation class can consist of the channel starting frequency, the channel interval (Channel Spacing), the channel set, the action limit set (Behavior Limit Set).

동작 클래스에서, 채널 시작 주파수는 해당 채널 번호 별로 주어지는 변수이며 주파수 값을 가진다. 채널 시작 주파수는 채널 번호와 함께 사용되어 채널 중심 주파수를 계산할 수 있다. 채널 간격은, 해당 동작 클래스에서 허용되는 최대 대역폭을 사용

In the operation class, it has the variable the frequency value in which the channel starting frequency is especially given with the corresponding channel number. The channel starting frequency is used with the

하는 경우에, 중첩하지 않는(non-overlapping) 인접한 채널의 중심 주파수들 간의 차이를 의미한다. 채널 세트는 해당 규제 도메인 및 클래스에서 합법적인(legal) 정수(integer) 채널 번호의 리스트이다. 행동 제한 세트는 다양한 규제 도메인에서 정의되는 행동 제한(구체적인 내용은 IEEE 802.11 표준 문서의 Annex D를 참조할 수 있음)을 지시한다.

channel number and the channel center frequency can be calculated. In case the channel interval uses the maximum bandwidth allowed in the corresponding operation class it means the difference between the center frequencies of the adjacent channel which does not overlap (non-overlapping). In the channel set is the corresponding regulatory domain and class, it is the list of the legal (legal) integer channel number. The action limit (the detailed content can refer to the Annex D of the IEEE 802.11 standard document) defined in the regulatory domain in which the action limit set is various is indicated.

아래의 표 9 내지 표 12는 각각 미국, 유럽, 일본 및 국제(global) 동작 클래스를 예시적으로 나타낸 것이다. 동작 클래스의 정의는 지역 또는 국가의 규정(regulations)의 변경에 따라서 수정되거나 대체될(superseded) 수도 있다.

The following table 9 through the table 12 illustratively shows the U.S., the Europe, and Japanese and international (global) operation class. It has the number which is modified according to the change of the rules (regulations) of the region or country or in which the definition of the operation class is replaced (superseded).

상기 표 9의 예시에서 알 수 있는 바와 같이, 미국의 경우에 TV 채널 번호 2 내지 4의 채널 시작 주파수와, TV 채널 번호 5 및 6의 채널 시작 주파수가 상이하다. 또한, TV 채널 번호 5 및 6의 채널 시작 주파수와, TV 채널 번호 7 내지 13의 채널 시작 주파수가 상이하다. 또한, TV 채널 번호 7 내지 13의 채널 시작 주파수와, TV 채널 번호 14 내지 51의 채널 시작 주파수가 상이하게 주어진다. 이는 미국에서 TV 채널 번호 4와 5가 주파수 상에서 이격되어 있고, TV 채널 번호 6과 7이 주파수 상에서 이격되어 있고, TV 채널 번호 13과 14가 주파수 상에서 이격되어 있기 때문이다 (TV 채널 번호 4와 5의 사이, TV 채널 번호 6과 7의 사이, TV 채널 번호 13과 14 사이는, 다양한 다른 용도(예를 들어, 아마추어 라디오 대역, 국제 FM 라디오 대역, 해양 VHF 라디오 대역 등)로 정의되어 있다).

As shown in it can know at the example of the table 9 the channel starting frequency of the channel starting frequency, of the TV channel number 2 through 4 and TV channel number 5 and 6 are different in case of the U.S. Moreover, the channel starting frequency of the channel starting frequency, of the TV channel number 5 and 6 and TV channel number 7 through 13 are different. Moreover, the channel starting frequency of the channel starting frequency, of the TV channel number 7 through 13 and TV channel number 14 through 51 are different it is given. In this is the U.S, the TV channel number 4 and 5 are located in the frequency domain and the TV channel number 6 and 7 are located in the frequency domain and the TV channel number 13 and 14 are located in the frequency domain (the interval of the TV channel number 4 and 5, the interval of the TV channel number 6 and 7, and the TV channel number 13 and 14 interval are defined as the various different use (for example, the armature radio band, the international FM radio band, the marine VHF radio band etc)).

여기서, 상기 수학식 4에서 설명한 바와 같이 WLAN 채널의 중심 주파수를 표현하기 위해서는 채널 시작 주파수 값이 주어져야 한다. 그러나, 모든 TV 채널의 주파수 위치에서 채널 시작 주파수 값을 동일하게 적용할 수는 없다. 왜냐하면, 전술한 바와 같이 TV 채널들이 주파수 상에서 연속적으로 정의되어 있지 않기 때문이다.

Here, in the Equation 4, as described above, the channel starting frequency value has to be given in order to express the center frequency of the WLAN channel. But in the frequency location of all TV channels, the channel starting frequency value cannot be identically applied. Because, as described above, in TV channels is the frequency domain, it is not consecutively defined.

도 10은 TV 채널의 주파수 위치를 예시적으로 나타내는 도면이다.

Figure 10 is drawing illustratively showing the frequency location of the TV channel.

도 10의 예시에서, TV 채널 번호 4에 해당하는 주파수 위치에 존재하는 주파수 세그먼트를 포함하는 WLAN 채널의 중심 주파수를 표현하기 위해서는 (상기 수학식 4 참조), 채널 시작 주파수 값이 0.045 GHz로 주어진다. 이러한 채널 시작 주파수

In the example of fig. 10, in order that the center frequency of the WLAN channel including the frequency segment existing in the frequency location corresponding to the TV channel number 4 is expressed (equation

값(= 45MHz)은 TV 채널 4의 중심 주파수(= 69 MHz)를 기준으로, 하나의 TV 채널 폭이 6 MHz일 때 TV 채널 번호 0 내지 4가 연속적으로 존재하는 것을 가정한 경우의, TV 채널 번호 0의 중심 주파수 값에 해당한다 (즉, TV 채널 3의 중심 주파수는 63 MHz, TV 채널 2의 중심 주파수는 57 MHz, 가상의(virtual) TV 채널 1의 중심 주파수는 51 MHz, 가상의 TV 채널 0의 중심 주파수는 45 MHz가 된다).

4 reference) the channel starting frequency value is given to 0.045 GHz. It corresponds to the central frequency value of the TV channel number 0 of the case, where such channel starting frequency value (= 45MHz) assumes that the TV channel number 0 through 4 exists based on the center frequency (= 69 MHz) of the TV channel 4 when one TV channel width is 6 MHz (that is, in as to as to as to the center frequency of the TV channel 3, 63 MHz, and the center frequency of the TV channel 2, 57 MHz, and the center frequency of the TV channel 1 of the virtual, 51 MHz, and the center frequency of the virtual TV channel 0, 45 MHz is).

이와 유사하게, TV 채널 번호 5에 해당하는 주파수 위치에 존재하는 주파수 세그먼트를 포함하는 WLAN 채널의 중심 주파수를 표현하기 위해서는 (상기 수학식 4 참조), 채널 시작 주파수 값이 0.049 GHz로 주어진다. 이러한 채널 시작 주파수 값(=49 MHz)은 TV 채널 5의 중심 주파수(= 79 MHz)를 기준으로, 하나의 TV 채널 폭이 6 MHz일 때 TV 채널 번호 0 내지 5가 연속적으로 존재하는 것을 가정한 경우의, TV 채널 번호 0의 중심 주파수 값에 해당한다 (즉, 가상의 TV 채널 4의 중심 주파수는 73 MHz, 가상의 TV 채널 3의 중심 주파수는 67 MHz, 가상의 TV 채널 2의 중심 주파수는 61 MHz, 가상의 TV 채널 1의 중심 주파수는 55 MHz, 가상의 TV 채널 0의 중심 주파수는 49 MHz가 된다).

In order that the center frequency of the WLAN channel including the frequency segment existing in the frequency location similarly corresponding to the TV channel number 5 with this is expressed (equation 4 reference) the channel starting frequency value is given to 0.049 GHz. It corresponds to the central frequency value of the TV channel number 0 of the case, where such channel starting frequency value (=49 MHz) assumes that the TV channel number 0 through 5 exists based on the center frequency (= 79 MHz) of the TV channel 5 when one TV channel width is 6 MHz (that is, in as to as to as to as to the center frequency of the virtual TV channel 4, 73 MHz, and the center frequency of the virtual TV channel 3, 67 MHz, and the center frequency of the virtual TV channel 2, 61 MHz, and the center frequency of the virtual TV channel 1, 55 MHz, and the center frequency of the virtual TV channel 0, 49 MHz is).

즉, 상기 표 9에서 어떤 TV 채널에 적용되는 채널 시작 주파수 값은, 해당 채널에서 가상의 첫 번째 TV 채널 번호(예를 들어, TV 채널 인덱스가 0 부터 매겨질 때, 가상의 TV 채널 번호 0)의 중심 주파수 값에 해당하는 것으로 설명할 수 있다.

That is, in the table 9, with it corresponds to the central frequency value of the virtual first TV channel number (the virtual TV channel number 0 the TV channel index is graded from 0 for example) the channel starting frequency value applied to any kind of TV channel can illustrate in the corresponding channel.

본 발명에서 제안하는 TVHT 채널화는, 상기 표 9 내지 12에서 정리한 바와 같이 dot11CurrentChannelCenterFrequencyIndex에 따라서 Channel starting frequency가 달라지고, 상기 수학식 4에서 나타내는 바와 같이 dot11CurrentChannelCenterFrequencyIndex 및 Channel starting frequency에 따라서 WLAN 동작 채널의 중심 주파수가 결정되는 것으로 표현할 수 있다.

In the present invention, as shown in the Equation 4 the TVHT channelizing suggested organizes in the table 9 through 12, it can express that the center frequency of the WLAN working channel is determined according to the dot11CurrentChannelCenterFrequencyIndex and Channel starting frequency.

예를 들어, 미국에서 dot11CurrentChannelBandwidth = TVHT_W+W (6+6 MHz)이고, dot11CurrentChannelCenterFrequencyIndex0 = 4 이고, dot11CurrentChannelCenterFrequencyIndex1 = 6 인 경우를 가정한다.

For example, in the U.S, it is the dot11CurrentChannelBandwidth = TVHT W+W (6+6 MHz) and it is the dot11CurrentChannelCenterFrequencyIndex0 = 4 and the case of being the dot11CurrentChannelCenterFrequencyIndex1 = 6 is assumed.

이 경우, 첫 번째 채널(즉, dot11CurrentChannelCenterFrequencyIndex0 = 4)에 대한 채널 시작 주파수는 상기 표 9에 따라서 0.045#215#1000 = 45 MHz 이고, 첫 번째 채널의 중심 주파수는 상기 수학식 4에 따라서 45 + 6#215#4 + 0 = 69 MHz 이다.

In this case, according to the channel starting frequency about the first channel (in other words, the dot11CurrentChannelCenterFrequencyIndex0 = 4) is the table 9, it is 0.045×1000 = 45 MHz and the center frequency of the first channel is 45 + 6×4 + 0 = 69 MHz according to the Equation 4.

다음으로, 두 번째 채널(즉, dot11CurrentChannelCenterFrequencyIndex1 = 6)에 대한 채널 시작 주파수는 상기 표 9에 따라서 0.049#215#1000 = 49 MHz 이고, 두 번째 채널의 중심 주파수는 상기 수학식 4

Next, according to the channel starting frequency about the secondary channel (in other words, the dot11CurrentChannelCenterFrequencyIndex1 = 6) is the table 9, it is 0.049×1000 = 49 MHz and the center frequen

에 따라서 49 + 6#215#6 + 0 = 85 MHz 이다.

cy of the secondary channel is 49 + 6×6 + 0 = 85 MHz according to the Equation 4.

요컨대, Channel starting frequency는 상기 표 9 내지 12 및 도 10을 참고하여 설명한 바와 같이 dot11CurrentChannelCenterFrequencyIndex의 함수(function)로서 정의된다. Channel starting frequency과 dot11CurrentChannelCenterFrequencyIndex의 관계는 각각의 규제 도메인에서 상이하게 정의될 수 있으며, 그 예시들은 상기 표 9 내지 12에서 나타내는 바와 같다.

In short, as described above, the Channel starting frequency is defined the table 9 through 12 and fig. 10 as the function of the dot11CurrentChannelCenterFrequencyIndex. The relation of the Channel starting frequency and dot11CurrentChannelCenterFrequencyIndex are same as those of is different it can be defined in each regulatory domain and the examples show in the table 9 through 12.

도 11은 본 발명의 일례에 따른 STA의 동작을 설명하기 위한 도면이다.

Figure 11 is a drawing illustrating the operation of STA according to one example of the invention.

단계 S1110에서 제 1 STA(예를 들어, AP STA)은 TVHT 동작 정보 파라미터를 결정할 수 있다. TVHT 동작 정보는 상기 도 7에서 설명한 TVHT 동작 정보 필드에 해당할 수 있다.

In the step S1110, the first STA (for example, the AP STA) can determine the TVHT operation information parameter. The TVHT operation information can come under the TVHT operation information field which the above illustrates in 7.

단계 S1120에서 제 1 STA은 제 2 STA으로 TVHT 동작 정보 필드를 포함하는 프레임을 전송할 수 있고, 단계 S1130에서 제 2 STA은 이를 수신할 수 있다.

In the step S1120, the first STA can transmit the frame including the TVHT operation information field with the second STA and the second STA can receive this by the step S1130.

단계 S1140에서 제 2 STA은 수신된 TVHT 동작 정보 필드로부터 동작 채널의 중심 주파수 등을 결정할 수 있다. 이에 따라, TVHT BSS에서 동작하는 STA의 채널화가 수행될 수 있다.

In the step S1140, the center frequency of the working channel etc. can be determined from the TVHT operation information field where the second STA is received. Accordingly, the channelizing of STA operating in the TVHT BSS can be performed.

도 11을 참조하여 설명한 TVHT 동작 정보 송수신 및 채널화 방법에 있어서, 전술한 본 발명의 다양한 실시예에서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용될 수 있다.

Referring to Figure 11, as to the TVHT operation information transmission and/or reception and the channelizing method illustrated, the matters which in various embodiments, it illustrates of the above-described invention are independently applied or the embodiment more than 2 can be simultaneously applied.

도 12는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

Figure 12 is a block diagram showing the configuration of the wireless device according to a preferred embodiment of the present invention.

제 1 STA(10)는 프로세서(11), 메모리(12), 송수신기(13)를 포함할 수 있다. 제 2 STA(20)는 프로세서(21), 메모리(22), 송수신기(23)를 포함할 수 있다. 송수신기(13 및 23)는 무선 신호를 송신/수신할 수 있고, 예를 들어, IEEE 802 시스템에 따른 물리 계층을 구현할 수 있다. 프로세서(11 및 21)는 송수신기(13 및 21)와 연결되어 IEEE 802 시스템에 따른 물리 계층 및/또는 MAC 계층을 구현할 수 있다. 프로세서(11 및 21)는 전술한 본 발명의 다양한 실시예에 따른 동작을 수행하도록 구성될 수 있다. 또한, 전술한 본 발명의 다양한 실시예에 따른 제 1 STA 및 제 2 STA의 동작을 구현하는 모듈이 메모리(12 및 22)에 저장되고, 프로세서(11 및 21)에 의하여 실행될 수 있다. 메모리(12 및 22)는 프로세서(11 및 21)의 내부에 포함되거나 또는 프로세서(11 및 21)의 외부에 설치되어 프로세서(11 및 21)와 공지의 수단에 의해 연결될 수 있다.

The first STA (10) may include the processor (11), the memory (12), and the transceiver (13). The second STA (20) may include the processor (21), the memory (22), and the transceiver (23). Transceiver (13 and 23) can receive the radio signal with the transmission / and for example, the physical layer according to the IEEE 802 system can be implemented. Processor (11 and 21) are connected to transceiver (13 and 21) and the physical layer according to the IEEE 802 system and/or the MAC layer can be implemented. The operation according to the various embodiment of the invention in which processor (11 and 21) describe in the above is configured to be performed. Moreover, the first STA according to the above-described various embodiment of the invention and the module implementing the 2STAth operation is stored in memory (12 and 22) and the module can be carried out by processor (11 and 21). Memory (12 and 22) are included inside processor (11 and 21) or it is installed outside processor (11 and 21) and it can be connected by processor (11 and 21) and publicly known means.

본 발명의 일례에 따른 제 1 STA(10) 장치의 프로세서(11)는 송수신기(13)을 이용하여 제 2 STA(20) 장치로 TVHT 동작 정보 필드를 포함하는 프레임을 전송하도록 설정될 수 있다. 제 1 STA(10) 장치의 프로세서(11)는 상기 TVHT 동작 정보 필드를 상기 도 7에서 설명한 바와 같이 구성할 수 있으며, 각 서브필드의 설정은 전술한 본 발명의 다양한 실시예에서 설명한 바에 따를 수 있다.

The including the TVHT operation information field frame can be set up so that the processor (11) of the first STA (10) apparatus according to one example of the invention transmits the frame with the second STA (20) apparatus using the transceiver (13). In the processor (11) of the first STA (10) apparatus the above is 7 the TVHT operation information field, it can configure as described above and it can follow in various embodiments, to illustrate of the invention in which the setting of each subfield describes in the above.

본 발명의 일례에 따른 제 2 STA(20) 장치의 프로세서(21)는 송수신기(23)을 이용하여 제 1 STA(10) 장치로부터 TVHT 동작 정보 필드를 포함하는 프레임을 수신하도록 설정될 수 있다. 제 2 STA(20) 장치의 프로세서(21)는 수신된 TVHT 동작 정보 필드에 포함된 서브필드들의 설정 값으로부터 동작 채널의 중심 주파수 결정 등의 채널화를 수행하고, 이에 따른 MAC 및/또는 PHY 동작을 수행하도록 설정될 수 있다.

The including the TVHT operation information field frame can be set up so that the processor (21) of the second STA (20) apparatus according to one example of the invention receives the frame using the transceiver (23) from the first STA (10) apparatus. The channelizing including the center frequency determination of the working channel etc. is performed from the set value of the subfields included in the TVHT operation information field where the processor (21) of the second STA (20) apparatus is received and the set value can be set up in order to perform the MAC according to the above and/or the PHY operation.

위와 같은 제 1 STA(10) 및 제 2 STA(20) 장치의 구체적인 구성은, 전술한 본 발명의 다양한 실시예에서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있으며, 중복되는 내용은 명확성을 위하여 설명을 생략한다.

The matters which in various embodiments, the detailed configuration of the second STA (20) apparatus and the first STA (10) as in the above illustrates of the above-described invention are independently applied or it can be implemented so that the embodiment more than 2 is simultaneously applied and the overlapped content omits the description for clarity.

상술한 본 발명의 실시예들은 다양한 수단을 통해 구현될 수 있다. 예를 들어, 본 발명의 실시예들은 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다.

It can be implemented through the means in which the embodiment of the inventions are various. For example, the embodiments of the invention can be implemented by hardware, the firmware, software or their combination etc.

하드웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 하나 또는 그 이상의 ASICs(Application Specific Integrated Circuits), DSPs(Digital Signal Processors), DSPDs(Digital Signal Processing Devices), PLDs(Programmable Logic Devices), FPGAs(Field Programmable Gate Arrays), 프로세서, 컨트롤러, 마이크로 컨트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

In case of the implementation by hardware, the method according to the embodiments of the invention can be implemented by one or more the ASICs (Application Specific Integrated Circuits), the DSPs (Digital Signal Processors), the DSPDs (Digital Signal Processing Devices), the PLDs (Programmable Logic Devices), the FPGAs (Field Programmable Gate Arrays), processor, controller, microcontroller, the microprocessor etc.

펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차 또는 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리 유닛에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리 유닛은 상기 프로세서 내부 또는 외부에 위치하여, 이미 공지된 다양한 수단에 의해 상기 프로세서와 데이터를 주고 받을 수 있다.

In case of the implementation by firmware or software, it can be implemented in the form of the function in which in the above, the method according to the embodiments of the invention is explained or the module, performing operations the procedure or the function etc. The software code is stored in the memory unit and it can be driven with the processor. The memory unit is positioned at the inner part of processor or the outside and the processor and data can be given and can be taken with the various publicly known means.

상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬

As described above, it was provided so that the person skilled in the art implemented the invention and the detailed explanation about the embodiment done with the desirable of the disclosed invention performed. In the above case, it illustrated with reference to the embodiment done with desirable of the invention. However it wil

수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

I be able to understand it is various changing the invention in the range that it does not deviate from thought and domain of the present invention in which the unskilled person skilled in the art of the target technology part is written in the following scope of claims with the correction. Therefore, the invention relates to be not here and to be limited in embodiments showing up to give the range of the strongest coinciding with the principles disclosed herein and the characteristics which are novel.

상술한 바와 같은 본 발명의 다양한 실시형태들은 IEEE 802.11 시스템을 중심으로 설명하였으나, 다양한 이동통신 시스템에 동일한 방식으로 적용될 수 있다.

The various embodiment of the invention as described aboves illustrated around the IEEE 802.11 system. But it can be applied to the various mobile communication system to the same mode.

## 도면에 대한 간단한 설명

본 명세서에 첨부되는 도면은 본 발명에 대한 이해를 제공하기 위한 것으로서 본 발명의 다양한 실시형태들을 나타내고 명세서의 기재와 함께 본 발명의 원리를 설명하기 위한 것이다.

도 1은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

도 2는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다.

도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다.

도 4는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

도 6은 TVHT 채널-리스트 파라미터 요소 및 채널 대역폭을 설명하기 위한 도면이다.

도 7은 본 발명에 따른 TVHT 동작 요소의 포맷을 설명하기 위한 도면이다.

도 8은 TVHT 동작 정보 필드의 포맷을 설명하기 위한 도면이다.

도 9는 TVHT 채널화를 예시적으로 설명하기 위한 도면이다.

도 10은 TV 채널의 주파수 위치를 예시적으로 나타내는 도면이다.

도 11은 본 발명의 일례에 따른 STA의 동작을 설명하기 위한 도면이다.

도 12는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

## Brief explanation of the drawing

Drawing appended to this specification is designed to provide the understanding about the invention and the various embodiments of the invention is to be shown and the principles of the invention is to be illustrated with the description of specification.

Figure 1 is drawing showing the structure of being illustrative of the IEEE 802.11 system the invention being applied.

Figure 2 is drawing showing the structure of being illustrative of being different of the IEEE 802.11 system the invention being applied.

Figure 3 is drawing showing another structure of being illustrative of the IEEE 802.11 system the invention being applied.

Figure 4 is drawing showing the structure of being illustrative of the WLAN system.

Figure 5 is a flowchart for illustrating the link set-up process of being illustrative according to one example of the invention.

Figure 6 is a drawing illustrating the TVHT channel - list parameter element and the channel bandwidth.

Figure 7 is a drawing illustrating the format of the TVHT action element according to the present invention.

Figure 8 is a drawing illustrating the format of the TVHT operation information field.

It is drawing in which fig. 9 illustratively illustrates the TVHT channelizing.

Figure 10 is drawing illustratively showing the frequency location of the TV channel.

Figure 11 is a drawing illustrating the operation of STA according to one example of the invention.

Figure 12 is a block diagram showing the configuration of the wireless device according to a preferred embodiment of the present invention.

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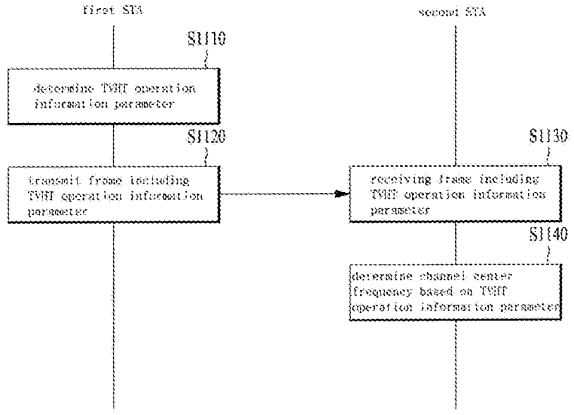
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(54) 발명의 명칭 **화이트 스페이스 대역에서 채널화 방법 및 이를 위한 장치**

(57) 요 약

본 발명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 화이트스페이스 대역에서의 채널화 방법 및 이를 위한 장치가 개시된다. 본 발명의 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 방법은, 제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

대 표 도 - 도11



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청구범위

**청구항 1**

화이트스페이스 동작 정보를 제공하는 방법에 있어서,

제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함하고,

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 제공 방법.

**청구항 2**

제 1 항에 있어서,

상기 채널 시작 주파수는,

상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스를 기준으로, 0 번째 TV 채널 인덱스에 해당하는 TV 채널의 중심 주파수 값으로 설정되는, 동작 정보 제공 방법.

**청구항 3**

제 1 항에 있어서,

상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스는, 상기 주파수 세그먼트 0 또는 상기 주파수 세그먼트 1에서 가장 낮은 TV 채널의 인덱스인, 동작 정보 제공 방법.

**청구항 4**

제 1 항에 있어서,

상기 채널 폭이 하나의 기본채널유닛(BCU), 2개의 연속된(contiguous) BCU들 또는 4개의 연속된 BCU들 중의 하나에 대응하는 경우에,

상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT 기본 서비스 세트(BSS)가 동작하는 상기 하나의 BCU, 상기 2개의 연속된 BCU들 또는 상기 4개의 연속된 BCU들을 포함하는 채널에 대한 가장 낮은(lowest) TV 채널 인덱스를 나타내는 값으로 설정되는, 동작 정보 제공 방법.

**청구항 5**

제 4 항에 있어서,

상기 채널 폭이 2 개의 불연속적인(non-contiguous) BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에,

상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 0의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정되며,

상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함하는, 동작 정보 제공 방법.

**청구항 6**

제 5 항에 있어서,

상기 주파수 세그먼트 0는 프라이머리 채널을 포함하는 주파수 세그먼트인, 동작 정보 제공 방법.

**청구항 7**

제 5 항에 있어서,

상기 채널 폭이 2 개의 불연속적인 BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에,

상기 채널 중심 주파수 세그먼트 1 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 1의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정되는, 동작 정보 제공 방법.

**청구항 8**

제 7 항에 있어서,

상기 주파수 세그먼트 1은 프라이머리 채널을 포함하지 않는 주파수 세그먼트인, 동작 정보 제공 방법.

**청구항 9**

제 1 항에 있어서,

Channel center frequency = Channel starting frequency + TVHT_W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection이고,

Channel center frequency는 채널의 중심 주파수이고,

Channel starting frequency는 상기 채널 시작 주파수이고,

TVHT_W는 하나의 BCU이고,

dot11CurrentChannelCenterFrequencyIndex는 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스이며,

ChannelCenterFrequencyCorrection은 소정의 교정 값인, 동작 정보 제공 방법.

**청구항 10**

제 9 항에 있어서,

PPDU((Physical layer convergence procedure (PLCP) Protocol Data Unit))가 하나의 BCU를 이용하여 전송되거나 또는 2 개의 불연속적인 BCU들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0이고,

PPDU가 2 개의 연속적인 BCU들을 이용하여 전송되거나 또는 2 개의 불연속적인 주파수 세그먼트들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0.5 × TVHT_W이고,

PPDU가 4 개의 연속적인 BCU들을 이용하여 전송되는 경우에 상기 소정의 교정 값은 1.5 × TVHT_W이며,

상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함하는, 동작 정보 제공 방법.

**청구항 11**

제 1 항에 있어서,

상기 TVHT 동작 정보 필드는 4 옥텟 크기를 가지고,

상기 프라이머리 채널 번호, 상기 채널 폭, 상기 채널 중심 주파수 세그먼트 0 및 상기 채널 중심 주파수 세그먼트 1 서브필드들의 각각은 1 옥텟 크기를 가지는, 동작 정보 제공 방법.

**청구항 12**

제 1 항에 있어서,

상기 제 1 STA는 액세스 포인트(AP) STA이고,

상기 제 2 STA는 비-액세스 포인트(non-AP) STA인, 동작 정보 제공 방법.

**청구항 13**

화이트스페이스 동작 정보를 수신하는 방법에 있어서,

제 2 STA이 제 1 STA으로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하는 단계를 포함하고,

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 수신 방법.

**청구항 14**

화이트스페이스 동작 정보를 제공하는 스테이션(STA) 장치에 있어서,

송수신기; 및

프로세서를 포함하고,

상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하도록 설정되고,

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 제공 STA 장치.

**청구항 15**

화이트스페이스 동작 정보를 수신하는 스테이션(STA) 장치에 있어서,

송수신기; 및

프로세서를 포함하고,

상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하도록 설정되고,

상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함하고,

주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정되며,

상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정되는, 동작 정보 수신 STA 장치.

## 발명의 설명

## 기 술 분 야

[0001] 이하의 설명은 무선 통신 시스템에 대한 것으로, 보다 구체적으로는 화이트 스페이스 대역에서의 채널화 방법 및 이를 위한 장치에 대한 것이다.

## 배 경 기 술

[0002] 무선랜(wireless local area network; WLAN) 기술에 대한 표준은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준으로서 개발되고 있다. IEEE 802.11a 및 b는 2.4. GHz 또는 5 GHz에서 비면허 대역(unlicensed band)을 이용하고, IEEE 802.11b는 11 Mbps의 전송 속도를 제공하고, IEEE 802.11a는 54 Mbps의 전송 속도를 제공한다. IEEE 802.11g는 2.4GHz에서 직교 주파수 분할 다중화(Orthogonal Frequency Division Multiplexing; OFDM)를 적용하여, 54 Mbps의 전송 속도를 제공한다. IEEE 802.11n은 다중입출력 OFDM(Multiple Input Multiple Output-OFDM; MIMO-OFDM)을 적용하여, 4 개의 공간적인 스트림(spatial stream)에 대해서 300 Mbps의 전송 속도를 제공한다. IEEE 802.11n에서는 채널 대역폭(channel bandwidth)을 40 MHz까지 지원하며, 이 경우에는 600 Mbps의 전송 속도를 제공한다.

[0003] 현재, TV 화이트 스페이스(TV whitespace, TVWS) 대역에서 비면허 기기(unlicensed device)의 동작을 규정하기 위한 IEEE 802.11af 표준이 개발되고 있다.

[0004] TVWS는 TV 방송을 위해 할당된 VHF(Very High Frequency) 대역(54~60, 76~88, 174~216MHz)과 UHF(Ultra High Frequency) 대역(470~698MHz)을 포함하며, 해당 주파수 대역에서 동작하는 면허 기기(licensed device; TV방송 및 무선 마이크 등)의 통신을 저해하지 않는다는 조건 하에서 비면허 기기(unlicensed device)에 대해 사용이 허가된 주파수 대역을 의미한다.

[0005] 512~608MHz, 614~698MHz에서는 특수한 몇 가지 경우를 제외하고 모든 비면허 기기들에게 동작이 허용되어 있으나, 54~60MHz, 76~88MHZ, 174~216MHz, 470~512MHz 대역은 고정형 기기(fixed device)간의 통신에만 허용되었다. 고정형 기기란 정해진 위치에서만 전송을 수행하는 기기를 말한다. 이하의 설명에 있어서 화이트 스페이스 대역은 상술한 TVWS를 포함하나, 이에 한정될 필요는 없다.

[0006] 화이트 스페이스 대역을 사용하기 원하는 비면허 기기는 면허 기기에 대한 보호 기능을 제공해야 한다. 따라서 화이트 스페이스 대역에서 전송을 시작하기 전에 반드시 면허 기기가 해당 대역을 점유하고 있는지 여부를 확인하도록 한다. 즉, 화이트 스페이스 대역에서 면허 기기가 사용 중이지 않은 경우에만 비면허 기기의 허용이 허용될 수 있다.

[0007] 이를 위하여, 비면허 기기는 인터넷 혹은 전용망을 통해 지리적-위치 데이터베이스(Geo-location DataBase; GDB)에 접속하여 해당 지역에서 사용 가능한 채널 리스트(즉, 사용 가능한 채널(들)의 세트) 정보를 얻어 와야 한다. GDB는 자신에게 등록된 면허 기기의 정보와 해당 면허 기기들의 지리적 위치 및 사용 시간에 따라 동적으로 변화하는 채널 사용 정보를 저장하고 관리하는 데이터베이스이다. 또한, 화이트 스페이스를 사용하는 비면허 기기들 간의 공존(coexistence) 문제를 해결하기 위해서, 공통 비콘 프레임(common beacon frame) 등과 같은 시그널링 프로토콜 및 스펙트럼 센싱 메커니즘(spectrum sensing mechanism) 등이 이용될 수 있다.

[0008] IEEE 802.11 시스템에서 TVWS 단말은 TVWS 스펙트럼에서 IEEE 802.11 MAC(Medium Access Control) 계층 및 PHY(Physical) 계층을 이용하여 동작하는 비면허 기기를 지칭할 수 있다. 본 문서에서 별도의 설명이 없으면 스테이션(STA)은 TVWS 스펙트럼에서 동작하는 TVWS 단말을 지칭한다.

[0009] STA은 면허 사용자(TV 사용자 및 무선 마이크 등)를 포함하여 우선 접속이 허용되는 사용자인 우선적 사용자(incumbent user) 또는 프라이머리 사용자(primary user)를 보호하는 기능을 제공해야 한다. 즉, 우선적 사용자가 TVWS를 사용중이면 STA는 해당 채널의 사용을 중단해야 한다. 따라서 STA는 비면허 기기가 사용할 수 있는 가용 채널(즉, 면허 기기가 사용하지 않는 채널)을 알아내서 가용 채널(available channel)에서 동작하여야 한다.

[0010] STA이 가용 채널을 알아내기 위한 방법에는, 스펙트럼 센싱 메커니즘을 수행하는 방식 및 GDB에 접속하여 TV 채널 스케줄을 알아내는 방식 등이 있다. 스펙트럼 센싱 메커니즘으로 에너지 검출(energy detection) 방식 (수신 신호의 강도가 일정 값 이상이면 우선적 사용자가 사용 중인 것으로 판단하는 방식), 특징부 검출(feature detection) 방식 (디지털 TV 프리엠블(Preamble) 이 검출되면 우선적 사용자가 사용 중인 것으로 판단하는 방식) 등이 활용될 수 있다. 다음으로, STA는 GDB 에 접속하여 자신의 위치 정보에 기반한 GDB 정보를 획득하여

해당 위치에서 면허 기기의 채널 사용 여부를 알아야 하고, GDB로의 접속 및 정보 획득은 면허 기기를 보호하기에 충분한 빈도로 수행되어야 한다.

[0011] 스펙트럼 센싱 방식 또는 GDB를 통하여, 현재 사용 중인 채널과 바로 인접해 있는 채널에서 우선적 사용자가 사용 중인 것으로 판단되면, 단말(또는 STA)과 기지국(또는 Access Point(AP))는 전송 전력을 낮추는 방식으로 우선적 사용자를 보호할 수 있다.

## 발명의 내용

### 해결하려는 과제

[0012] 본 발명의 기술적 과제는 화이트 스페이스 대역에서 무선랜 동작을 위한 채널을 올바르고 효율적으로 설정하는 방안이 제공하는 데에 있다.

[0013] 본 발명에서 이루고자 하는 기술적 과제들은 이상에서 언급한 기술적 과제들로 제한되지 않으며, 언급하지 않은 또 다른 기술적 과제들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

### 과제의 해결 수단

[0014] 상기의 기술적 과제를 해결하기 위하여 본 발명의 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 방법은, 제 1 스테이션(STA)이 제 2 STA에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 전송하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

[0015] 상기의 기술적 과제를 해결하기 위하여 본 발명의 다른 일 실시예에 따른 화이트스페이스 동작 정보를 수신하는 방법은, 제 2 STA이 제 1 STA으로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보 (Operation Information) 필드를 포함하는 프레임을 수신하는 단계를 포함할 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

[0016] 상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 동작 정보를 제공하는 스테이션(STA) 장치는, 송수신기; 및 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치에게, TV 화이트스페이스 고수율 (TVHT) 동작 정보(Operation Information) 필드를 포함하는 프레임을 전송하도록 설정될 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

[0017] 상기의 기술적 과제를 해결하기 위하여 본 발명의 또 다른 일 실시예에 따른 화이트스페이스 동작 정보를 수신하는 스테이션(STA) 장치는, 송수신기; 및 프로세서를 포함하고, 상기 프로세서는, 상기 송수신기를 이용하여 상기 STA 장치가 다른 STA 장치로부터, TV 화이트스페이스 고수율 (TVHT) 동작 정보(Operation Information) 필드를 포함하는 프레임을 수신하도록 설정될 수 있다. 상기 TVHT 동작 정보 필드는 프라이머리 채널 번호, 채널 폭, 채널 중심 주파수 세그먼트 0 및 채널 중심 주파수 세그먼트 1 서브필드들을 포함할 수 있다. 여기서, 주파수 세그먼트 0 또는 주파수 세그먼트 1의 채널 중심 주파수는, 채널 시작 주파수(Channel starting frequency)를 기준으로 결정될 수 있다. 또한, 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스의 함수로서 결정될 수 있다.

[0018] 상기 본 발명에 따른 실시예들에 있어서 이하의 사항이 공통으로 적용될 수 있다.

[0019] 상기 채널 시작 주파수는, 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에

대응하는 TV 채널 인덱스를 기준으로, 0번째 TV 채널 인덱스에 해당하는 TV 채널의 중심 주파수 값으로 설정될 수 있다.

[0020] 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스는, 상기 주파수 세그먼트 0 또는 상기 주파수 세그먼트 1에서 가장 낮은 TV 채널의 인덱스일 수 있다.

[0021] 상기 채널 폭이 하나의 기본채널유닛(BCU), 2개의 연속된(contiguous) BCU들 또는 4개의 연속된 BCU들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT 기본 서비스 세트(BSS)가 동작하는 상기 하나의 BCU, 상기 2개의 연속된 BCU들 또는 상기 4개의 연속된 BCU들을 포함하는 채널에 대한 가장 낮은(lowest) TV 채널 인덱스를 나타내는 값으로 설정될 수 있다.

[0022] 상기 채널 폭이 2 개의 불연속적인(non-contiguous) BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 0 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 0의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정될 수 있다. 상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함할 수 있다.

[0023] 상기 주파수 세그먼트 0는 프라이머리 채널을 포함하는 주파수 세그먼트일 수 있다.

[0024] 상기 채널 폭이 2 개의 불연속적인 BCU들 또는 2 개의 불연속적인 주파수 세그먼트들 중의 하나에 대응하는 경우에, 상기 채널 중심 주파수 세그먼트 1 서브필드는, TVHT BSS가 동작하는 상기 주파수 세그먼트 1의 하나의 BCU 또는 2 개의 연속적인 BCU들을 포함하는 채널에 대한 가장 낮은 TV 채널의 인덱스를 나타내는 값으로 설정될 수 있다.

[0025] 상기 주파수 세그먼트 1은 프라이머리 채널을 포함하지 않는 주파수 세그먼트일 수 있다.

[0026] Channel center frequency = Channel starting frequency + TVHT_W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection으로 정의될 수 있다. 여기서, Channel center frequency는 채널의 중심 주파수이고, Channel starting frequency는 채널 시작 주파수이고, TVHT_W는 하나의 BCU이고, dot11CurrentChannelCenterFrequencyIndex는 상기 주파수 세그먼트 0에 대응하는 TV 채널 인덱스 또는 상기 주파수 세그먼트 1에 대응하는 TV 채널 인덱스이며, , ChannelCenterFrequencyCorrection은 소정의 교정 값일 수 있다.

[0027] PPDU((Physical layer convergence procedure (PLCP) Protocol Data Unit))가 하나의 BCU를 이용하여 전송되거나 또는 2 개의 불연속적인 BCU들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0일 수 있다.

[0028] PPDU가 2 개의 연속적인 BCU들을 이용하여 전송되거나 또는 2 개의 불연속적인 주파수 세그먼트들을 이용하여 전송되는 경우에, 상기 소정의 교정 값은 0.5 × TVHT_W일 수 있다. 상기 주파수 세그먼트들의 각각은 2 개의 연속적인 BCU들을 포함할 수 있다.

[0029] PPDU가 4 개의 연속적인 BCU들을 이용하여 전송되는 경우에 상기 소정의 교정 값은 1.5 × TVHT_W일 수 있다.

[0030] 상기 TVHT 동작 정보 필드는 4 옥텟 크기를 가질 수 있다. 상기 프라이머리 채널 번호, 상기 채널 폭, 상기 채널 중심 주파수 세그먼트 0 및 상기 채널 중심 주파수 세그먼트 1 서브필드들의 각각은 1 옥텟 크기를 가질 수 있다.

[0031] 상기 제 1 STA는 액세스 포인트(AP) STA이고, 상기 제 2 STA는 비-액세스 포인트(non-AP) STA일 수 있다.

[0032] 본 발명에 대하여 전술한 일반적인 설명과 후술하는 상세한 설명은 예시적인 것이며, 청구항 기재 발명에 대한 추가적인 설명을 위한 것이다.

## 발명의 효과

[0033] 본 발명에 따르면 화이트 스페이스 대역에서 무선랜 동작을 위한 채널을 올바르고 효율적으로 설정하는 방안이 제공될 수 있다.

[0034] 본 발명에서 얻은 수 있는 효과는 이상에서 언급한 효과들로 제한되지 않으며, 언급하지 않은 또 다른 효과들은 아래의 기재로부터 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 명확하게 이해될 수 있을 것이다.

## 도면의 간단한 설명

[0035] 본 명세서에 첨부되는 도면은 본 발명에 대한 이해를 제공하기 위한 것으로서 본 발명의 다양한 실시형태들을 나타내고 명세서의 기재와 함께 본 발명의 원리를 설명하기 위한 것이다.

도 1은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

도 2는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다.

도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다.

도 4는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다.

도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

도 6은 TVHT 채널-리스트 파라미터 요소 및 채널 대역폭을 설명하기 위한 도면이다.

도 7은 본 발명에 따른 TVHT 동작 요소의 포맷을 설명하기 위한 도면이다.

도 8은 TVHT 동작 정보 필드의 포맷을 설명하기 위한 도면이다.

도 9는 TVHT 채널화를 예시적으로 설명하기 위한 도면이다.

도 10은 TV 채널의 주파수 위치를 예시적으로 나타내는 도면이다.

도 11은 본 발명의 일례에 따른 STA의 동작을 설명하기 위한 도면이다.

도 12는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

## *발명을 실시하기 위한 구체적인 내용*

[0036] 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다.

[0037] 이하의 실시예들은 본 발명의 구성요소들과 특징들을 소정 형태로 결합한 것들이다. 각 구성요소 또는 특징은 별도의 명시적 언급이 없는 한 선택적인 것으로 고려될 수 있다. 각 구성요소 또는 특징은 다른 구성요소나 특징과 결합되지 않은 형태로 실시될 수 있다. 또한, 일부 구성요소들 및/또는 특징들을 결합하여 본 발명의 실시예를 구성할 수도 있다. 본 발명의 실시예들에서 설명되는 동작들의 순서는 변경될 수 있다. 어느 실시예의 일부 구성이나 특징은 다른 실시예에 포함될 수 있고, 또는 다른 실시예의 대응하는 구성 또는 특징과 교체될 수 있다.

[0038] 이하의 설명에서 사용되는 특정 용어들은 본 발명의 이해를 돕기 위해서 제공된 것이며, 이러한 특정 용어의 사용은 본 발명의 기술적 사상을 벗어나지 않는 범위에서 다른 형태로 변경될 수 있다.

[0039] 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

[0040] 본 발명의 실시예들은 무선 접속 시스템들인 IEEE 802 시스템, 3GPP 시스템, 3GPP LTE 및 LTE-A(LTE-Advanced)시스템 및 3GPP2 시스템 중 적어도 하나에 개시된 표준 문서들에 의해 뒷받침될 수 있다. 즉, 본 발명의 실시예들 중 본 발명의 기술적 사상을 명확히 드러내기 위해 설명하지 않은 단계들 또는 부분들은 상기 문서들에 의해 뒷받침될 수 있다. 또한, 본 문서에서 개시하고 있는 모든 용어들은 상기 표준 문서에 의해 설명될 수 있다.

[0041] 이하의 기술은 CDMA(Code Division Multiple Access), FDMA(Frequency Division Multiple Access), TDMA(Time Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier Frequency Division Multiple Access) 등과 같은 다양한 무선 접속 시스템에 사용될 수 있다. CDMA는 UTRA(Universal Terrestrial Radio Access)나 CDMA2000과 같은 무선 기술(radio technology)로 구현될 수 있다. TDMA는 GSM(Global System for Mobile communications)/GPRS(General Packet Radio Service)/EDGE(Enhanced Data Rates for GSM Evolution)와 같은 무선 기술로 구현될 수 있다. OFDMA는 IEEE

802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, E-UTRA(Evolved UTRA) 등과 같은 무선 기술로 구현될 수 있다. 명확성을 위하여 이하에서는 IEEE 802.11 시스템을 위주로 설명하지만 본 발명의 기술적 사상이 이에 제한되는 것은 아니다.

[0042] 도 1 은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 예시적인 구조를 나타내는 도면이다.

[0043] IEEE 802.11 구조는 복수개의 구성요소들로 구성될 수 있고, 이들의 상호작용에 의해 상위계층에 대해 트랜스패런트한 STA 이동성을 지원하는 WLAN이 제공될 수 있다. 기본 서비스 세트(Basic Service Set; BSS)는 IEEE 802.11 LAN에서의 기본적인 구성 블록에 해당할 수 있다. 도 1 에서는 2 개의 BSS(BSS1 및 BSS2)가 존재하고 각각의 BSS의 멤버로서 2 개의 STA이 포함되는 것(STA1 및 STA2는 BSS1에 포함되고, STA3 및 STA4는 BSS2에 포함됨)을 예시적으로 도시한다. 도 1에서 BSS를 나타내는 타원은 해당 BSS에 포함된 STA들이 통신을 유지하는 커버리지 영역을 나타내는 것으로도 이해될 수 있다. 이 영역을 BSA(Basic Service Area)라고 칭할 수 있다. STA가 BSA 밖으로 이동하게 되면 해당 BSA 내의 다른 STA들과 직접적으로 통신할 수 없게 된다.

[0044] IEEE 802.11 LAN에서 가장 기본적인 타입의 BSS는 독립적인 BSS(Independent BSS; IBSS)이다. 예를 들어, IBSS는 2 개의 STA만으로 구성된 최소의 형태를 가질 수 있다. 또한, 가장 단순한 형태이고 다른 구성요소들이 생략되어 있는 도 1 의 BSS(BSS1 또는 BSS2)가 IBSS의 대표적인 예시에 해당할 수 있다. 이러한 구성은 STA들이 직접 통신할 수 있는 경우에 가능하다. 또한, 이러한 형태의 LAN은 미리 계획되어서 구성되는 것이 아니라 LAN이 필요한 경우에 구성될 수 있으며, 이를 애드-혹(ad-hoc) 네트워크라고 칭할 수도 있다.

[0045] STA의 켜지거나 꺼짐, STA가 BSS 영역에 들어오거나 나감 등에 의해서, BSS에서의 STA의 멤버십이 동적으로 변경될 수 있다. BSS의 멤버가 되기 위해서는, STA는 동기화 과정을 이용하여 BSS에 조인할 수 있다. BSS 기반구조의 모든 서비스에 액세스하기 위해서는, STA는 BSS에 연관(associated)되어야 한다. 이러한 연관(association)은 동적으로 설정될 수 있고, 분배시스템서비스(Distribution System Service; DSS)의 이용을 포함할 수 있다.

[0046] 도 2 는 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 다른 예시적인 구조를 나타내는 도면이다. 도 2 에서는 도 1 의 구조에서 분배시스템(Distribution System; DS), 분배시스템매체(Distribution System Medium; DSM), 액세스 포인트(Access Point; AP) 등의 구성요소가 추가된 형태이다.

[0047] LAN에서 직접적인 스테이션-대-스테이션의 거리는 PHY 성능에 의해서 제한될 수 있다. 어떠한 경우에는 이러한 거리의 한계가 충분할 수도 있지만, 경우에 따라서는 보다 먼 거리의 스테이션 간의 통신이 필요할 수도 있다. 확장된 커버리지를 지원하기 위해서 분배시스템(DS)이 구성될 수 있다.

[0048] DS는 BSS들이 상호연결되는 구조를 의미한다. 구체적으로, 도 1 과 같이 BSS가 독립적으로 존재하는 대신에, 복수개의 BSS들로 구성된 네트워크의 확장된 형태의 구성요소로서 BSS가 존재할 수도 있다.

[0049] DS는 논리적인 개념이며 분배시스템매체(DSM)의 특성에 의해서 특정될 수 있다. 이와 관련하여, IEEE 802.11 표준에서는 무선 매체(Wireless Medium; WM)와 분배시스템매체(DSM)을 논리적으로 구분하고 있다. 각각의 논리적 매체는 상이한 목적을 위해서 사용되며, 상이한 구성요소에 의해서 사용된다. IEEE 802.11 표준의 정의에서는 이러한 매체들이 동일한 것으로 제한하지도 않고 상이한 것으로 제한하지도 않는다. 이와 같이 복수개의 매체들이 논리적으로 상이하다는 점에서, IEEE 802.11 LAN 구조(DS 구조 또는 다른 네트워크 구조)의 유연성이 설명될 수 있다. 즉, IEEE 802.11 LAN 구조는 다양하게 구현될 수 있으며, 각각의 구현예의 물리적인 특성에 의해서 독립적으로 해당 LAN 구조가 특정될 수 있다.

[0050] DS는 복수개의 BSS들의 끊김 없는(seamless) 통합을 제공하고 목적지로의 어드레스를 다루는 데에 필요한 논리적 서비스들을 제공함으로써 이동 기기를 지원할 수 있다.

[0051] AP 는, 연관된 STA들에 대해서 WM을 통해서 DS 로의 액세스를 가능하게 하고 STA 기능성을 가지는 개체를 의미한다. AP를 통해서 BSS 및 DS 간의 데이터 이동이 수행될 수 있다. 예를 들어, 도 2 에서 도시하는 STA2 및 STA3 은 STA의 기능성을 가지면서, 연관된 STA들(STA1 및 STA4)가 DS로 액세스하도록 하는 기능을 제공한다. 또한, 모든 AP는 기본적으로 STA에 해당하므로, 모든 AP는 어드레스 가능한 개체이다. WM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스와 DSM 상에서의 통신을 위해 AP 에 의해서 사용되는 어드레스는 반드시 동일할 필요는 없다.

[0052] AP에 연관된 STA들 중의 하나로부터 그 AP의 STA 어드레스로 전송되는 데이터는, 항상 비제어 포트(uncontrolled port)에서 수신되고 IEEE 802.1X 포트 액세스 개체에 의해서 처리될 수 있다. 또한, 제어 포트

(controlled port)가 인증되면 전송 데이터(또는 프레임)는 DS로 전달될 수 있다.

[0053] 도 3은 본 발명이 적용될 수 있는 IEEE 802.11 시스템의 또 다른 예시적인 구조를 나타내는 도면이다. 도 3에서는 도 2 의 구조에 추가적으로 넓은 커버리지를 제공하기 위한 확장된 서비스 세트(Extended Service Set; ESS)를 개념적으로 나타낸다.

[0054] 임의의(arbitrary) 크기 및 복잡도를 가지는 무선 네트워크가 DS 및 BSS들로 구성될 수 있다. IEEE 802.11 시스템에서는 이러한 방식의 네트워크를 ESS 네트워크라고 칭한다. ESS는 하나의 DS에 연결된 BSS들의 집합에 해당할 수 있다. 그러나, ESS는 DS를 포함하지는 않는다. ESS 네트워크는 LLC(Logical Link Control) 계층에서 IBSS 네트워크로 보이는 점이 특징이다. ESS에 포함되는 STA들은 서로 통신할 수 있고, 이동 STA들은 LLC에 트랜스패런트하게 하나의 BSS에서 다른 BSS로 (동일한 ESS 내에서) 이동할 수 있다.

[0055] IEEE 802.11 에서는 도 3 에서의 BSS들의 상대적인 물리적 위치에 대해서 아무것도 가정하지 않으며, 다음과 같은 형태가 모두 가능하다. BSS들은 부분적으로 중첩될 수 있고, 이는 연속적인 커버리지를 제공하기 위해서 일반적으로 이용되는 형태이다. 또한, BSS들은 물리적으로 연결되어 있지 않을 수 있고, 논리적으로는 BSS들 간의 거리에 제한은 없다. 또한, BSS들은 물리적으로 동일한 위치에 위치할 수 있고, 이는 리던던시를 제공하기 위해서 이용될 수 있다. 또한, 하나 (또는 하나 이상의) IBSS 또는 ESS 네트워크들이 하나 (또는 하나 이상의) ESS 네트워크로서 동일한 공간에 물리적으로 존재할 수 있다. 이는 ESS 네트워크가 존재하는 위치에 애드-혹 네트워크가 동작하는 경우나, 상이한 기관(organizations)에 의해서 물리적으로 중첩되는 IEEE 802.11 네트워크들이 구성되는 경우나, 동일한 위치에서 2 이상의 상이한 액세스 및 보안 정책이 필요한 경우 등에서의 ESS 네트워크 형태에 해당할 수 있다.

[0056] 도 4 는 WLAN 시스템의 예시적인 구조를 나타내는 도면이다. 도 4 에서는 DS를 포함하는 기반 구조 BSS 의 일례가 도시된다.

[0057] 도 4 의 예시에서 BSS1 및 BSS2가 ESS를 구성한다. WLAN 시스템에서 STA는 IEEE 802.11 의 MAC/PHY 규정에 따라 동작하는 기기이다. STA는 AP STA 및 비-AP(non-AP) STA을 포함한다. Non-AP STA는 랩탑 컴퓨터, 이동 전화기와 같이 일반적으로 사용자가 직접 다루는 기기에 해당한다. 도 4 의 예시에서 STA1, STA3, STA4 는 non-AP STA에 해당하고, STA2 및 STA5 는 AP STA 에 해당한다.

[0058] 이하의 설명에서 non-AP STA는 단말(terminal), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장치(User Equipment; UE), 이동국(Mobile Station; MS), 이동단말(Mobile Terminal), 이동 가입자국(Mobile Subscriber Station; MSS) 등으로 칭할 수도 있다. 또한, AP는 다른 무선 통신 분야에서의 기지국(Base Station; BS), 노드-B(Node-B), 발전된 노드-B(evolved Node-B; eNB), 기저 송수신 시스템(Base Transceiver System; BTS), 펨토 기지국(Femto BS) 등에 대응하는 개념이다.

[0059] 화이트 스페이스에서의 가용 채널

[0060] 화이트 스페이스에서 STA이 동작하기 위해서는 면허 기기(또는, 우선적 사용자)에 대한 보호 기법이 우선적으로 제공되어야 한다. 따라서, STA는 면허 기기에 의해 사용되지 않아서 비면허 기기가 사용할 수 있는 가용 채널을 알아내서 가용 채널 상에서 동작해야 한다. 만약 STA이 사용중인 채널이 더 이상 가용 채널에 해당하지 않으면 채널 사용을 중단한다.

[0061] STA이 화이트 스페이스(예를 들어, TVWS)에서의 채널(예를 들어, TV 채널) 가용성(availability)을 파악하기 위해서, 스펙트럼 센싱을 수행하거나, GDB에 접속하여 TV 채널 스케줄을 알아낼 수 있다. GDB 정보는 특정 위치에서 면허 기기의 특정 채널의 사용 스케줄 (즉, 채널 사용 시간) 등의 정보를 포함할 수 있다. TV 채널의 가용성을 파악하기 원하는 STA은, 인터넷 등을 통하여 GDB에 접속해서 자신의 위치 정보에 기반한 GDB 정보를 얻어와야 하며, 이는 면허 기기를 보호하기에 충분한 시간 단위로 수행되어야 한다.

[0062] 본 문서에서는 설명의 편의를 위하여 GDB로부터 수신하는 가용 채널 및 주파수에 관한 정보를 화이트 스페이스 맵(White Space Map; WSM)이라 칭할 수 있다. WSM은 STA가 GDB로부터 획득한 채널 및 주파수 정보를 기반으로 TVWS 대역에서 비면허 기기가 사용할 수 있는 채널에 관한 정보를 맵의 형태로 만든 것이다. WSM은 비면허 기기가 사용할 수 있는 가용 채널 리스트 또는 주파수(available channel list or frequencies)에 대한 정보를 포함할 수 있다. 가용 채널 리스트에 포함된 채널들은 법적으로 보호되어야 하는 신호(또는, 사용자)들이 사용하고 있지 않는 채널들이고, 비면허 기기가 GDB에 접속한 시점에서 비면허 기기가 사용 가능한 채널이다. 또는, 비면허 기기가 GDB에 접속한 시점으로부터 특정 시간 이후로부터의 사용 가능 채널에 대한 요청을 했을 경우, 해당 시점으로부터 사용 가능한 채널 및 주파수에 대한 정보를 포함할 수 있다. 다른 실시예로서, 비면허 기기

가 GDB에 가용 채널에 대한 요청을 했을 경우, 비면허 기기가 사용할 수 없는 채널을 시그널링 함으로써 사용 가능 채널 및 주파수에 대한 정보를 전달할 수도 있다.

[0063] 현재 FCC(Federal Communications Commission)의 TVWS에 대한 규정(regulation)에서는 크게 두 가지 종류의 기기 타입을 정의한다. 즉, 소출력의 개인이 휴대할 수 있는 개인용/휴대용 기기(Personal/Portable Device) 및 고정된 위치에서 동작하는 대출력의 고정된 기기(Fixed Device)이 정의된다. 고정된 기기(Fixed Device)는 고정된 STA으로 칭할 수도 있고, 개인용/휴대용(Personal/Portable) 기기는 P/P STA으로 칭할 수도 있다. 고정된 STA 및 P/P SA는 모두 WLAN 시스템에서 일반적인 STA(즉, STA라는 용어는 AP 및 non-AP를 포함한다)에 해당할 수 있다. 이들 두 종류의 기기는 각각 TVWS에서 동작할 때, 각각 다른 동작 규칙(operation rule)이 적용될 수 있다. 고정된 기기는 그 위치가 변하지 않는 특정 위치에서 신호를 송/수신 한다. 물론 고정된 기기 역시 해당 위치에서 신호를 전송하기 위해서는, GDB에 접속하여 가용 채널 정보를 획득해야 한다. 고정된 기기는 GPS와 같은 위치를 확인할 수 있는 장비가 내장되어 있을 수도 있지만, 설치자(installer)에 의해서 그 위치를 사람이 직접 입력함으로써 그 위치 정보를 GDB에 전달할 수 있다. 물론, 위치를 사람이 직접 입력하는 경우에는 한 번 설치되고 위치가 입력되고 나면 그 위치가 바뀌지 않는다는 것을 전제로 하며, 위치가 변경되는 경우에는 그에 따른 위치도 변경/등록되어야 한다. 고정된 기기는 동종의 다른 고정된 기기를 서비스 할 수도 있고, P/P 기기를 서비스 할 수도 있다. 고정된 기기가 가용 채널 정보를 GDB로부터 받아 올 때, 반드시 자신의 기기 타입을 전달하여 자신이 직접 사용할 수 있는 자신의 가용 채널 정보를 받아와야 한다. 동시에, P/P 기기를 위한 서비스를 하기 위해서는 P/P 기기가 사용할 수 있는 가용 채널 정보를 GDB로부터 또는 GDB와 연결되어 있는 프록시(proxy) 서버로부터 추가로 받아와야 한다. 고정된 기기와 P/P 기기가 사용할 수 있는 채널 구간이 다르고, 각각의 동작시 최대 허용 전송 전력과 인접 채널에 대한 요구조건이 다르기 때문에, 각 기기 타입 별로 가용 채널 리스트가 달라지기 때문이다. 예를 들어, 고정된 기기는 54~60 MHz, 76~88 MHz, 174~216 MHz, 470~512 MHz 대역의 주파수 구간 뿐 아니라, 512~608 MHz, 614~698 MHz 대역의 주파수 구간에서도 신호 전송이 허용된다. 그러나, P/P 기기는 512~608 MHz, 614~698 MHz 대역의 주파수 구간 이외의 다른 주파수 대역의 TVWS 대역에서는 신호 전송이 허용되지 않는다. 고정된 기기는 P/P 기기보다 높은 전력으로 신호를 전송할 수 있으며, 실효 등방 방사 전력(Effective Isotropic Radiated Power; EIRP)으로 최대 4 Watt의 전송 전력이 허용된다.

[0064] P/P 기기는 특정되지 않은 위치에서 신호를 송/수신 할 수 있는 장비이며, 그 위치가 변할 수 있다는 점이 특징이다. 대부분의 경우 사람이 휴대 할 수 있는 장비로서, 그 이동성을 예측할 수 없다. 가용 주파수 대역은 512~608 MHz, 614~698 MHz 의 주파수 구간이고, 최대 전송 전력은 100mW (EIRP)이다. 즉, P/P 기기에 대한 허용 전송 전력은 고정형 기기에 비하여 제한된다.

[0065] P/P 기기는, 자신의 위치에 대한 식별 능력(identification capability), 즉, 지리적-위치결정 능력(geo-location capability)과 인터넷 액세스를 통한 GDB로의 접속 능력을 갖고 있는지 여부에 따라서, 모드 II 기기(Mode II device)와 모드 I 기기(Mode I device)의 두 가지 종류로 분류될 수 있다. 즉, 모드 II 기기는 지리적-위치결정 능력과 인터넷 액세스 능력을 가지며, GDB에 접속해서 자신의 위치에서의 가용 채널에 대한 정보를 획득한 후 해당 위치에서 TVWS 상에서 동작할 수 있다. 또한, 모드 II 기기는 가용 채널정보를 GDB로부터 획득한 후, 모드 I 기기에게 통신을 시작할 수 있도록 명령할 수 있는 신호(예를 들어, 인에이블(enable) 신호)를 전송함으로써 네트워크를 시작할 수 있다. 한편, 모드 I 기기에게는 지리적-위치결정 능력이나 GDB 액세스 능력이 요구되지 않으며, GDB에 액세스하여 유효한 가용 채널 정보를 가지고 있는 모드 II 기기 또는 고정된 기기에 의해 제어 받아서 동작하는 것이 요구된다. 모드 I 기기는 모드 II 기기 또는 고정된 기기로부터 가용 채널 정보를 획득할 수 있으며, 주기적으로 가용채널의 유효성을 확인해야 한다. 또한, 모드 I 기기에 대해서는 해당 기기의 식별자(device ID)에 대한 확인을 거친 후 가용 채널에서의 동작이 허용될 수 있다. 여기서, 모드 II 기기 또는 고정된 기기는 인에이블링 STA에 해당하고, 모드 I 기기는 종속(dependent) STA에 해당할 수 있다. 인에이블링 STA이 종속 STA에게 전송하는 인에이블링 신호는 비콘 프레임에 해당할 수 있다.

[0066] 모드 II 기기에 해당하는 P/P 기기가 다른 P/P 기기를 서비스 할 수 있고, 또는 모드 II 에 해당하는 P/P 기기가 고정된 기기에게 서비스를 제공할 수도 있다. 이 경우, 모드 II P/P 기기는 고정된 기기를 위한 가용 채널 정보를 GDB로부터 획득하여 고정된 기기에게 전달할 수 있다.

[0067] 한편, GDB는 DTV나 마이크로-폰 등의 우선적 사용자의 채널 사용 스케줄 및 보호 범위(protection contour)를 고려하여, 비면허 기기가 요청하는 위치에서의 가용 채널 정보를 계산하여 비면허 기기에게 전달할 수 있다. GDB에서 가용 채널 정보를 계산할 때 고려하는 파라미터들은 기기 타입, 동작하고자 하는 위치, 전송 전력 그리고 스펙트럼 마스크(spectrum mask) 등이 있다. 기기 타입에 따라서, FCC 규정에서는 인접채널에 대한 사용 여부도 달라지는데, 예를 들어 DTV가 30번 채널에서 사용 중일 때, 29번과 31번 채널이 비어 있더라도 고정된 기

기는 29번 및 31번 채널들을 사용할 수 없지만, P/P 기기는 이 두 채널을 사용할 수 있다. 이는, 고정된 기기의 경우에 전송 전력이 높아서 인접 채널에 대한 간섭을 유발할 가능성이 높기 때문이다.

[0068] 이하에서는 설명의 편의를 위해서 화이트 스페이스의 일례로서 TVWS를 들어서 본 발명의 예시들에 대해서 설명하지만, 본 발명의 범위가 이에 제한되는 것은 아니다. 즉, 본 발명의 범위는, 특정 위치에서의 사용 가능한 채널에 대한 정보를 제공하는 DB에 의해서 제어되는 모든 화이트 스페이스에서의 동작에 대해서 적용되는 본 발명의 예시들을 포함한다. 예를 들어, 현재 시점에서는 화이트 스페이스에 해당하지 않지만, 추후 화이트 스페이스에 해당할 것으로 기대되는 다른 주파수 대역에서도 GDB에 의해 제어되는 비면허 장비의 동작이 허용될 것으로 기대되며, 이에 대해서 적용되는 본 발명의 원리에 따른 예시들은 본 발명의 범위에 포함될 수 있다. 또한, 본 발명에서는 설명의 편의를 위해서 현재 최종 규칙이 발표된 TVWS에 대한 FCC 규칙을 기반으로 본 발명의 원리에 대해서 설명하지만, 본 발명의 범위는 FCC 규칙에 따른 화이트 스페이스 대역 상에서의 동작에만 제한되는 것은 아니고, 다른 규칙을 준수하는 화이트 스페이스 대역 상에서의 본 발명의 원리에 따른 예시들을 포함한다.

[0069] 이하에서는 화이트 스페이스 대역에서 동작하는 모드 I 기기가 모드 II 기기 또는 고정된 기기로부터 가용 채널 정보를 획득하는 과정의 일례를 설명한다.

[0070] 도 5는 본 발명의 일례에 따른 예시적인 링크 셋업 과정을 설명하기 위한 흐름도이다.

[0071] 단계 S510에서 모드 II 기기 또는 고정된 기기(이하에서는, 모드 II 기기/고정된 기기로 표현함)는 인터넷 등을 통해 GDB에 액세스하여, 현재 자신의 위치에서 사용가능한 채널 리스트(예를 들어, WSM)을 획득할 수 있다.

[0072] 단계 S520에서, 모드 II 기기/고정된 기기는 비콘을 전송하여 BSS를 구성할 수 있다. 비콘 프레임에는 가용 채널 리스트에 대한 정보 등이 포함될 수 있다. 또한, 비콘 프레임은 주기적으로 전송될 수 있다.

[0073] 단계 S530에서, BSS에 참여하기 원하는 모드 I 기기는 TVWS에 대한 스캐닝 과정을 수행할 수 있다. 만약, 모드 I 기기가 현재 자신의 위치에서 사용 가능한 채널 리스트를 알고 있는 경우에는 사용 가능한 채널 리스트 상의 채널에 대해서만 수동적(passive) 또는 능동적(active) 스캐닝을 수행할 수 있다. 수동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 모드 II 기기/고정된 기기로부터의 비콘 전송을 듣는(listen) 과정을 의미한다. 능동적 스캐닝은, 모드 I 기기가 스캐닝 채널 상에서 프로브 요청 프레임(probe request frame)을 전송하고, 모드 II 기기/고정된 기기로부터 프로브 응답 프레임(probe response frame)을 수신하는 것을 의미한다.

[0074] 여기서, 모드 I 기기가 BSS에 참여하기 위해서는 모드 II 기기/고정된 기기의 제어를 받아서 동작해야 한다. 따라서, 모드 I 기기는 모드 II 기기/고정된 기기와 링크 셋업을 수행해야 한다.

[0075] 단계 S540에서, 모드 I 기기는 스캐닝 과정이 완료된 후에 BSS에 참여하기 위해서 연관(association) 과정을 수행할 수 있다. 이를 위해서, 모드 I 기기는 연관 요청 프레임을 모드 II 기기/고정된 기기에게 전송할 수 있다.

[0076] 연관 요청/응답 과정이 성공적으로 완료된 후에, 단계 S550에서 보안 셋업(security setup) 과정을 수행하게 된다. 보안 셋업은, 예를 들어, EAPOL(Extensible Authentication Protocol over LAN) 프레임을 통한 4-웨이 핸드쉐이킹을 통해서, 프라이빗 키 셋업(private key setup)을 하는 과정을 포함할 수 있다. 모드 II 기기/고정된 기기와 모드 I 기기 간에는 보안 셋업이 반드시 수행되어야 한다. 이는 모드 II 기기/고정된 기기가 모드 I 기기에게 WSM을 전달할 때에, 무결성 확인(integrity check) 등이 요구되기 때문이다.

[0077] 단계 S560에서 모드 I 기기는, 보안 셋업이 완료된 후에, 모드 II 기기/고정된 기기에게 채널 가용성(Channel Availability) 요청 프레임(또는 채널 가용성 질의(Channel Availability Query; CAQ) 요청 프레임)을 전송하여 사용가능한 채널의 리스트(예를 들어, WSM)을 요청할 수 있다. 모드 II 기기/고정된 기기는, 채널 가용성 응답 프레임(또는 CAQ 응답 프레임)을 모드 I 기기에게 전송함으로써 가용 채널 리스트(예를 들어, WSM)를 제공할 수 있다. 모드 I 기기가 가용 채널 리스트(예를 들어, WSM)을 수신함으로써, 모드 II 기기/고정된 기기와의 링크 셋업 과정을 완료할 수 있다. 링크 셋업이 완료되면, 모드 I 기기는 모드 II 기기/고정된 기기와 데이터, 제어, 관리 프레임 등에 대한 상호 송수신을 시작할 수 있다.

[0078] TVWS 물리계층(PHY) 동작

[0079] MAC 계층으로부터 PHY으로 제공되는 데이터 유닛(예를 들어, PSDU((Physical layer convergence procedure(PLCP) Service Data Unit))을 무선 매체(wireless medium) 상에서 전송으로 변환(convert)하고 (즉, 데이터 전송 동작), 무선 매체 상에서의 전송을 PSDU로 변환하는 동작 (즉, 데이터 수신 동작)을 수행하기 위한 동작에 대해서 이하에서 설명한다.

[0080] 특히, TVWS에서 동작하는 통신 시스템(예를 들어, 무선랜)을 위한 채널(이하에서는, TV 채널과 구분하기 위해서, WLAN 채널, WLAN 동작 채널, 또는 동작 채널이라고 칭한다)을 구성하는 방안이 요구된다. TVWS 기기에 의해 사용가능한 TV 채널은 기기의 위치 등에 따라 달라질 수 있다. 특히 주파수 상에서 연속적인 TV 채널을 이용할 수 없는 경우에도 TVWS 기기의 동작을 원활하게 지원하기 위해서, 연속적인 또는 불연속적인(non-contiguous) 동작 채널을 구성하는 방안이 고려될 수 있다.

[0081] 또한, TVWS에서 무선랜의 고수율(High Throughput; HT) 동작을 지원할 수 있으며, 이를 TVHT 동작이라고 칭한다.

[0082] 본 발명에서는 TVHT 동작 채널을 구성하는 기본적인 단위의 대역폭을 W MHz 라고 표현한다. TVHT 동작 채널을 구성하는 기본적인 단위를 기본 채널 유닛(Basic Channel Unit; BCU)이라고 칭할 수 있다. BCU의 대역폭의 크기 W는 TV 채널의 크기에 따라서 정의될 수 있다. 예를 들어, 미국과 한국은 6 MHz 단위의 TV 채널을 정의하고, 호주와 뉴질랜드는 7 MHz 단위의 TV 채널을 정의하며, 유럽은 8 MHz 단위의 TV 채널을 정의하고 있다. 따라서, W MHz의 값은 규제 도메인(regulatory domain)에 따라서 6, 7 또는 8 MHz 중의 어느 하나로 정의될 수 있다.

[0083] 또한, 주파수 세그먼트 또는 주파수 섹션은 하나 이상의 연속적인 주파수 단위를 지칭한다. 예를 들어, TVHT 동작을 위해서 2 개의 BCU가 연속적으로 구성되는 경우에, 2 개의 연속적인 BCU를 하나의 주파수 세그먼트라고 칭할 수 있다.

[0084] 예를 들어, W=6 인 경우에, 하나의 BCU로 구성되는 동작 채널(즉, W = 6 MHz 채널), 2 개의 연속적인 BCU들로 구성되는 동작 채널(즉, 2W = 12 MHz 채널), 4 개의 연속적인 BCU들로 구성되는 동작 채널(즉, 4W = 24 MHz 채널) 등이 정의될 수 있다. 또한, 2 개의 불연속적인 BCU들로 구성되는 동작 채널(즉, W+W = 6+6 MHz 채널), 2 개의 불연속적인 주파수 세그먼트로 구성되며, 각각의 주파수 세그먼트는 연속적인 BCU들을 포함하는 동작 채널(즉, 2W+2W = 12 + 12 MHz 채널) 등이 구성될 수 있다.

[0085] 또한, 이하의 설명에서 프라이머리 채널(primary channel)은, BSS에 속한 모든 STA들에 대한 공통의 동작 채널을 의미한다. 예를 들어, 프라이머리 채널은 데이터 유닛(예를 들어, PPDU(PLCP Protocol Data Unit))의 전송을 위해서 기본적으로 사용되는 채널이며, 비콘 등의 기본적인 신호 전송을 위하여 사용될 수 있다. 즉, 프라이머리 채널은 STA의 동작의 기본적인 채널에 해당한다.

[0086] 한편, 세컨더리 채널(secondary channel)은, 프라이머리 채널에 연관(associate)되는 채널이며, 프라이머리 채널과 합하여 보다 넓은 대역폭 및 높은 수율(high throughput)을 지원하기 위해 사용되는 채널이다.

[0087] 예를 들어, 2W MHz 채널을 구성하는 2 개의 W MHz 채널들 중에서 프라이머리 채널의 위치(location)가 결정되어야 한다. 프라이머리 채널의 위치는 2 개의 W MHz 채널 중에서 높은 주파수 부분인지 낮은 주파수 부분인지를 지시(indicate)할 수 있다. 본 발명에서의 프라이머리 채널은, 가용 TV 채널이 시간 또는 STA의 위치에 따라 가변하는 TVWS에서 정의되는 것을 특징으로 한다. 구체적으로, 본 발명의 TVWS 동작 채널의 구성에 있어서 정의되는 프라이머리 채널은, TVWS에서의 가용 TV 채널을 고려하여 설정될 수 있다.

[0088] 도 6은 TVHT 채널-리스트 파라미터 요소 및 채널 대역폭을 설명하기 위한 도면이다.

[0089] 채널-리스트 파라미터 요소는 STA이 CCA(Clear Channel Assessment) 동작에 관련된 정보이며, CCA는 무선 매체(Wireless Medium)이 사용중(busy)인지 여부를 확인하는 동작이다. STA은 CCA를 수행할 때에 해당 채널이 프라이머리 채널 또는 세컨더리 채널인지 여부를 지시하는 위해서, 채널-리스트 파라미터가 이용될 수 있다.

[0090] TVHT 채널-리스트 파라미터 요소에는 primaryTVHT_W, primaryTVHT_2W, secondaryTVHT_W, secondaryTVHT_2W 등의 요소가 정의될 수 있다. 여기서 TVHT_W는 하나의 BCU에 해당할 수 있고, TVHT_2W는 연속적인 2개의 BCU 에 해당할 수 있다.

[0091] 또한, TVWS에서의 동작하는 시스템을 위한 동작 채널의 정의(즉, 채널화(channelization))는, 가용 TV 채널(즉, 우선적 사용자가 존재하지 않는 TV 채널)에 기초하여 결정될 수 있다. 예를 들어, 연속적인 TV 채널의 사용이 불가능한 경우(즉, TV 채널 n 은 사용가능하지만 TV 채널 n-1과 n+1은 사용가능하지 않은 경우), 또는 연속적인 TV 채널이 사용가능한 경우 몇 개의 연속적인 TV 채널이 사용가능한지를 고려하여, TVWS 시스템을 위한 채널화가 결정될 수 있다.

[0092] 위와 같이 가용 TV 채널에 기초하여 결정되는 동작 채널에 대한 설정 정보는 인에이블링 STA로부터 종속 STA에게, 또는 AP STA으로부터 non-AP STA에게 제공될 수 있다. 예를 들어, 동작 채널에 대한 설정 정보는, 채널 시작 주파수, 채널 폭, 채널 중심 주파수 인덱스(프라이머리 채널을 포함하는 BCU의 중심 주파수 인덱스 및 프라

이머리 채널을 포함하지 않는 BCU의 중심 주파수 인덱스), 프라이머리 채널 위치 등을 포함할 수 있다. 여기서, 채널 시작 주파수는 동작 클래스(operating class) 정보에 의해 정의될 수 있다. 또한, 채널 폭(예를 들어, W, 2W, 4W, W+W, 2W+2W 등)에 대한 정보는, 상기 동작 채널 정보 요소 등에 의해 정의될 수 있다. 채널 중심 주파수 인덱스, 프라이머리 채널 위치 등에 대한 파라미터는 PLMEMIB(Physical Layer Management Entity Management Information Base) 등에 의하여 정의될 수 있다.

[0093] 이하에서는 본 발명에 따른 TVWS에서의 무선랜 동작을 위한 채널화, 특히 TVHT 동작을 위한 채널화의 실시예들에 대해서 설명한다.

[0094] TVHT 동작 요소

[0095] 도 7은 본 발명에 따른 TVHT 동작 요소의 포맷을 설명하기 위한 도면이다.

[0096] BSS에서 TVHT STA들의 동작은 TVHT 동작 요소(Operation element)에 의해서 제어될 수 있다. 도 7에서 도시하는 바와 같이, TVHT 동작 요소의 포맷은 요소 ID(Element ID) 필드, 길이(Length) 필드, TVHT 동작 정보(TVHT Operation Information) 필드, 및 TVHT 기본 MCS 세트(TVHT Basic Modulation and Coding Scheme (MCS) Set) 필드를 포함할 수 있다.

[0097] 도 7의 요소 ID 필드는 해당 정보 요소가 TVHT 동작 요소임을 나타내는 식별자에 해당하는 값을 가질 수 있다.

[0098] 도 7의 길이 필드는 길이 필드 이후의 필드들의 크기를 나타내는 값을 가질 수 있으며, 본 예시에서는 6 옥텟을 나타내는 값으로 설정될 수 있다.

[0099] 도 7의 TVHT 동작 정보 필드는 TVHT 동작 정보 필드는 프라이머리 채널 번호(Primary Channel Number), 채널 폭(Channel Width), 채널 중심 주파수 세그먼트 0(Channel Center Frequency Segment 0), 채널 중심 주파수 세그먼트 1(Channel Center Frequency Segment 1) 서브필드들을 포함할 수 있다.

[0100] 도 8은 TVHT 동작 정보 필드의 포맷을 설명하기 위한 도면이다. 본 발명에서 제안하는 TVHT 동작 정보 필드의 서브필드들은 아래 표 1과 같이 정의될 수 있다.

표 1

| 필드 | 정의 | 인코딩(Encoding) |
|---|---|---|
| Primary Channel Number | 프라이머리 채널의 채널 번호를 지시함. | 프라이머리 채널의 채널 번호. |
| Channel Width | 이 필드는 BSS 동작 채널 폭을 정의함. | TVHT_W 동작 채널 폭에 대해서 0으로 설정됨.<br>TVHT_2W 동작 채널 폭에 대해서 1로 설정됨.<br>TVHT_W+W 동작 채널 폭에 대해서 2로 설정됨.<br>TVHT_4W 동작 채널 폭에 대해서 3으로 설정됨.<br>TVHT_2W+2W 동작 채널 폭에 대해서 4로 설정됨.<br>5 내지 255 범위의 값은 유보됨(reserved). |
| Channel Center Frequency Segment 0 | TVHT_W 및 TVHT_2W 및 TVHT_4W의 TVHT BSS에 대해서 채널 중심 주파수를 정의함.<br><br>TVHT_W+W 및 TVHT_2W+2W의 TVHT BSS에 대해서 세그먼트 0 채널 중심 주파수를 정의함. | TVHT_W 또는 TVHT_2W 또는 TVHT_4W 동작 채널 폭에 대해서, TVHT BSS가 동작하는 TVHT_W 또는 TVHT_2W 또는 TVHT_4W 채널에 대한 가장 낮은(lowest) TV 채널의 중심 주파수를 나타내는 인덱스.<br><br>TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭에 대해서, TVHT BSS가 동작하는 주파수 세그먼트 0의 TVHT_W 또는 TVHT_2W 채널에 대한 가장 낮은 TV 채널의 중심 주파수를 나타내는 인덱스.<br><br>그 외의 경우에는 유보됨(Reserved otherwise). |
| Channel Center Frequency Segment 1 | TVHT_W+W 및 TVHT_2W+2W의 TVHT BSS에 대해서 세그먼트 1 채널 중심 주파수를 정의함. | TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭에 대해서, TVHT BSS가 동작하는 주파수 세그먼트 1의 TVHT_W 또는 TVHT_2W 채널에 대한 가장 낮은 TV 채널의 중심 주파수를 나타내는 인덱스.<br><br>그 외의 경우에는 유보됨. |

[0101]

[0102] 종래 기술에서는 Channel Center Frequency Segment 0가, TVHT_W 또는 TVHT_2W 또는 TVHT_4W의 동작 채널 폭의 경우에는 TVWS BSS가 동작하는 TVHT_W 또는 TVHT_2W 또는 TVHT_4W 채널의 중심 주파수(즉, WLAN 동작 채널의 중심 주파수)를 지시(indicate)하거나, TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭의 경우에는 프라이머리 채널을 포함하는 주파수 세그먼트의 중심 주파수를 지시하는 것으로 정의되어 있다. 또한, Channel Center Frequency Segment 1이, TVHT_W+W 또는 TVHT_2W+2W 동작 채널 폭의 경우에는, 프라이머리 채널을 포함하지 않는 주파수 세그먼트의 TVHT_W 또는 TVHT_2W 채널의 중심 주파수를 지시하는 것으로 정의되어 있다.

[0103] WLAN 동작 채널의 중심 주파수는 후술하는 수학식 4에 따라서 표현/계산될 수 있다. 예를 들어, TVHT_2W 또는 TVHT_4W 동작 채널 폭의 경우에, Channel Center Frequency Segment 0 필드의 값이 곧 WLAN 동작 채널의 주파수가 되는 문제가 있다. 이 경우, 수학식 4의 교정값(즉, ChannelCenterFrequencyCorrection)이 적용되는 경우에, 실제 WLAN 동작 채널의 중심 주파수에서 교정 값이 더해진 잘못된 값이 WLAN 동작 채널의 중심 주파수로서 표현되는 문제가 있다.

[0104] 유사하게, TVHT_2W+2W 동작 채널 폭의 경우에, Channel Center Frequency Segment 0 필드의 값이 곧 주파수 세그먼트 0(즉, 프라이머리 채널을 포함하는 주파수 세그먼트)의 중심 주파수의 값을 가지게 되므로, 주파수 세그먼트 0의 중심 주파수의 값에 수학식 4의 교정값이 더해진 잘못된 값이 해당 주파수 세그먼트의 중심 주파수로서 표현되는 문제가 있다.

[0105] 따라서, 본 발명에서는 상기 표 1 및 후술하는 표 4에서 나타내는 바와 같이, Channel Center Frequency Segment(즉, 후술하는 표 4의 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1)을 해당 WLAN 동작 채널에 포함된 TV 채널(들) 중에서 "가장 낮은" TV 채널의 중심 주파수를 나타내는 인덱스로서 정의하는 것을 제안한다. 이에 따라, 수학식 4에 따라서 WLAN 동작 채널의 중심 주파수가 올바르게 표현될 수 있다. 구체적인 사항은 후술하는 수학식 4와 관련된 부분에서 설명한다.

[0106] 다음으로, 도 7의 TVHT 기본 MCS 세트 필드는 BSS 내의 모든 TVHT STA들에 의해서 지원되는 TVHT PPDU들의 공간 스트림(spatial stream)의 개수별 MCS를 나타낸다. TVHT 기본 MCS 세트 필드는 8 비트 크기의 비트맵으로 정의될 수 있으며, 상기 비트맵의 8 비트 중에서 각각의 2 비트씩은 Nss (Nss는 공간 스트림의 개수를 의미하고, 1부터 4 중의 하나의 값을 가질 수 있음)에 대한 지원되는 MCS를 나타낸다. TVHT 기본 MCS 세트 필드는, 수신(Rx) MCS 맵 서브필드(VHT Supported MCS Set 필드의 서브필드 중 하나)의 B0-B7으로서 정의될 수도 있다. 이러한 경우에는, TVHT 기본 MCS 세트 필드는 1 옥텟(즉, 8 비트) 크기로 정의될 수 있다. 그러나, 이에 제한되는 것은 아니고, 상기 8 비트 크기의 비트맵에 추가적인 8 비트를 포함하는 2 옥텟 (즉, 16 비트) 크기로 TVHT 기본 MCS 세트 필드가 정의될 수도 있다.

[0107] TVHT BSS 동작

[0108] BSS를 생성하는 STA은 TVHT BSS가 기본적으로 지원하는 MCS의 세트(즉, TVHTBSSBasicMCSSet) 및 TVHT 동작을 위해 지원되는 MCS의 세트(즉, TVHTOperationalMCSSet)에서 정의하는 MCS 값에 따라서 수신 및 전송할 수 있어야 한다.

[0109] TVHT AP는 TVHT 캐퍼빌리티 요소(TVHT Capabilities element)의 TVHT 캐퍼빌리티 정보(TVHT Capability Info) 필드의 지원되는 채널 폭 세트(Supported Channel Width Set) 서브필드에서, 자신이 지원하는 채널 폭 캐퍼빌리티를 선언한다.

[0110] 또한, TVHT AP는 TVHT 동작 요소(TVHT Operation element)의 TVHT 동작 정보(TVHT Operation Information) 필드의 채널 폭(Channel Width) 서브필드를 BSS 동작 채널 폭(BSS operating channel width)을 지시하도록 설정한다. 예를 들어, TVHT AP가 BSS 동작 채널 폭을 W, 2W, W+W, 4W, 2W+2W 중의 하나의 것을 지시할 수 있다.

[0111] 여기서, BSS에서 전송되는 PPDU(transmitted PPDU)의 대역폭은 BSS 동작 채널 폭의 서브세트일 수 있다. 예를 들어, BSS 동작 대역폭이 2W인 경우에, 지원되는 PPDU 대역폭은 W 또는 2W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 W+W인 경우에, 지원되는 PPDU 대역폭은 W 또는 W+W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 4W인 경우에, 지원되는 PPDU 대역폭은 W, 2W 또는 4W 중의 하나일 수 있다. 또한, BSS 동작 대역폭이 2W+2W인 경우에, 지원되는 PPDU 대역폭은 W, 2W 또는 2W+2W 중의 하나일 수 있다.

[0112] 따라서, PPDU 대역폭을 정확하게 지시하기 위해서는, BSS 동작 채널 폭 정보 외에 추가적인 추가적인 정보가 필요하다.

[0113] 여기서, PPDU는 PLCP 프리앰블 필드, PLCP 헤더 필드 및 데이터 필드를 포함할 수 있다. PLCP 프리앰블 필드는 트레이닝 필드(training field) 등을 포함한다. PLCP 헤더 필드는 SIG(Signal) 필드 등을 포함한다. 데이터 필드는 PSDU(PLCP Service Data Unit) 등을 포함한다. PLCP 헤더 필드에 포함되는 SIG 필드는, BW(Bandwidth) 필드 등을 포함한다. BW 필드는 2 비트 크기로 정의된다. 기존의 BW 필드는 X(예를 들어, X=20 MHz), 2X, 4X 또는 8X/4X+4X의 PPDU 대역폭을 지시하는 기능을 한다.

[0114] TVHT PPDU에서는 PLCP 헤더의 SIG 필드를 TVHT-SIG-A1 및 TVHT-SIG-A2로 구성될 수 있고, 이 중에서 TVHT-SIG-A1의 처음 2개의 비트(B0 및 B1)이 BW 필드로서 정의될 수 있다.

[0115] 본 발명에서는 PPDU 대역폭을 정확하게 지시하기 위해서, 상기 BSS 동작 대역폭 정보와 함께 TVHT-SIG-A1의 BW 필드를 이용하는 것에 대해서 제안한다.

[0116] 아래의 표 2는 TVHT BSS 동작 채널 폭을 나타낸다. 표 2에서 나타내는 바와 같이, 전송되는 PPDU의 타입은 BSS

동작 채널 폭 및 TVHT-SIG-A1 필드의 B0-B1의 값에 의존하여 결정될 수 있다.

표 2

| TVHT Operation element Channel Width field | BSS operating channel width | B0-B1 (BW) in TVHT-SIG-A1 | PPDU type |
|---|---|---|---|
| 0 | TVHT_W | 1 | TVHT_MODE_1 |
| 1 | TVHT_2W | 1 | TVHT_MODE_1 |
| | | 2 | TVHT_MODE_2C |
| 2 | TVHT_W+W | 1 | TVHT_MODE_1 |
| | | 2 | TVHT_MODE_2N |
| 3 | TVHT_4W | 1 | TVHT_MODE_1 |
| | | 2 | TVHT_MODE_2C |
| | | 3 | TVHT_MODE_4C |
| 4 | TVHT_2W+2W | 1 | TVHT_MODE_1 |
| | | 2 | TVHT_MODE_2C |
| | | 3 | TVHT_MODE_4N |

[0117]

[0118] 상기 표 2에서 TVHT_MODE_1 PPDU는 TVHT_W VHT PPDU 또는 TVHT_W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_W NON_HT PPDU는 하나의 BCU(즉, TVHT_W 대역폭)에서 non-HT PPDU가 2 번 반복(replicate)되는 것을 의미한다.

[0119] TVHT_MODE_2C PPDU는 TVHT_2W VHT PPDU 또는 TVHT_2W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_2W NON_HT PPDU는 2개의 연속적인 BCU(즉, TVHT_2W 대역폭)에서 non-HT PPDU가 4 번 반복되는 것을 의미한다.

[0120] TVHT_MODE_2N PPDU는 TVHT_W+W VHT PPDU 또는 TVHT_W+W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_W+W NON_HT PPDU는 2 개의 불연속적인 BCU(즉, TVHT_W+W 대역폭)에서 non-HT PPDU가 4 번 반복되는 것을 의미한다.

[0121] TVHT_MODE_4C PPDU는 TVHT_4W VHT PPDU 또는 TVHT_4W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_4W NON_HT PPDU는 4개의 연속적인 BCU(즉, TVHT_4W 대역폭)에서 non-HT PPDU가 8 번 반복되는 것을 의미한다.

[0122] TVHT_MODE_4N PPDU는 TVHT_2W+2W VHT PPDU 또는 TVHT_2W+2W NON_HT PPDU 중의 하나에 해당한다. 여기서, TVHT_2W+2W NON_HT PPDU는, 하나의 주파수 세그먼트가 2 개의 연속적인 BCU들을 포함하고, 이러한 주파수 세그먼트의 2 개가 불연속적으로 존재하는 대역폭(즉, TVHT_2W+2W 대역폭)에서 non-HT PPDU가 8 번 반복되는 것을 의미한다.

[0123] TVHT 동작 요소를 포함하는 프레임을 수신한 TVHT non-AP STA은 TVHT 동작 정보 필드(상기 표 1 참조)의 "채널 중심 주파수 세그먼트 0", "채널 중심 주파수 세그먼트 1" 서브필드, 및 "프라이머리 채널 오프셋"을 이용하여 채널화(channelization)을 결정할 수 있다. 채널화에 대한 보다 구체적인 설명은 후술한다.

[0124] TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접 링크(off-channel Tunneled Direct-Link Setup(TDLS) direct link) 상의 TVHT_MODE_1 PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT_W 채널을 제외한 채널 상에서 TVHT_MODE_1 PPDU를 전송하지 않도록 동작할 수 있다 (즉, BSS의 프라이머리 TVHT_W 채널 상에서만 TVHT_MODE_1 PPDU를 전송하도록 동작할 수 있다). 여기서, 오프-채널은 기본 채널(base channel)이 아닌 다른 채널을 의미하고, 기본 채널은 TDLS 피어(peer) STA이 AP와 연관을 맺은 채널을 의미한다.

[0125] TVHT_2W, TVHT_4W 또는 TVHT_W+W 동작 채널 폭을 가지는 TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접

링크 상의 TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_2N PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT_W 채널 및 세컨더리 TVHT_W 채널을 사용하지 않는 TVHT_MODE_2C 또는 TVHT_MODE_2N PPDU를 전송하지 않도록 동작할 수 있다.

[0126] TVHT_4W 또는 TVHT_2W+2W 동작 채널 폭을 가지는 TVHT BSS의 멤버인 TVHT STA은, 오프-채널 TDLS 직접 링크 상의 TVHT_MODE_4C 또는 TVHT_MODE_4N PPDU 전송을 제외하고는, BSS의 프라이머리 TVHT_2W 채널 및 세컨더리 TVHT_2W 채널을 사용하지 않는 TVHT_MODE_4C 또는 TVHT_MODE_4N PPDU를 전송하지 않도록 동작할 수 있다.

[0127] TVHT STA은 다른 TVHT STA으로부터 최근에 수신된 TVHT 캐퍼빌리티 요소 또는 동작 모드 통지(Operating Mode Notification) 프레임의 지원되는 채널 폭 세트(Supported Channel Width Set) 서브필드에서 지원되는 것으로 지시되지 않는 대역폭을 사용해서는, 상기 다른 TVHT STA으로 전송하지 않도록 동작할 수 있다.

[0128] TDLS 오프-채널 직접-링크의 경우를 제외하고는, STA은 TXVECTOR의 CH_BANDWIDTH 파라미터가 BSS 동작 채널 폭보다 넓은 채널 대역폭을 지시하는 PPDU를 전송하지 않도록 동작할 수 있다. 여기서, TXVECTOR는 MAC이 PHY에게 PSDU의 전송을 위해서 제공하는 파라미터들의 리스트를 의미하며, 상기 파라미터들 중에서 CH_BANDWIDTH 파라미터는 패킷 전송에 이용되는 채널 폭을 나타낸다.

[0129] 신호의 수학적 표현

[0130] 모든 TVHT PPDU 전송 모드에 대해서, 신호는 아래 표 3에서 정의되는 서브캐리어(subcarrier) 상에서 전송된다. 표 3은 톤 위치(tone location)를 나타낸 것이다.

표 3

| 파라미터 | TVHT_MODE_1 | TVHT_MODE_2C | TVHT_MODE_2N | TVHT_MODE_4C | TVHT_MODE_4N | 설명 |
|---|---|---|---|---|---|---|
| $N_{ST}$ | 114 | 114 | 114 | 114 | 114 | BCU 당 점유된 서브캐리어의 총 개수 |
| $N_{TT}$ | 114 | 228 | 228 | 456 | 456 | 모든 BCU에 걸쳐서 점유된 서브캐리어의 총 개수 |
| 서브캐리어 인덱스 | [-58 내지 -2] 및 [+2 내지 +58] | [-130 내지 -74], [-70 내지 -14], [+14 내지 +70] 및 [+74 내지 +130] | 각 BCU에 대해서 [-58 내지 -2] 및 [+2 내지 +58] | [-274 내지 -218], [-214 내지 -158], [-130 내지 -74], [-70 내지 -14], [+14 내지 +70], [+74 내지 +130], [+158 내지 +214] 및 [+218 내지 +274] | 각 BCU에 대해서 [-130 내지 -74], [-70 내지 -14], [+14 내지 +70] 및 [+74 내지 +130] | 6 MHz / 8 MHz 채널 단위에서 점유된 서브캐리어의 위치 |
| 서브캐리어 인덱스 | [-58 내지 -2] 및 [+2 내지 +58] | 각 BCU에 대해서 [-58 내지 -2] 및 [+2 내지 +58] | 각 BCU에 대해서 [-58 내지 -2] 및 [+2 내지 +58] | [-310 내지 -254], [-250 내지 -194], [-142 내지 -86], [-82 내지 -26], [+26 내지 +82], [+86 내지 +142], [+194 내지 +250] 및 [+254 내지 +310] | 각 BCU에 대해서 [-142 내지 -86], [-82 내지 -26], [+26 내지 +82] 및 [+86 내지 +142] | 7 MHz 채널 단위에서 점유된 서브캐리어의 위치 |

[0131]

[0132] 다음으로, TVHT 채널은 아래의 표 4에서 정의되는 PLME(Physical Layer Management Entity) MIB(Management Information Base) 필드들에 의해서 정의된다. 표 4는 TVHT 채널들을 특정(specify)하는 필드들을 나타낸 것이다.

표 4

| 필드 | 의미 |
|---|---|
| dot11CurrentChannelWidth | 채널 폭을 나타냄 (이 필드가 가질 수 있는 값은, TVHT_W, TVHT_2W, TVHT_W+W, TVHT_4W, TVHT_2W+2W임). |
| dot11CurrentChannelCenterFrequencyIndex0 | TVHT_MODE_1, TVHT_MODE_2C 및 TVHT_MODE_4C 동작에서, 가장 낮은(lowest) TV 채널의 중심 주파수를 나타내는 인덱스.<br>TVHT_MODE_2N 및 TVHT_MODE_4N 동작에서, 프라이머리 채널이 포함된 주파수 세그먼트의 가장 낮은 TV 채널의 중심 주파수를 나타내는 인덱스.<br>유효한 범위는 1 내지 200 임. |
| dot11CurrentChannelCenterFrequencyIndex1 | TVHT_MODE_2N 및 TVHT_MODE_4N 동작에서, 프라이머리 채널을 포함하지 않는 주파수 세그먼트의 가장 낮은 TV 채널의 중심 주파수를 나타내는 인덱스.<br>유효한 범위는 1 내지 200 임.<br>TVHT_MODE_1, TVHT_MODE_2C 및 TVHT_MODE_4C 동작에서는 정의되지 않음. |
| dot11CurrentPrimaryChannel | 프라이머리 TVHT_W 채널의 위치를 나타냄.<br>유효한 범위는 1 내지 200 임. |

[0133]

[0134] 상기 표 1에서 설명한 바와 같이, 본 발명에서는 Channel Center Frequency Segment(즉, 상기 표 4의 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1)을 해당 WLAN 동작 채널에 포함된 TV 채널(들) 중에서 "가장 낮은" TV 채널의 중심 주파수를 나타내는 인덱스의 값으로 정의하는 것을 제안한다.

[0135] 다음으로, 채널 주파수를 수학적으로 표현하기 위해서 다음의 표 5와 같이 각각의 변수를 정의할 수 있다.

표 5

| 변수 | 의미 |
|---|---|
| $f_{c,idx0}$ | dot11CurrentChannelCenterFrequencyIndex0 (상기 표 4 참조) |
| $f_{c,idx1}$ | dot11CurrentChannelCenterFrequencyIndex1 (상기 표 4 참조) |
| $f_{PW,idx}$ | dot11CurrentPrimaryChannel (상기 표 4 참조) |
| $f_{CH,start}$ | 채널 시작 주파수(Channel starting frequency) |

[0136]

[0137] 상기 표 5에서 채널 시작 주파수($f_{CH,start}$)는 국가 정보 및 동작 클래스(Country information and operating classes) 항목에서 정의되는 값에 따라서 결정된다 (표 9 내지 표 12 참조).

[0138] 상기 표 5와 같이 변수가 정의된 경우에, TVHT_MODE_1, TVHT_MODE_2C, TVHT_MODE_2N, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에서 $f_{c,idx}$ 와 $f_{c,idx0}$ 는 아래의 수학식 1에 의해서 특정되는 관계를 가진다 (또는, dot11CurrentChannelWidth가 TVHT_W, TVHT_2W, TVHT_W+W, TVHT_4W 또는 TVHT_2W+2W인 경우에, $f_{PW,idx}$ 와 $f_{c,idx0}$ 는 아래의 수학식 1에 의해서 특정되는 관계를 가진다).

수학식 1

[0139] $$f_{PW,idx} = f_{c,idx0} + n_{PW}$$

[0140] 상기 수학식 1에서 $0 \leq n_{PW} \leq N_{PW} - 1$ 이다.

[0141] $N_{PW}$ 의 값은 다음과 같이 결정된다. TVHT_MODE_1 및 TVHT_MODE_2N에서 (또는 TVHT_W 및 TVHT_W+W인 경우에) $N_{PW} = 1$이다. TVHT_MODE_2C 및 TVHT_MODE_4N에서 (또는 TVHT_2W 및 TVHT_2W+2W인 경우에) $N_{PW} = 2$이다. TVHT_MODE_4C에서 (또는 TVHT_4W인 경우에) $N_{PW} = 4$이다.

[0142] 다음으로, TVHT 동작 모드 또는 TVHT 채널 폭에 따라서 프라이머리 채널, 세컨더리 채널의 주파수 특성(예를 들어, 주파수 위치)의 수학적 표현에 대해서 설명한다.

[0143] TVHT_MODE_1, TVHT_MODE_2C, TVHT_MODE_2N, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_W, TVHT_2W, TVHT_W+W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 프라이머리 TVHT_W 채널은 $f_{CH,start} + W \times f_{PW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $f_{PW,idx}$ 는 상기 수학식 1에 따라서 결정된다.

[0144] TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 세컨더리 TVHT_W 채널은 $f_{CH,start} + W \times f_{SW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $n_{PW}$ 가 짝수(even)인 경우에 $f_{SW,idx} = f_{PW,idx} + 1$ 이고, $n_{PW}$ 가 홀수(odd)인 경우에 $f_{SW,idx} = f_{PW,idx} - 1$ 이다.

[0145] TVHT_MODE_2N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_W+W 인 경우에), 세컨더리 TVHT_W 채널은 $f_{CH,start} + W \times f_{SW,idx}$ 에 중심을 두는 TVHT_W 대역폭을 가지는 채널이다. 여기서, $f_{SW,idx} = f_{c,idx1}$ 이다(상기 표 5 참조).

[0146] TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 프라이머리 TVHT_2W 채널은 $f_{CH,start} + W \times f_{P2W,idx} + 0.5 \times W$ 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $f_{P2W,idx}$ 는 다음의 수학식 2에 따라서 결정된다.

수학식 2

[0147] $$f_{P2W,idx} = f_{c,idx0} + 2 \times n_{P2W}$$

[0148] 상기 수학식 2에서 $0 \leq n_{P2W} \leq N_{P2W} - 1$ 이다.

[0149] $N_{P2W}$ 의 값은 다음과 같이 결정된다. TVHT_MODE_2C 및 TVHT_MODE_4N에서 (또는 TVHT_2W 및 TVHT_2W+2W인 경우에) $N_{P2W} = 1$이다. TVHT_MODE_4C에서 (또는 TVHT_4W인 경우에) $N_{PW} = 2$이다.

[0150] TVHT_MODE_2C, TVHT_MODE_4C 또는 TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W, TVHT_4W 또는 TVHT_2W+2W 인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start} + W \times f_{S2W,idx} + 0.5 \times W$ 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $n_{P2W}$ 가 짝수(even)인 경우에 $f_{S2W,idx} = f_{P2W,idx} + 2$ 이고, $n_{P2W}$ 가 홀수(odd)인 경우에 $f_{S2W,idx} = f_{P2W,idx} - 2$ 이다.

[0151] TVHT_MODE_4C 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_4W인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start} + W \times f_{S2W,idx} + 0.5 \times W$ 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $n_{P2W}$ 가 짝수(even)인 경우에 $f_{S2W,idx} = f_{P2W,idx} + 2$ 이고, $n_{P2W}$ 가 홀수(odd)인 경우에 $f_{S2W,idx} = f_{P2W,idx} - 2$ 이다.

[0152] TVHT_MODE_4N 동작에 있어서 (또는 dot11CurrentChannelWidth가 TVHT_2W+2W인 경우에), 세컨더리 TVHT_2W 채널은 $f_{CH,start} + W \times f_{2SW,idx} + 0.5 \times W$ 에 중심을 두는 TVHT_2W 대역폭을 가지는 채널이다. 여기서, $f_{SW,idx} = f_{c,idx1}$ 이다(상기 표 5 참조).

[0153] 전송된 신호는 복소 기저대역(complex baseband) 신호 표기법(notation)으로 기술(describe)된다. 실제 전송되는 신호는 아래의 수학식 3에서 정의되는 관계에 따라서 상기 복소 기저대역 신호에 관련된다.

수학식 3

[0154]
$$r_{RF}^{(i_{Seg}, i_{TX})}(t) = \mathrm{Re}\left\{ \frac{1}{\sqrt{N_{Seg}}} r_{\mathrm{PPDU}}^{(i_{Seg}, i_{TX})}(t) \exp(j2\pi f_c^{(i_{Seg})} t) \right\},$$
$$i_{Seg} = 0, \ldots, N_{Seg} - 1; \quad i_{TX} = 1, \ldots, N_{TX}$$

[0155] 상기 수학식 3에서 Re{X}는 복소 값 X의 실수부(real part)를 의미한다. $N_{Seg}$는 전송 신호의 주파수 세그먼트의 개수를 의미한다. $r_{\mathrm{PPDU}}^{(i_{Seg}, i_{TX})}(t)$ 는 전송 안테나 $i_{TX}$에서 주파수 세그먼트 $i_{Seg}$의 복소 기저대역 신호를 의미한다. $f_c^{(i_{Seg})}$ 는 주파수 세그먼트 $i_{Seg}$에서 전송되는 PPDU의 일부의 중심 주파수를 나타낸다.

[0156] TVHT_MODE_2C 및 TVHT_MODE_4C에서, 인접한(adjacent) 주파수 세그먼트들의 중심 주파수 간의 갭(gap)은 상기 표 3에서 나타낸 바와 같다.

[0157] 아래의 표 6에서와 같이 $f_c^{(i_{Seg})}$ 을 dot11CurrentChannelBandwidth의 함수로서 표현할 수 있다. 표 6은 주파수 세그먼트 $i_{Seg}$ 에서 전송되는 PPDU의 중심 주파수를 나타낸 것이다.

표 6

[0158]

| dot11CurrentChannel Bandwidth | CH_BANDWIDTH | $f_c^{(i_{Seg})} = f_{CH,start} + W \times f_{(i_{Seg})} + Correction$ | |
|---|---|---|---|
| | | $(f_{(0)}, Correction)$ | $(f_{(1)}, Correction)$ |
| TVHT_W | TVHT_W | ($f_{c,idx0}$, 0) | - |
| TVHT_2W | TVHT_W | ($f_{PW,idx}$, 0) | - |
| | TVHT_2W | ($f_{c,idx0}$, 0.5×W) | - |
| TVHT_W+W | TVHT_W | ($f_{PW,idx}$, 0) | - |
| | TVHT_W+W | ($f_{c,idx0}$, 0) | ($f_{c,idx1}$, 0) |
| TVHT_4W | TVHT_W | ($f_{PW,idx}$, 0) | - |
| | TVHT_2W | ($f_{P2W,idx}$, 0.5×W) | - |
| | TVHT_4W | ($f_{c,idx0}$, 1.5×W) | - |
| TVHT_2W+2W | TVHT_W | ($f_{PW,idx}$, 0) | - |
| | TVHT_2W | ($f_{P2W,idx}$, 0.5×W) | - |
| | TVHT_2W+2W | ($f_{c,idx0}$, 0.5×W) | ($f_{c,idx1}$, 0.5×W) |

[0159] 상기 표 6에서 dot11CurrentChannelBandwidth = TVHT_2W+2W 인 경우에, 채널 대역폭 TVHT_W에서 상기 수학식 1에 따라서 $f_{PW,idx} = f_{c,idx0}$ 이다. 또한, 상기 표 6에서 dot11CurrentChannelBandwidth = TVHT_2W+2W 인 경우에, 채널 대역폭이 TVHT_2W에서 상기 수학식 2에 따라서 $f_{2PW,idx} = f_{c,idx0}$ 이다.

[0160] TVHT_MODE_2N 및 TVHT_MODE_4N 에서 전송되는 신호는, TVHT_MODE_2N 또는 TVHT_MODE_4N에서의 두 개의 주파수 세그먼트 간의 위상 오프셋(phase offset) 또는 위상 잡음과 같은 상이한 특성을 겪을 수 있지만, 명료성을 위해서 이러한 특성은 상기 수학식 3에서 표현되어 있지 않다.

[0161] 한편, 아래의 표 7은 PLCP 필드들에 대한 톤 스케일링 팩터(tone scaling factor) 및 가드 인터벌 듀레이션(guard interval duration) 값을 나타낸다. 표 7에서는 BCU의 개수(즉, TVHT_MODE_1은 하나의 BCU를 가지고, TVHT_MODE_2C 및 TVHT_MODE_2N은 2 개의 BCU들을 가지고, TVHT_MODE_4C 및 TVHT_MODE_4N은 4 개의 BCU들을 가짐)의 함수로서 다양한 필드들의 $N_{Field}^{Tone}$ 값을 정리한 것이다.

표 7

[0162]

| 필드 | $N_{Field}^{Tone}$ | | | 가드 인터벌 듀레이션 |
|---|---|---|---|---|
| | BCU의 개수=1 | BCU의 개수=2 | BCU의 개수=4 | |
| L-STF | 24 | 48 | 96 | - |
| L-LTF | 104 | 208 | 416 | $T_{GI2}$ |
| L-SIG | 104 | 208 | 416 | $T_{GI}$ |
| TVHT-SIG-A | 104 | 208 | 416 | $T_{GI}$ |
| TVHT-STF | 24 | 48 | 96 | - |
| TVHT-LTF | 114 | 228 | 456 | $T_{GI}$ |
| TVHT-SIG-B | 114 | 228 | 456 | $T_{GI}$ |
| TVHT-Data | 114 | 228 | 484 | $T_{GI}$ or $T_{GIS}$ |
| NON_HT_DUP_OFDM-Data | 104 | 208 | 416 | $T_{GI}$ |

[0163] 상기 표 7에서 NON_HT_DUP_OFDM-Data는 NON_HT_DUP_OFDM 포맷 타입을 가지는 NON_NT PPDU 의 데이터 필드를 의미한다.

[0164] 상기 표 7에서 $T_{GI}$ 는 일반적인 가드 인터벌 듀레이션 (마이크로초의 단위로 정의됨)을 의미하고 $T_{GI2}$는 더블 가드 인터벌 값(일반 가드 인터벌 듀레이션의 2배)을 의미한다. 또한, TVHT-Data에서 $T_{GI}$ 는 TXVECTOR 파라미터의 GI_TYPE이 LONG_GI 값을 가지는 경우의 가드 인터벌 듀레이션을 의미하고, $T_{GIS}$는 TXVECTOR 파라미터의 GI_TYPE이 SHORT_GI 값을 가지는 경우의 짧은 가드 인터벌 듀레이션을 의미한다.

[0165] 또한, 톤 로테이션을 나타내는 $\gamma_{k,M}$ 함수는 다음의 표 8과 같이 정의될 수 있다. 아래의 표 8은 전송 모드와 $\gamma_{k,M}$ 를 정리한 것이다.

표 8

| 전송 모드 | $\gamma_{k,M}$ |
|---|---|
| TVHT_MODE_1, TVHT_MODE_2N | 세그먼트 당 $\gamma_{k,1}$ |
| TVHT_MODE_2C, TVHT_MODE_4N | 2 개의 연속된 세그먼트 당 $\gamma_{k,2}$ |
| TVHT_MODE_4C | $\gamma_{k,4}$ |

[0166]

[0167] 상기 표 8과 관련하여, TVHT_MODE_1 및 TVHT_MODE_2N PPDU 전송에 대해서, k<0 인 경우에 $\gamma_{k,1}=1$ 이고 k≥0 인 경우에 $\gamma_{k,1}=j$ 이다.

[0168] TVHT_MODE_2C 및 TVHT_MODE_4N PPDU 전송에 대해서, 6MHz 및 8MHz 채널에 대해서 k<-72 인 경우에 $\gamma_{k,2}=1$ 이고 k≥-72 인 경우에 $\gamma_{k,2}=-1$ 이며, 7MHz 채널에 대해서 k<-84 인 경우에 $\gamma_{k,2}=1$ 이고 k≥-84 인 경우에 $\gamma_{k,2}=-1$ 이다.

[0169] TVHT_MODE_4C PPDU 전송에 대해서, 6MHz 및 8MHz 채널에 대해서 k<-216 인 경우에 $\gamma_{k,4}=1$ 이고 -216<k<0 인 경우에 $\gamma_{k,4}=-1$ 이고 0<k<72 인 경우에 $\gamma_{k,4}=1$ 이고 k≥72 인 경우에 $\gamma_{k,4}=-1$ 이며, 7MHz 채널에 대해서 k<-252 인 경우에 $\gamma_{k,4}=1$ 이고 -252<k<0 인 경우에 $\gamma_{k,4}=-1$ 이고 0<k<84 인 경우에 $\gamma_{k,4}=1$ 이고 1≥84 인 경우에 $\gamma_{k,4}=-1$ 이다.

[0170] 채널화

[0171] TVHT 채널은 상기 표 4에서와 같이 TVHT 채널을 특정하기 위한 필드들에 의해서 특정될 수 있다.

[0172] W 또는 TVHT_W는 MHz 단위의 값으로 주어지며, 규제 도메인(regulatory domain)에 따라서 6, 7 또는 8 MHz 중의 어느 하나로 정의될 수 있다.

[0173] dot11CurrentChannelCenterFrequencyIndex0 및 dot11CurrentChannelCenterFrequencyIndex1 필드가 주어지면, 각각의 중심 주파수는 아래의 수학식 4에 따라 결정된다.

수학식 4

[0174]
$$\text{Channel center frequency [MHz]} = \text{Channel starting frequency} + \text{TVHT\_W} \times \text{dot11CurrentChannelCenterFrequencyIndex} + \text{ChannelCenterFrequencyCorrection}$$

[0175] 상기 수학식 4에서 Channel starting frequency는 국가 정보 및 동작 클래스(Country information and operating classes) 항목에서 정의되는 값에 따라서 결정된다 (표 9 내지 표 12 참조).

[0176] 상기 수학식 4에서 dot11CurrentChannelCenterFrequencyIndex는 dot11CurrentChannelCenterFrequencyIndex0 또는 dot11CurrentChannelCenterFrequencyIndex1 이다.

[0177] 상기 수학식 4에서 ChannelCenterFrequencyCorrection은, TVHT_MODE_1에 대해서 0이고, TVHT_MODE_2C 및 TVHT_MODE_2N에 대해서 0.5 × TVHT_W이고, TVHT_MODE_4C 및 TVHT_MODE_4N에 대해서 1.5 × TVHT_W으로 정의될 수 있다. 또는, ChannelCenterFrequencyCorrection은, TVHT_MODE_1 및 TVHT_MODE_2N에 대해서 0이고, TVHT_MODE_2C 및 TVHT_MODE_4N에 대해서 0.5 × TVHT_W이고, TVHT_MODE_4C에 대해서 1.5 × TVHT_W으로 정의될 수도 있다.

[0178] 여기서, Channel starting frequency는, 규제 도메인의 채널 번호가 RLAN(Radio Local Area Network) 채널 번호가 되는 주파수이다. 즉, Channel starting frequency는 첫 번째 채널의 중심 주파수로서 정의된다. 채널 인덱스가 0 부터 시작하는 경우에는 Channel starting frequency는 채널 인덱스 0의 중심 주파수이고, 채널 인덱스가 1 부터 시작하는 경우에는 Channel starting frequency는 채널 인덱스 1의 중심 주파수이다.

[0179] 예를 들어, 미국 TV 채널 2의 중심 주파수는 57MHz이다. 이는 다음과 같이 상기 수학식 4에 따라서 획득된다. 미국에서 TV 채널 2에 대한 Channel starting frequency는 45MHz이고 (표 9 참조), TVHT_W = 6MHz이며, TVHT_MODE_1에서 ChannelCenterFrequencyCorrection = 0 이다. 따라서, Channel center frequency [MHz] = Channel starting frequency + TVHT_W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 × 2 + 0 = 57 MHz 임을 확인할 수 있다.

[0180] 도 9는 TVHT 채널화를 예시적으로 설명하기 위한 도면이다.

[0181] TVWS 대역에서 가용 채널 리스트는 TV 채널 번호에 기초하여 주어지고, 가용 채널 리스트를 고려하여 WLAN 채널(또는 WLAN 동작 채널)이 결정될 수 있다. 도 9에서는 가용 채널 리스트에서 TV 채널 인덱스 0 내지 4가 가용한 경우를 가정한다. 또한, WLAN 채널은 TV 채널 인덱스 2 및 3에 걸쳐서 설정되는 경우를 가정한다. 즉, WLAN 채널은 TVHT_2W의 채널 폭을 가지고, TVHT_MODE_2C 동작에 따라서 PPDU가 전송되는 것으로 가정한다.

[0182] 이 경우, Channel center frequency 는 전술한 바와 같이 0.045 GHz 즉 45 MHz이다 (표 9 참조). 또한, 상기 표 4에서 설명한 바와 같이, dot11CurrentChannelCenterFrequencyIndex는 주파수 세그먼트(즉, 2 개의 BCU로 구성된 단위)의 가장 낮은 TV 채널의 중심 주파수를 나타낸다. 도 9의 예시에서는 dot11CurrentChannelCenterFrequencyIndex = 2인 경우에, WLAN 채널의 주파수 세그먼트에 포함되는 TV 채널(들) 중에서 가장 낮은 TV 채널의 중심 주파수의 인덱스(즉, TV 채널 번호)가 2 라는 의미이다.

[0183] 도 9의 예시에서 WLAN 채널이 2 개의 연속적인 BCU를 포함하는 주파수 세그먼트로 구성되므로, WLAN 채널의 중심 주파수를 상기 수학식 4에 기초하여 계산할 수 있다. 미국에서 TV 채널 2 및 3에 대한 Channel starting frequency는 45MHz이고 (표 9 참조), TVHT_W = 6MHz이며, TVHT_MODE_2C 에서 ChannelCenterFrequencyCorrection = 0.5 × TVHT_W = 3 이다. 따라서, Channel center frequency [MHz] = Channel starting frequency + TVHT_W × dot11CurrentChannelCenterFrequencyIndex + ChannelCenterFrequencyCorrection = 45 + 6 × 2 + 3 = 60 MHz 임을 확인할 수 있다.

[0184] 한편, 도 9의 예시에서 WLAN 채널을 위해서, 하나의 TV 채널의 전체 주파수 대역을 사용하지 않고 일부만을 사용하는 것은, 인접 채널 누출 전력 비(Adjacent Channel Leakage power Ratio; ACLR)의 요구조건이 높기 때문이다. 또한, 상이한 BSS의 상이한 대역폭이 공존하는 경우에 STA이 이를 지원하기 위한 복잡도와 비용이 증가하기 때문에, 이를 해결하기 위해서 TV 채널 대역의 중앙(middle)에 WLAN 채널이 위치하도록 한다. 따라서, 도 9의 예시에서 하나의 BCU는 하나의 TV 채널의 중앙에 위치한다. 하나의 TV 채널의 서브캐리어가 144개라고 하면, BCU가 점유하는 서브캐리어의 개수는 128개로 주어질 수 있다.

[0185] 다음으로, 프라이머리 TVHT_W 채널의 중심 주파수는 다음의 수학식 5에 따라서 결정될 수 있다.

*수학식 5*

[0186] $$\text{Primary channel center frequency [MHz]} = \text{Channel starting frequency} + \text{TVHT\_W} \times \text{dot11CurrentPrimaryChannel}$$

[0187] 한편, TVHT_MODE_2N 동작에 있어서, 임의의(any) 두 개의 동일하지 않은(non-identical) 채널들이 사용될 수 있다.

[0188] TVHT_MODE_4N 동작에 있어서는, TVHT_2W 채널로서 허용되는 임의의 2 개의 채널들이 사용될 수 있는데, 상기 2 개의 채널들의 중심 주파수는 TVHT_2W 보다 많이 이격(separated)되어야 한다. 즉, dot11CurrentChannelCenterFrequencyIndex0와 dot11CurrentChannelCenterFrequencyIndex1 사이의 차이가 2 보다 큰 주파수 차이에 대응하여야 한다.

[0189] 예를 들어, 미국에서 dot11CurrentChannelBandwidth = TVHT_2W (12 MHz)이고, dot11CurrentChannelCenterFrequencyIndex0 = 15 이고, dot11CurrentPrimaryChannel = 16 로 특정되는 채널을

가정한다. 이러한 채널은, 대역폭이 12 MHz이고, 중심 주파수가 482MHz이며, 프라이머리 6 MHz 채널의 중심 주파수는 485 MHz인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

[0190] 다른 예시로서, 미국에서 dot11CurrentChannelBandwidth = TVHT_4W (24 MHz) 이고, dot11CurrentChannelCenterFrequencyIndex0 = 14 이고, dot11CurrentPrimaryChannel = 17 로 특정되는 채널을 가정한다. 이러한 채널은, 대역폭이 24 MHz 이고, 중심 주파수가 482 MHz이며, 프라이머리 6 MHz 채널의 중심 주파수는 491 MHz 인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

[0191] 다른 예시로서, 미국에서 dot11CurrentChannelBandwidth = TVHT_2W+2W (12+12 MHz) 이고, dot11CurrentChannelCenterFrequencyIndex0=15 이고, dot11CurrentChannelCenterFrequencyIndex1 = 40 이며, dot11CurrentPrimaryChannel = 16 인 채널을 가정한다. 이러한 채널은, 대역폭이 12+12 MHz 이고, 주파수 세그먼트 0의 대역폭은 12 MHz이고 그 중심 주파수는 482 MHz 이고, 주파수 세그먼트 1의 대역폭은 12 MHz이고 그 중심 주파수는 632 MHz 이며, 프라이머리 6 MHz 채널의 중심 주파수는 485 MHz 인 채널이다 (상기 수학식 4, 5 및 표 9 참조).

[0192] 국가 정보 및 동작 클래스

[0193] 국가 요소(Country element)는 STA이 동작 트리플렛(Operating triplet)이 존재하는 경우에 자신의 PHY 및 MAC이 동작하도록 설정하기 위한 정보를 포함한다. 동작 트리플렛은 동작 확장 식별자(Operating Extension Identifier), 동작 클래스(Operating Class) 및 커버리지 클래스(Coverage Class) 필드를 포함할 수 있다.

[0194] 동작 클래스는 규제 도메인에서의 무선 동작(radio operation)을 위한 값들의 세트를 지시하는 인덱스이다. 이하에서 예시하는 동작 클래스를 나타내는 표(표 9 내지 표 12)는, 또한 행동 및 신호 검출 제한(behaviors and signal detection limits)에 대한 추가적인 동작 요구조건을 지시하는 정보를 포함한다. 즉, 동작 클래스는 채널 시작 주파수(Channel Starting Frequency), 채널 간격(Channel Spacing), 채널 세트(Channel Set), 행동 제한 세트(Behavior Limit Set)으로 구성될 수 있다.

[0195] 동작 클래스에서, 채널 시작 주파수는 해당 채널 번호 별로 주어지는 변수이며 주파수 값을 가진다. 채널 시작 주파수는 채널 번호와 함께 사용되어 채널 중심 주파수를 계산할 수 있다. 채널 간격은, 해당 동작 클래스에서 허용되는 최대 대역폭을 사용하는 경우에, 중첩하지 않는(non-overlapping) 인접한 채널의 중심 주파수들 간의 차이를 의미한다. 채널 세트는 해당 규제 도메인 및 클래스에서 합법적인(legal) 정수(integer) 채널 번호의 리스트이다. 행동 제한 세트는 다양한 규제 도메인에서 정의되는 행동 제한(구체적인 내용은 IEEE 802.11 표준 문서의 Annex D를 참조할 수 있음)을 지시한다.

[0196] 아래의 표 9 내지 표 12는 각각 미국, 유럽, 일본 및 국제(global) 동작 클래스를 예시적으로 나타낸 것이다. 동작 클래스의 정의는 지역 또는 국가의 규정(regulations)의 변경에 따라서 수정되거나 대체될(superseded) 수도 있다.

표 9

| Operating class | Global operating class (표 12) | Channel starting frequency (GHz) | Channel spacing (MHz) | Channel set | Channel center frequency index | Behavior limits set |
|---|---|---|---|---|---|---|
| <ANA> | | 0.045 (channels 2-4), 0.049 (channels 5, 6), 0.135 (channels 7-13) or 0.389 (channels 14-51) | 6 | - | - | GeoDB |
| <ANA+1> | | 0.045 (channels 2-4), 0.049 (channels 5, 6), 0.099 (channels 7-13) or 0.389 (channels 14-51) | 12 | - | - | GeoDB |
| <ANA+2> | | 0.099 (channels 7-13) or 0.389 (channels 14-51) | 24 | - | - | GeoDB |

[0197]

표 10

| Operating class | Global operating class (표 12) | Channel starting frequency (GHz) | Channel spacing (MHz) | Channel set | Channel center frequency index | Behavior limits set |
|---|---|---|---|---|---|---|
| <ANA> | | | 7, 8 | - | - | GeoDB |
| <ANA+1> | | | 14, 16 | - | - | GeoDB |
| <ANA+2> | | | 28, 32 | - | - | GeoDB |

[0198]

표 11

| Operating class | Global operating class (표 12) | Channel starting frequency (GHz) | Channel spacing (MHz) | Channel set | Channel center frequency index | Behavior limits set |
|---|---|---|---|---|---|---|
| <ANA> | | 0.087 (channels 1-3), 0.149 (channels 4-12), or 0.395 (channels 13-62) | 6 | – | – | GeoDB |
| <ANA+1> | | 0.087 (channels 1-3), 0.149 (channels 4-12), or 0.395 (channels 13-62) | 12 | – | – | GeoDB |
| <ANA+2> | | 0.149 (channels 4-12) or 0.395 (channels 13-62) | 24 | – | – | GeoDB |

[0199]

표 12

| Operating class | Nonglobal operating class(es) | Channel starting frequency (GHz) | Channel spacing (MHz) | Channel set | Channel center frequency index | Behavior limits set |
|---|---|---|---|---|---|---|
| <ANA> | <ANA> | | 6, 7, 8 | – | – | GeoDB |
| <ANA+1> | <ANA+1> | | 12, 14, 18 | – | – | GeoDB |
| <ANA+2> | <ANA+2> | | 24, 28, 32 | – | – | GeoDB |

[0200]

[0201] 상기 표 9의 예시에서 알 수 있는 바와 같이, 미국의 경우에 TV 채널 번호 2 내지 4의 채널 시작 주파수와, TV 채널 번호 5 및 6의 채널 시작 주파수가 상이하다. 또한, TV 채널 번호 5 및 6의 채널 시작 주파수와, TV 채널 번호 7 내지 13의 채널 시작 주파수가 상이하다. 또한, TV 채널 번호 7 내지 13의 채널 시작 주파수와, TV 채널 번호 14 내지 51의 채널 시작 주파수가 상이하게 주어진다. 이는 미국에서 TV 채널 번호 4와 5가 주파수 상에서 이격되어 있고, TV 채널 번호 6과 7이 주파수 상에서 이격되어 있고, TV 채널 번호 13과 14가 주파수 상에서 이격되어 있기 때문이다 (TV 채널 번호 4와 5의 사이, TV 채널 번호 6과 7의 사이, TV 채널 번호 13과 14 사이는, 다양한 다른 용도(예를 들어, 아마추어 라디오 대역, 국제 FM 라디오 대역, 해양 VHF 라디오 대역 등)로 정의되어 있다).

[0202] 여기서, 상기 수학식 4에서 설명한 바와 같이 WLAN 채널의 중심 주파수를 표현하기 위해서는 채널 시작 주파수 값이 주어져야 한다. 그러나, 모든 TV 채널의 주파수 위치에서 채널 시작 주파수 값을 동일하게 적용할 수는 없다. 왜냐하면, 전술한 바와 같이 TV 채널들이 주파수 상에서 연속적으로 정의되어 있지 않기 때문이다.

[0203] 도 10은 TV 채널의 주파수 위치를 예시적으로 나타내는 도면이다.

[0204] 도 10의 예시에서, TV 채널 번호 4에 해당하는 주파수 위치에 존재하는 주파수 세그먼트를 포함하는 WLAN 채널의 중심 주파수를 표현하기 위해서는 (상기 수학식 4 참조), 채널 시작 주파수 값이 0.045 GHz로 주어진다. 이러한 채널 시작 주파수 값(= 45MHz)은 TV 채널 4의 중심 주파수(= 69 MHz)를 기준으로, 하나의 TV 채널 폭이 6 MHz일 때 TV 채널 번호 0 내지 4가 연속적으로 존재하는 것을 가정한 경우의, TV 채널 번호 0의 중심 주파수 값에 해당한다 (즉, TV 채널 3의 중심 주파수는 63 MHz, TV 채널 2의 중심 주파수는 57 MHz, 가상의(virtual) TV 채널 1의 중심 주파수는 51 MHz, 가상의 TV 채널 0의 중심 주파수는 45 MHz가 된다).

[0205] 이와 유사하게, TV 채널 번호 5에 해당하는 주파수 위치에 존재하는 주파수 세그먼트를 포함하는 WLAN 채널의 중심 주파수를 표현하기 위해서는 (상기 수학식 4 참조), 채널 시작 주파수 값이 0.049 GHz로 주어진다. 이러한 채널 시작 주파수 값(=49 MHz)은 TV 채널 5의 중심 주파수(= 79 MHz)를 기준으로, 하나의 TV 채널 폭이 6 MHz일 때 TV 채널 번호 0 내지 5가 연속적으로 존재하는 것을 가정한 경우의, TV 채널 번호 0의 중심 주파수 값에 해당한다 (즉, 가상의 TV 채널 4의 중심 주파수는 73 MHz, 가상의 TV 채널 3의 중심 주파수는 67 MHz, 가상의 TV 채널 2의 중심 주파수는 61 MHz, 가상의 TV 채널 1의 중심 주파수는 55 MHz, 가상의 TV 채널 0의 중심 주파수는 49 MHz가 된다).

[0206] 즉, 상기 표 9에서 어떤 TV 채널에 적용되는 채널 시작 주파수 값은, 해당 채널에서 가상의 첫 번째 TV 채널 번호(예를 들어, TV 채널 인덱스가 0 부터 매겨질 때, 가상의 TV 채널 번호 0)의 중심 주파수 값에 해당하는 것으로 설명할 수 있다.

[0207] 본 발명에서 제안하는 TVHT 채널화는, 상기 표 9 내지 12에서 정리한 바와 같이 dot11CurrentChannelCenterFrequencyIndex에 따라서 Channel starting frequency가 달라지고, 상기 수학식 4에서 나타내는 바와 같이 dot11CurrentChannelCenterFrequencyIndex 및 Channel starting frequency에 따라서 WLAN 동작 채널의 중심 주파수가 결정되는 것으로 표현할 수 있다.

[0208] 예를 들어, 미국에서 dot11CurrentChannelBandwidth = TVHT_W+W (6+6 MHz)이고, dot11CurrentChannelCenterFrequencyIndex0 = 4 이고, dot11CurrentChannelCenterFrequencyIndex1 = 6 인 경우를 가정한다.

[0209] 이 경우, 첫 번째 채널(즉, dot11CurrentChannelCenterFrequencyIndex0 = 4)에 대한 채널 시작 주파수는 상기 표 9에 따라서 0.045×1000 = 45 MHz 이고, 첫 번째 채널의 중심 주파수는 상기 수학식 4에 따라서 45 + 6×4 + 0 = 69 MHz 이다.

[0210] 다음으로, 두 번째 채널(즉, dot11CurrentChannelCenterFrequencyIndex1 = 6)에 대한 채널 시작 주파수는 상기 표 9에 따라서 0.049×1000 = 49 MHz 이고, 두 번째 채널의 중심 주파수는 상기 수학식 4에 따라서 49 + 6×6 + 0 = 85 MHz 이다.

[0211] 요컨대, Channel starting frequency는 상기 표 9 내지 12 및 도 10을 참고하여 설명한 바와 같이 dot11CurrentChannelCenterFrequencyIndex의 함수(function)로서 정의된다. Channel starting frequency과 dot11CurrentChannelCenterFrequencyIndex의 관계는 각각의 규제 도메인에서 상이하게 정의될 수 있으며, 그 예시들은 상기 표 9 내지 12에서 나타내는 바와 같다.

[0212] 도 11은 본 발명의 일례에 따른 STA의 동작을 설명하기 위한 도면이다.

[0213] 단계 S1110에서 제 1 STA(예를 들어, AP STA)은 TVHT 동작 정보 파라미터를 결정할 수 있다. TVHT 동작 정보는 상기 도 7에서 설명한 TVHT 동작 정보 필드에 해당할 수 있다.

[0214] 단계 S1120에서 제 1 STA은 제 2 STA으로 TVHT 동작 정보 필드를 포함하는 프레임을 전송할 수 있고, 단계 S1130에서 제 2 STA은 이를 수신할 수 있다.

[0215] 단계 S1140에서 제 2 STA은 수신된 TVHT 동작 정보 필드로부터 동작 채널의 중심 주파수 등을 결정할 수 있다. 이에 따라, TVHT BSS에서 동작하는 STA의 채널화가 수행될 수 있다.

[0216] 도 11을 참조하여 설명한 TVHT 동작 정보 송수신 및 채널화 방법에 있어서, 전술한 본 발명의 다양한 실시예에

서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용될 수 있다.

[0217] 도 12는 본 발명의 일 실시예에 따른 무선 장치의 구성을 나타내는 블록도이다.

[0218] 제 1 STA(10)는 프로세서(11), 메모리(12), 송수신기(13)를 포함할 수 있다. 제 2 STA(20)는 프로세서(21), 메모리(22), 송수신기(23)를 포함할 수 있다. 송수신기(13 및 23)는 무선 신호를 송신/수신할 수 있고, 예를 들어, IEEE 802 시스템에 따른 물리 계층을 구현할 수 있다. 프로세서(11 및 21)는 송수신기(13 및 21)와 연결되어 IEEE 802 시스템에 따른 물리 계층 및/또는 MAC 계층을 구현할 수 있다. 프로세서(11 및 21)는 전술한 본 발명의 다양한 실시예에 따른 동작을 수행하도록 구성될 수 있다. 또한, 전술한 본 발명의 다양한 실시예에 따른 제 1 STA 및 제 2 STA의 동작을 구현하는 모듈이 메모리(12 및 22)에 저장되고, 프로세서(11 및 21)에 의하여 실행될 수 있다. 메모리(12 및 22)는 프로세서(11 및 21)의 내부에 포함되거나 또는 프로세서(11 및 21)의 외부에 설치되어 프로세서(11 및 21)와 공지의 수단에 의해 연결될 수 있다.

[0219] 본 발명의 일례에 따른 제 1 STA(10) 장치의 프로세서(11)는 송수신기(13)을 이용하여 제 2 STA(20) 장치로 TVHT 동작 정보 필드를 포함하는 프레임을 전송하도록 설정될 수 있다. 제 1 STA(10) 장치의 프로세서(11)는 상기 TVHT 동작 정보 필드를 상기 도 7에서 설명한 바와 같이 구성할 수 있으며, 각 서브필드의 설정은 전술한 본 발명의 다양한 실시예에서 설명한 바에 따를 수 있다.

[0220] 본 발명의 일례에 따른 제 2 STA(20) 장치의 프로세서(21)는 송수신기(23)을 이용하여 제 1 STA(10) 장치로부터 TVHT 동작 정보 필드를 포함하는 프레임을 수신하도록 설정될 수 있다. 제 2 STA(20) 장치의 프로세서(21)는 수신된 TVHT 동작 정보 필드에 포함된 서브필드들의 설정 값으로부터 동작 채널의 중심 주파수 결정 등의 채널화를 수행하고, 이에 따른 MAC 및/또는 PHY 동작을 수행하도록 설정될 수 있다.

[0221] 위와 같은 제 1 STA(10) 및 제 2 STA(20) 장치의 구체적인 구성은, 전술한 본 발명의 다양한 실시예에서 설명한 사항들이 독립적으로 적용되거나 또는 2 이상의 실시예가 동시에 적용되도록 구현될 수 있으며, 중복되는 내용은 명확성을 위하여 설명을 생략한다.

[0222] 상술한 본 발명의 실시예들은 다양한 수단을 통해 구현될 수 있다. 예를 들어, 본 발명의 실시예들은 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다.

[0223] 하드웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 하나 또는 그 이상의 ASICs(Application Specific Integrated Circuits), DSPs(Digital Signal Processors), DSPDs(Digital Signal Processing Devices), PLDs(Programmable Logic Devices), FPGAs(Field Programmable Gate Arrays), 프로세서, 컨트롤러, 마이크로 컨트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

[0224] 펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차 또는 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리 유닛에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리 유닛은 상기 프로세서 내부 또는 외부에 위치하여, 이미 공지된 다양한 수단에 의해 상기 프로세서와 데이터를 주고 받을 수 있다.

[0225] 상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

[0226] 상술한 바와 같은 본 발명의 다양한 실시형태들은 IEEE 802.11 시스템을 중심으로 설명하였으나, 다양한 이동통신 시스템에 동일한 방식으로 적용될 수 있다.

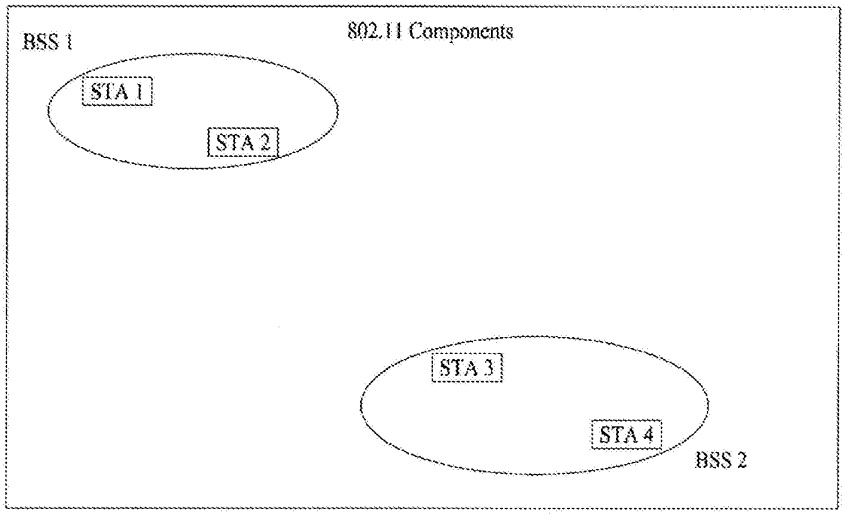
## 부호의 설명

[0227]

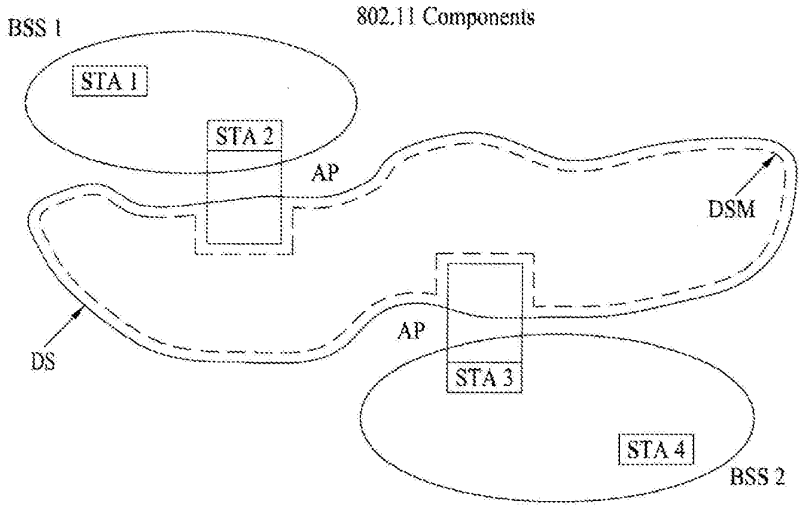
| | |
|---|---|
| 10 제 1 STA | 11 프로세서 |
| 12 메모리 | 13 송수신기 |
| 20 제 2 STA | 21 프로세서 |
| 22 메모리 | 23 송수신기 |

도면

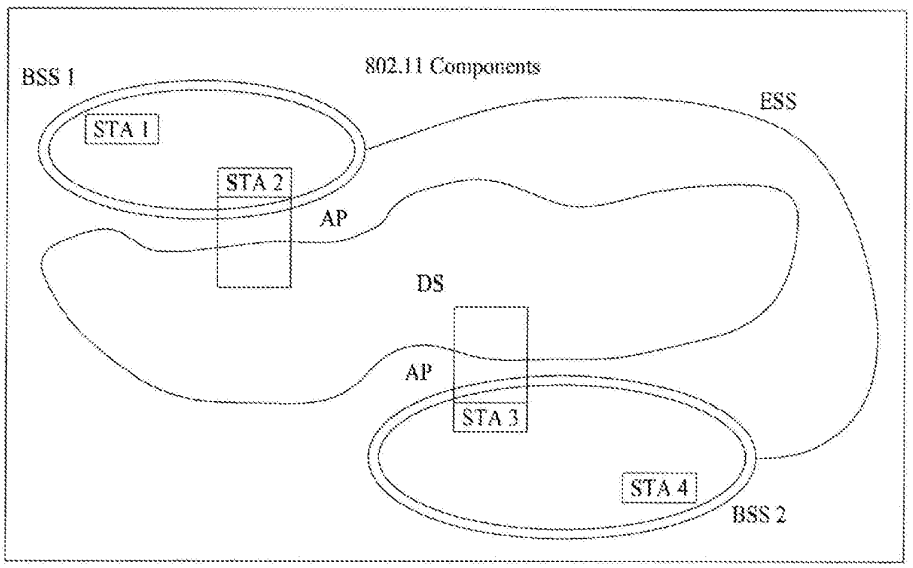
도면1


BSS 1
802.11 Components
STA 1
STA 2
STA 3
STA 4
BSS 2

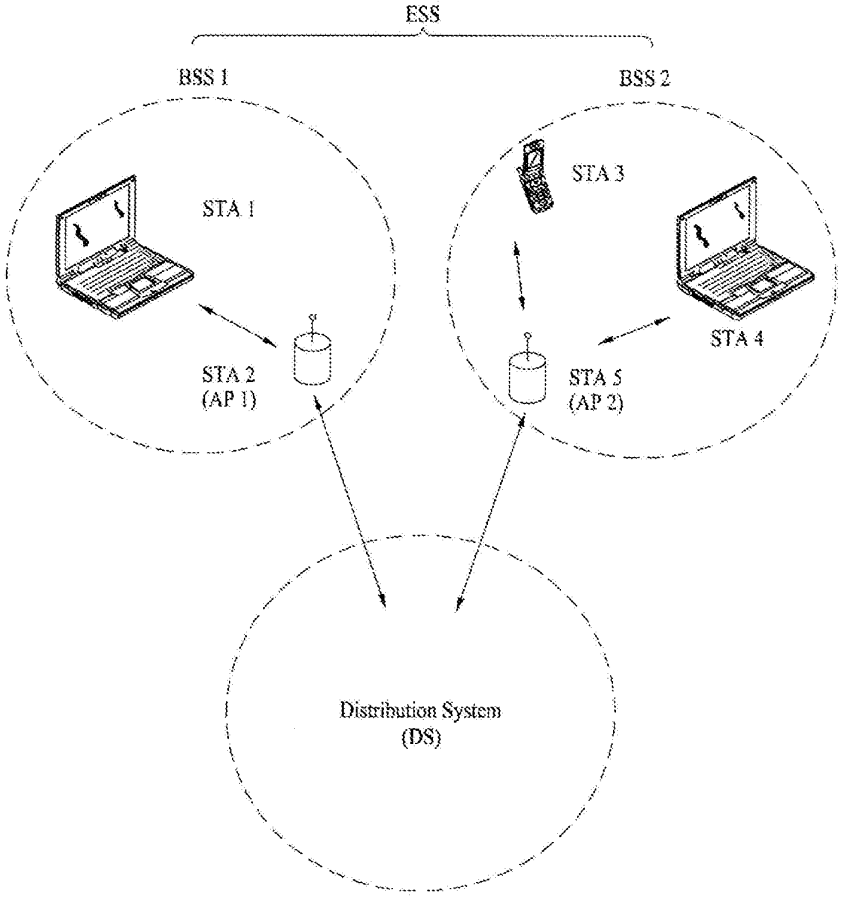
도면2


BSS 1
802.11 Components
STA 1
STA 2
AP
DSM
DS
AP
STA 3
STA 4
BSS 2

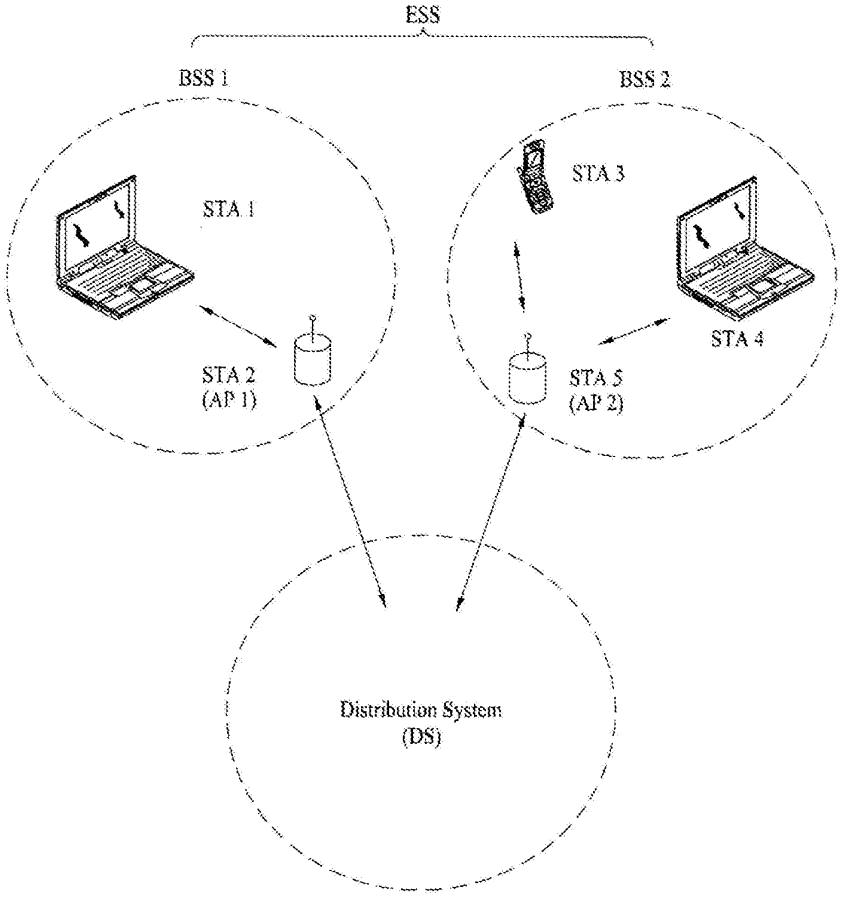
도면3



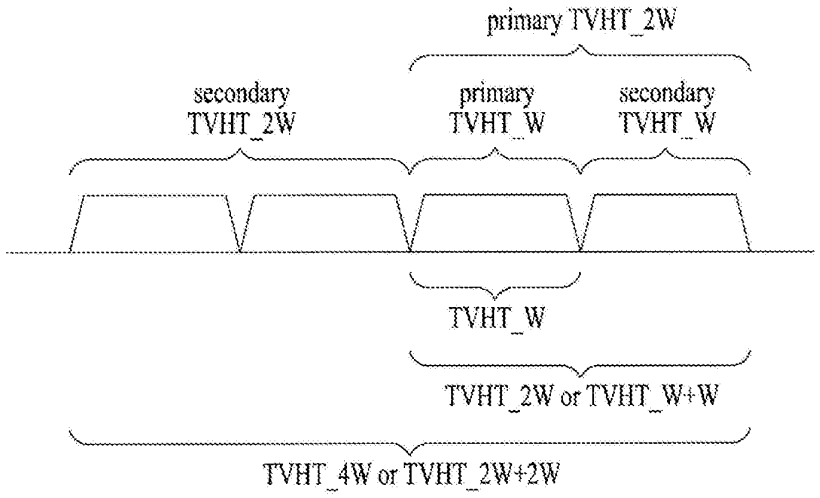
도면4


ESS
BSS 1
BSS 2
STA 1
STA 3
STA 4
STA 2
(AP 1)
STA 5
(AP 2)
Distribution System
(DS)

도면8


ESS
BSS 1
BSS 2
STA 1
STA 3
STA 4
STA 2
(AP 1)
STA 5
(AP 2)
Distribution System
(DS)

도면6



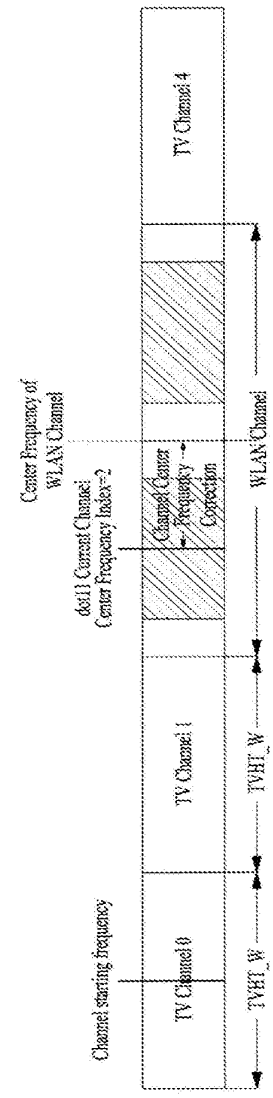

도면7

| | Element ID | Length | TVHT Operation Information | TVHT Basic MCS Set |
|---|---|---|---|---|
| Octets: | 1 | 1 | 4 | 1 or 2 |

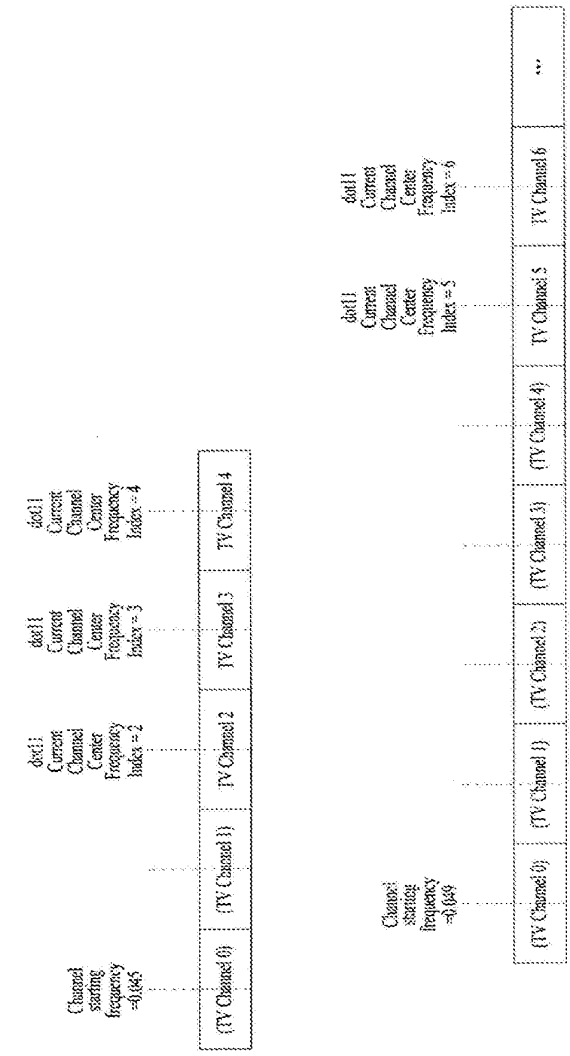
도면8

| | Primary Channel Number | Channel Width | Channel Center Frequency Segment 0 | Channel Center Frequency Segment 1 |
|---|---|---|---|---|
| Octets: | 1 | 1 | 1 | 1 |

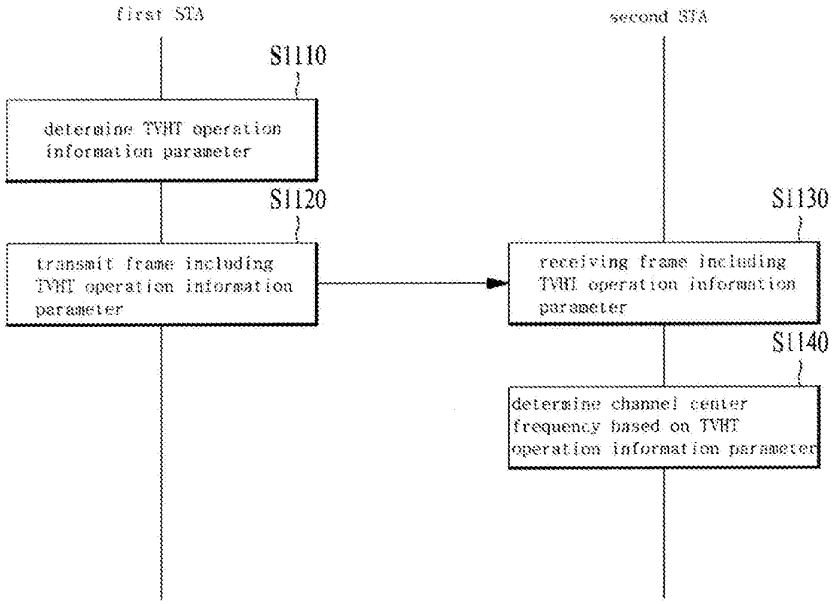
도면9


Center Frequency of WLAN Channel
dot11 Current Channel Center Frequency Index=2
Channel Center Frequency Correction
WLAN Channel
TV Channel 4
TV Channel 1
TV Channel 0
Channel starting frequency
TVHT_W
TVHT_W

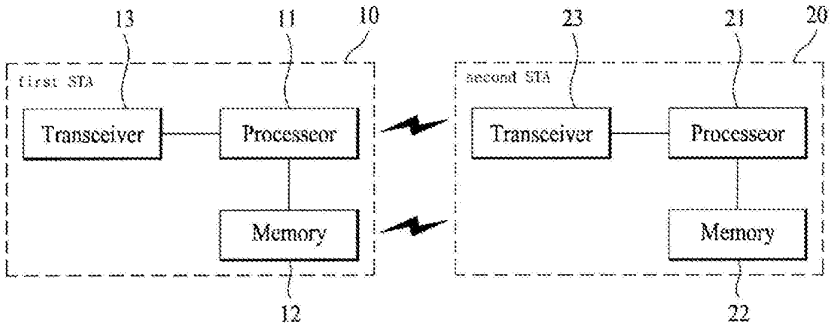
도면10


Channel starting frequency =0.1645
(TV Channel 0)
(TV Channel 1)
TV Channel 2
TV Channel 3
TV Channel 4
dot11 Current Channel Center Frequency Index = 2
dot11 Current Channel Center Frequency Index = 3
dot11 Current Channel Center Frequency Index = 4
Channel starting frequency =0.049
(TV Channel 0)
(TV Channel 1)
(TV Channel 2)
(TV Channel 3)
(TV Channel 4)
TV Channel 5
TV Channel 6
...
dot11 Current Channel Center Frequency Index = 5
dot11 Current Channel Center Frequency Index = 6

도면11


first STA
second STA
S1110
determine TVHT operation information parameter
S1120
transmit frame including TVHT operation information parameter
S1130
receiving frame including TVHT operation information parameter
S1140
determine channel center frequency based on TVHT operation information parameter

도면12


13
11
10
23
21
20
first STA
second STA
Transceiver
Processeor
Memory
Transceiver
Processeor
Memory
12
22

KIPO

Unexamined Patent Publication(A)

## Bibliographic Data


| | |
|---|---|
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| **Priority Claims** | 61/261,197 \| 20091113 \| US |
| **Requested Date of Examination** | 20151111 |
| **Agent.** | Kim Tae Hong |
| **Inventor** | GRANDHI,Sudheer,A. |
| **Applicant** | InterDigital Patent Holdings, Inc. |
| **Rightholder** | InterDigital Patent Holdings, Inc. |


## 발명의 명칭

무선 통신에서 초고처리율을 위한 관리 동작을 지원하는 방법 및 장치

## Title of Invention

METHOD AND APPARATUS FOR SUPPORTING MANAGEMENT ACTIONS FOR VERY HIGH THROUGHPUT IN WIRELESS COMMUNICATIONS

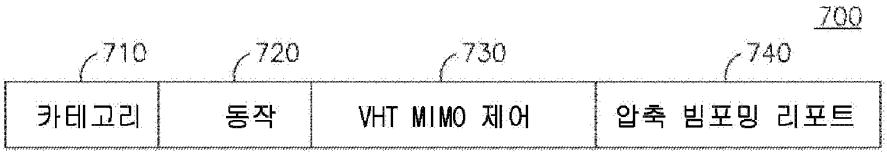
## 요약

초고처리율(VHT)의 무선 로컬 영역 네트워크(WLAN) 관리 동작에서 사용될 수 있는 방법 및 장치가 제공된다. VHT 동작 프레임과 같은 관리 동작 프레임은 WLAN에서 VHT 특징을 구현하기 위해 사용될 수 있다. 802.11 동작 프레임에 대한 확장판이 VHT 특징을 지원하고 역방향 능력을 제공하기 위해 사용될 수 있다. VHT 관리 동작은 직접 링크 설정(DLS), 퍼블릭, 스펙트럼 관리 및 고처리율(HT)과 같은 다양한 카테고리에서 VHT 동작 프레임, 및 802.11 동작 프레임에 대한 VHT 확장판에 의해 지원될 수 있다. 접근점(AP) 또는 무선 송신/수신 유닛(WTRU)은 시그널링에 의해 VHT 능력을 표시할 수 있다.

## Abstract

A method and apparatus for being used in the wireless local area network (WLAN) management operation of the draft processing ratio (VHT) are provided. In the administration action frame like the VHT action frame is WLAN, it can be used the VHT characteristic is implemented. It can be used the extended plate about 802.11 action frame supports the VHT characteristic and the backward direction capability is provided. In the VHT management operation is the direct link establishment (DLS), public, and the various category like the spectrum management and high throughput (HT), it can be supported by the VHT extended plate for 802.11 action frame and VHT action frame. The access point (AP) or the wireless transmission / receiving unit (WTRU) can indicate the VHT capability with the signaling.

## 대표도면(Representative drawing)




## 청구의 범위

청구 **1**항:

무선 통신에서 사용하는 방법에 있어서,

초고처리율(Very High Throughput; VHT) 전송을 지원하도록 구성된 스테이션(station; STA)에서, VHT 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 전송과 관련된 것임 - 을 지원하기 위한 필드를 포함한 관리 동작 프레임을 수신하는 단계와;

수신된 관리 동작 프레임에 기초하여 운용 파라미터를 변경하는 단계

를 포함한, 무선 통신에서 사용하는 방법.

청구 **2**항:

제1항에 있어서, 상기 필드는 VHT 다중입력 다중출력 (multiple input multiple output; MIMO) 제어 필드인, 무선 통신에서 사용하는 방법.

청구 **3**항:

제2항에 있어서, VHT MIMO 제어 필드는 대역폭 구성을 표시하는 MIMO 제어 채널 폭 표시자를 포함한 것인, 무선 통신에서 사용하는 방법.

청구 **4**항:

제3항에 있어서, 대역폭 구성은 1차 채널과 관련된 VHT 다채널 전송을 위한 복수의 2차 채널을 포함한 것인, 무선 통신에서 사용하는 방법.

청구 **5**항:

제2항에 있어서, VHT MIMO 제어 필드는 복수의 직교 주파수 분할 다중화(orthogonal frequency division mutliplex; OFDM) 부반송파를 포함한 것이고, OFDM 부반송파는 세트로 그룹화된 것인, 무선 통신에서 사용하는 방법.

청구 **6**항:

제2항에 있어서, VHT MIMO 제어 필드는 채널 상태 정보 (channel state information; CSI) 또는 전송 빔포밍 피드백 매트릭스 내의 각 요소의 실수부와 허수부를 표시하는 복수의

## Scope of Claims

**Claim 1:**

The method for using in the wireless communication including the step

changing the operation parameter based on the administration action frame which the step :

receiving the administration action frame including the field where the VHT function manager - VHT function manager supports in the station (station: STA) which is configured to support

draft processing ratio (Very High Throughput: VHT) transmission as to the method for using in the wireless communication it is associated with the multi-channel discontinuous spectrum transmission is received.

**Claim 2:**

As for claim 1, the method which field uses in the VHT multiple input multiple output (multiple input multiple output: MIMO) control field phosphorus, and the wireless communication.

**Claim 3:**

The method for using in the wireless communication of claim 2, wherein the VHT MIMO control field comprises the MIMO control channel width indicator that indicates the bandwidth configuration.

**Claim 4:**

As for claim 3, the method for using in the wireless communication in which the bandwidth configuration includes the multiple secondary channels for the VHT multichannel transmission associated with the first channel.

**Claim 5:**

As for claim 2, the method for using in the wireless communication in which the OFDM subcarrier is grouped as set the VHT MIMO control field includes multiple orthogonal frequency division multiplex (orthogonal frequency division mutliplex: OFDM) subcarriers.

**Claim 6:**

The method for using in the wireless communication of claim 2, wherein the VHT MIMO control field comprises the multiple bits that indicates the real part of each ele

비트를 포함한 것인, 무선 통신에서 사용하는 방법.

ment within the channel state information (channel sta te information: CSI) or the transmission beamforming fe edback matrix and imaginary part.

청구 **7**항:

**Claim 7:**

제2항에 있어서, VHT MIMO 제어 필드는 압축 빔포밍 매트릭스 코드북 정보 사이즈를 포함한 것인 방법.

As for claim 2, the method in which the VHT MIMO control field includes the compression beam forming ma trix code book information size.

청구 **8**항:

**Claim 8:**

제2항에 있어서, VHT MIMO 제어 필드는 관련 측정 리포트의 나머지 세그멘트 번호를 표시하는 것인, 무선 통신에서 사용하는 방법.

As for claim 2, the method for using in the wireless communication in which the VHT MIMO control field indi cates the rest segment number of the related measure report.

청구 **9**항:

**Claim 9:**

제1항에 있어서,

사운딩 패킷을 수신하는 단계와;

관리 동작 프레임 내의 사운딩 패킷에 기초하여 피드백을 전송하는 단계

를 더 포함하고, VHT MIMO 제어 필드는 사운딩 패킷의 수신의 끝에 대응하는 사운딩 타임스탬프를 포함한 것인, 무선 통신에서 사용하는 방법.

As for claim 1, the method for using in the wireless communication which includes the sounding time stamp in which the VHT MIMO control field corresponds to the end of the reception of the sounding packet it further i ncludes the step

transmitting the feedback based on the sounding packe t of the step :

management operation in-frame receiving

sounding packet.

청구 **10**항:

**Claim 10:**

제1항에 있어서, 관리 동작 프레임은 압축 빔포밍 리포트 필드를 포함한 것인, 무선 통신에서 사용하는 방법.

As for claim 1, the method for using in the wireless communication in which the administration action frame includes the compression beam forming report field.

청구 **11**항:

**Claim 11:**

제10항에 있어서, 압축 빔포밍 리포트 필드는 STA의 평균 신호대 잡음비(signal to noise ratio; SNR)를 포함한 것인, 무선 통신에서 사용하는 방법.

As for claim 10, the method for using in the wireless communication in which the compression beam forming report field includes the average signal to noise ratio (s ignal to noise ratio: SNR) of STA.

청구 **12**항:

**Claim 12:**

제10항에 있어서, 압축 빔포밍 리포트 필드는 복수의 직교 주파수 분할 다중화(orthogonal frequency division multiplex; OFDM) 부반송파용의 빔포밍 피드백 매트릭스를 포함한 것인, 무선 통신에서 사용하는 방법.

As for claim 10, the method for using in the wireless communication in which the compression beam forming report field includes the beamforming feedback matrix f or the multiple orthogonal frequency division multiplex (orthogonal frequency division multiplex: OFDM) subcar riers.

청구 **13**항:

**Claim 13:**

제1항에 있어서, 상기 필드는 VHT 80 MHz 대역폭 전송, VHT 20 MHz 대역폭 전송 및 VHT 다채널 불연속 전송 중 적어도 하나를 포함한 하나 이상의 2차 채널 구성의 지원을 표시하는 값을 포함한 VHT 2차 채널 옵셋 필드인, 무선 통신에서 사용하는 방법.

As for claim 1, the method wherein field uses in the VHT secondary channel offset field phosphorus which i ncludes, and the wireless communication the value tha t expresses the support of at least one second channel configuration which includes at least one of the VHT 80 MHz bandwidth transmission, and the VHT 20 MHz band width transmission and VHT multi-channel discontinuou s transmission.

청구 **14**항:

제13항에 있어서, 2차 채널 옵셋 필드는 비콘 프레임, 프로브 응답 프레임, 연결 응답 프레임, 독립 기본 서비스 세트(basic service set; BSS)의 재연결 응답 프레임, 독립 BSS의 VHT 운용 IE, 독립 BSS의 채널 스위치 고지 동작 프레임, 또는 VHT 능력 IE에 포함된 것인, 무선 통신에서 사용하는 방법.

**Claim 14:**

As for claim 13, the method for using in the wireless communication in which the secondary channel offset field is included in the reassociation response frame of the beacon frame, probe response frame, connection response frame, the independence basic service set (basic service set: BSS), the VHT operation IE of the independent BSS, and the channel switch announcement operation frame or the VHT capability IE of the independent BSS.

청구 **15**항:

제1항에 있어서, 관리 동작 프레임은 VHT 무선 로컬 영역 네트워크(wireless local area network; WLAN)에서 20 MHz, 40 MHz, 80 MHz, 및 다채널 불연속 대역폭을 지원하기 위해 사용되는 VHT 통지 대역폭 구성 프레임인, 무선 통신에서 사용하는 방법.

**Claim 15:**

As for claim 1, the method for using in the VHT notification bandwidth organization frame phosphorus, and the wireless communication wherein the administration action frame is used to support 20 MHz in the VHT wireless local area network (wireless local area network: WLAN), 40 MHz, 80 MHz and the multi-channel discontinuity bandwidth.

청구 **16**항:

제15항에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 대역폭 구성 필드를 포함하고 STA에 보내진 프레임의 대역폭 구성을 변경하도록 전송되며, VHT 대역폭 구성 필드는 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 불연속 전송 중 적어도 하나의 지원을 표시하는 것인, 무선 통신에서 사용하는 방법.

**Claim 16:**

The method of claim 15, wherein the VHT notification bandwidth organization frame comprises the VHT bandwidth constituent field, and the VHT bandwidth constituent field the bandwidth configuration of the frame sent to STA is changed uses in the wireless communication which indicates the VHT 80 MHz bandwidth transmission, and at least one support among the VHT 40 MHz bandwidth transmission and VHT multi-channel discontinuous transmission.

청구 **17**항:

제1항에 있어서, 관리 동작 프레임은 서브타입 #39#확인응답(acknowledgement; ACK) 있는 동작#39# 또는 #39#ACK 없는 동작#39#의 것인, 무선 통신에서 사용하는 방법.

**Claim 17:**

As for claim 1, the method for using in the wireless communication in which the administration action frame is which there is no has of the operation '.

청구 **18**항:

제17항에 있어서, 관리 동작 프레임이 서브타입 #39#ACK 있는 동작#39#의 것인 조건하에 ACK를 전송하는 단계를 더 포함한, 무선 통신에서 사용하는 방법.

**Claim 18:**

As for claim 17, the method for using in the wireless communication which further includes the step of transmitting ACK in which it is the administration action frame having of the operation '.

청구 **19**항:

초고처리율(very high throughput; VHT) 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 운용과 관련된 것임 -을 지원하기 위한 필드를 포함한 관리 동작 프레임을 수신하도록 구성된 수신기와;

수신된 관리 동작 프레임에 기초하여 운용 파라미터를 변경하도록 구성된 프로세서

를 포함한 스테이션(station; STA).

**Claim 19:**

The station including the processor

which is configured to change the operation parameter based on the receiver which is configured to receive the administration action frame including the field where is associated with the multi-channel discontinuous spectrum operation the draft processing ratio (very high throughput: VHT) function manager - VHT function manager supports and the administration action frame which :

is received (station; STA).

청구 **20**항:

**Claim 20:**

초고처리율(very high throughput; VHT) 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 운용과 관련된 것임 -을 지원하기 위한 필드를 포함한 관리 동작 프레임을 전송하도록 구성된 송신기와;

관리 동작 프레임이 서브타입 #39#확인응답(acknowledgement; ACK) 있는 동작#39#의 것인 조건하에 관리 동작 프레임에 응답하여 ACK 프레임을 수신하도록 구성된 수신기

를 포함한 접근점(access point; AP).

The access point including the receiver

which is configured to receive the ACK frame in response to the administration action frame which is the transmitter which is configured to transmit the administration action frame including the field where is associated with the multi-channel discontinuous spectrum operation the draft processing ratio (very high throughput: VHT) function manager - VHT function manager supports and :

administration action frame having of the operation ' (access point; AP).

## 기술분야

## Technical Field

관련 출원에 대한 교차 참조

The cross reference about the related application.

본 출원은 2009년 11월 13일자 출원한 미국 가출원 제 61/261,197호를 우선권 주장하며, 이 우선권 출원의 내용은 인용에 의해 여기에 통합된다.

This application claims preference US61/261,197 A and it files an application with 2009 year November 13 here the content of this priority application is integrated by the quoting.

## 배경기술

## Background Art

더 높은 데이터율을 지원하는 것은 예컨대 무선 로컬 영역 네트워크(WLAN)를 비롯한 무선 통신 기술에서 오랫동안 목표가 되어왔다. WLAN 기반시설 기본 서비스 세트(basic service set; BSS) 모드는 BSS를 위한 접근점(AP) 및 이 AP와 관련된 하나 이상의 스테이션(station; STA)을 가질 수 있다. AP는 전형적으로 BSS 내외에서 트래픽을 담당하는 분산 시스템(DS) 또는 다른 유형의 유/무선 네트워크에 액세스하거나 또는 이들과 인터페이스 접속할 수 있다. BSS 밖으로부터 시작하는 STA에 대한 트래픽은 AP를 통해 도착하여 STA에 전달될 수 있다. STA로부터 시작하여 BSS 밖의 목적지로 향하는 트래픽은 AP로 보내진 다음 각각의 목적지로 전달될 수 있다.

It had been being goaled from for example, the radio transmission technology including the wireless local area network (WLAN) to for a long time to support the higher data rate. The WLAN infrastructure basic service set (basic service set: BSS) mode has the access point (AP) for BSS and at least one station (station: STA) associated with this AP. It accesses in the dissimilar wired/wireless network of the distributed system (DS) in which AP typically manages traffic in BSS in and out or the type or it can connect with interface. The traffic about STA started from the BSS outside arrives through AP and it can be delivered to STA. It starts from STA and after it is sent to AP the traffic going to the destination location of the BSS outside can be delivered to each destination location.

BSS 내에서 STA들 간의 트래픽은 AP를 통해 또한 보내질 수 있고, 이 경우 소스 STA가 트래픽을 AP에 보내고 AP는 트래픽을 목적지 STA에 전달한다. BSS 내에서 STA들 간의 이러한 트래픽은 피어투피어 트래픽이라고 부른다. 이러한 피어투피어 트래픽은 802.11e 직접 링크 설정(direct link setup; DLS) 또는 802.11z 터널형 DLS를 이용하는 직접 링크 설정에 의해 소스 STA와 목적지 STA 간에 직접 보내질 수도 있다. 독립 BSS 모드에서의 WLAN은 서로 간에 직접 통신하는 AP와 STA를 갖지 않을 수 있다.

Traffic between STA can be moreover sent in BSS through AP and in this case, the source STA sends traffic to AP and AP delivers traffic to the destination location STA. Such traffic between STA calls the peer-to-peer traffic in BSS. Such peer-to-peer traffic can be directly sent with 802.11e direct link establishment (direct link setup: DLS) or the direct link establishment using 802.11z tunnel type DLS between the source STA and destination location STA. WLAN at the independent BSS mode does not have the direct AP communicating and STA on the liver.

802.11 표준의 가장 조기의 버전은 1 Mbps의 데이터율을 제공하였다. 후속 개정판, 즉 802.11b는 11 Mbps의 물리층 데이터율을 제공하였다. 2.4 GHz 및 5 GHz 대역을 위한 802.11g 및 802.11a 개정판에서 각각 직교 주파수 분할 다중화(OFDM)를 도입함으로써, 지원되는 데이터율은 PHY 층에서 54 Mbps까지 증가하였다. 802.11n 개정판은 지원되는 데이터율을 최상위 MAC 계층에서 100 Mbps까지 증가시켰다. 그러나, 100 Mbps 이상의 데이터율을 지원하도록 구성된 방법 및 장치를 갖는 것이 바람직하다.

The version of the early most provided data rate of 1 Mbps of 802.11 standard. The following revision edition, in other words, 802.11b provided the physical layer data rate of 11 Mbps. In 802.11g for 2.4 GHz and 5 GHz band and 802.11a revision edition, the orthogonal frequency division multiplex (OFDM) was introduced. In that way the supported data rate increased in the PHY layer to 54 Mbps. The data rate in which 802.11n revision edition was supported was increased in the highest MAC layer to 100 Mbps. But it is the be desirable to have method and apparatus which are configured to support

at least 100Mbps data rate.

## 발명을 실시하기 위한 구체적인 내용

## Description of Embodiments

도 1a는 하나 이상의 본 발명의 실시형태를 구현할 수 있는 예시적인 통신 시스템(100)을 보인 도이다. 통신 시스템(100)은 복수의 무선 사용자에게 음성, 데이터, 영상, 메시지, 방송 등의 콘텐트를 제공하는 다중 접속 시스템일 수 있다. 통신 시스템(100)은 복수의 무선 사용자들이 무선 대역폭을 포함한 시스템 리소스를 공유함으로써 상기 콘텐트에 접근할 수 있게 한다. 예를 들면, 통신 시스템(100)은 코드 분할 다중 접속(CDMA), 시분할 다중 접속(TDMA), 주파수 분할 다중 접속(FDMA), 직교 FDMA(OFDMA), 단일 반송파 FDMA(SC-FDMA) 등과 같은 하나 이상의 채널 접속 방법을 이용할 수 있다.

Figure 1a is drawing showing the illustrative communication system (100) implementing the embodiment of at least one the invention. It can be the multiple-access system in which the communication system (100) provides the content of the voice, data, the image, the message, the broadcast etc for multiple mobile users. Since multiple mobile users share the system resource including the wireless bandwidth the communication system (100) approaches the content. For example, the communication system (100) can use at least one method for channel connection like the code division multiple access (CDMA), the time-division multiple access (TDMA), the frequency multiplex connection (FDMA), the orthogonal FDMA (OFDMA), the single carrier FDMA (SC-FDMA) etc.

도 1a에 도시된 것처럼, 통신 시스템(100)은 무선 송신/수신 유닛(WTRU)(102a, 102b, 102c, 102d), 무선 접근 네트워크(RAN)(104), 코어 네트워크(106), 공중 교환식 전화망(PSTN)(108), 인터넷(110) 및 기타의 네트워크(112)를 포함하고 있지만, 본 발명의 실시형태는 임의 수의 WTRU, 기지국, 네트워크 및/또는 네트워크 요소를 포함할 수 있다는 것을 이해할 것이다. 각 WTRU(102a, 102b, 102c, 102d)는 무선 환경에서 동작 및/또는 통신하도록 구성된 임의 유형의 장치일 수 있다. 예를 들면, WTRU(102a, 102b, 102c, 102d)는 무선 신호를 송신 및/또는 수신하도록 구성되고 사용자 장비(UE), 이동국, 고정식 또는 이동식 가입자 유닛, 페이저, 셀룰러 전화기, 개인 정보 단말기(PDA), 스마트폰, 랩톱, 넷북, 퍼스널 컴퓨터, 무선 센서, 소비자 전자제품 등을 포함할 수 있다.

The communication system (100) is illustrated in the drawing 1a comprises the wireless transmission / receiving unit (WTRU) (102a, 102b, 102c, 102d), the radio access network (RAN) (104), the core network (106), the public switched telephone network (PSTN) (108), the internet (110) and miscellaneous network (112). And the embodiment of the invention will understand WTRU of the random number, the base station, and the network and/or the maying include the network element thing. In each WTRU (102a, 102b, 102c, 102d) is the radio environment, it can be the apparatus of the operation and/or the arbitrary type which is configured to communicate. For example, WTRUs (102a, 102b, 102c, 102d) may include the transmission and/or the user equipment (UE) the radio signal, the mobile station, and the fixed type or the transportable subscriber unit, the pager, the cell phone, the personal data assistant (PDA), the smartphone, the laptop, the netbook, the personal computer, the radio frequency sensor, the consumer electronics etc it is configured to receive.

통신 시스템(100)은 기지국(114a, 114b)을 또한 포함할 수 있다. 각 기지국(114a, 114b)은 적어도 하나의 WTRU(102a, 102b, 102c, 102d)와 무선으로 인터페이스 접속하여 코어 네트워크(106), 인터넷(110) 및/또는 네트워크(112) 등의 하나 이상의 통신 네트워크에 액세스하도록 구성된 임의 유형의 장치일 수 있다. 예를 들면, 기지국(114a, 114b)은 베이스 송수신기 스테이션(BTS), 노드-B, e노드 B, 홈 노드 B, 사이트 제어기, 접근점(AP), 무선 라우터 등일 수 있다. 비록 기지국(114a, 114b)이 각각 단일 요소로서 도시되어 있지만, 기지국(114a, 114b)은 임의 수의 상호접속된 기지국 및/또는 네트워크 요소를 포함할 수 있다는 것을 이해할 것이다.

The communication system (100) moreover may include base stations (114a, 114b). Each base station (114a, 114b) can be the apparatus of the arbitrary type which is the interface connect and which it wirelessly is configured to access in at least one communication network including the core network (106), the internet (110) and/or the network (112) etc. and at least one WTRUs (102a, 102b, 102c, 102d). For example, base stations (114a, 114b) can be the base transceiver station (BTS), node -B, E node-B, groove node-B, site controller, access point (AP), the wireless router etc. Base stations (114a, 114b) are even if respectively illustrated as the single element. However base stations (114a, 114b) will understand the interconnected base station of the random number and/or the maying include the network element.

기지국(114a)은 RAN(104)의 일부일 수 있고, RAN(104)은 기지국 제어기(BSC), 라디오 네트워크 제어기(RNC), 중계 노드 등과 같은 다른 기지국 및/또는 네트워크 요소(도시 생략됨)를 또한 포함할 수 있다. 기지국(114a 및/또는 114b)은 셀(도

The base station (114a) can be the part of the RAN (104) and the RAN (104) moreover may include the base station and/or the dissimilar network element (it is abbreviated) including the base station controller (BSC), t

시 생략됨)이라고도 부르는 특정의 지리적 영역 내에서 무선 신호를 송신 및/또는 수신하도록 구성될 수 있다. 셀은 복수의 셀 섹터로 세분될 수 있다. 예를 들면, 기지국(114a)과 관련된 셀은 3개의 섹터로 나누어질 수 있다. 따라서, 일 실시형태에 있어서, 기지국(114a)은 셀의 각 섹터마다 하나씩 3개의 송수신기를 포함할 수 있다. 다른 실시형태에 있어서, 기지국(114a)은 다중입력 다중출력(MIMO) 기술을 사용할 수 있고, 따라서 셀의 각 섹터마다 복수의 송수신기를 사용할 수 있다.

he radio network controller (RNC), the transit node etc. The radio signal is configured to be received in the specific geographic area which the base station (114a and/or 114b) calls (it is abbreviated) and/or the transmission. It can be subdivided by multiple cell sectors. For example, associated with the base station (114a) can be divided into the sector of 3. Therefore, as to one embodiment, the base station (114a) one by one may include the transceiver of 3 at the angular sector of NULL. As to another operating type, the base station (114a) can use the multiple input multiple output (MIMO) technology and therefore multiple transceivers can be used at the angular sector of NULL.

기지국(114a, 114b)은 임의의 적당한 무선 통신 링크(예를 들면, 라디오 주파수(RF), 마이크로파, 적외선(IR), 자외선(UV), 가시광선 등)일 수 있는 무선 인터페이스(116)를 통하여 하나 이상의 WTRU(102a, 102b, 102c, 102d)과 통신할 수 있다. 무선 인터페이스(116)는 임의의 적당한 무선 접근 기술(RAT)을 이용하여 확립될 수 있다.

Base stations (114a, 114b) can communicate through *** (116) maying be the fit wireless communication link (for example, the radio frequency (RF), microwave, infrared ray (IR), ultraviolet ray (UV), the visible ray etc) with at least one WTRUs (102a, 102b, 102c, 102d). *** (116) can be established using the fit radio access technology (RAT).

더 구체적으로, 위에서 언급한 것처럼, 통신 시스템(100)은 다중 접근 시스템일 수 있고, CDMA, TDMA, FDMA, OFDMA, SC-FDMA 등과 같은 하나 이상의 채널 접근 방식을 이용할 수 있다. 예를 들면, RAN(104) 내의 기지국(114a)과 WTRU(102a, 102b, 102c)는 광대역 CDMA(WCDMA)를 이용하여 무선 인터페이스(116)를 확립하는 범용 이동통신 시스템(UMTS) 지상 라디오 액세스(UTRA)와 같은 라디오 기술을 구현할 수 있다. WCDMA는 고속 패킷 액세스(HSPA) 및/또는 진화형 HSPA(HSPA+)와 같은 통신 프로토콜을 포함할 수 있다. HSPA는 고속 다운링크 패킷 액세스(HSDPA) 및/또는 고속 업링크 패킷 액세스(HSUPA)를 포함할 수 있다.

More specifically, as it mentions in the upper part. The communication system (100) can be the multiaccess system and at least one channel access mode like the CDMA, TDMA, FDMA, OFDMA, the SC-FDMA etc can be used. For example, the radio technology like the universal mobile telecommunications system (UMTS) ground radio access (UTRA) in which the base station (114a) within the RAN (104) and WTRUs (102a, 102b, 102c) establishes *** (116) using the broadband CDMA (WCDMA) can be implemented. WCDMA may include the communication protocol like the fast packet access (HSPA) and/or the apomorph HSPA (HSPA+). HSPA may include the high speed downlink packet access (HSDPA) and/or the high speed uplink packet access (HSUPA).

다른 실시형태에 있어서, 기지국(114a)과 WTRU(102a, 102b, 102c)는 롱텀 에볼루션(LTE) 및/또는 LTE-어드반스드(LTE-A)를 이용하여 무선 인터페이스(116)를 확립하는 진화형 UMTS 지상 라디오 액세스(E-UTRA)와 같은 라디오 기술을 구현할 수 있다.

As to another operating type, the radio technology like the apomorph UMTS ground radio access (E-UTRA) in which the base station (114a) and WTRUs (102a, 102b, 102c) establish *** (116) using the long-term evolution (LTE) and/or the LTE- *** (LTE-A) can be implemented.

다른 실시형태에 있어서, 기지국(114a)과 WTRU(102a, 102b, 102c)는 전기 전자 기술자 연구소(IEEE) 802.16(즉, WiMAX(Worldwide Interoperability for Microwave Access)), CDMA2000, CDMA2000 1X, CDMA2000 EV-DO, 임시(Interim) 표준 2000(IS-2000), 임시 표준 95(IS-95), 임시 표준 856(IS-856), 글로벌 이동통신 시스템(GSM), EDGE (Enhanced Data rates for GSM Evolution), GSM EDGE (GERAN) 등과 같은 라디오 기술을 구현할 수 있다.

As to another operating type, the base station (114a) and WTRUs (102a, 102b, 102c) can implement the radio technology like the electricity electronic technical engineer research institute (IEEE) 802.16 (in other words, the WiMAX (Worldwide Interoperability for Microwave Access)), CDMA2000, CDMA2000 1X, CDMA2000 EV-DO, provisional (Interim) standard 2000 (IS-2000), interim standard 95 (IS-95), interim standard 856 (IS-856), global system for mobile communication (GSM), the EDGE (Enhanced Data rates for GSM Evolution), the GSM EDGE (GERAN) etc.

도 1a의 기지국(114b)은 예를 들면 무선 라우터, 홈 노드 B, 홈 e노드B, 또는 접근점일 수 있고, 사업장, 홈, 자동차, 캠퍼스 등과 같은 국소 지역에서 무선 접속을 가능하게 하는 임의의 적당한 RAT를 이용할 수 있다. 일 실시형태에 있어서, 기지국(114b)과 WTRU(102c, 102d)는 IEEE 802.11과 같은 라디오 기술을 구현하여 무선 로컬 영역 네트워크(WLAN)를 확립

The base station (114b) of the drawing 1a can be for example, the wireless router, the groove node-B, and the groove e node-B or the access point and fit RAT making the wireless access possible in the local area like the place of business, groove, vehicle, the campus etc can be used. As to one embodiment, the base station

할 수 있다. 다른 실시형태에 있어서, 기지국(114b)과 WTRU (102c, 102d)는 IEEE 802.15와 같은 라디오 기술을 구현하여 무선 개인 영역 네트워크(WPAN)를 확립할 수 있다. 또 다른 실시형태에 있어서, 기지국(114b)과 WTRU(102c, 102d)는 셀룰러 기반 RAT(예를 들면, WCDMA, CDMA2000, GSM, LTE, LTE-A 등)를 이용하여 피코셀 또는 펨토셀을 확립할 수 있다. 도 1a에 도시된 바와 같이, 기지국(114b)은 인터넷(110)에 직접 접속될 수 있다. 그러므로, 기지국(114b)은 코어 네트워크(106)를 통해 인터넷(110)에 액세스할 필요가 없다.

(114b) and WTRUs (102c, 102d) implement the radio technology like the IEEE 802.11 and the wireless local area network (WLAN) can be established. As to another operating type, the base station (114b) and WTRUs (102c, 102d) implement the radio technology like the IEEE 802.15 and the wireless personal area network (WPAN) can be established. And as to another operating type, the base station (114b) and WTRUs (102c, 102d) can establish the picocell or the femtocell using the cellular base RAT (for example, the WCDMA, the CDMA2000, GSM, LTE, the LTE-A etc). As shown in FIG. 1a, the base station (114b) can be directly connected to the internet (110). Therefore, the base station (114b) does not have to access in the internet (110) through the core network (106).

RAN(104)은 코어 네트워크(106)와 통신하고, 코어 네트워크(106)는 하나 이상의 WTRU(102a, 102b, 102c, 102d)에게 음성, 데이터, 애플리케이션 및/또는 인터넷 프로토콜을 통한 음성(VoIP) 서비스를 제공하도록 구성된 임의 유형의 네트워크일 수 있다. 예를 들면, 코어 네트워크(106)는 호출 제어, 빌링(billing) 서비스, 모바일 위치 기반 서비스, 선불 통화, 인터넷 접속, 영상 분배 등을 제공할 수 있고, 및/또는 사용자 인증과 같은 고급 보안 기능을 수행할 수 있다. 비록 도 1a에 도시되어 있지 않지만, RAN(104) 및/또는 코어 네트워크(106)는 RAN(104)과 동일한 RAT 또는 다른 RAT를 이용하는 다른 RAN과 직접 또는 간접 통신을 할 수 있다는 것을 이해할 것이다. 예를 들면, E-UTRA 라디오 기술을 이용하는 RAN(104)에 접속되는 것 외에, 코어 네트워크(106)는 GSM 라디오 기술을 이용하는 다른 RAN(도시 생략됨)과도 또한 통신할 수 있다.

The RAN (104) communicates with the core network (106) and it can be the network of the arbitrary type in which the core network (106) is configured to provide voice, data, and the voice (VoIP) service through the application and/or the internet protocol to at least one WTRUs (102a, 102b, 102c, 102d). For example, the core network (106) controls call and the billing service, mobile location based service, advance payment call, internet connection, the image distribution etc can be provided and the high-class security function such as the / and user authentication can be performed. Is not even if illustrated in the drawing 1a. However it will understand doing dissimilar RAN in which the RAN (104) and/or the core network (106) uses the same RAT as the RAN (104) or dissimilar RAT and direct or the indirect communication. For example, it is connected to the RAN (104) using the E-UTRA radio technology. Besides moreover can communicate with the dissimilar RAN (it is abbreviated) in which the core network (106) uses the GSM radio technology.

코어 네트워크(106)는 WTRU(102a, 102b, 102c, 102d)가 PSTN(108), 인터넷(110) 및/또는 기타 네트워크(112)에 액세스하게 하는 게이트웨이로서 또한 기능할 수 있다. PSTN(108)은 재래식 전화 서비스(POTS)를 제공하는 회선 교환식 전화망을 포함할 수 있다. 인터넷(110)은 TCP/IP 인터넷 프로토콜 스위트(suite)에서 전송 제어 프로토콜(TCP), 사용자 데이터그램 프로토콜(UDP) 및 인터넷 프로토콜(IP)과 같은 공통의 통신 프로토콜을 이용하는 상호접속된 컴퓨터 네트워크 및 장치의 글로벌 시스템을 포함할 수 있다. 네트워크(112)는 다른 서비스 공급자에 의해 소유 및/또는 운용되는 유선 또는 무선 통신 네트워크를 포함할 수 있다. 예를 들면, 네트워크(112)는 RAN(104)과 동일한 RAT 또는 다른 RAT를 이용하는 하나 이상의 RAN에 접속된 다른 코어 네트워크를 포함할 수 있다.

The core network (106) moreover can function as the gateway which WTRUs (102a, 102b, 102c, 102d) access in the PSTN (108), and the internet (110) and/or the other network (112). The call switching equation telephone network in which the PSTN (108) provides the plain old telephone service (POTS) is include might. The internet (110) comprises the transmission control protocol (TCP) in the TCP / IP internet protocol suite, and the user datagram protocol (UDP) and the global system mobile of the interconnected computer network using the communication protocol of the common like the internet protocol (IP) and apparatus thereof. Ownership and/or wire or the used wireless communication network is include might with the service provider in which the network (112) is different. For example, the network (112) comprises the RAN (104) and the dissimilar core network which is connected to at least one RAN using the same RAT or dissimilar RAT.

통신 시스템(100)의 WTRU(102a, 102b, 102c, 102d)의 일부 또는 전부는 다중 모드 능력을 구비할 수 있다. 즉, WTRU (102a, 102b, 102c, 102d)는 다른 무선 링크를 통하여 다른 무선 네트워크와 통신하기 위한 복수의 송수신기를 포함할 수 있다. 예를 들면, 도 1a에 도시된 WTRU(102c)는 셀룰러 기반 라디오 기술을 이용할 수 있는 기지국(114a) 및 IEEE 802 라디오 기술을 이용할 수 있는 기지국(114b)과 통신하도록 구성될 수 있다.

A portion or the whole of WTRUs (102a, 102b, 102c, 102d) of the communication system (100) can include the multiplex mode capability. That is, WTRUs (102a, 102b, 102c, 102d) comprises the wireless network different through the dissimilar radio link and the multiple transceivers for communicating. For example, it is configured to communicate with the base station (114a) in which the WTRU (102c) illustrated in Figure 1a can use the cellular base radio technology and the base station (11

4b) using the IEEE 802 radio technology.

도 1b는 예시적인 WTRU(102)의 계통도이다. 도 1b에 도시된 바와 같이, WTRU(102)는 프로세서(118), 송수신기(120), 송신/수신 엘리멘트(122), 스피커/마이크로폰(124), 키패드(126), 디스플레이/터치패드(128), 비분리형 메모리(130), 분리형 메모리(132), 전원(134), 글로벌 위치추적 시스템(GPS) 칩세트(136) 및 기타 주변장치(138)를 포함할 수 있다. WTRU(102)는 실시형태의 일관성을 유지하면서 전술한 요소들의 임의의 부조합(sub-combination)을 포함할 수 있다.

Figure 1b is a schematic diagram of the illustrative WTRU (102). As shown in FIG. 1b, the WTRU (102) comprises the processor (118), the transceiver (120), the transmission / reception element (122), the speaker / microphone (124), the keypad (126), the display / touch pad (128), the non-removable memory (130), the de coupling-type memory (132), the power source (134), the global positioning system (GPS) chip set (136) and the other peripherals (138). The arbitrary sub-combination of the elements which describe in the above while the WTRU (102) maintains the consistency of the embodiment is include might.

프로세서(118)는 범용 프로세서, 특수 용도 프로세서, 전통적 프로세서, 디지털 신호 프로세서(DSP), 복수의 마이크로프로세서, DSP 코어와 연결(association)하는 하나 이상의 마이크로프로세서, 컨트롤러, 마이크로컨트롤러, 용도 지정 집적회로(ASIC), 현장 프로그램가능 게이트 어레이(FPGA) 회로, 임의의 다른 유형의 집적회로(IC), 상태 머신 등일 수 있다. 프로세서(118)는 신호 부호화, 데이터 처리, 전력 제어, 입력/출력 처리, 및/또는 WTRU(102)가 무선 환경에서 동작하게 하는 임의의 다른 기능을 수행할 수 있다. 프로세서(118)는 송수신기(120)에 결합되고, 송수신기(120)는 송신/수신 엘리멘트(122)에 결합될 수 있다. 비록 도 1b에서는 프로세서(118)와 송수신기(120)가 별도의 구성요소로서 도시되어 있지만, 프로세서(118)와 송수신기(120)는 전자 패키지 또는 칩으로 함께 통합될 수 있음을 이해할 것이다.

It can be at least one microprocessor, controller, microcontroller, usage designation integrated circuit (ASIC), field programmable gate array (FPGA) circuit, which the processor (118) does with the universal processor, special purpose processor, conventional processor, digital signal processor (DSP), the multiple microprocesors, DSP core and connection (association) the dissimilar integrated circuit (IC) of the disposable type, the state machine etc. The processor (118) can perform signal encoding, data processing, power control, the input/output processing and / and the dissimilar function in which the WTRU (102) operates in the radio environment. The processor (118) is combined in the transceiver (120) and the transceiver (120) can be combined in the transmission / reception element (122). In even if, the drawing 1b, the processor (118) and transceiver (120) are illustrated as the separate element. However it will understand that the processor (118) and transceiver (120) can be together integrated into the electronics package or the chip.

송신/수신 엘리멘트(122)는 무선 인터페이스(116)를 통하여 기지국(예를 들면 기지국(114a))에 신호를 전송하거나 상기 기지국으로부터 신호를 수신하도록 구성된다. 예를 들면, 일 실시형태에 있어서, 송신/수신 엘리멘트(122)는 RF 신호를 송신 및/또는 수신하도록 구성된 안테나일 수 있다. 다른 실시형태에 있어서, 송신/수신 엘리멘트(122)는 예를 들면, IR, UV 또는 가시광 신호를 송신 및/또는 수신하도록 구성된 에미터/검지기일 수 있다. 또 다른 실시형태에 있어서, 송신/수신 엘리멘트(122)는 RF 신호와 광신호 둘 다를 송신 및 수신하도록 구성될 수 있다. 송신/수신 엘리멘트(122)는 임의의 무선 신호 조합을 송신 및/또는 수신하도록 구성될 수 있다는 것을 이해할 것이다.

Signal are transmitted through *** (116) in the base station (for example, the base station (114a)) or the transmission / reception element (122) is configured to receive signal from the base station. For example, as to one embodiment, the transmission / reception element (122) can be the radio frequency signal the transmission and/or the antenna which is configured to receive. As to another operating type, the transmission / reception element (122) can be for example, IR, and UV or the visible light signal the transmission and/or the emitter / detector which it is configured to receive. And as to an other operating type, the transmission / reception element (122) can be the radio frequency signal and the optical signal both composed with *** primer lock. The transmission / reception element (122) will understand the transmission and/or the configured to receiving thing the arbitrary radio signal combination.

또한, 비록 송신/수신 엘리멘트(122)가 도 1b에서 단일 엘리멘트로서 도시되어 있지만, WTRU(102)는 임의 수의 송신/수신 엘리멘트(122)를 포함할 수 있다. 더 구체적으로, WTRU(102)는 MIMO 기술을 이용할 수 있다. 따라서, 일 실시형태에 있어서, WTRU(102)는 무선 인터페이스(116)를 통해 무선 신호를 송신 및 수신하기 위해 2개 이상의 송신/수신 엘리멘트(122)(예를 들면, 다중 안테나)를 포함할 수 있다.

Moreover, even if, the transmission / reception element (122) may include the WTRU (102) is the transmission / reception element (122) of the random number is illustrated in the drawing 1b as the single element. More specifically, the WTRU (102) can use the MIMO technology. Therefore, as to one embodiment, the WTRU (102) is for the radio signal through *** (116) with *** and the transmission / reception element (122) (for example, the multiple antenna) more than 2 is include might.

송수신기(120)는 송신/수신 엘리멘트(122)에 의해 송신할 신

Signals transmitted a message are configured to be

호들을 변조하고 송신/수신 엘리멘트(122)에 의해 수신된 신호를 복조하도록 구성될 수 있다. 전술한 바와 같이, WTRU(102)는 다중 모드 능력을 구비할 수 있다. 따라서, 송수신기(120)는 WTRU(102)가 예를 들면 UTRA 및 IEEE 802.11과 같은 복수의 RAT를 통하여 통신하게 하는 복수의 송수신기를 포함할 수 있다.

modulated with the transmission / reception element (122) and the transceiver (120) is configured to demodulate the received signal with the transmission / reception element (122). As described above, the WTRU (102) can include the multiplex mode capability. Therefore, the transceiver (120) comprises the WTRU (102), for example, UTRA and the multiple transceivers communicating through a plurality of RATs such as the IEEE 802.11.

WTRU(102)의 프로세서(118)는 스피커/마이크로폰(124), 키패드(126), 및/또는 디스플레이/터치패드(128)(예를 들면, 액정 디스플레이(LCD) 표시 장치 또는 유기 발광 다이오드(OLED) 표시 장치)에 결합되어 이들로부터 사용자 입력 데이터를 수신할 수 있다. 프로세서(118)는 또한 스피커/마이크로폰(124), 키패드(126), 및/또는 디스플레이/터치패드(128)에 사용자 데이터를 출력할 수 있다. 또한, 프로세서(118)는 비분리형 메모리(130) 및/또는 분리형 메모리(132)와 같은 임의 유형의 적당한 메모리로부터 정보를 액세스하고 상기 적당한 메모리에 데이터를 저장할 수 있다. 비분리형 메모리(130)는 랜덤 액세스 메모리(RAM), 읽기 전용 메모리(ROM), 하드 디스크 또는 임의의 다른 유형의 메모리 기억장치를 포함할 수 있다. 분리형 메모리(132)는 가입자 식별 모듈(SIM) 카드, 메모리 스틱, 보안 디지털(SD) 메모리 카드 등을 포함할 수 있다. 다른 실시형태에 있어서, 프로세서(118)는 서버 또는 홈 컴퓨터(도시 생략됨)와 같이 WTRU(102)에 물리적으로 위치되지 않은 메모리로부터 정보를 액세스하고 그러한 메모리에 데이터를 저장할 수 있다.

It is combined in the display / touch pad (128) (for example, the liquid crystal display (LCD) display device or the organic light emitting diode (OLED) display device) and the processor (118) of the WTRU (102) can receive user input data from these. The processor (118) can output user data to the display / touch pad (128). Moreover, the processor (118) can access the information from the memory of being appropriate of the arbitrary type like the non-removable memory (130) and/or the decoupling-type memory (132) and data can be stored in the above-mentioned memory of being appropriate. The non-removable memory (130) may include the random access memory (RAM), the read only memory (ROM), and the dissimilar memory store of the hard disk or the disposable type. The decoupling-type memory (132) may include the subscriber identity module (SIM) card, the memory stick, the security digital (SD) memory card etc. As to another operating type, the processor (118) can access the information from memory which are not physically located like the server or the home computer (it is abbreviated) in the WTRU (102) and data can be stored in that memory.

프로세서(118)는 전원(134)으로부터 전력을 수신하고, WTRU(102)의 각종 구성요소에 대하여 전력을 분배 및/또는 제어하도록 구성될 수 있다. 전원(134)은 WTRU(102)에 전력을 공급하는 임의의 적당한 장치일 수 있다. 예를 들면, 전원(134)은 하나 이상의 건전지 배터리(예를 들면, 니켈-카드뮴(NiCd), 니켈-아연(NiZn), 니켈 금속 하이드라이드(NiMH), 리튬-이온(Li-ion) 등), 태양 전지, 연료 전지 등을 포함할 수 있다.

The processor (118) receives electricity from the power source (134) and electricity is configured to be controlled about the various kinds configuration element of the WTRU (102) and/or dispersion. It can be the fit apparatus in which the power source (134) supplies electricity to the WTRU (102). For example, the power source (134) may include at least one dry cell battery ***, the solar cell, the fuel cell etc.

프로세서(118)는 WTRU(102)의 현재 위치에 관한 위치 정보(예를 들면, 경도 및 위도)를 제공하도록 구성된 GPS 칩세트(136)에 또한 결합될 수 있다. GPS 칩세트(136)로부터의 정보에 추가해서 또는 그 대신으로, WTRU(102)는 기지국(예를 들면 기지국(114a, 114b))으로부터 무선 인터페이스(116)를 통해 위치 정보를 수신하고, 및/또는 2개 이상의 인근 기지국으로부터 신호가 수신되는 타이밍에 기초하여 그 위치를 결정할 수 있다. WTRU(102)는 실시형태의 일관성을 유지하면서 임의의 적당한 위치 결정 방법에 의해 위치 정보를 획득할 수 있다른 것을 이해할 것이다.

It the moreover can be combined in the GPS chip set (136) in which the processor (118) is configured to provide location information (for example, the hardness and latitude) about the current position of the WTRU (102). It adds to the information from the GPS chip set (136) and or the WTRU (102) receives the location information to the Representation from base stations (for example, base stations (114a, 114b)) through *** (116) and the position can be determined based on the timing when the signal is received from the base station more than the / or 2. The number *** will be understood obtains the location information with fit *** while the WTRU (102) maintains the consistency of the embodiment.

프로세서(118)는 추가의 특징, 기능 및/또는 유선 또는 무선 접속을 제공하는 하나 이상의 소프트웨어 및/또는 하드웨어 모듈을 포함한 기타 주변 장치(138)에 또한 결합될 수 있다. 예를 들면, 주변 장치(138)는 가속도계, e-콤파스, 위성 송수신기, 디지털 카메라(사진용 또는 영상용), 범용 직렬 버스(USB) 포트, 진동 장치, 텔레비전 송수신기, 핸즈프리 헤드셋, 블루투스? 모듈, 주파수 변조(FM) 라디오 장치, 디지털 뮤직 플레이어, 미디어 플레이어, 비디오 게임 플레이어 모듈, 인터넷 브라우저 등을 포함할 수 있다.

It the moreover can be combined in the other peripherals (138) in which the processor (118) includes the additional characteristic, and at least one software and/or the hardware module providing the function and/or wire or the wireless access. For example, the peripheral device (138) is the accelerometer, E- compass, satellite-based transceiver, the digital camera (the photo or the image dragon), universal serial bus (USB) port, vibrator, television transceiver, hands-free head set, bluetooth.

도 1c는 실시형태에 따른 RAN(104) 및 코어 네트워크(106)의 계통도이다. 전술한 바와 같이, RAN(104)은 E-UTRA 라디오 기술을 이용하여 무선 인터페이스(116)를 통해 WTRU(102a, 102b, 102c)와 통신할 수 있다. RAN(104)은 코어 네트워크(106)와 또한 통신할 수 있다.

Figure 1c is a schematic diagram of the core network (106) and RAN (104) according to the embodiment. As described above, the RAN (104) can communicate using the E-UTRA radio technology through *** (116) with WTRUs (102a, 102b, 102c). The RAN (104) moreover can communicate with the core network (106).

RAN(104)이 e노드-B(140a, 140b, 140c)를 포함하고 있지만, RAN(104)은 실시형태의 일관성을 유지하면서 임의 수의 e노드-B를 포함할 수 있다는 것을 이해할 것이다. e노드-B(140a, 140b, 140c)는 무선 인터페이스(116)를 통하여 WTRU(102a, 102b, 102c)와 통신하는 하나 이상의 송수신기를 각각 포함할 수 있다. 일 실시형태에 있어서, e노드-B(140a, 140b, 140c)는 MIMO 기술을 구현할 수 있다. 따라서, 예를 들면 e노드-B(140a)는 복수의 안테나를 사용하여 WTRU(102a)에 무선 신호를 전송하고 WTRU(102a)로부터 무선 신호를 수신할 수 있다.

The RAN (104) includes e node - Bs (140a, 140b, 140c). However it will understand while the RAN (104) maintains the consistency of the embodiment maying include the e node -B of the random number. At least one transceiver in which e node - Bs (140a, 140b, 140c) communicate through *** (116) with WTRUs (102a, 102b, 102c) can be included. As to one embodiment, E node - Bs (140a, 140b, 140c) can implement the MIMO technology. Therefore, for example, the e node - B (140a) can transmit the radio signal using multiple antennae in the WTRU (102a) and the radio signal can be received from the WTRU (102a).

각각의 e노드-B(140a, 140b, 140c)는 특정 셀(도시 생략됨)과 관련될 수 있고, 라디오 리소스 관리 결정, 핸드오버 결정, 업링크 및/또는 다운링크에서 사용자의 스케줄링 등을 취급하도록 구성될 수 있다. 도 1c에 도시된 바와 같이, e노드-B(140a, 140b, 140c)는 X2 인터페이스를 통해 서로 통신할 수 있다.

Each e node - Bs (140a, 140b, 140c) can relate to the specific cell (it is abbreviated) and the scheduling of the user etc. is configured to be handled in the radio resource management Decision, the handover decision, and the up-link and/or the down-link. As shown in FIG. 1c, E node - Bs (140a, 140b, 140c) can communicate through the X2 interface.

도 1c에 도시된 코어 네트워크(106)는 이동도 관리 게이트웨이(MME)(142), 서빙 게이트웨이(144) 및 패킷 데이터 네트워크(PDN) 게이트웨이(146)를 포함할 수 있다. 전술한 요소들이 각각 코어 네트워크(106)의 일부로서 도시되어 있지만, 이들 요소들 중 임의의 요소는 코어 네트워크 운용자가 아닌 다른 엔티티에 의해 소유되거나 운용될 수 있다는 것을 이해할 것이다.

The core network (106) illustrated in Figure 1c comprises the movement is the administration gateway (MME) (142), and the serving gateway (144) and the packet data network (PDN) gateway (146). Above-described elements are respectively illustrated as the part of the core network (106). However it will understand the arbitrary element being possessed among these elements with the dissimilar entity which is not core network operator or being used.

MME(142)는 S1 인터페이스를 통해 RAN(104) 내의 각각의 e노드-B(140a, 140b, 140c)에 접속될 수 있고, 제어 노드로서 기능할 수 있다. 예를 들면, MME(142)는 WTRU(102a, 102b, 102c)의 사용자를 인증하고, 베어러를 활성화/비활성화하고, WTRU(102a, 102b, 102c)의 초기 접속중에 특정의 서빙 게이트웨이를 선택하는 등의 임무를 수행한다. MME(142)는 또한 GSM 또는 WCDMA와 같은 다른 라디오 기술을 이용하는 다른 RAN(도시 생략됨)과 RAN(104) 간의 스위칭을 위한 제어 평면 기능(control plane function)을 또한 제공할 수 있다.

The MME (142) can be connected to each e node - Bs (140a, 140b, 140c) within the RAN (104) through the S1 interface and it can function as the control node. For example, the MME (142) authenticates the user of WTRUs (102a, 102b, 102c) and the bearer is inactivated with the activation / and the task of the etc. selecting the specific serving gateway is performed among the handshaking of WTRUs (102a, 102b, 102c). The control plane function for the switching between the dissimilar RAN (is abbreviated) in which the MME (142) uses moreover, the dissimilar radio technology such as GSM and WCDMA and the RAN (104) can be moreover provided.

서빙 게이트웨이(144)는 RAN(104) 내의 각각의 e노드-B(140a, 140b, 140c)에 S1 인터페이스를 통해 접속될 수 있다. 서빙 게이트웨이(144)는 일반적으로 WTRU(102a, 102b, 102c)로/로부터 사용자 데이터 패킷을 라우트 및 회송할 수 있다. 서빙 게이트웨이(144)는 또한 e노드-B 간의 핸드오버 중에 사용자 평면(user plane)을 고정(anchoring)하는 것, 다운링크 데이터가 WTRU(102a, 102b, 102c)에 이용할 수 있을 때 페이징을 시동하는 것, WTRU(102a, 102b, 102c)의 콘텍스트를 관리 및 저장하는 것 등의 다른 기능을 수행할 수 있다.

The serving gateway (144) can be connected to each e node - Bs (140a, 140b, 140c) within the RAN (104) through the S1 interface. The generally the serving gateway (144) can send back the user data packet to WTRUs (102a, 102b, 102c) with the route. The serving gateway (144) the user plane among moreover, the handover between the e node -B the fixing (anchoring). The paging is started when downlink data can use only in WTRUs (102a, 102b, 102c). The context of WTRUs (102a, 102b, 102c) is stored with the administration the dissimilar function of the etc. can be performed.

서빙 게이트웨이(144)는 PDN 게이트웨이(146)에 또한 접속될 수 있고, PDN 게이트웨이(146)는 WTRU(102a, 102b, 102c)와 IP-인에이블 장치 간의 통신을 돕도록 인터넷(110)과 같은 패킷 교환식 네트워크에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다. 무선 로컬 영역 네트워크(WLAN)(155)의 액세스 라우터(AR)(150)는 인터넷(110)과 통신할 수 있다. AR(150)은 AP(160a, 160b, 160c)들 간에 통신을 할 수 있게 한다. AP(160a, 160b, 160c)들은 STA(170a, 170b, 170c)와 통신할 수 있다.

The serving gateway (144) can be moreover connected to the PDN gateway (146) and the access about the packet exchange network like the internet (110) can be provided for WTRUs (102a, 102b, 102c) so that the PDN gateway (146) helps the communication between the IP- enable device and WTRUs (102a, 102b, 102c). The access router (AR) (150) of the wireless local area network (WLAN) (155) can communicate with the internet (110). The AR (150) communicates between APs (160a, 160b, 160c). APs (160a, 160b, 160c) can communicate with STAs (170a, 170b, 170c).

코어 네트워크(106)는 다른 네트워크와의 통신을 가능하게 한다. 예를 들면, 코어 네트워크(106)는 WTRU(102a, 102b, 102c)와 전통적인 지상선(land-line) 통신 장치 간의 통신이 가능하도록, PSTN(108)과 같은 회선 교환식 네트워크에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다. 예를 들면, 코어 네트워크(106)는 코어 네트워크(106)와 PSTN(108) 간의 인터페이스로서 기능하는 IP 게이트웨이(예를 들면, IP 멀티미디어 서브시스템(IMS) 서버)를 포함하거나 그러한 IP 게이트웨이와 통신할 수 있다. 또한, 코어 네트워크(106)는 다른 서비스 공급자에 의해 소유되거나 운용되는 다른 유선 또는 무선 네트워크를 포함하는 기타 네트워크(112)에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다.

It makes the communication with the dissimilar network the core network (106) possible. For example, in order that the communication between the merchant ship (land-line) communication device is possible whether the core network (106) is traditional with WTRUs (102a, 102b, 102c) the access about the call switching equation network like the PSTN (108) can be provided for WTRUs (102a, 102b, 102c). For example, the IP gateway (for example, the IP multimedia subsystem (IMS) server) functioning as the interface between the PSTN (108) and the core network (106) is included or the core network (106) can communicate with that IP gateway. Moreover, the access about the other network (112) including wire or the dissimilar wireless network which is possessed with the service provider in which the core network (106) is different or which is used can be provided for WTRUs (102a, 102b, 102c).

여기에서 사용하는 용어 #34#스테이션#34#(station)(STA)은, 비제한적인 예를 들자면, 무선 송신/수신 유닛(WTRU), 사용자 장비(UE), 이동국, 고정식 또는 이동식 가입자 유닛, 페이저, 셀룰러 전화기, 개인 정보 단말기(PDA), 컴퓨터, 모바일 인터넷 장치(MID), 또는 무선 환경에서 동작할 수 있는 임의의 다른 유형의 장치를 포함한다. 여기에서 사용하는 용어 #34#기지국#34#은, 비제한적인 예를 들자면, 노드-B, 사이트 제어기, 접근점(AP), 또는 무선 환경에서 동작할 수 있는 임의의 다른 유형의 인터페이스 장치를 포함한다.

Here, the term " station #34 # (station) (STA) used comprises the unlimited wireless transmission / receiving unit (WTRU), the user equipment (UE), the mobile station, and the fixed type, or the dissimilar apparatus for operating in the transportable subscriber unit, the pager, the cell phone, the personal data assistant (PDA), the computer, the mobile internet apparatus (MID) or the radio environment of the disposable type. Here, the term " base station " using comprises the unlimited node - B, the site controller, the access point (AP), or the dissimilar interface equipment for operating in the radio environment of the disposable type.

설명을 위해 각종 실시형태가 WLAN 상황에서 설명되지만, 각종 실시형태는 임의의 무선 통신 기술에서 구현될 수 있다. 일부 예시적인 유형의 무선 통신 기술은, 비제한적인 예를 들자면, WiMAX(Worldwide Interoperability for Microwave Access), 802.xx, 글로벌 이동통신 시스템(GSM), 코드분할 다중 접속(CDMA2000), 범용 이동통신 시스템(UMTS), 롱텀 에볼루션(LTE), 또는 임의의 미래 기술을 포함한다.

All kinds of the embodiments is illustrated for the description in the WLAN situation. However all kinds of the embodiments can be implemented in the arbitrary radio transmission technology. The radio transmission technology which is the partial indication of the type comprises the unlimited WiMAX (Worldwide Interoperability for Microwave Access), 802, the global system for mobile communication (GSM), the code division multiple access (CDMA2000), the universal mobile telecommunications system (UMTS), the long-term evolution (LTE), or the arbitrary future technology.

최상위 MAC 계층에서 100 Mbps 이상의 초고처리율(VHT)을 가진 WLAN은 여기에서 설명하는 실시형태들을 구현하도록 설계될 수 있다. 이러한 실시형태를 구현하는 VHT WLAN은 다중 사용자 다중입력 다중출력(MU-MIMO) 기술, 새로운 부호

In the highest MAC layer, it can be designed in order to implement embodiments which here WLAN having the draft processing ratio (VHT) more than 100 Mbps illustrates. The VHT WLAN implementing such embodiment mor

화 특징, 새로운 절전 특징 등과 같은 특징들을 또한 포함할 수 있다. MU-MIMO 기술은 동일한 주파수로 복수의 STA에 대한 동시 전송을 가능하게 하고, 또한 동일한 주파수로 복수의 STA로부터 동시 수신을 또한 가능하게 한다. VHT 패킷 전송 및 레가시 패킷 전송을 위한 새로운 VHT 보호 특징이 구현될 수 있다. VHT AP가 조밀하게 전개되어 있는 시나리오에서는 이웃 BSS로부터의 간섭이 높기 때문에 중첩 BSS 관리가 필요할 수 있다. 텔레비전 여백(white space)(TVWS) 시나리오에서는 독립적으로 동작하는 네트워크/장치(및 라디오 기술에서의 다른 네트워크/장치까지)가 공통 TVWS 주파수 스펙트럼에서 공존 및 동작할 수 있다.

eover may include characteristics including the multius er multiple input multiple output (MU-MIMO) technolog y, the new coding characteristic, the power save char acteristic etc. new. It makes the simultaneous transmis sion about the multiple STAs the MU-MIMO technology possible to the same frequency and it makes the simult aneous reception the moreover possible to moreover, t he same frequency from multiple STAs. The new VHT p rotection feature for the VHT packet transmission and l egacy packet transmission can function. In the scenari o in which the VHT AP tightly develops, the overlapping BSS administration can be required because the interfe rence from the neighbor BSS is high. In the television m argin (white space) (TVWS) scenario, it can coexist an d the network / apparatus (to the dissimilar network / apparatus at the radio technology) which independentl y operates can operate in the common TVWS frequenc y spectrum.

고처리율(HT) 특징에 대한 관리 동작을 지원하기 위해 사용되는 IEEE 802.11 HT 동작 프레임은 VHT 특징을 가진 WLAN에서 적당하지 않을 수 있다. 여기에서 #34#VHT 동작 프레임 #34#이라고 부르는 새로운 관리 동작 프레임은 VHT 특징에 대한 관리 동작을 확장하기 위해 필요할 수 있다. 또한, IEEE 802.11 동작 프레임에 대한 확장판(extensions)이 VHT 특징을 지원하기 위해 필요할 수 있다. WLAN에서 VHT 동작 프레임의 형태 및 IEEE 802.11 동작 프레임의 VHT 확장판의 형태로 VHT 관리 동작을 지원하기 위해 사용되는 예시적인 방법 및 장치가 여기에서 설명된다. VHT 동작 프레임은 새로운 카테고리 내에 있거나 또는 DLS, 퍼블릭, 스펙트럼 관리, HT 등과 같은 기존 802.11 카테고리 내에 있다. VHT 동작 프레임은, 만일 기존 802.11 카테고리로 지정되지 않으면, #34#VHT#34# 카테고리라고 부르는 새로운 카테고리 하에서 그룹화될 것이다.

It is not appropriate in WLAN in which the IEEE 802.11 HT action frame which is used it supports the managem ent operation about the high throughput (HT) characte ristic has the VHT characteristic. Here, so that the ne w administration action frame called the "VHT action fr ame " expand the management operation about the VH T characteristic, it can be necessary. Moreover, it can be necessary so that the extended plate (extensions) about the IEEE 802.11 action frame support the VHT c haracteristic. In WLAN, here here illustrative method an d apparatus for being used in order to support the VHT management operation in the form of the form of the V HT action frame and VHT extended plate of the IEEE 8 02.11 action frame, are explained. It is in the new cate gory or the VHT action frame is in the existing 802.11 c ategory like the DLS, public, the spectrum managemen t, HT etc. If the VHT action frame is not designated for the existing 802.11 category , it will be grouped under the new category called the "VHT" category.

기반시설 BSS, 독립 BSS/애드혹, 또는 직접 링크 설정 시나리오에서의 VHT STA는 VHT 관리 동작 프레임을 전송하거나 수신할 수 있다. 기반시설 BSS 시나리오에서, VHT AP도 또한 VHT 관리 동작 프레임을 전송하거나 수신할 수 있다.

The infrastructure BSS , and the VHT STA at the independent BSS / ad hoc or the direct link establishme nt scenario transmit or can receive the VHT administrat ion action frame. In the infrastructure BSS scenario, th e VHT AP transmits moreover, the VHT administration a ction frame or it can receive.

802.11에서 서브타입 #34#동작#34#과 #34#확인응답(ACK) 없는 동작#34#의 관리 프레임은 스펙트럼 관리, QoS, DLS, 퍼블릭, HT 등과 같은 각종 카테고리에 관계된 확장형 관리 동작을 위해 사용된다. 예를 들어서, 802.11 퍼블릭 동작 프레임은 예컨대 상호 BSS(inter-BSS) 및 AP가 비연결 STA와 통신할 수 있게 하는 퍼블릭으로 설정된 카테고리 필드를 가진 관리 동작 프레임일 수 있다. 이 예에서, 송신측 STA/AP 및 수신측 STA/AP는 다른 BSS와 연결될 수 있고, 또는 송신측 STA와 수신측 STA 중의 어느 하나 또는 둘 다가 BSS와 연결되지 않을 수 있다.

In 802.11, it is used for the extensible management operation in which the management frame of the opera tion " which there is no with the subtype " operation " and " acknowledge (ACK) is connected to all kinds of th e categories like the spectrum management, qoS, DLS, public, HT etc. The example is given and it can be the administration action frame having the category field in which 802.11 public action frame is set up as the publi c in which for example, the reciprocity BSS (inter-BSS) and AP communicate with the connectionless STA. In t his example, it can be connected to the transmission si de STA / AP and BSS in which the receiving side STA / AP is different and or any one among the transmission side STA and receiving side STA or both are not conne cted to BSS.

서브타입 #34#ACK 없는 동작#34#의 관리 프레임은 성공적인 수신을 한 수신측 STA/AP로부터 ACK 프레임을 수신하지 않을 수 있다. 또한, 관리 프레임 서브타입 #34#ACK 없는 동

The management frame of the operation " which there is no with the subtype "ACK does not receive the ACK f rame the successful reception from one receiving side

작#34#의 이러한 동작 프레임은 집성된 패킷 데이터 유닛(PDU)으로의 전송을 위해 데이터 프레임, 제어 프레임 및 관리 프레임 중 하나 이상으로 STA/AP에 의해 집성될 수 있다. 집성된 PDU는 패킷에 관한 정보를 포함하는 패킷/프레임 구분문자(delimiter)가 선행하는 각각의 개별 패킷, 및 만일 필요하다면 필요한 길이로, 예컨대 802.11n에서처럼 4 옥텟의 배수로 반올림하는 패딩 비트가 뒤따르는 각각의 개별 패킷을 구비한 개별 프레임/패킷을 포함할 수 있다. 서브타입 #34#동작#34#과 #34#ACK 없는 동작#34#의 관리 프레임은 모두 본원에서 #34#동작 프레임#34# 또는 #34#관리 동작 프레임#34#이라고 부를 것이다.

STA / AP. Moreover, it can be gathered for the transmission to the packet data unit (PDU) in which such action frame of the operation " which there is no with the management frame subtype "ACK is gathered among data frame, and the control frame and management frame over one with the STA / AP. Gathered PDU comprises each individual packet in which the packet / frame delimiter character including the information about the packet is ahead and the individual frame / packet which includes each individual packet in which the padding bit which rounds is followed to the necessary length like for example, 802.11n to the drainage of 4 octet if the if is necessary. The management frame of the operation " which there is no with the subtype " operation " and "ACK altogether will call the " action frame " or the " administration action frame " on the present application.

도 2는 예시적인 매체 접근 제어(MAC) 프레임(200)을 보인 것이다. MAC 프레임(200)은 프리앰블(210), 헤더(220) 및 프레임 바디(body)(230)를 포함할 수 있다. 프레임 바디(230)는 VHT 관리 동작 프레임 바디(240)를 포함할 수 있다. VHT 관리 동작 프레임 바디(240)는 동작 카테고리 필드(250) 및 그 뒤에 동작 필드(260)를 포함할 수 있다. 동작 필드(260)는 동작 프레임의 유형, 예를 들면, 설정 요청, 설정 응답, 또는 해체(teardown)를 식별할 수 있다. 동작 필드(260) 뒤에는 다른 필드들(270a, 270b, ..., 270k)이 따를 수 있다. 다른 필드들(270a, 270b,..., 270k)은 동작 프레임 유형에 따라 특정될 수 있고, 이때 이 필드들 중의 하나 이상이 정보 요소(IE)일 수 있다.

Figure 2 shows the illustrative media access control (MAC) frame (200). The MAC frame (200) comprises the preamble (210), and the header (220) and the frame body (body) (230). The frame body (230) may include the VHT management operation frame body (240). The VHT management operation frame body (240) comprises the operating category field (250) and the movement field (260) in after that. The movement field (260) can distinguish the type of the action frame, for example, the setting request, and the configuration acknowledgement or the dismantlement (teardown). Dissimilar fields (270a, 270b, ., 270k) can follow after the movement field (260). May be over one of these fields dissimilar fields (270a, 270b, ., 270k) can be specified according to the action frame type the information element (IE).

AP와 STA는 예를 들면 연결, 재연결, 프로브 또는 비콘 프레임과 같은 관리 프레임의 임의의 새로운 또는 기존 관리/제어/데이터 프레임에서 VHT 관리 동작을 표시할 수 있다. IE는 정보를 전송하기 위해 MAC 프레임에 포함될 수 있다.

AP and STA can indicate the VHT management operation in for example, the connection, the reconnect, and the new existing administration / control / data frame of the management frame like the probe or the beacon frame. The information can be included in the MAC frame so that IE transmit the information.

도 3은 IE(310)를 포함하는 예시적인 VHT 관리 동작 프레임(300)을 보인 것이다. IE(310)는 엘리먼트 ID 필드(320), 길이 필드(330) 및 다수의 IE 필드(340a, 340b,...340n)를 포함할 수 있다. 엘리먼트 ID 필드(320)는 IE(310)에 특정된 ID를 포함할 수 있다. 길이 필드(330)는 길이 필드(330)를 뒤따르는 IE(310)의 길이를 표시할 수 있다.

Figure 3 shows the illustrative VHT administration action frame (300) including the IE (310). The IE (310) comprises the element ID field (320), and the length field (330) and the multiple IE fields (340a, 340b, .340n). ID in which the element ID field (320) is specified in the IE (310) is include might. The length of the IE (310) in which the length field (330) follows the length field (330) around can be indicated.

제1 예로서, 802.11 채널 스위치 고지 프레임은 80 MHz의 VHT 증가형 채널 대역폭 전송 모드를 지원하도록 수정될 수 있다. 채널 스위치 고지 프레임은 새로운 채널, 채널 번호 및 대역폭 구성으로 전환될 때를 광고하도록 BSS에서의 AP에 의해 또는 독립 BSS에서의 STA에 의해 보내질 수 있다. 802.11 채널 스위치 고지 프레임은 2차 채널 옵셋 IE를 내포한 카테고리 스펙트럼 관리의 동작 프레임일 수 있다.

As the first example, it can be modified so that 802.11 channel switch notice frame supports the VHT enhancement mode channel bandwidth transmission mode of 80 MHz. Or it can be sent with AP at BSS with STA at the independent BSS in order to advertise the time converted into the channel in which the channel switch notice frame is new, and the channel number and bandwidth configuration. It can be the action frame of the category spectrum management in which 802.11 channel switch notice frame contains the second channel offset IE.

도 4는 VHT 80 MHz 대역폭 전송 및 VHT 다채널 전송을 지원하게끔 2차 채널 옵셋 정보값을 표시하도록 수정될 수 있는 예시적인 2차 채널 옵셋 IE(400)을 보인 것이다. 2차 채널 옵셋 IE(400)는 엘리먼트 ID 필드(410), 길이 필드(420) 및 2차 채

Figure 4 show the VHT 80 MHz bandwidth transmission and the illustrative second channel offset IE (400) which can be modified it indicates the second channel offset information it supports the VHT multichannel transmis

널 옵셋 필드(430)를 포함할 수 있다.

sion. The second channel offset IE (400) comprises the element ID field (410), and the length field (420) and t he secondary channel offset field (430).

2차 채널 옵셋 필드(430)는 기존의 802.11n 표준의 40 MHz 전송 대역폭에 대하여 20 MHz 1차 채널에 대한 20 MHz 2차 채널의 위치를 표시할 수 있다. VHT 80 MHz 대역폭 전송 시나리오에서는 80 MHz 전송 대역폭을 제공하는 1차 20 MHz 채널과 함께 3개의 20 MHz 2차 채널이 있을 수 있다. 따라서, 80 MHz 대역폭 전송을 위하여, 20 MHz 1차 채널에 대한 3개의 20 MHz 2차 채널의 위치는 2차 채널 옵셋 필드(430) 내의 값으로 표시될 수 있다. 80 MHz 대역폭을 구성하는 20 MHz 채널은 연속적인 것일 필요가 없다. VHT 특징은 이러한 80 MHz 대역폭 신호의 전송 및 수신을 지원할 수 있다. VHT 특징은 20 MHz 채널의 각종 조합을 이용하여 복수의 병렬 전송을 비롯해서 다채널 전송을 또한 지원할 수 있다.

The secondary channel offset field (430) can indicate the position of 20 MHz secondary channel about 20 MH z first channel about 40 MHz transmission bandwidth of the existing 802.11n standard. In the VHT 80 MHz band width transmission scenario, it can have 20 MHz secon dary channel of 3 with 20 first the MHz channel providi ng 80 MHz transmission bandwidth. Therefore, the posi tion of 20 MHz secondary channel of 3 about 20 MHz fir st channel can be indicated as the value within the sec ondary channel offset field (430) for 80 MHz bandwidth transmission. 20 MHz channel comprising 80 MHz bandw idth is successive. The VHT characteristic can support the transmission and reception of such 80 MHz bandwid th signal. The VHT characteristic includes multiple paral lel transfers using all kinds of the combinations of 20 M Hz channel and the multichannel transmission can be m oreover supported.

다채널 전송 시나리오에서, 채널들의 구성은 2차 채널 옵셋 필드(430)에서 1차 채널에 대하여 표시될 수 있다. 또한, VHT 특징은 2차 채널이 1차 채널에 인접하지 않은 경우에 40 MHz 대역폭 신호의 전송 및 수신을 지원할 수 있고, 2차 채널 옵셋 필드(430)에서 표시될 수 있다. VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송에 대응하는 2차 채널 옵셋 필드(430)에 대한 가능한 2차 채널 구성 및 대응하는 값들의 예는 표 1에 나타내었다. 정확한 수치값은 0 내지 255의 범위 내에서 임의의 비사용(unused) 값으로부터 플렉시블하게하게 선택할 수 있다.

In the multichannel transmission scenario, the configuration of the channels can be indicated in the s econdary channel offset field (430) about the first cha nnel. Moreover, the transmission and reception of 40 M Hz bandwidth signal can be supported in case the VHT characteristic the secondary channel is not adjacent t o the first channel and it can be indicated in the secon dary channel offset field (430). The example of the val ues corresponding with the VHT 80 MHz bandwidth tran smission, and the possible second channel configuratio n for the secondary channel offset field (430) correspo nding to the VHT multichannel transmission and VHT 40 MHz bandwidth transmission showed in the table 1. The exact numeric value can choose in the range of 0 throu gh 255 from the arbitrary unused value to make flexibl e.

2차 채널 구성

| 값 | 설명 |
|---|---|
| 0 | 2차 채널이 존재하지 않음을 표시한다(20 MHz) |
| 1 | 2차 채널이 1차 채널 위에 있음을 표시한다(40 MHz에 대해) |
| 2 | 비사용 |
| 3 | 2차 채널이 1차 채널 아래에 있음을 표시한다(40 MHz에 대해) |
| 256까지의 임의의 비사용 값(플렉시블) | 3개의 2차 채널이 1차 채널 바로 위에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 3개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 2개의 2차 채널이 1차 채널 바로 위에 있고 1개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 1개의 2차 채널이 1차 채널 바로 위에 있고 2개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |

Second channel configuration

| Value | Description |
|---|---|
| 0 | It indicates that the secondary channel is nonexistent (20 MHz) |
| 1 | The secondary channel indicates having on the first c hannel(About 40 MHz) |
| 2 | Unused |
| 3 | The secondary channel indicates having under the firs t channel(About 40 MHz) |
| The arbit rary unus ed value of 256(Fl exible) | 3 secondary channels indicate being in the first chann el, immediately, the upper part(80 MHz bandwidth co nsisting of 4 successive 20 MHz channels) |
| The arbit rary unus ed value of 256(Fl exible) | 3 secondary channels indicate immediately beneath h aving with the first channel(80 MHz bandwidth consisti ng of 4 successive 20 MHz channels) |
| The arbit rary unus ed value of 256(Fl exible) | 2 secondary channels are in the first channel, immedi ately, the upper part and one secondary channel indic ates immediately beneath having with the first chann el(80 MHz bandwidth consisting of 4 successive 20 MH z channels) |
| The arbit rary unus ed value | One secondary channel is in the first channel, immedi ately, the upper part and the secondary channel of 2 i ndicates immediately beneath having with the first ch |

| | |
|---|---|
| 256까지의 임의의 비사용 값(플렉시블) | 80 MHz 대역폭이 4개의 연속적인 20 MHz 채널로 구성되지 않은 경우에 1차 채널에 대한 3개의 2차 채널 각각의 위치 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 40 MHz 대역폭이 2개의 연속적인 20 MHz 채널로 구성되지 않은 경우에 1차 채널에 대한 2차 채널의 위치 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 1차 채널에 대한 VHT 다채널 전송용 2차 채널의 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 255까지의 나머지 | 비사용/리저브 |

| | |
|---|---|
| of 256(Flexible) | annel(80 MHz bandwidth consisting of 4 successive 20 MHz channels) |
| The arbitrary unused value of 256(Flexible) | In case 80 MHz bandwidth does not consist of successive 20 MHz channel of 4 the secondary channel each composition of location of 3 about the first channel is indicated. Such configuration is manifoldly possible,Each configuration can have the value associated with the configuration |
| The arbitrary unused value of 256(Flexible) | In case 40 MHz bandwidth does not consist of successive 20 MHz channel of 2 the composition of location of the secondary channel about the first channel is indicated. Such configuration is manifoldly possible,Each configuration can have the value associated with the configuration |
| The arbitrary unused value of 256(Flexible) | The configuration of the secondary channel for the VHT multichannel transmission about the first channel is indicated. Such configuration is manifoldly possible,Each configuration can have the value associated with the configuration |
| The rest of 255 | Unused / reserve |

2차 채널 옵셋 필드(430)는 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송을 지원하는 2차 채널 구성을 표시하는 하나 이상의 값을 포함하도록 수정될 수 있다. 2차 채널 옵셋 필드(430)는 예를 들면, 1) 독립 BSS의 AP 또는 STA에 의해 보내진 비콘, 프로브 응답, 연결 응답, 및 재연결 응답 프레임에; 2) 독립 BSS의 AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 운용 IE에; 3) 독립 BSS의 AP 또는 STA에 의해 보내진 채널 스위치 고지(동작) 프레임에; 또는 4) AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 능력 IE에 포함될 수 있다.

It can be modified so that the secondary channel offset field (430) includes VHT 80 MHz bandwidth transmission, and at least one value indicating the VHT 40 MHz bandwidth transmission and the second channel configuration of supporting the VHT multichannel transmission. It can be included in the VHT capability IE included in the channel switch notice (operation) frame: sent to the VHT operation IE included in the frame sent to the beacon, in which the secondary channel offset field (430) is sent with for example, AP or STA of 1) independent BSS the probe response, and the linked reply and reassociation response frame with AP or STA of 2) independent BSS with AP or STA of 3) independent BSS or the frame sent with 4) AP or STA.

제2 예로서, VHT 통지 대역폭 구성 프레임은 카테고리 VHT의 동작 프레임이고, VHT WLAN에서 각종 대역폭 20/40/80 MHz를 지원하기 위해 사용될 수 있다. 이 예에서, VHT STA 또는 AP는 VHT 통지 대역폭 구성 프레임을 보내서 자신에게 보내진 프레임의 대역폭 구성을 변경할 수 있다.

As the second example, the VHT notification bandwidth organization frame is the action frame of the category VHT and it can be used all kinds of the bandwidths 20/40/80 MHz is supported in the VHT WLAN. In this example, the VHT STA or AP sends the VHT notification bandwidth organization frame and the bandwidth configuration of the frame sent to oneself can be changed.

도 5는 예시적인 VHT 통지 대역폭 구성 프레임(500)을 보인 것이다. VHT 통지 대역폭 구성 프레임(500)은 카테고리 필드(510), 동작 필드(520), 및 VHT 대역폭 구성 필드(530)를 포함할 수 있다. 카테고리 필드(510)는 VHT를 표시하는 값으로 설정될 수 있다. 동작 필드(520)는 VHT 통지 대역폭 구성을 표시하는 값으로 설정될 수 있다. VHT 대역폭 구성 필드(530)는 이 동작 프레임을 전송하는 STA 또는 AP에 보내질 프레임에 대하여 요청된 대역폭 구성을 포함할 수 있다. VHT 대역폭 구성 필드(530)의 값들은 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송이 가능한 각종 대역폭 구성에 대응할 수 있다. 각종 대역폭 구성은 예를 들면 제1 예로서 설명하고 도 4 및 표 1에 각각 나타낸 수정 2차 채널 옵셋 IE 및/또는 2차 채널 옵셋 필드(430)에서 제공될 수 있다. 대안적으로, 카테고리 HT의 802.11 통지 채널 폭 프레임은 표 1에 나타낸 하나 이상의 VHT 대역폭 구성을 802.11 채널 폭 필드에 추가함으로써 VHT를 지원하도록 수정될 수 있다.

Figure 5 shows the illustrative VHT notification bandwidth organization frame (500). The VHT notification bandwidth organization frame (500) comprises the category field (510), and the movement field (520) and the VHT bandwidth constituent field (530). It can be set up as the value in which the category field (510) indicates VHT. The movement field (520) can be set up as the value indicating the VHT notification bandwidth configuration. The bandwidth configuration requested about STA in which the VHT bandwidth constituent field (530) transmits this action frame or the frame sent to AP is include might. The value of the VHT bandwidth constituent field (530)s can correspond to the VHT 80 MHz bandwidth transmission, and the VHT 40 MHz bandwidth transmission and all kinds of the bandwidths the configuration in which the VHT multichannel transmission is possible. It can be provided from the correction second channel offset IE and/or the secondary channel offset field (430) in which all kinds of the bandwidth the configurations illustrate as for example, the first example and shown for fig. 4 and table 1. Alternatively, in order to support VHT by adding at least one VHT bandwidth configuration where 802.11 broadcast channel width frame of the category HT shows in the table 1 to 802.11 cha

nnel width field it can be modified.

제3 예로서, VHT 세트 위상조정형(phased) 공존 운용(PCO) 위상 프레임은 카테고리 VHT의 동작 프레임이고, VHT WLAN에서 PCO를 지원하기 위해 사용될 수 있다. VHT WLAN BSS는 VHT PCO를 채용할 수 있고, 이 경우 VHT AP는 20/40/80 MHz 대역폭 동작 사이에서 시간을 분할할 수 있다. 예를 들면, 20/40/80 MHz, 40/80 MHz, 20/80 MHz 및 20/40 MHz와 같이 모든 가능한 조합이 고려될 수 있다. 또한, 40 MHz 및 80 MHz 대역폭을 구성하는 연속적 및 불연속적 채널 구성이 있을 수 있기 때문에, 40 MHz 및 80 MHz에 대하여 수 개의 가능한 대역폭 구성 또는 PCO 위상이 있을 수 있다. 예를 들면, AP는 VHT 위상조정형 공존 운용을 위하여 미리 정해진 대역폭 집합 중에서 BSS 운용을 스위칭할 수 있다. 다른 특징이 VHT PCO에 추가될 수 있고, 이 경우, 병렬 채널 전송 구성을 비롯한 다채널 전송 구성이 추가의 PCO 위상으로서 지원된다. 이 예에서, VHT AP는 상기 다채널 전송 구성/위상으로의 스위칭을 표시할 수 있다. VHT 세트 PCO 위상 프레임은 20 MHz, 40 MHz 및 80 MHz 위상 중에서 위상 변화를 고지하도록 AP에 의해 보내질 수 있다.

As the third example, the VHT set phase adjustment type (phased) coexistence operation (PCO) phase frame is the action frame of the category VHT and it can be used PCO is supported in the VHT WLAN. The VHT WLAN BSS can employ the VHT PCO and in this case, the VHT AP can divide time between 20/40/80 MHz bandwidth operation. For example, the possible combination can be taken into consideration like 20/40/80 MHz, 40/80 MHz, 20/80 MHz and 20/40 MHz. Moreover, it can have the continuous discontinuously channel configuration of configuring 40 MHz and 80 MHz bandwidth. Therefore it can have the plurality of possible bandwidth configurations or the PCO phase about 40 MHz and 80 MHz. For example, AP can switch the BSS operation for the VHT phase adjustment type coexistence operation among the predetermined bandwidth gathering. The dissimilar characteristic can be added to the VHT PCO and in this case, the multichannel transmission configuration including the parallel channel transmissions configuration is supported as the additional PCO phase. In this example, the VHT AP can indicate the switching to the multichannel transmission configuration / phase. The VHT set PCO phase frame can be sent with AP in order to notify phase change among 20 MHz, 40 MHz and 80 MHz phase.

도 6은 예시적인 VHT 세트 PCO 위상 프레임(600)을 보인 도이다. VHT 세트 PCO 위상 프레임(600)은 카테고리 필드(610), 동작 필드(620) 및 VHT PCO 위상 제어 필드(630)를 포함할 수 있다. 카테고리 필드(610)는 VHT를 표시하는 값으로 설정될 수 있다. 동작 필드(620)는 VHT 세트 PCO 위상을 표시하기 위해 규정된 값으로 설정될 수 있다. VHT PCO 위상 제어 필드(630)는 현재 PCO 위상을 표시할 수 있다. 이 정보는 수정된 802.11 PCO 위상 제어 필드에서 표시될 수 있고, 표 2에 나타낸 값들 중에서 하나 이상을 포함할 수 있다.

It is drawing showing the VHT set PCO phase frame (600) in which fig. 6 is illustrative. The VHT set PCO phase frame (600) comprises the category field (610), and the movement field (620) and the VHT PCO phase control field (630). It can be set up as the value in which the category field (610) indicates VHT. It can be set up as the value in which the movement field (620) is prescribed in order to indicate the VHT set PCO phase. The VHT PCO phase control field (630) can indicate the current PCO phase. It can be indicated in 802.11 PCO phase control field in which this information is modified and one or greater is include might among values showing in the table 2.

VHT PCO 위상에 대한 값을 가진 수정된 802.11 PCO 위상 제어 필드

| 값 | 설명 |
|---|---|
| 0 | 20 MHz 위상을 표시한다 |
| 1 | 40 MHz 위상을 표시한다 |
| 256까지의 임의의 비사용 값(플렉시블) | (a) 2개의 연속적인 또는 (b) 2개의 불연속적인 20 MHz 채널에 의해 형성된 1차 채널에 대한 40 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 4개의 연속적인 20 MHz 채널에 의해 형성된 1차 채널에 대한 80 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 4개의 연속적인 20 MHz 채널에 의해 형성되지 않은 1차 채널에 대한 80 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 1차 채널에 대한 VHT 다채널 전송 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 255까지의 나머지 | 사용되지 않음/리저브 |

Modified 802.11 PCO phase control field having the value about the VHT PCO phase

| Value | Description |
|---|---|
| 0 | 20 MHz phase is indicated |
| 1 | 40 MHz phase is indicated |
| The arbitrary unused value of 256(Flexible) | (a)As 2 consecutives(b)40 MHz bandwidth configuration about the first channel formed by 2 discontinuous 20 MHz channels is indicated. Such configuration of being many can be possible and each configuration can have the value associated with the configuration |
| The arbitrary unused value of 256(Flexible) | 80 MHz bandwidth configuration about the first channel formed by 4 successive 20 MHz channels is indicated. Such configuration of being many can be possible and each configuration can have the value associated with the configuration |
| The arbitrary unused value of 256(Flexible) | 80 MHz bandwidth configuration about the first channel which is not formed by 4 successive 20 MHz channels is indicated. Such configuration of being many can be possible and each configuration can have the value associated with the configuration |
| The arbitrary unused value of 256(Flexible) | The VHT multichannel transmission configuration about the first channel is indicated. Such configuration of being many can be possible and each configuration can have the value associated with the configuration |
| The rest of 255 | The / reserve it is not used |

VHT PCO 위상은 표 2에 나타낸 것처럼 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송, 및 VHT 다채널 전송에서 지원될 수 있는 각종의 대역폭 구성 중에서 하나 이상에 대응할 수 있다. 하나의 대안예로서, 카테고리 HT의 802.11 세트 PCO 위상 프레임은 802.11 PCO 위상 제어 필드를 표 2에 나타낸 것처럼 VHT PCO 위상에 대한 값을 포함하는 수정된 PCO 위상 제어 필드로 교체함으로써 VHT PCO를 지원하도록 수정될 수 있다. 다른 대안예로서, 운용 표시의 현재 VHT PCO 위상 또는 그에 관한 정보는 독립 BSS의 AP 또는 STA에 의해 보내진 비콘, 프로브 응답, 연결 응답 및 재연결 응답 프레임에 포함될 수 있고, 또는 독립 BSS의 AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 운용 IE에 포함될 수 있다.

As the VHT PCO phase shows in the table 2 it can correspond to one or greater among the VHT 80 MHz bandwidth transmission, and the VHT 40 MHz bandwidth transmission and the various bandwidth configuration of being supported in the VHT multichannel transmission. As one alternative example, in order to support the VHT PCO by replacing with the modified PCO phase control field including the value about the VHT PCO phase as 802.11 set PCO phase frame of the category HT shows 802.11 PCO phase control field in the table 2 it can be modified. As the dissimilar alternative example, it can be included in the beacon, in which the information about the current VHT PCO phase of the operation display or that is sent with AP or STA of the independent BSS the probe response, and the linked reply and reassociation response frame and or it can be included in the VHT operation IE included in the frame sent with AP or STA of the independent BSS.

제4의 예로서, 하기의 것, 즉, 1) 1~32 범위의 채널 상태 정보 및/또는 전송 빔포밍(beamforming) 피드백 매트릭스에 대한 다수의 열; 2) 1~32 범위의 채널 상태 정보/전송 빔포밍 피드백 매트릭스에 대한 다수의 행; 3) 표 1에 나타낸 20/40/80 MHz에 대한 각종 대역폭 구성의 경우를 망라하는 MIMO 제어 채널 폭 표시; 4) 1~16 범위의 하나 이상의 부반송파 집합으로 그룹화된 다수의 OFDM 부반송파; 5) 4~6 범위의 채널 상태 정보/전송 빔포밍 피드백 매트릭스 내 각 요소의 실수부와 허수부 표시의 다수의 비트; 6) 압축된 빔포밍 매트릭스에 대한 코드북 정보의 사이즈; 7) 관련 측정 리포트의 세그멘트에 대한 0~31 범위의 나머지 세그멘트 번호; 및 8) 사운딩 패킷의 수신의 끝에 대응하는 사운딩 타임스탬프 중의 하나 이상을 포함하도록, 802.11 MIMO 제어 필드가 수정되거나 또는 VHT MIMO 제어 필드가 생성될 수 있고, 이 경우 사운딩 패킷은 MIMO 제어 필드를 포함하는 프레임에 포함될 피드백 정보를 발생하기 위해 사용될 수 있다. 수정된 MIMO 제어 필드와 VHT MIMO 제어 필드는 802.11 HT 채널 상태 정보(CSI) 동작 프레임, VHT CSI 동작 프레임, 802.11 HT 비압축 빔포밍 동작 프레임, VHT 비압축 빔포밍 동작 프레임, 802.11 HT 압축 빔포밍 동작 프레임, 또는 VHT 압축 빔포밍 동작 프레임에 포함될 수 있다.

In order that the fourth, for example, the following, the rest segment number compacted with the multiple bit : 6)s of the real part of the channel state information / transmission beamforming feedback matrix closed angle element of the multiple OFDM subcarrier : 5) 4~6 ranges and imaginary part display grouped as at least one subcarrier gathering of the MIMO control channel width display : 4) 1~16 range containing all the case of all kinds of the bandwidths the configuration about 20/40/80 MHz shown for in other words, the multiple row : 3) table 1s about the channel state information / transmission beamforming feedback matrix of the multiple heat : 2) 1~32 ranges about the channel state information of 1) 1~32 range and/or the transmission beamforming feedback matrix of 0~31 range about the segment of the size : 7) related measure report of the code book information about the beam forming matrix, and one or greater among the sounding time stamp corresponding to the end of the reception of 8) sounding packet are included 802.11 MIMO control field is changed or the VHT MIMO control field can be generated and it can be used it is generated the feedback information included in the frame in which in this case, the sounding packet includes the MIMO control field. The modified MIMO control field and the VHT MIMO control field can be included in 802.11 HT channel state information (CSI) action frame, VHT CSI action frame, 802.11 HT noncompressive beam forming action frame, VHT noncompressive beam forming action frame, 802.11 HT compression beam forming action frame or the VHT compression beam forming action frame.

도 7은 VHT 압축 빔포밍 리포트 동작 프레임(700)의 예시적인 프레임 바디를 보인 것이다. VHT 압축 빔포밍 리포트 동작 프레임(700)은 카테고리 필드(710), 동작 필드(720), VHT MIMO 제어 필드(730) 및 압축 빔포밍 리포트(740)를 포함할 수 있다.

Figure 7 shows the illustrative frame body of the VHT compression beam forming report action frame (700). The VHT compression beam forming report action frame (700) comprises the category field (710), the movement field (720), and the VHT MIMO control field (730) and the compression beam forming report (740).

제5 예로서, 20/40/80 MHz에 대한 수정된 802.11 압축 빔포밍 리포트 필드, 또는 VHT를 지원하도록 구성된 압축 빔포밍 리포트 필드(740)는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 각각의 공간-시간 스트림에 대

As the fifth example, one or greater among the beamforming feedback matrix about the OFDM subcarrier having the index of -28~28 range about the beamforming feedback matrix : 4) 20 MHz about the OFDM sub

한 리포트를 보내는 STA의 평균 신호대 잡음비(이 경우 스트림의 수는 매트릭스의 다수의 열로서 대응하는 MIMO 제어 필드에 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 압축 빔포밍 리포트 필드와 VHT를 지원하도록 구성된 압축 빔포밍 리포트 필드는 802.11 HT 압축 빔포밍 동작 프레임 또는 VHT 압축 빔포밍 동작 프레임에 포함될 수 있다. 802.11 HT 압축 빔포밍 동작 프레임과 VHT 압축 빔포밍 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 압축 빔포밍 피드백 요청 표시에 응답하여 STA/AP에 의해 보내질 수 있다.

carrier having the index of -58~58 range about the beamforming feedback matrix : 3) 40 MHz about the OFDM subcarrier having the index of -128~128 range about the average signal to noise ratio (it can be specified in the MIMO control field in which the number of in this case, the streams correspond as the multiple heats of the matrix) : 2) 80 MHz of STA expressing the report about each space-time stream in which 802.11 compression beam forming report field about 20/40/80 MHz or the compression beam forming report field (740) which is configured to support VHT has the resolution which can be the following, in other words, 1) 8-bit to 16 bit extent modified is include might. 802.11 compression beam forming report field and the compression beam forming report field about 20/40/80 MHz which is configured to support VHT can be included in 802.11 HT compression beam forming action frame or the VHT compression beam forming action frame modified. It can be sent in response to the HT control field of 802.11 HT compression beam forming action frame and the frame in which the VHT compression beam forming action frame is received from the requested part STA / AP or the compression beam forming feedback requested table time included in the VHT control field with the STA / AP.

제6 예로서, 20/40/80 MHz에 대한 수정된 802.11 비압축 빔포밍 리포트 필드, 또는 VHT를 지원하도록 구성된 비압축 빔포밍 리포트 필드는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 각각의 공간-시간 스트림에 대한 리포트를 보내는 STA의 평균 신호대 잡음비(이 경우 스트림의 수는 매트릭스의 다수의 열로서 대응하는 MIMO 제어 필드에 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 비압축 빔포밍 리포트 필드 및 VHT를 지원하도록 구성된 비압축 빔포밍 리포트 필드는 802.11 HT 비압축 빔포밍 동작 프레임 또는 VHT 비압축 빔포밍 동작 프레임에 포함될 수 있다. 802.11 HT 비압축 빔포밍 동작 프레임과 VHT 비압축 빔포밍 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 비압축 빔포밍 피드백 요청 표시에 응답하여 STA/AP에 의해 보내질 수 있다.

As the sixth example, one or greater among the beamforming feedback matrix about the OFDM subcarrier having the index of -28~28 range about the beamforming feedback matrix : 4) 20 MHz about the OFDM subcarrier having the index of -58~58 range about the beamforming feedback matrix : 3) 40 MHz about the OFDM subcarrier having the index of -128~128 range about the average signal to noise ratio (it can be specified in the MIMO control field in which the number of in this case, the streams correspond as the multiple heats of the matrix) : 2) 80 MHz of STA expressing the report about each space-time stream in which 802.11 noncompressive beam forming report field about 20/40/80 MHz or the noncompressive beam forming report field which is configured to support VHT has the resolution which can be the following, in other words, 1) 8-bit to 16 bit extent modified is include might. 802.11 noncompressive beam forming report field and the noncompressive beam forming report field about 20/40/80 MHz which is configured to support VHT can be included in 802.11 HT noncompressive beam forming action frame or the VHT noncompressive beam forming action frame modified. It can be sent in response to the HT control field of 802.11 HT noncompressive beam forming action frame and the frame in which the VHT noncompressive beam forming action frame is received from the requested part STA / AP or the noncompressive beam forming feedback requested table time included in the VHT control field with the STA / AP.

제7 예로서, 20/40/80 MHz에 대한 수정된 802.11 CSI 리포트 필드, 또는 VHT를 지원하도록 구성된 CSI 리포트 필드는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 리포트를 보내는 STA의 각 수신 체인에 대한 신호대

As the seventh example, one or greater among the CSI matrix about the OFDM subcarrier having the index of -28~28 range about the CSI matrix : 4) 20 MHz about the OFDM subcarrier having the index of -58~58 range

잡음비(SNR)(이 경우 수신 체인의 수는 매트릭스의 다수의 행으로서 대응하는 MIMO 제어 필드에서 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 CSI 리포트 필드 및 VHT를 지원하도록 구성된 CSI 리포트 필드는 802.11 HT CSI 동작 프레임 또는 VHT CSI 동작 프레임에 포함될 수 있다. 802.11 HT CSI 동작 프레임과 VHT CSI 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 CSI 피드백 요청 표시에 응답하여 STA 또는 AP에 의해 보내질 수 있다.

about the CSI matrix : 3) 40 MHz about the OFDM subcarrier having the index of -128~128 range about the signal-noise ratio (SNR) (it can be specified in the MIMO control field in which the number of in this case, the receiving chains correspond as the multiple rows of the matrix) : 2) 80 MHz toward each receiving chain of STA expressing the report in which 802.11 CSI report field about 20/40/80 MHz or the CSI report field which is configured to support VHT has the resolution which can be the following, in other words, 1) 8-bit to 16 bit extent modified is include might. 802.11 CSI report field and the CSI report field about 20/40/80 MHz which is configured to support VHT can be included in 802.11 HT CSI action frame or the VHT CSI action frame modified. It can be sent in response to the HT control field of 802.11 HT CSI action frame and the frame in which the VHT CSI action frame is received from the requested part STA / AP or the CSI feedback requested table time included in the VHT control field with STA or AP.

제8 예로서, 802.11 동작 프레임은 VHT 능력 IE를 포함하도록 수정될 수 있다. 예를 들면, VHT 능력 IE는 802.11 DLS 요청 프레임, 802.11 DLS 응답 프레임, 802.11 터널형 직접 링크 설정(TDLS) 셋업 요청 프레임, 및 802.11 TDLS 셋업 응답 프레임의 프레임 바디에 추가될 수 있다. VHT 능력 IE는 VHT STA/AP에 의해 802.11 DLS 요청 및 응답 프레임에 추가될 수 있다. VHT 능력 IE는 VHT STA에 의해 802.11 TDLS 셋업 요청 및 TDLS 셋업 응답 프레임에 추가될 수 있다.

As the eighth example, it can be modified so that 802.11 action frame includes the VHT capability IE. For example, the VHT capability IE can be added to 802.11 DLS request frame, 802.11 DLS response frame, and the frame body of 802.11 TDLS setup response frame and 802.11 tunnel type direct link establishment (TDLS) setup request frame. The VHT capability IE can be added in 802.11 DLS request and response frame by the VHT STA / AP. The VHT capability IE can be added in 802.11 TDLS setup request and TDLS setup response frame by the VHT STA.

제9 예로서, 20/40/80 공존 관리 프레임은 퍼블릭의 카테고리를 가진 동작 프레임일 수 있고, 80 MHz의 VHT 증가형 채널 대역폭 전송 모드를 지원하기 위해 사용될 수 있다. 20/40/80 BSS 공존 프레임은 20/40/80 BSS 공존을 위한 정보를 교환하기 위해 STA 또는 AP에 의해 사용될 수 있다.

As the ninth example, it can be the action frame in which 20/40/80 coexistence management frame has the category of public and it can be used the VHT enhancement mode channel bandwidth transmission mode of 80 MHz is supported. The information can be used with STA or AP so that 20/40/80 BSS coexistence frame exchange the information for 20/40/80 BSS coexistence.

도 8은 예시적인 20/40/80 BSS 공존 관리 프레임(800)을 보인 것이다. 20/40/80 BSS 공존 관리 프레임(800)은 카테고리 필드(810), 동작 필드(820), 20/40/80 BSS 공존 필드(830), 및 20/40/80 BSS 편협(intolerant) 채널 리포트 필드(840)를 포함할 수 있다. 카테고리 필드(810)는 퍼블릭을 표시하는 값으로 설정될 수 있다. 동작 필드(820)는 20/40/80 BSS 공존 관리를 위해 규정된 값으로 설정될 수 있다.

Figure 8 shows illustrative 20/40/80 BSS coexistence management frame (800). 20/40/80 BSS coexistence management frame (800) comprises the category field (810), the movement field (820), and 20/40/80 BSS coexistence field (830) and 20/40/80 BSS narrow-mindedness (intolerant) channel report field (840). It can be set up as the value in which the category field (810) indicates public. It can be set up as the value in which the movement field (820) is prescribed for 20/40/80 BSS coexistence administration.

20/40/80 BSS 공존 필드(830)는 20/40/80 BSS 공존에 관련된 정보를 포함할 수 있다. 20/40/80 BSS 공존 필드(830)는 도 9에 도시된 바와 같은 20/40/80 BSS 공존 IE(900)를 포함할 수 있다. 20/40/80 BSS 공존 IE(900)는 20/40/80 BSS 공존을 위한 정보를 교환하기 위해 STA 또는 AP에 의해 사용될 수 있다. 20/40/80 BSS 공존 관리 프레임(800) 외에, STA 또는 AP는 20/40/80 BSS 공존 IE(900)를 비콘, 프로브 요청, 프로브 응답, 연결 요청, 연결 응답, 재연결 요청 및 재연결 응답 프레임에 포함시킬 수 있다.

20/40/80 BSS coexistence field (830) may include the related information in 20/40/80 BSS coexistence. 20/40/80 BSS coexistence field (830) may include 20/40/80 BSS coexistence IE (900) as illustrated in Figure 9. The information can be used with STA or AP so that 20/40/80 BSS coexistence IE (900) exchange the information for 20/40/80 BSS coexistence. STA or AP can include 20/40/80 BSS coexistence IE (900) in the beacon, probe request, probe response, connection request, linked reply, reconnect request and reassociation response frame besides 20/40/80 BSS coexistence management frame (800).

20/40/80 BSS 공존 IE(900)는 엘리먼트 ID 필드(910), 길

20/40/80 BSS coexistence IE (900) comprises the

이 필드(920), 정보 요청 표시 필드(930), 40 MHz 편협 표시 필드(940), 80 MHz 편협 표시 필드(950), 20 MHz BSS 폭 요청 필드(960), 중첩 BSS(OBSS) 스캐닝 면제 요청 필드(970), 및 OBSS 스캐닝 면제 허가 필드(980)를 포함할 수 있다. 엘리먼트 ID 필드(910)는 특히 20/40/80 BSS 공존 IE(900)에 대한 값을 표시할 수 있다. 길이 필드(920)는 길이 필드(920) 다음에 20/40/80 BSS 공존 IE(900)의 길이를 내포할 수 있다. 정보 요청 표시 필드(930)는 응답으로 20/40/80 BSS 공존 관리 프레임(800)을 보낸다는 것을 수신자에게 표시하기 위해 전송측 STA 또는 AP에 의해 사용될 수 있다.

element ID field (910), the length field (920), the information request display field (930), 40 MHz narrow-mindedness display field (940), 80 MHz narrow-mindedness display field (950), 20 MHz BSS width request field (960), the overlapping BSS (OBSS) scanning waiver request field (970) and the OBSS scanning waiver Huh is the field (980). The element ID field (910) can indicate especially, the value about 20/40/80 BSS coexistence IE (900). Next the length field (920) can contain the length of 20/40/80 BSS coexistence IE (900) with the length field (920). It can be used by the transmitting STA or AP it expresses to the receiver that the information request display field (930) sends 20/40/80 BSS coexistence management frame (800) to the response.

40 MHz 편협 표시 필드(940)는, 소정의 값으로 설정된 때, 이 정보를 수신하거나 리포팅하는 AP가 20/40 MHz BSS를 운용하는 것이 금지된다는 것을 표시할 수 있다. 이 필드가 상기 특정 값으로 설정되지 않은 때, 이 필드는 수신측 AP가 20/40 MHz BSS로서 운용하는 것을 금지하지 않을 수 있다. 80 MHz 편협 표시 필드(950)는, 소정의 값으로 설정된 때, 이 정보를 수신하거나 리포팅하는 AP가 20/40/80 MHz BSS를 운용하는 것이 금지된다는 것을 표시할 수 있다. 이 필드가 상기 특정 값으로 설정되지 않은 때, 이 필드는 수신측 AP가 20/40/80 MHz BSS로서 운용하는 것을 금지하지 않을 수 있다. 20 MHz BSS 폭 요청 필드(960)는, 소정의 값으로 설정된 때, 수신측 AP가 20/40/80 MHz BSS 또는 20/40 MHz BSS로서 운용하는 것이 금지된다는 것을 표시할 수 있다.

When 40 MHz narrow-mindedness display field (940) is set up as the predetermined value it can indicate that it is prohibited that AP which receives this information or reported uses 20/40 MHz BSS. When this field is not set up as the definite value this field does not prohibit that the receiving side AP uses as 20/40 MHz BSS. When 80 MHz narrow-mindedness display field (950) is set up as the predetermined value it can indicate that it is prohibited that AP which receives this information or reported uses 20/40/80 MHz BSS. When this field is not set up as the definite value this field does not prohibit that the receiving side AP uses as 20/40/80 MHz BSS. When 20 MHz BSS width request field (960) is set up as the predetermined value it can indicate that it is prohibited that the receiving side AP uses as 20/40/80 MHz BSS or 20/40 MHz BSS.

OBSS 스캐닝 면제 요청 필드(970)는, 소정의 값으로 설정된 때, 전송측 STA가 수신측 AP에 의한 OBSS 스캐닝으로부터 면제될 것을 요청한다는 것을 표시할 수 있다. OBSS 스캐닝 면제 허가 필드(980)는, 소정의 값으로 설정된 때, 수신측 STA가 전송측 AP에 의해 OBSS 스캐닝을 수행하는 것으로부터 면제된다는 것을 표시할 수 있다. 대안적인 실시형태로서, 20/40/80 BSS 공존 IE(900)는 80 MHz 편협 필드(950)를 추가함으로써 802.11 20/40 BSS 공존 엘리먼트를 수정하여 생성될 수 있다.

When the OBSS scanning waiver request field (970) is set up as the predetermined value it can indicate requesting that the transmitting STA is exempt from the OBSS scanning by the receiving side AP. When the OBSS scanning waiver Huh the field (980) is set up as the predetermined value it can indicate the receiving side STA performs the OBSS scanning with the transmitting AP being exempted. As the alternative embodiment, since 20/40/80 BSS coexistence IE (900) adds 80 MHz narrow-mindedness field (950) 802.11 20/40 BSS coexistence element is modified and it can be generated.

20/40/80 BSS 편협 채널 리포트(840)는 20/40/80 MHz BSS 운용을 허용하지 않는 채널에 대한 정보를 내포할 수 있다. 예를 들면, 20/40/80 BSS 편협 채널 리포트 필드(840)는 도 10에 도시된 바와 같은 20/40/80 BSS 편협 채널 리포트 IE(1000)를 내포할 수 있다.

20/40/80 BSS narrow-mindedness channel report (840) can contain the information about the channel which does not give a permission of 20/40/80 MHz BSS operation. For example, 20/40/80 BSS narrow-mindedness channel report field (840) can contain 20/40/80 BSS narrow-mindedness channel report IE (1000) as illustrated in Figure 10.

20/40/80 BSS 편협 채널 리포트 IE(1000)는 엘리먼트 ID 필드(1010), 길이 필드(1020), 단속 분류 정보 필드(1030) 및 채널 리스트 필드(1040)를 포함할 수 있다. 엘리먼트 ID 필드(1010)는 특히 20/40/80 BSS 편협 채널 리포트 IE(1000)에 대한 값을 표시할 수 있다. 길이 필드(1020)는 길이 필드(1020) 다음에 20/40/80 BSS 편협 채널 리포트 IE(1000)의 길이를 내포할 수 있다. 단속 분류 정보 필드(1030)는 채널 리스트 필드(1040) 내의 채널 리스트가 유효인 단속 분류를 특정하는 정보를 내포할 수 있다. 채널 리스트 필드(1040)는 20/40/80 MHz BSS 운용이 허용되지 않는 채널들의 리스트를 내포할 수 있다.

20/40/80 BSS narrow-mindedness channel report IE (1000) comprises the element ID field (1010), the length field (1020), and the secure classification information field (1030) and the channel list field (1040). The element ID field (1010) can indicate especially, the value about 20/40/80 BSS narrow-mindedness channel report IE (1000). Next the length field (1020) can contain the length of 20/40/80 BSS narrow-mindedness channel report IE (1000) with the length field (1020). The secure classification information field (1030) the channel list within the channel list field (1040) can contain the specify information the available phosphorus secure classification. The channel list field (1040) can contain the list of

the channels in which 20/40/80 MHz BSS operation is n ot approved.

제10 예로서, 16개까지의 안테나를 지원하도록 802.11 안테나 선택 지수 필드가 수정되거나, 또는 VHT 안테나 선택 지수 필드가 생성될 수 있다. 802.11 안테나 선택 지수 필드는 길이가 8 비트이고 8개의 안테나만을 지원할 수 있으며, 이 경우, 필드 내의 각 비트는 대응하는 안테나의 선택을 표시하기 위해 사용될 수 있다. 수정된 802.11 안테나 선택 지수 필드 및 VHT 안테나 선택 지수 필드는 16 비트일 수 있고, 이 경우, 각 비트는 안테나 지수에 대응할 수 있으며 대응하는 안테나의 선택을 표시하기 위해 사용될 수 있다. 수정된 802.11 안테나 선택 지수 필드 및 VHT 안테나 선택 지수 필드는 802.11 HT 안테나 선택 지수 피드백 동작 프레임 또는 VHT 안테나 선택 지수 피드백 동작 프레임에 포함될 수 있고, 요청측 STA 또는 AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 안테나 선택 지수 피드백 요청 표시에 응답하여 STA 또는 AP에 의해 보내질 수 있다.

As the tenth example, 802.11 antenna selection index field is changed in order to support the antenna to 16 or or the VHT antenna selection index field can be gen erated. The length can be 8-bit and 802.11 antenna se lection index field can support only the antenna of 8 an d the selection can be used in order to indicate the sel ection of the antenna in which in this case each bit wit hin field corresponds. Modified 802.11 antenna selectio n index field and the VHT antenna selection index field can be 16 bit and so that the selection of the antenna corresponding to be indicated while in this case each bi t can correspond to the antenna index the selection ca n be used. Modified 802.11 antenna selection index fiel d and the VHT antenna selection index field can be incl uded in 802.11 HT antenna selection index feedback op eration frame or the VHT antenna selection index feedb ack operation frame and it can be sent in response to t he HT control field or the antenna selection index feed back requested table time included in the VHT control f ield of the frame received from the requested part STA or AP with STA or AP.

도 11은 VHT 통신의 관리 동작을 지원하는 예시적인 방법(1100)의 흐름도이다. STA/AP(1110)는 관리 동작 프레임(1120)을 다른 STA2(1130)에게 전송할 수 있다. 관리 동작 프레임(1120)은 VHT 동작 프레임일 수 있고, 카테고리 및/또는 서브타입이 지정될 수 있다. STA2(1130)는 운용 파라미터(1140)를 관리 동작 프레임(1120) 내의 필드에 기초하여 변경할 수 있다.

Figure 11 is a flowchart of the illustrative method (1100) supporting the management operation of the VH T communication. The STA / AP (1110) can transmit th e administration action frame (1120) to the dissimilar S TA 2 (1130). The administration action frame (1120) ca n be the VHT action frame and the category and/or th e subtype can be designated. The STA 2 (1130) can c hange the operation parameter (1140) based on the fie ld within the administration action frame (1120).

각각의 VHT 동작 프레임에 대한 카테고리의 지정은 VHT 동작 프레임이 #34#VHT#34# 또는 임의의 802.11 카테고리와 같은 새로운 카테고리가 지정되도록 플렉시블할 수 있다. 또한, VHT 동작 프레임은 서브타입 #34#동작#34# 또는 #34#ACK 있는 동작#34#, 및 #34#ACK 없는 동작#34#을 가질 수 있다. 더욱이, #34#ACK 없는 동작#34# 서브타입 VHT 동작 프레임은 집성된 패킷 데이터 유닛의 전송을 위해 데이터 프레임, 제어 프레임 및 관리 프레임 중 하나 이상과 STA/AP에 의해 집성될 수 있다. 예를 들면, STA2(1130) 또는 AP는, 만일 서브타입 #34#동작#34#의 VHT 동작 프레임을 수신하면, ACK(1150)를 전송할 수 있다. STA2(1130) 또는 AP는, 만일 서브타입 #34#ACK 없는 동작#34#의 VHT 동작 프레임을 수신하면, ACK(1150)를 전송하지 않을 수 있다.

The VHT action frame the designation of the category about each VHT action frame can be flexible so that th e new category such as the "VHT" and arbitrary 802.11 category is designated. Moreover, the VHT action fram e has the operation " having with the subtype " operati on " or the "ACK and the operation " which there is no with "ACK. Furthermore, it can be gathered for the tran smission of the packet data unit in which the operation " subtype VHT action frame which there is no with "AC K is gathered among the data frame, and the control fr ame and management frame with one or greater and S TA / AP. For example, if the STA 2 (1130) or AP receiv es the VHT action frame of the subtype " operation " , i t can transmit the ACK (1150). If the STA 2 (1130) or AP receives the VHT action frame which there is no wit h the subtype "ACK of the operation " , it does not tran smit the ACK (1150).

실시형태

Embodiment.

1. 무선 통신에서 사용하는 방법에 있어서,

1. As to the method for using in the wireless communication.

관리 동작 프레임을 수신하는 단계와;

The step of receiving the administration action frame.

수신된 관리 동작 프레임 내의 표시에 따라 운용 파라미터를 변경하는 단계를 포함한 방법.

The method including the step of changing the operation parameter according to the display of the rec eived management operation in-frame.

2. 실시형태 1에 있어서, 관리 동작 프레임은 VHT 관리 기능을 지원하는 필드를 포함한 것인 방법.

2. The method including the field where the administration action frame supports the VHT function manager as to the embodiment 1.

3. 실시형태 2에 있어서, VHT 관리 기능은 다채널 전송과 관련된 것인 방법.

3. The method in which the VHT function manager is associated with the multichannel transmission as to the embodiment 2.

4. 실시형태 2에 있어서, VHT 관리 기능은 불연속 스펙트럼 전송과 관련된 것인 방법.

4. The method in which the VHT function manager is associated with the discontinuous spectrum transmission as to the embodiment 2.

5. 실시형태 2~4 중 어느 하나에 있어서, 상기 필드는 VHT 다중입력 다중출력(MIMO) 제어 필드인 방법.

5. The method in which field is the VHT multiple input multiple output (MIMO) control field as to any one of embodiment 2~4.

6. 실시형태 5에 있어서, VHT MIMO 제어 필드는 대역폭 구성을 표시하는 MIMO 제어 채널 폭 표시자를 포함한 것인 방법.

6. The method including the MIMO control channel width indicator in which the VHT MIMO control field indicates the bandwidth configuration as to the embodiment 5.

7. 실시형태 6에 있어서, 대역폭 구성은 VHT 다채널 전송을 위한 복수의 2차 채널을 포함한 것인 방법.

7. The method in which the bandwidth configuration includes the multiple secondary channels for the VHT multichannel transmission as to the embodiment 6.

8. 실시형태 7에 있어서, 복수의 2차 채널은 1차 채널과 관계있는 것인 방법.

8. The method in which it has multiple secondary channels as to the embodiment 7 with the first channel and relation.

9. 실시형태 5~8 중 어느 하나에 있어서, VHT MIMO 제어 필드는 복수의 직교 주파수 분할 다중화(OFDM) 부반송파를 포함한 것인 방법.

9. The method in which the VHT MIMO control field includes multiple orthogonal frequency division multiplex (OFDM) subcarriers as to any one of embodiment 5~8.

10. 실시형태 10에 있어서, 복수의 OFDM 부반송파는 세트로 그룹화된 것인 방법.

10. The method in which multiple OFDM subcarriers are grouped as set as to the embodiment 10.

11. 실시형태 5~10 중 어느 하나에 있어서, VHT MIMO 제어 필드는 채널 상태 정보(CSI) 요소 내의 각 요소의 실수부와 허수부를 표시하는 복수의 비트를 포함한 것인 방법.

11. The method including multiple bits in which the VHT MIMO control field indicates the real part of each element within the channel state information (CSI) element and imaginary part as to any one of embodiment 5~10.

12. 실시형태 5~11 중 어느 하나에 있어서, VHT MIMO 제어 필드는 전송 빔포밍 피드백 매트릭스 내의 각 요소의 실수부와 허수부를 표시하는 복수의 비트를 포함한 것인 방법.

12. The method including multiple bits in which the VHT MIMO control field indicates the real part of each element within the transmission beamforming feedback matrix and imaginary part as to any one of embodiment 5~11.

13. 실시형태 5~12 중 어느 하나에 있어서, VHT MIMO 제어 필드는 압축 빔포밍 매트릭스 코드북 정보 사이즈를 포함한 것인 방법.

13. The method in which the VHT MIMO control field includes the compression beam forming matrix code book information size as to any one of embodiment 5~12.

14. 실시형태 5~13 중 어느 하나에 있어서, VHT MIMO 제어 필드는 관련 측정 리포트의 나머지 세그멘트 번호를 표시하는 것인 방법.

14. The method in which the VHT MIMO control field indicates the rest segment number of the related measure report as to any one of embodiment 5~13.

15. 실시형태 1~14 중 어느 하나에 있어서, 사운딩 패킷을 수신하는 단계와;

15. The step of receiving the sounding packet as to any one of embodiment 1~14.

관리 동작 프레임 내의 사운딩 패킷에 기초하여 피드백을 전송하는 단계를 더 포함한 방법.

The method which further includes the step of transmitting the feedback based on the sounding packet of the management operation in-frame.

16. 실시형태 15에 있어서, VHT 다중입력 다중출력(MIMO)

16. The method in which the VHT multiple input

제어 필드는 사운딩 타임스탬프를 포함한 것인 방법.

multiple output (MIMO) control field includes the soundi ng time stamp as to the embodiment 15.

17. 실시형태 16에 있어서, 사운딩 타임스탬프는 사운딩 패킷의 수신의 끝에 대응하는 것인 방법.

17. The method in which the sounding time stamp corresponds to the end of the reception of the soundin g packet as to the embodiment 16.

18. 실시형태 1~17 중 어느 하나에 있어서, 관리 프레임은 압축 빔포밍 리포트 필드를 포함한 것인 방법.

18. The method in which the management frame includes the compression beam forming report field as t o any one of embodiment 1~17.

19. 실시형태 18에 있어서, 압축 빔포밍 리포트 필드는 스테이션(STA)의 평균 신호대 잡음비(SNR)를 포함한 것인 방법.

19. The method in which the compression beam forming report field includes the average signal to noise ratio (S NR) of the station (STA) as to the embodiment 18.

20. 실시형태 18 또는 19에 있어서, 압축 빔포밍 리포트 필드는 접근점(AP)의 평균 신호대 잡음비(SNR)를 포함한 것인 방법.

20. The method in which the compression beam forming report field includes the average signal to noise ratio (S NR) of the access point (AP) as to the embodiment 18 or 19.

21. 실시형태 18~20 중 어느 하나에 있어서, 압축 빔포밍 리포트 필드는 빔포밍 피드백 매트릭스를 포함한 것인 방법.

21. The method in which the compression beam forming report field includes the beamforming feedback matrix a s to any one of embodiment 18~20.

22. 실시형태 21에 있어서, 빔포밍 피드백 매트릭스는 복수의 직교 주파수 분할 다중화(OFDM) 부반송파용인 방법.

22. The beamforming feedback matrix as to the embodiment 21, is the multiple orthogonal frequency di vision multiplex (OFDM) subcarrier admitting methods.

23. 실시형태 2~22 중 어느 하나에 있어서, 상기 필드는 VHT 2차 채널 옵셋 필드인 방법.

23. The method in which field is the VHT secondary channel offset field as to any one of embodiment 2~2 2.

24. 실시형태 23에 있어서, VHT 2차 채널 옵셋 필드는 하나 이상의 2차 채널 구성의 지원을 표시하는 값을 포함한 것인 방법.

24. The method including the value in which the VHT secondary channel offset field indicates the support of at least one second channel configuration as to the em bodiment 23.

25. 실시형태 24에 있어서, 2차 채널 구성은 VHT 80 MHz 대역폭 전송을 포함한 것인 방법.

25. The method in which the second channel configuration includes the VHT 80 MHz bandwidth trans mission as to the embodiment 24.

26. 실시형태 24 또는 25에 있어서, 2차 채널 구성은 VHT 20 MHz 대역폭 전송을 포함한 것인 방법.

26. The method in which the second channel configuration includes the VHT 20 MHz bandwidth trans mission as to the embodiment 24 or 25.

27. 실시형태 24~26 중 어느 하나에 있어서, 2차 채널 구성은 VHT 다채널 전송을 포함한 것인 방법.

27. The method in which the second channel configuration includes the VHT multichannel transmissio n as to any one of embodiment 24~26.

28. 실시형태 23~27 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 비콘 프레임에 포함된 것인 방법.

28. The method in which the secondary channel offset field is included as to any one of embodiment 23~27 in the beacon frame.

29. 실시형태 23~28 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 프로브 응답 프레임에 포함된 것인 방법.

29. The method in which the secondary channel offset field is included as to any one of embodiment 23~28 in the probe response frame.

30. 실시형태 23~29 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 연결 응답 프레임에 포함된 것인 방법.

30. The method in which the secondary channel offset field is included as to any one of embodiment 23~29 in the connection response frame.

31. 실시형태 23~30 중 어느 하나에 있어서, 2차 채널 옵셋

31. The method in which the secondary channel offset

필드는 독립 기본 서비스 세트(BSS)의 재연결 응답 프레임에 포함된 것인 방법.

field is included as to any one of embodiment 23~30 in the reassociation response frame of the independence basic service set (BSS).

32. 실시형태 23~31 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 독립 기본 서비스 세트(BSS)의 VHT 운용 IE에 포함된 것인 방법.

32. The method in which the secondary channel offset field is included as to any one of embodiment 23~31 in the VHT operation IE of the independence basic service set (BSS).

33. 실시형태 23~32 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 독립 기본 서비스 세트(BSS)의 채널 스위치 고지 동작 프레임에 포함된 것인 방법.

33. The method in which the secondary channel offset field is included as to any one of embodiment 23~32 in the channel switch announcement operation frame of the independence basic service set (BSS).

34. 실시형태 23~33 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 VHT 능력 정보 요소(IE)에 포함된 것인 방법.

34. The method in which the secondary channel offset field is included as to any one of embodiment 23~33 in the VHT capability information element (IE).

35. 실시형태 1~34 중 어느 하나에 있어서, 관리 프레임은 VHT 통지 대역폭 구성 프레임인 방법.

35. The method in which the management frame is the VHT notification bandwidth organization frame as to any one of embodiment 1~34.

36. 실시형태 35에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 20 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

36. The method which is used so that the VHT notification bandwidth organization frame support 20 MHz bandwidth in the VHT wireless local area network (WLAN) as to the embodiment 35.

37. 실시형태 35 또는 36에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 40 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

37. The method which is used so that the VHT notification bandwidth organization frame support 40 MHz bandwidth in the VHT wireless local area network (WLAN) as to the embodiment 35 or 36.

38. 실시형태 35~37 중 어느 하나에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 80 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

38. The method which is used so that the VHT notification bandwidth organization frame support 80 MHz bandwidth in the VHT wireless local area network (WLAN) as to any one of embodiment 35~37.

39. 실시형태 35~38 중 어느 하나에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 대역폭 구성 필드를 포함한 것인 방법.

39. The method in which the VHT notification bandwidth organization frame includes the VHT bandwidth constituent field as to any one of embodiment 35~38.

40. 실시형태 35~39 중 어느 하나에 있어서, 스테이션(STA) 또는 접근점(AP)에 보내진 프레임의 대역폭 구성을 변경하도록 VHT 통지 대역폭 구성 프레임을 전송하는 단계를 더 포함한 방법.

40. The method which further includes the step of transmitting the VHT notification bandwidth organization frame in order to change the bandwidth configuration of the frame sent to the station (STA) or the access point (AP) as to any one of embodiment 35~39.

41. 실시형태 39 또는 40에 있어서, VHT 대역폭 구성 필드는 VHT 80 MHz 대역폭 전송의 지원을 표시하는 것인 방법.

41. The method in which the VHT bandwidth constituent field indicates the support of the VHT 80 MHz bandwidth transmission as to the embodiment 39 or 40.

42. 실시형태 39~41 중 어느 하나에 있어서, VHT 대역폭 구성 필드는 VHT 40 MHz 대역폭 전송의 지원을 표시하는 것인 방법.

42. The method in which the VHT bandwidth constituent field indicates the support of the VHT 40 MHz bandwidth transmission as to any one of embodiment 39~41.

43. 실시형태 39~42 중 어느 하나에 있어서, VHT 대역폭 구성 필드는 VHT 다채널 전송의 지원을 표시하는 것인 방법.

43. The method in which the VHT bandwidth constituent field indicates the support of the VHT multi channel transmission as to any one of embodiment 39~42.

44. 실시형태 1~43 중 어느 하나에 있어서, 관리 동작 프레임은 서브타입 #39#확인응답(ACK) 있는 동작#39#의 것인 방법.

44. The method in which the administration action frame is having of the operation ' as to any one of embodiment 1~43.

45. 실시형태 44에 있어서, ACK를 전송하는 단계를 더 포함한 방법.

45. The method which further includes the step of transmitting ACK as to the embodiment 44.

46. 실시형태 1~43 중 어느 하나에 있어서, 관리 동작 프레임은 서브타입 #39#확인응답(ACK) 없는 동작#39#의 것인 방법.

46. The method in which the administration action frame is which there is no of the operation ' as to any one of embodiment 1~43.

47. 실시형태 1~46의 방법들 중 임의의 하나를 구현하도록 구성된 스테이션(STA).

47.The station which is configured to implement the arbitrary one among the methods of the embodiment 1~46(STA).

48. 실시형태 1~46의 방법들 중 임의의 하나를 구현하도록 구성된 접근점(AP).

48.The access point which is configured to implement the arbitrary one among the methods of the embodiment 1~46(AP).

지금까지 특징 및 요소들을 특수한 조합으로 설명하였지만, 이 기술에 통상의 지식을 가진 사람이라면 각 특징 또는 요소는 단독으로 또는 다른 특징 및 요소와 함께 임의의 조합으로 사용될 수 있다는 것을 이해할 것이다. 또한, 여기에서 설명한 방법들은 컴퓨터 또는 프로세서에 의해 실행되는 컴퓨터 판독가능 매체에 통합된 컴퓨터 프로그램, 소프트웨어 또는 펌웨어로 구현될 수 있다. 컴퓨터 판독가능 매체의 예로는 전자 신호(유선 또는 무선 접속을 통해 전송된 것) 및 컴퓨터 판독가능 기억 매체가 있다. 컴퓨터 판독가능 기억 매체의 비제한적인 예로는 읽기 전용 메모리(ROM), 랜덤 액세스 메모리(RAM), 레지스터, 캐시 메모리, 반도체 메모리 소자, 내부 하드 디스크 및 착탈식 디스크와 같은 자기 매체, 자기 광학 매체, 및 CD-ROM 디스크 및 디지털 다기능 디스크(DVD)와 같은 광학 매체가 있다. 프로세서는 소프트웨어와 연결해서 WTRU, UE, 단말기, 기지국, RNC, 또는 임의의 호스트 컴퓨터에서 사용되는 라디오 주파수 송수신기를 구현하기 위해 사용될 수 있다.

So far, the characteristic and elements were illustrated as the special combination. However if it is the human having the normal knowledge upon this technology or each characteristic or the element independently will understand the dissimilar characteristic and the being used as the arbitrary combination with the element. Moreover, here, it can be implemented as the computer program integrated with the computer readable medium in which the methods illustrated is performed by the computer or the processor, and software or firmware. As an example of the computer readable medium, there are the electronic signal (transmitted through the wire or the wireless access) and computer-readable storage medium. It has the computer-readable storage medium, for example, the magnetic media like the read only memory (ROM), the random access memory (RAM), register, the cache memory, the semiconductor memory device, the internal hard disk and the unlimited removable disk, and the optical media like the magneto-optic media and CD-ROM disc and DVD. So that it connects to software and the processor implement the radio frequency transceiver used in the WTRU, UE, the terminal, the base station, RNC or the arbitrary host computer, software can be used.

## 도면에 대한 간단한 설명

더욱 상세한 이해는 첨부 도면과 함께 예로서 주어지는 이하의 설명으로부터 얻을 수 있다.

도 1a는 하나 이상의 본 발명의 실시형태가 구현되는 예시적인 통신 시스템의 계통도이다.

도 1b는 도 1a의 통신 시스템에서 사용할 수 있는 예시적인 무선 송신/수신 유닛(WTRU)의 계통도이다.

도 1c는 도 1a의 통신 시스템에서 사용할 수 있는 예시적인 무선 접근 네트워크 및 예시적인 코어 네트워크의 계통도이다.

도 2는 예시적인 매체 접근 제어(MAC) 프레임을 보인 도이다.

도 3은 예시적인 초고처리율(VHT) 관리 동작 프레임을 보인 도이다.

도 4는 예시적인 2차 채널 옵셋 정보 요소(IE)를 보인 도이다.

## Brief explanation of the drawing

The understanding of more giving full details can obtain from the description of less than which for example, is given with the attached view.

Figure 1a is a schematic diagram of the illustrative communication system the embodiment of at least one the invention being implemented.

Figure 1b is a schematic diagram of the illustrative wireless transmission / receiving unit (WTRU) using in the communication system of the drawing 1a.

Figure 1c is a schematic diagram of the illustrative core network and the illustrative radio access network using in the communication system of the drawing 1a.

It is drawing showing the media access control (MAC) frame in which fig. 2 is illustrative.

도 5는 예시적인 VHT 통지 대역폭 구성 프레임을 보인 도이다.

도 6은 예시적인 VHT 세트 위상조정형 공존 운용(PCO) 위상 프레임을 보인 도이다.

도 7은 예시적인 VHT 다중입력 다중출력(MIMO) 제어 동작 프레임을 보인 도이다.

도 8은 예시적인 20/40/80 BSS 공존 관리 프레임을 보인 도이다.

도 9는 예시적인 20/40/80 BSS 공존 IE를 보인 도이다.

도 10은 예시적인 20/40/80 BSS 편협 채널 리포트 IE를 보인 도이다.

도 11은 VHT 통신에서 관리 동작을 지원하는 예시적인 방법의 흐름도이다.

It is drawing showing the draft processing ratio (VHT) administration action frame in which fig. 3 is illustrative.

It is drawing showing the second channel offset information element (IE) in which fig. 4 is illustrative.

It is drawing showing the VHT notification bandwidth organization frame in which fig. 5 is illustrative.

It is drawing showing the VHT set phase adjustment type coexistence operation (PCO) phase frame in which fig. 6 is illustrative.

It is drawing showing the VHT multiple input multiple output (MIMO) control action frame in which fig. 7 is illustrative.

It is drawing showing 20/40/80 BSS coexistence management frame in which fig. 8 is illustrative.

It is drawing showing 20/40/80 BSS coexistence IE in which fig. 9 is illustrative.

It is drawing showing 20/40/80 BSS narrow-mindedness channel report IE in which fig. 10 is illustrative.

Figure 11 is a flowchart of the illustrative method in the VHT communication, the management operation is supported.

## Disclaimer

본 문서는 특허 및 과학기술문헌 전용의 첨단 자동번역 시스템을 이용해 생성되었습니다. 따라서 부분적으로 오역의 가능성이 있으며, 본 문서를 자격을 갖춘 전문 번역가에 의한 번역물을 대신하는 것으로 이용되어서는 안 됩니다. 시스템 및 네트워크의 특성때문에 발생한 오역과 부분 누락, 데이터의 불일치등에 대하여 본원은 법적인 책임을 지지 않습니다. 본 문서는 당사의 사전 동의 없이 권한이 없는 일반 대중을 위해 DB 및 시스템에 저장되어 재생, 복사, 배포될 수 없음을 알려드립니다.
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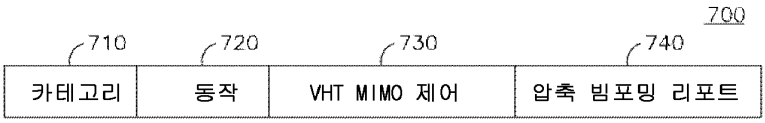
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(54) 발명의 명칭 **무선 통신에서 초고처리율을 위한 관리 동작을 지원하는 방법 및 장치**

(57) 요 약

초고처리율(VHT)의 무선 로컬 영역 네트워크(WLAN) 관리 동작에서 사용될 수 있는 방법 및 장치가 제공된다. VHT 동작 프레임과 같은 관리 동작 프레임은 WLAN에서 VHT 특징을 구현하기 위해 사용될 수 있다. 802.11 동작 프레임에 대한 확장판이 VHT 특징을 지원하고 역방향 능력을 제공하기 위해 사용될 수 있다. VHT 관리 동작은 직접 링크 설정(DLS), 퍼블릭, 스펙트럼 관리 및 고처리율(HT)과 같은 다양한 카테고리에서 VHT 동작 프레임, 및 802.11 동작 프레임에 대한 VHT 확장판에 의해 지원될 수 있다. 접근점(AP) 또는 무선 송신/수신 유닛(WTRU)은 시그널링에 의해 VHT 능력을 표시할 수 있다.

대 표 도 - 도7



*특허청구의 범위*

**청구항 1**

무선 통신에서 사용하는 방법에 있어서,

초고처리율(Very High Throughput; VHT) 전송을 지원하도록 구성된 스테이션(station; STA)에서, VHT 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 전송과 관련된 것임 -을 지원하기 위한 필드를 포함한 관리 동작 프레임을 수신하는 단계와;

수신된 관리 동작 프레임에 기초하여 운용 파라미터를 변경하는 단계

를 포함한, 무선 통신에서 사용하는 방법.

**청구항 2**

제1항에 있어서, 상기 필드는 VHT 다중입력 다중출력(multiple input multiple output; MIMO) 제어 필드인, 무선 통신에서 사용하는 방법.

**청구항 3**

제2항에 있어서, VHT MIMO 제어 필드는 대역폭 구성을 표시하는 MIMO 제어 채널 폭 표시자를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 4**

제3항에 있어서, 대역폭 구성은 1차 채널과 관련된 VHT 다채널 전송을 위한 복수의 2차 채널을 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 5**

제2항에 있어서, VHT MIMO 제어 필드는 복수의 직교 주파수 분할 다중화(orthogonal frequency division mutliplex; OFDM) 부반송파를 포함한 것이고, OFDM 부반송파는 세트로 그룹화된 것인, 무선 통신에서 사용하는 방법.

**청구항 6**

제2항에 있어서, VHT MIMO 제어 필드는 채널 상태 정보(channel state information; CSI) 또는 진송 빔포밍 피드백 매트릭스 내의 각 요소의 실수부와 허수부를 표시하는 복수의 비트를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 7**

제2항에 있어서, VHT MIMO 제어 필드는 압축 빔포밍 매트릭스 코드북 정보 사이즈를 포함한 것인 방법.

**청구항 8**

제2항에 있어서, VHT MIMO 제어 필드는 관련 측정 리포트의 나머지 세그멘트 번호를 표시하는 것인, 무선 통신에서 사용하는 방법.

**청구항 9**

제1항에 있어서,

사운딩 패킷을 수신하는 단계와;

관리 동작 프레임 내의 사운딩 패킷에 기초하여 피드백을 전송하는 단계

를 더 포함하고, VHT MIMO 제어 필드는 사운딩 패킷의 수신의 끝에 대응하는 사운딩 타임스탬프를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 10**

제1항에 있어서, 관리 동작 프레임은 압축 빔포밍 리포트 필드를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 11**

제10항에 있어서, 압축 빔포밍 리포트 필드는 STA의 평균 신호대 잡음비(signal to noise ratio; SNR)를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 12**

제10항에 있어서, 압축 빔포밍 리포트 필드는 복수의 직교 주파수 분할 다중화(orthogonal frequency division multiplex; OFDM) 부반송파용의 빔포밍 피드백 매트릭스를 포함한 것인, 무선 통신에서 사용하는 방법.

**청구항 13**

제1항에 있어서, 상기 필드는 VHT 80 MHz 대역폭 전송, VHT 20 MHz 대역폭 전송 및 VHT 다채널 불연속 전송 중 적어도 하나를 포함한 하나 이상의 2차 채널 구성의 지원을 표시하는 값을 포함한 VHT 2차 채널 옵셋 필드인, 무선 통신에서 사용하는 방법.

**청구항 14**

제13항에 있어서, 2차 채널 옵셋 필드는 비콘 프레임, 프로브 응답 프레임, 연결 응답 프레임, 독립 기본 서비스 세트(basic service set; BSS)의 재연결 응답 프레임, 독립 BSS의 VHT 운용 IE, 독립 BSS의 채널 스위치 고지 동작 프레임, 또는 VHT 능력 IE에 포함된 것인, 무선 통신에서 사용하는 방법.

**청구항 15**

제1항에 있어서, 관리 동작 프레임은 VHT 무선 로컬 영역 네트워크(wireless local area network; WLAN)에서 20 MHz, 40 MHz, 80 MHz, 및 다채널 불연속 대역폭을 지원하기 위해 사용되는 VHT 통지 대역폭 구성 프레임인, 무선 통신에서 사용하는 방법.

**청구항 16**

제15항에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 대역폭 구성 필드를 포함하고 STA에 보내진 프레임의 대역폭 구성을 변경하도록 전송되며, VHT 대역폭 구성 필드는 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 불연속 전송 중 적어도 하나의 지원을 표시하는 것인, 무선 통신에서 사용하는 방법.

**청구항 17**

제1항에 있어서, 관리 동작 프레임은 서브타입 '확인응답(acknowledgement; ACK) 있는 동작' 또는 'ACK 없는 동작'의 것인, 무선 통신에서 사용하는 방법.

**청구항 18**

제17항에 있어서, 관리 동작 프레임이 서브타입 'ACK 있는 동작'의 것인 조건하에 ACK를 전송하는 단계를 더 포함한, 무선 통신에서 사용하는 방법.

**청구항 19**

초고처리율(very high throughput; VHT) 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 운용과 관련된 것임 -을 지원하기 위한 필드를 포함한 관리 동작 프레임을 수신하도록 구성된 수신기와;

수신된 관리 동작 프레임에 기초하여 운용 파라미터를 변경하도록 구성된 프로세서

를 포함한 스테이션(station; STA).

**청구항 20**

초고처리율(very high throughput; VHT) 관리 기능- VHT 관리 기능은 다채널 불연속 스펙트럼 운용과 관련된

것임 -을 지원하기 위한 필드를 포함한 관리 동작 프레임을 전송하도록 구성된 송신기와;

관리 동작 프레임이 서브타입 '확인응답(acknowledgement; ACK) 있는 동작'의 것인 조건하에 관리 동작 프레임에 응답하여 ACK 프레임을 수신하도록 구성된 수신기

를 포함한 접근점(access point; AP).

## 명 세 서

### 기 술 분 야

[0001] 관련 출원에 대한 교차 참조

[0002] 본 출원은 2009년 11월 13일자 출원한 미국 가출원 제61/261,197호를 우선권 주장하며, 이 우선권 출원의 내용은 인용에 의해 여기에 통합된다.

### 배 경 기 술

[0003] 더 높은 데이터율을 지원하는 것은 예컨대 무선 로컬 영역 네트워크(WLAN)를 비롯한 무선 통신 기술에서 오랫동안 목표가 되어왔다. WLAN 기반시설 기본 서비스 세트(basic service set; BSS) 모드는 BSS를 위한 접근점(AP) 및 이 AP와 관련된 하나 이상의 스테이션(station; STA)을 가질 수 있다. AP는 전형적으로 BSS 내외에서 트래픽을 담당하는 분산 시스템(DS) 또는 다른 유형의 유/무선 네트워크에 액세스하거나 또는 이들과 인터페이스 접속할 수 있다. BSS 밖으로부터 시작하는 STA에 대한 트래픽은 AP를 통해 도착하여 STA에 전달될 수 있다. STA로부터 시작하여 BSS 밖의 목적지로 향하는 트래픽은 AP로 보내진 다음 각각의 목적지로 전달될 수 있다.

[0004] BSS 내에서 STA들 간의 트래픽은 AP를 통해 또한 보내질 수 있고, 이 경우 소스 STA가 트래픽을 AP에 보내고 AP는 트래픽을 목적지 STA에 전달한다. BSS 내에서 STA들 간의 이러한 트래픽은 피어투피어 트래픽이라고 부른다. 이러한 피어투피어 트래픽은 802.11e 직접 링크 설정(direct link setup; DLS) 또는 802.11z 터널형 DLS를 이용하는 직접 링크 설정에 의해 소스 STA와 목적지 STA 간에 직접 보내질 수도 있다. 독립 BSS 모드에서의 WLAN은 서로 간에 직접 통신하는 AP와 STA를 갖지 않을 수 있다.

[0005] 802.11 표준의 가장 조기의 버전은 1 Mbps의 데이터율을 제공하였다. 후속 개정판, 즉 802.11b는 11 Mbps의 물리층 데이터율을 제공하였다. 2.4 GHz 및 5 GHz 대역을 위한 802.11g 및 802.11a 개정판에서 각각 직교 주파수 분할 다중화(OFDM)를 도입함으로써, 지원되는 데이터율은 PHY 층에서 54 Mbps까지 증가하였다. 802.11n 개정판은 지원되는 데이터율을 최상위 MAC 계층에서 100 Mbps까지 증가시켰다. 그러나, 100 Mbps 이상의 데이터율을 지원하도록 구성된 방법 및 장치를 갖는 것이 바람직하다.

### 발명의 내용

[0006] 무선 통신에서 초고처리율(Very High Throughput; VHT)을 위한 관리 동작을 지원하는 방법 및 장치가 사용될 수 있다. STA 또는 AP는 관리 동작 프레임을 전송할 수 있다. 관리 동작 프레임은 하나 이상의 VHT 관리 기능을 지원하는 필드를 포함할 수 있다. 하나 이상의 VHT 관리 기능은 다채널 불연속 스펙트럼 운용과 관계될 수 있다. 관리 동작 프레임의 수신에 응답해서, STA 또는 AP는 수신된 관리 동작 프레임에 따른 동작을 수행할 수 있다. 수신측의 STA 또는 AP는 관리 동작 프레임에서 표시된 카테고리 또는 서브타입(subtype)에 기초하여 확인응답(ACK)을 전송할 수 있다.

### 도면의 간단한 설명

[0007] 더욱 상세한 이해는 첨부 도면과 함께 예로서 주어지는 이하의 설명으로부터 얻을 수 있다.

도 1a는 하나 이상의 본 발명의 실시형태가 구현되는 예시적인 통신 시스템의 계통도이다.

도 1b는 도 1a의 통신 시스템에서 사용할 수 있는 예시적인 무선 송신/수신 유닛(WTRU)의 계통도이다.

도 1c는 도 1a의 통신 시스템에서 사용할 수 있는 예시적인 무선 접근 네트워크 및 예시적인 코어 네트워크의 계통도이다.

도 2는 예시적인 매체 접근 제어(MAC) 프레임을 보인 도이다.

도 3은 예시적인 초고처리율(VHT) 관리 동작 프레임을 보인 도이다.

도 4는 예시적인 2차 채널 옵셋 정보 요소(IE)를 보인 도이다.

도 5는 예시적인 VHT 통지 대역폭 구성 프레임을 보인 도이다.

도 6은 예시적인 VHT 세트 위상조정형 공존 운용(PCO) 위상 프레임을 보인 도이다.

도 7은 예시적인 VHT 다중입력 다중출력(MIMO) 제어 동작 프레임을 보인 도이다.

도 8은 예시적인 20/40/80 BSS 공존 관리 프레임을 보인 도이다.

도 9는 예시적인 20/40/80 BSS 공존 IE를 보인 도이다.

도 10은 예시적인 20/40/80 BSS 편협 채널 리포트 IE를 보인 도이다.

도 11은 VHT 통신에서 관리 동작을 지원하는 예시적인 방법의 흐름도이다.

## 발명을 실시하기 위한 구체적인 내용

[0008] 도 1a는 하나 이상의 본 발명의 실시형태를 구현할 수 있는 예시적인 통신 시스템(100)을 보인 도이다. 통신 시스템(100)은 복수의 무선 사용자에게 음성, 데이터, 영상, 메시지, 방송 등의 콘텐트를 제공하는 다중 접속 시스템일 수 있다. 통신 시스템(100)은 복수의 무선 사용자들이 무선 대역폭을 포함한 시스템 리소스를 공유함으로써 상기 콘텐트에 접근할 수 있게 한다. 예를 들면, 통신 시스템(100)은 코드 분할 다중 접속(CDMA), 시분할 다중 접속(TDMA), 주파수 분할 다중 접속(FDMA), 직교 FDMA(OFDMA), 단일 반송파 FDMA(SC-FDMA) 등과 같은 하나 이상의 채널 접속 방법을 이용할 수 있다.

[0009] 도 1a에 도시된 것처럼, 통신 시스템(100)은 무선 송신/수신 유닛(WTRU)(102a, 102b, 102c, 102d), 무선 접근 네트워크(RAN)(104), 코어 네트워크(106), 공중 교환식 전화망(PSTN)(108), 인터넷(110) 및 기타의 네트워크(112)를 포함하고 있지만, 본 발명의 실시형태는 임의 수의 WTRU, 기지국, 네트워크 및/또는 네트워크 요소를 포함할 수 있다는 것을 이해할 것이다. 각 WTRU(102a, 102b, 102c, 102d)는 무선 환경에서 동작 및/또는 통신하도록 구성된 임의 유형의 장치일 수 있다. 예를 들면, WTRU(102a, 102b, 102c, 102d)는 무선 신호를 송신 및/또는 수신하도록 구성되고 사용자 장비(UE), 이동국, 고정식 또는 이동식 가입자 유닛, 페이저, 셀룰러 전화기, 개인 정보 단말기(PDA), 스마트폰, 랩톱, 넷북, 퍼스널 컴퓨터, 무선 센서, 소비자 전자제품 등을 포함할 수 있다.

[0010] 통신 시스템(100)은 기지국(114a, 114b)을 또한 포함할 수 있다. 각 기지국(114a, 114b)은 적어도 하나의 WTRU(102a, 102b, 102c, 102d)와 무선으로 인터페이스 접속하여 코어 네트워크(106), 인터넷(110) 및/또는 네트워크(112) 등의 하나 이상의 통신 네트워크에 액세스하도록 구성된 임의 유형의 장치일 수 있다. 예를 들면, 기지국(114a, 114b)은 베이스 송수신기 스테이션(BTS), 노드-B, e노드 B, 홈 노드 B, 사이트 제어기, 접근점(AP), 무선 라우터 등일 수 있다. 비록 기지국(114a, 114b)이 각각 단일 요소로서 도시되어 있지만, 기지국(114a, 114b)은 임의 수의 상호접속된 기지국 및/또는 네트워크 요소를 포함할 수 있다는 것을 이해할 것이다.

[0011] 기지국(114a)은 RAN(104)의 일부일 수 있고, RAN(104)은 기지국 제어기(BSC), 라디오 네트워크 제어기(RNC), 중계 노드 등과 같은 다른 기지국 및/또는 네트워크 요소(도시 생략됨)를 또한 포함할 수 있다. 기지국(114a 및/또는 114b)은 셀(도시 생략됨)이라고도 부르는 특정의 지리적 영역 내에서 무선 신호를 송신 및/또는 수신하도록 구성될 수 있다. 셀은 복수의 셀 섹터로 세분될 수 있다. 예를 들면, 기지국(114a)과 관련된 셀은 3개의 섹터로 나누어질 수 있다. 따라서, 일 실시형태에 있어서, 기지국(114a)은 셀의 각 섹터마다 하나씩 3개의 송수신기를 포함할 수 있다. 다른 실시형태에 있어서, 기지국(114a)은 다중입력 다중출력(MIMO) 기술을 사용할 수 있고, 따라서 셀의 각 섹터마다 복수의 송수신기를 사용할 수 있다.

[0012] 기지국(114a, 114b)은 임의의 적당한 무선 통신 링크(예를 들면, 라디오 주파수(RF), 마이크로파, 적외선(IR), 자외선(UV), 가시광선 등)일 수 있는 무선 인터페이스(116)를 통하여 하나 이상의 WTRU(102a, 102b, 102c, 102d)과 통신할 수 있다. 무선 인터페이스(116)는 임의의 적당한 무선 접근 기술(RAT)을 이용하여 확립될 수 있다.

[0013] 더 구체적으로, 위에서 언급한 것처럼, 통신 시스템(100)은 다중 접근 시스템일 수 있고, CDMA, TDMA, FDMA, OFDMA, SC-FDMA 등과 같은 하나 이상의 채널 접근 방식을 이용할 수 있다. 예를 들면, RAN(104) 내의 기지국

(114a)과 WTRU(102a, 102b, 102c)는 광대역 CDMA(WCDMA)를 이용하여 무선 인터페이스(116)를 확립하는 범용 이동통신 시스템(UMTS) 지상 라디오 액세스(UTRA)와 같은 라디오 기술을 구현할 수 있다. WCDMA는 고속 패킷 액세스(HSPA) 및/또는 진화형 HSPA(HSPA+)와 같은 통신 프로토콜을 포함할 수 있다. HSPA는 고속 다운링크 패킷 액세스(HSDPA) 및/또는 고속 업링크 패킷 액세스(HSUPA)를 포함할 수 있다.

[0014] 다른 실시형태에 있어서, 기지국(114a)과 WTRU(102a, 102b, 102c)는 롱텀 에볼루션(LTE) 및/또는 LTE-어드반스드(LTE-A)를 이용하여 무선 인터페이스(116)를 확립하는 진화형 UMTS 지상 라디오 액세스(E-UTRA)와 같은 라디오 기술을 구현할 수 있다.

[0015] 다른 실시형태에 있어서, 기지국(114a)과 WTRU(102a, 102b, 102c)는 전기 전자 기술자 연구소(IEEE) 802.16(즉, WiMAX(Worldwide Interoperability for Microwave Access)), CDMA2000, CDMA2000 1X, CDMA2000 EV-DO, 임시(Interim) 표준 2000(IS-2000), 임시 표준 95(IS-95), 임시 표준 856(IS-856), 글로벌 이동통신 시스템(GSM), EDGE(Enhanced Data rates for GSM Evolution), GSM EDGE(GERAN) 등과 같은 라디오 기술을 구현할 수 있다.

[0016] 도 1a의 기지국(114b)은 예를 들면 무선 라우터, 홈 노드 B, 홈 e노드B, 또는 접근점일 수 있고, 사업장, 홈, 자동차, 캠퍼스 등과 같은 국소 지역에서 무선 접속을 가능하게 하는 임의의 적당한 RAT를 이용할 수 있다. 일 실시형태에 있어서, 기지국(114b)과 WTRU(102c, 102d)는 IEEE 802.11과 같은 라디오 기술을 구현하여 무선 로컬 영역 네트워크(WLAN)를 확립할 수 있다. 다른 실시형태에 있어서, 기지국(114b)과 WTRU(102c, 102d)는 IEEE 802.15와 같은 라디오 기술을 구현하여 무선 개인 영역 네트워크(WPAN)를 확립할 수 있다. 또 다른 실시형태에 있어서, 기지국(114b)과 WTRU(102c, 102d)는 셀룰러 기반 RAT(예를 들면, WCDMA, CDMA2000, GSM, LTE, LTE-A 등)를 이용하여 피코셀 또는 펨토셀을 확립할 수 있다. 도 1a에 도시된 바와 같이, 기지국(114b)은 인터넷(110)에 직접 접속될 수 있다. 그러므로, 기지국(114b)은 코어 네트워크(106)를 통해 인터넷(110)에 액세스할 필요가 없다.

[0017] RAN(104)은 코어 네트워크(106)와 통신하고, 코어 네트워크(106)는 하나 이상의 WTRU(102a, 102b, 102c, 102d)에게 음성, 데이터, 애플리케이션 및/또는 인터넷 프로토콜을 통한 음성(VoIP) 서비스를 제공하도록 구성된 임의 유형의 네트워크일 수 있다. 예를 들면, 코어 네트워크(106)는 호출 제어, 빌링(billing) 서비스, 모바일 위치 기반 서비스, 선불 통화, 인터넷 접속, 영상 분배 등을 제공할 수 있고, 및/또는 사용자 인증과 같은 고급 보안 기능을 수행할 수 있다. 비록 도 1a에 도시되어 있지 않지만, RAN(104) 및/또는 코어 네트워크(106)는 RAN(104)과 동일한 RAT 또는 다른 RAT를 이용하는 다른 RAN과 직접 또는 간접 통신을 할 수 있다는 것을 이해할 것이다. 예를 들면, E-UTRA 라디오 기술을 이용하는 RAN(104)에 접속되는 것 외에, 코어 네트워크(106)는 GSM 라디오 기술을 이용하는 다른 RAN(도시 생략됨)과도 또한 통신할 수 있다.

[0018] 코어 네트워크(106)는 WTRU(102a, 102b, 102c, 102d)가 PSTN(108), 인터넷(110) 및/또는 기타 네트워크(112)에 액세스하게 하는 게이트웨이로서 또한 기능할 수 있다. PSTN(108)은 재래식 전화 서비스(POTS)를 제공하는 회선 교환식 전화망을 포함할 수 있다. 인터넷(110)은 TCP/IP 인터넷 프로토콜 스위트(suite)에서 전송 제어 프로토콜(TCP), 사용자 데이터그램 프로토콜(UDP) 및 인터넷 프로토콜(IP)과 같은 공통의 통신 프로토콜을 이용하는 상호접속된 컴퓨터 네트워크 및 장치의 글로벌 시스템을 포함할 수 있다. 네트워크(112)는 다른 서비스 공급자에 의해 소유 및/또는 운용되는 유선 또는 무선 통신 네트워크를 포함할 수 있다. 예를 들면, 네트워크(112)는 RAN(104)과 동일한 RAT 또는 다른 RAT를 이용하는 하나 이상의 RAN에 접속된 다른 코어 네트워크를 포함할 수 있다.

[0019] 통신 시스템(100)의 WTRU(102a, 102b, 102c, 102d)의 일부 또는 전부는 다중 모드 능력을 구비할 수 있다. 즉, WTRU(102a, 102b, 102c, 102d)는 다른 무선 링크를 통하여 다른 무선 네트워크와 통신하기 위한 복수의 송수신기를 포함할 수 있다. 예를 들면, 도 1a에 도시된 WTRU(102c)는 셀룰러 기반 라디오 기술을 이용할 수 있는 기지국(114a) 및 IEEE 802 라디오 기술을 이용할 수 있는 기지국(114b)과 통신하도록 구성될 수 있다.

[0020] 도 1b는 예시적인 WTRU(102)의 계통도이다. 도 1b에 도시된 바와 같이, WTRU(102)는 프로세서(118), 송수신기(120), 송신/수신 엘리먼트(122), 스피커/마이크로폰(124), 키패드(126), 디스플레이/터치패드(128), 비분리형 메모리(130), 분리형 메모리(132), 전원(134), 글로벌 위치추적 시스템(GPS) 칩세트(136) 및 기타 주변장치(138)를 포함할 수 있다. WTRU(102)는 실시형태의 일관성을 유지하면서 전술한 요소들의 임의의 부조합(sub-combination)을 포함할 수 있다.

[0021] 프로세서(118)는 범용 프로세서, 특수 용도 프로세서, 전통적 프로세서, 디지털 신호 프로세서(DSP), 복수의 마이크로프로세서, DSP 코어와 연결(association)하는 하나 이상의 마이크로프로세서, 컨트롤러, 마이크로컨

트롤러, 용도 지정 집적회로(ASIC), 현장 프로그램가능 게이트 어레이(FPGA) 회로, 임의의 다른 유형의 집적회로(IC), 상태 머신 등일 수 있다. 프로세서(118)는 신호 부호화, 데이터 처리, 전력 제어, 입력/출력 처리, 및/또는 WTRU(102)가 무선 환경에서 동작하게 하는 임의의 다른 기능을 수행할 수 있다. 프로세서(118)는 송수신기(120)에 결합되고, 송수신기(120)는 송신/수신 엘리멘트(122)에 결합될 수 있다. 비록 도 1b에서는 프로세서(118)와 송수신기(120)가 별도의 구성요소로서 도시되어 있지만, 프로세서(118)와 송수신기(120)는 전자 패키지 또는 칩으로 함께 통합될 수 있음을 이해할 것이다.

[0022] 송신/수신 엘리멘트(122)는 무선 인터페이스(116)를 통하여 기지국(예를 들면 기지국(114a))에 신호를 전송하거나 상기 기지국으로부터 신호를 수신하도록 구성된다. 예를 들면, 일 실시형태에 있어서, 송신/수신 엘리멘트(122)는 RF 신호를 송신 및/또는 수신하도록 구성된 안테나일 수 있다. 다른 실시형태에 있어서, 송신/수신 엘리멘트(122)는 예를 들면, IR, UV 또는 가시광 신호를 송신 및/또는 수신하도록 구성된 에미터/검지기일 수 있다. 또 다른 실시형태에 있어서, 송신/수신 엘리멘트(122)는 RF 신호와 광신호 둘 다를 송신 및 수신하도록 구성될 수 있다. 송신/수신 엘리멘트(122)는 임의의 무선 신호 조합을 송신 및/또는 수신하도록 구성될 수 있다는 것을 이해할 것이다.

[0023] 또한, 비록 송신/수신 엘리멘트(122)가 도 1b에서 단일 엘리멘트로서 도시되어 있지만, WTRU(102)는 임의 수의 송신/수신 엘리멘트(122)를 포함할 수 있다. 더 구체적으로, WTRU(102)는 MIMO 기술을 이용할 수 있다. 따라서, 일 실시형태에 있어서, WTRU(102)는 무선 인터페이스(116)를 통해 무선 신호를 송신 및 수신하기 위해 2개 이상의 송신/수신 엘리멘트(122)(예를 들면, 다중 안테나)를 포함할 수 있다.

[0024] 송수신기(120)는 송신/수신 엘리멘트(122)에 의해 송신할 신호들을 변조하고 송신/수신 엘리멘트(122)에 의해 수신된 신호를 복조하도록 구성될 수 있다. 전술한 바와 같이, WTRU(102)는 다중 모드 능력을 구비할 수 있다. 따라서, 송수신기(120)는 WTRU(102)가 예를 들면 UTRA 및 IEEE 802.11과 같은 복수의 RAT를 통하여 통신하게 하는 복수의 송수신기를 포함할 수 있다.

[0025] WTRU(102)의 프로세서(118)는 스피커/마이크로폰(124), 키패드(126), 및/또는 디스플레이/터치패드(128)(예를 들면, 액정 디스플레이(LCD) 표시 장치 또는 유기 발광 다이오드(OLED) 표시 장치)에 결합되어 이들로부터 사용자 입력 데이터를 수신할 수 있다. 프로세서(118)는 또한 스피커/마이크로폰(124), 키패드(126), 및/또는 디스플레이/터치패드(128)에 사용자 데이터를 출력할 수 있다. 또한, 프로세서(118)는 비분리형 메모리(130) 및/또는 분리형 메모리(132)와 같은 임의 유형의 적당한 메모리로부터 정보를 액세스하고 상기 적당한 메모리에 데이터를 저장할 수 있다. 비분리형 메모리(130)는 랜덤 액세스 메모리(RAM), 읽기 전용 메모리(ROM), 하드 디스크 또는 임의의 다른 유형의 메모리 기억장치를 포함할 수 있다. 분리형 메모리(132)는 가입자 식별 모듈(SIM) 카드, 메모리 스틱, 보안 디지털(SD) 메모리 카드 등을 포함할 수 있다. 다른 실시형태에 있어서, 프로세서(118)는 서버 또는 홈 컴퓨터(도시 생략됨)와 같이 WTRU(102)에 물리적으로 위치되지 않은 메모리로부터 정보를 액세스하고 그러한 메모리에 데이터를 저장할 수 있다.

[0026] 프로세서(118)는 전원(134)으로부터 전력을 수신하고, WTRU(102)의 각종 구성요소에 대하여 전력을 분배 및/또는 제어하도록 구성될 수 있다. 전원(134)은 WTRU(102)에 전력을 공급하는 임의의 적당한 장치일 수 있다. 예를 들면, 전원(134)은 하나 이상의 건전지 배터리(예를 들면, 니켈-카드뮴(NiCd), 니켈-아연(NiZn), 니켈 금속 하이드라이드(NiMH), 리튬-이온(Li-ion) 등), 태양 전지, 연료 전지 등을 포함할 수 있다.

[0027] 프로세서(118)는 WTRU(102)의 현재 위치에 관한 위치 정보(예를 들면, 경도 및 위도)를 제공하도록 구성된 GPS 칩세트(136)에 또한 결합될 수 있다. GPS 칩세트(136)로부터의 정보에 추가해서 또는 그 대신으로, WTRU(102)는 기지국(예를 들면 기지국(114a, 114b))으로부터 무선 인터페이스(116)를 통해 위치 정보를 수신하고, 및/또는 2개 이상의 인근 기지국으로부터 신호가 수신되는 타이밍에 기초하여 그 위치를 결정할 수 있다. WTRU(102)는 실시형태의 일관성을 유지하면서 임의의 적당한 위치 결정 방법에 의해 위치 정보를 획득할 수 있다른 것을 이해할 것이다.

[0028] 프로세서(118)는 추가의 특징, 기능 및/또는 유선 또는 무선 접속을 제공하는 하나 이상의 소프트웨어 및/또는 하드웨어 모듈을 포함한 기타 주변 장치(138)에 또한 결합될 수 있다. 예를 들면, 주변 장치(138)는 가속도계, e-콤파스, 위성 송수신기, 디지털 카메라(사진용 또는 영상용), 범용 직렬 버스(USB) 포트, 진동 장치, 텔레비전 송수신기, 핸즈프리 헤드셋, 블루투스® 모듈, 주파수 변조(FM) 라디오 장치, 디지털 뮤직 플레이어, 미디어 플레이어, 비디오 게임 플레이어 모듈, 인터넷 브라우저 등을 포함할 수 있다.

[0029] 도 1c는 실시형태에 따른 RAN(104) 및 코어 네트워크(106)의 계통도이다. 전술한 바와 같이, RAN(104)은 E-UTRA 라디오 기술을 이용하여 무선 인터페이스(116)를 통해 WTRU(102a, 102b, 102c)와 통신할 수 있다.

RAN(104)은 코어 네트워크(106)와 또한 통신할 수 있다.

[0030] RAN(104)이 e노드-B(140a, 140b, 140c)를 포함하고 있지만, RAN(104)은 실시형태의 일관성을 유지하면서 임의 수의 e노드-B를 포함할 수 있다는 것을 이해할 것이다. e노드-B(140a, 140b, 140c)는 무선 인터페이스(116)를 통하여 WTRU(102a, 102b, 102c)와 통신하는 하나 이상의 송수신기를 각각 포함할 수 있다. 일 실시형태에 있어서, e노드-B(140a, 140b, 140c)는 MIMO 기술을 구현할 수 있다. 따라서, 예를 들면 e노드-B(140a)는 복수의 안테나를 사용하여 WTRU(102a)에 무선 신호를 전송하고 WTRU(102a)로부터 무선 신호를 수신할 수 있다.

[0031] 각각의 e노드-B(140a, 140b, 140c)는 특정 셀(도시 생략됨)과 관련될 수 있고, 라디오 리소스 관리 결정, 핸드오버 결정, 업링크 및/또는 다운링크에서 사용자의 스케줄링 등을 취급하도록 구성될 수 있다. 도 1c에 도시된 바와 같이, e노드-B(140a, 140b, 140c)는 X2 인터페이스를 통해 서로 통신할 수 있다.

[0032] 도 1c에 도시된 코어 네트워크(106)는 이동도 관리 게이트웨이(MME)(142), 서빙 게이트웨이(144) 및 패킷 데이터 네트워크(PDN) 게이트웨이(146)를 포함할 수 있다. 전술한 요소들이 각각 코어 네트워크(106)의 일부로서 도시되어 있지만, 이들 요소들 중 임의의 요소는 코어 네트워크 운용자가 아닌 다른 엔티티에 의해 소유되거나 운용될 수 있다는 것을 이해할 것이다.

[0033] MME(142)는 S1 인터페이스를 통해 RAN(104) 내의 각각의 e노드-B(140a, 140b, 140c)에 접속될 수 있고, 제어 노드로서 기능할 수 있다. 예를 들면, MME(142)는 WTRU(102a, 102b, 102c)의 사용자를 인증하고, 베어러를 활성화/비활성화하고, WTRU(102a, 102b, 102c)의 초기 접속중에 특정의 서빙 게이트웨이를 선택하는 등의 임무를 수행한다. MME(142)는 또한 GSM 또는 WCDMA와 같은 다른 라디오 기술을 이용하는 다른 RAN(도시 생략됨)과 RAN(104) 간의 스위칭을 위한 제어 평면 기능(control plane function)을 또한 제공할 수 있다.

[0034] 서빙 게이트웨이(144)는 RAN(104) 내의 각각의 e노드-B(140a, 140b, 140c)에 S1 인터페이스를 통해 접속될 수 있다. 서빙 게이트웨이(144)는 일반적으로 WTRU(102a, 102b, 102c)로/로부터 사용자 데이터 패킷을 라우트 및 회송할 수 있다. 서빙 게이트웨이(144)는 또한 e노드-B 간의 핸드오버 중에 사용자 평면(user plane)을 고정(anchoring)하는 것, 다운링크 데이터가 WTRU(102a, 102b, 102c)에 이용할 수 있을 때 페이징을 시동하는 것, WTRU(102a, 102b, 102c)의 콘텍스트를 관리 및 저장하는 것 등의 다른 기능을 수행할 수 있다.

[0035] 서빙 게이트웨이(144)는 PDN 게이트웨이(146)에 또한 접속될 수 있고, PDN 게이트웨이(146)는 WTRU(102a, 102b, 102c)와 IP-인에이블 장치 간의 통신을 돕도록 인터넷(110)과 같은 패킷 교환식 네트워크에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다. 무선 로컬 영역 네트워크(WLAN)(155)의 액세스 라우터(AR)(150)는 인터넷(110)과 통신할 수 있다. AR(150)은 AP(160a, 160b, 160c)들 간에 통신을 할 수 있게 한다. AP(160a, 160b, 160c)들은 STA(170a, 170b, 170c)와 통신할 수 있다.

[0036] 코어 네트워크(106)는 다른 네트워크와의 통신을 가능하게 한다. 예를 들면, 코어 네트워크(106)는 WTRU(102a, 102b, 102c)와 전통적인 지상선(land-line) 통신 장치 간의 통신이 가능하도록, PSTN(108)과 같은 회선 교환식 네트워크에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다. 예를 들면, 코어 네트워크(106)는 코어 네트워크(106)와 PSTN(108) 간의 인터페이스로서 기능하는 IP 게이트웨이(예를 들면, IP 멀티미디어 서브시스템(IMS) 서버)를 포함하거나 그러한 IP 게이트웨이와 통신할 수 있다. 또한, 코어 네트워크(106)는 다른 서비스 공급자에 의해 소유되거나 운용되는 다른 유선 또는 무선 네트워크를 포함하는 기타 네트워크(112)에 대한 액세스를 WTRU(102a, 102b, 102c)에게 제공할 수 있다.

[0037] 여기에서 사용하는 용어 "스테이션"(station)(STA)은, 비제한적인 예를 들자면, 무선 송신/수신 유닛(WTRU), 사용자 장비(UE), 이동국, 고정식 또는 이동식 가입자 유닛, 페이저, 셀룰러 전화기, 개인 정보 단말기(PDA), 컴퓨터, 모바일 인터넷 장치(MID), 또는 무선 환경에서 동작할 수 있는 임의의 다른 유형의 장치를 포함한다. 여기에서 사용하는 용어 "기지국"은, 비제한적인 예를 들자면, 노드-B, 사이트 제어기, 접근점(AP), 또는 무선 환경에서 동작할 수 있는 임의의 다른 유형의 인터페이스 장치를 포함한다.

[0038] 설명을 위해 각종 실시형태가 WLAN 상황에서 설명되지만, 각종 실시형태는 임의의 무선 통신 기술에서 구현될 수 있다. 일부 예시적인 유형의 무선 통신 기술은, 비제한적인 예를 들자면, WiMAX(Worldwide Interoperability for Microwave Access), 802.xx, 글로벌 이동통신 시스템(GSM), 코드분할 다중 접속(CDMA2000), 범용 이동통신 시스템(UMTS), 롱텀 에볼루션(LTE), 또는 임의의 미래 기술을 포함한다.

[0039] 최상위 MAC 계층에서 100 Mbps 이상의 초고처리율(VHT)을 가진 WLAN은 여기에서 설명하는 실시형태들을 구현하도록 설계될 수 있다. 이러한 실시형태를 구현하는 VHT WLAN은 다중 사용자 다중입력 다중출력(MU-MIMO) 기술, 새로운 부호화 특징, 새로운 절전 특징 등과 같은 특징들을 또한 포함할 수 있다. MU-MIMO 기술은 동일한

주파수로 복수의 STA에 대한 동시 전송을 가능하게 하고, 또한 동일한 주파수로 복수의 STA로부터 동시 수신을 또한 가능하게 한다. VHT 패킷 전송 및 레가시 패킷 전송을 위한 새로운 VHT 보호 특징이 구현될 수 있다. VHT AP가 조밀하게 전개되어 있는 시나리오에서는 이웃 BSS로부터의 간섭이 높기 때문에 중첩 BSS 관리가 필요할 수 있다. 텔레비전 여백(white space)(TVWS) 시나리오에서는 독립적으로 동작하는 네트워크/장치(및 라디오 기술에서의 다른 네트워크/장치까지)가 공통 TVWS 주파수 스펙트럼에서 공존 및 동작할 수 있다.

[0040] 고처리율(HT) 특징에 대한 관리 동작을 지원하기 위해 사용되는 IEEE 802.11 HT 동작 프레임은 VHT 특징을 가진 WLAN에서 적당하지 않을 수 있다. 여기에서 "VHT 동작 프레임"이라고 부르는 새로운 관리 동작 프레임은 VHT 특징에 대한 관리 동작을 확장하기 위해 필요할 수 있다. 또한, IEEE 802.11 동작 프레임에 대한 확장판(extensions)이 VHT 특징을 지원하기 위해 필요할 수 있다. WLAN에서 VHT 동작 프레임의 형태 및 IEEE 802.11 동작 프레임의 VHT 확장판의 형태로 VHT 관리 동작을 지원하기 위해 사용되는 예시적인 방법 및 장치가 여기에서 설명된다. VHT 동작 프레임은 새로운 카테고리 내에 있거나 또는 DLS, 퍼블릭, 스펙트럼 관리, HT 등과 같은 기존 802.11 카테고리 내에 있다. VHT 동작 프레임은, 만일 기존 802.11 카테고리로 지정되지 않으면, "VHT" 카테고리라고 부르는 새로운 카테고리 하에서 그룹화될 것이다.

[0041] 기반시설 BSS, 독립 BSS/애드혹, 또는 직접 링크 설정 시나리오에서의 VHT STA는 VHT 관리 동작 프레임을 전송하거나 수신할 수 있다. 기반시설 BSS 시나리오에서, VHT AP도 또한 VHT 관리 동작 프레임을 전송하거나 수신할 수 있다.

[0042] 802.11에서 서브타입 "동작"과 "확인응답(ACK) 없는 동작"의 관리 프레임은 스펙트럼 관리, QoS, DLS, 퍼블릭, HT 등과 같은 각종 카테고리에 관계된 확장형 관리 동작을 위해 사용된다. 예를 들어서, 802.11 퍼블릭 동작 프레임은 예컨대 상호 BSS(inter-BSS) 및 AP가 비연결 STA와 통신할 수 있게 하는 퍼블릭으로 설정된 카테고리 필드를 가진 관리 동작 프레임일 수 있다. 이 예에서, 송신측 STA/AP 및 수신측 STA/AP는 다른 BSS와 연결될 수 있고, 또는 송신측 STA와 수신측 STA 중의 어느 하나 또는 둘 다가 BSS와 연결되지 않을 수 있다.

[0043] 서브타입 "ACK 없는 동작"의 관리 프레임은 성공적인 수신을 한 수신측 STA/AP로부터 ACK 프레임을 수신하지 않을 수 있다. 또한, 관리 프레임 서브타입 "ACK 없는 동작"의 이러한 동작 프레임은 집성된 패킷 데이터 유닛(PDU)으로의 전송을 위해 데이터 프레임, 제어 프레임 및 관리 프레임 중 하나 이상으로 STA/AP에 의해 집성될 수 있다. 집성된 PDU는 패킷에 관한 정보를 포함하는 패킷/프레임 구분문자(delimiter)가 선행하는 각각의 개별 패킷, 및 만일 필요하다면 필요한 길이로, 예컨대 802.11n에서처럼 4 옥텟의 배수로 반올림하는 패딩 비트가 뒤따르는 각각의 개별 패킷을 구비한 개별 프레임/패킷을 포함할 수 있다. 서브타입 "동작"과 "ACK 없는 동작"의 관리 프레임은 모두 본원에서 "동작 프레임" 또는 "관리 동작 프레임"이라고 부를 것이다.

[0044] 도 2는 예시적인 매체 접근 제어(MAC) 프레임(200)을 보인 것이다. MAC 프레임(200)은 프리앰블(210), 헤더(220) 및 프레임 바디(body)(230)를 포함할 수 있다. 프레임 바디(230)는 VHT 관리 동작 프레임 바디(240)를 포함할 수 있다. VHT 관리 동작 프레임 바디(240)는 동작 카테고리 필드(250) 및 그 뒤에 동작 필드(260)를 포함할 수 있다. 동작 필드(260)는 동작 프레임의 유형, 예를 들면, 설정 요청, 설정 응답, 또는 해체(teardown)를 식별할 수 있다. 동작 필드(260) 뒤에는 다른 필드들(270a, 270b, ..., 270k)이 따를 수 있다. 다른 필드들(270a, 270b,..., 270k)은 동작 프레임 유형에 따라 특정될 수 있고, 이때 이 필드들 중의 하나 이상이 정보 요소(IE)일 수 있다.

[0045] AP와 STA는 예를 들면 연결, 재연결, 프로브 또는 비콘 프레임과 같은 관리 프레임의 임의의 새로운 또는 기존 관리/제어/데이터 프레임에서 VHT 관리 동작을 표시할 수 있다. IE는 정보를 전송하기 위해 MAC 프레임에 포함될 수 있다.

[0046] 도 3은 IE(310)를 포함하는 예시적인 VHT 관리 동작 프레임(300)을 보인 것이다. IE(310)는 엘리먼트 ID 필드(320), 길이 필드(330) 및 다수의 IE 필드(340a, 340b,...340n)를 포함할 수 있다. 엘리먼트 ID 필드(320)는 IE(310)에 특정된 ID를 포함할 수 있다. 길이 필드(330)는 길이 필드(330)를 뒤따르는 IE(310)의 길이를 표시할 수 있다.

[0047] 제1 예로서, 802.11 채널 스위치 고지 프레임은 80 MHz의 VHT 증가형 채널 대역폭 전송 모드를 지원하도록 수정될 수 있다. 채널 스위치 고지 프레임은 새로운 채널, 채널 번호 및 대역폭 구성으로 전환될 때를 광고하도록 BSS에서의 AP에 의해 또는 독립 BSS에서의 STA에 의해 보내질 수 있다. 802.11 채널 스위치 고지 프레임은 2차 채널 옵셋 IE를 내포한 카테고리 스펙트럼 관리의 동작 프레임일 수 있다.

[0048] 도 4는 VHT 80 MHz 대역폭 전송 및 VHT 다채널 전송을 지원하게끔 2차 채널 옵셋 정보값을 표시하도록 수정될 수 있는 예시적인 2차 채널 옵셋 IE(400)을 보인 것이다. 2차 채널 옵셋 IE(400)는 엘리먼트 ID 필드(410), 길이 필드(420) 및 2차 채널 옵셋 필드(430)를 포함할 수 있다.

[0049] 2차 채널 옵셋 필드(430)는 기존의 802.11n 표준의 40 MHz 전송 대역폭에 대하여 20 MHz 1차 채널에 대한 20 MHz 2차 채널의 위치를 표시할 수 있다. VHT 80 MHz 대역폭 전송 시나리오에서는 80 MHz 전송 대역폭을 제공하는 1차 20 MHz 채널과 함께 3개의 20 MHz 2차 채널이 있을 수 있다. 따라서, 80 MHz 대역폭 전송을 위하여, 20 MHz 1차 채널에 대한 3개의 20 MHz 2차 채널의 위치는 2차 채널 옵셋 필드(430) 내의 값으로 표시될 수 있다. 80 MHz 대역폭을 구성하는 20 MHz 채널은 연속적인 것일 필요가 없다. VHT 특징은 이러한 80 MHz 대역폭 신호의 전송 및 수신을 지원할 수 있다. VHT 특징은 20 MHz 채널의 각종 조합을 이용하여 복수의 병렬 전송을 비롯해서 다채널 전송을 또한 지원할 수 있다.

[0050] 다채널 전송 시나리오에서, 채널들의 구성은 2차 채널 옵셋 필드(430)에서 1차 채널에 대하여 표시될 수 있다. 또한, VHT 특징은 2차 채널이 1차 채널에 인접하지 않은 경우에 40 MHz 대역폭 신호의 전송 및 수신을 지원할 수 있고, 2차 채널 옵셋 필드(430)에서 표시될 수 있다. VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송에 대응하는 2차 채널 옵셋 필드(430)에 대한 가능한 2차 채널 구성 및 대응하는 값들의 예는 표 1에 나타내었다. 정확한 수치값은 0 내지 255의 범위 내에서 임의의 비사용(unused) 값으로부터 플렉시블하게하게 선택할 수 있다.

표 1

[0051] 2차 채널 구성

| 값 | 설명 |
|---|---|
| 0 | 2차 채널이 존재하지 않음을 표시한다(20 MHz) |
| 1 | 2차 채널이 1차 채널 위에 있음을 표시한다(40 MHz에 대해) |
| 2 | 비사용 |
| 3 | 2차 채널이 1차 채널 아래에 있음을 표시한다(40 MHz에 대해) |
| 256까지의 임의의 비사용 값(플렉시블) | 3개의 2차 채널이 1차 채널 바로 위에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 3개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 2개의 2차 채널이 1차 채널 바로 위에 있고 1개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 1개의 2차 채널이 1차 채널 바로 위에 있고 2개의 2차 채널이 1차 채널 바로 아래에 있음을 표시한다(4개의 연속적인 20 MHz 채널로 구성된 80 MHz 대역폭) |
| 256까지의 임의의 비사용 값(플렉시블) | 80 MHz 대역폭이 4개의 연속적인 20 MHz 채널로 구성되지 않은 경우에 1차 채널에 대한 3개의 2차 채널 각각의 위치 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 40 MHz 대역폭이 2개의 연속적인 20 MHz 채널로 구성되지 않은 경우에 1차 채널에 대한 2차 채널의 위치 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 1차 채널에 대한 VHT 다채널 전송용 2차 채널의 구성을 표시한다. 이러한 구성이 다수개 가능하고, 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 255까지의 나머지 | 비사용/리저브 |

[0052] 2차 채널 옵셋 필드(430)는 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송을 지원하는 2차 채널 구성을 표시하는 하나 이상의 값을 포함하도록 수정될 수 있다. 2차 채널 옵셋 필드(430)는 예를 들면, 1) 독립 BSS의 AP 또는 STA에 의해 보내진 비콘, 프로브 응답, 연결 응답, 및 재연결 응답 프레임에; 2) 독립 BSS의 AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 운용 IE에; 3) 독립 BSS의 AP 또는 STA에 의해 보내진 채널 스위치 고지(동작) 프레임에; 또는 4) AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 능력 IE에 포함될 수 있다.

[0053] 제2 예로서, VHT 통지 대역폭 구성 프레임은 카테고리 VHT의 동작 프레임이고, VHT WLAN에서 각종 대역폭 20/40/80 MHz를 지원하기 위해 사용될 수 있다. 이 예에서, VHT STA 또는 AP는 VHT 통지 대역폭 구성 프레임

을 보내서 자신에게 보내진 프레임의 대역폭 구성을 변경할 수 있다.

[0054] 도 5는 예시적인 VHT 통지 대역폭 구성 프레임(500)을 보인 것이다. VHT 통지 대역폭 구성 프레임(500)은 카테고리 필드(510), 동작 필드(520), 및 VHT 대역폭 구성 필드(530)를 포함할 수 있다. 카테고리 필드(510)는 VHT를 표시하는 값으로 설정될 수 있다. 동작 필드(520)는 VHT 통지 대역폭 구성을 표시하는 값으로 설정될 수 있다. VHT 대역폭 구성 필드(530)는 이 동작 프레임을 전송하는 STA 또는 AP에 보내질 프레임에 대하여 요청된 대역폭 구성을 포함할 수 있다. VHT 대역폭 구성 필드(530)의 값들은 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송 및 VHT 다채널 전송이 가능한 각종 대역폭 구성에 대응할 수 있다. 각종 대역폭 구성은 예를 들면 제1 예로서 설명하고 도 4 및 표 1에 각각 나타낸 수정 2차 채널 옵셋 IE 및/또는 2차 채널 옵셋 필드(430)에서 제공될 수 있다. 대안적으로, 카테고리 HT의 802.11 통지 채널 폭 프레임은 표 1에 나타낸 하나 이상의 VHT 대역폭 구성을 802.11 채널 폭 필드에 추가함으로써 VHT를 지원하도록 수정될 수 있다.

[0055] 제3 예로서, VHT 세트 위상조정형(phased) 공존 운용(PCO) 위상 프레임은 카테고리 VHT의 동작 프레임이고, VHT WLAN에서 PCO를 지원하기 위해 사용될 수 있다. VHT WLAN BSS는 VHT PCO를 채용할 수 있고, 이 경우 VHT AP는 20/40/80 MHz 대역폭 동작 사이에서 시간을 분할할 수 있다. 예를 들면, 20/40/80 MHz, 40/80 MHz, 20/80 MHz 및 20/40 MHz와 같이 모든 가능한 조합이 고려될 수 있다. 또한, 40 MHz 및 80 MHz 대역폭을 구성하는 연속적 및 불연속적 채널 구성이 있을 수 있기 때문에, 40 MHz 및 80 MHz에 대하여 수 개의 가능한 대역폭 구성 또는 PCO 위상이 있을 수 있다. 예를 들면, AP는 VHT 위상조정형 공존 운용을 위하여 미리 정해진 대역폭 집합 중에서 BSS 운용을 스위칭할 수 있다. 다른 특징이 VHT PCO에 추가될 수 있고, 이 경우, 병렬 채널 전송 구성을 비롯한 다채널 전송 구성이 추가의 PCO 위상으로서 지원된다. 이 예에서, VHT AP는 상기 다채널 전송 구성/위상으로의 스위칭을 표시할 수 있다. VHT 세트 PCO 위상 프레임은 20 MHz, 40 MHz 및 80 MHz 위상 중에서 위상 변화를 고지하도록 AP에 의해 보내질 수 있다.

[0056] 도 6은 예시적인 VHT 세트 PCO 위상 프레임(600)을 보인 도이다. VHT 세트 PCO 위상 프레임(600)은 카테고리 필드(610), 동작 필드(620) 및 VHT PCO 위상 제어 필드(630)를 포함할 수 있다. 카테고리 필드(610)는 VHT를 표시하는 값으로 설정될 수 있다. 동작 필드(620)는 VHT 세트 PCO 위상을 표시하기 위해 규정된 값으로 설정될 수 있다. VHT PCO 위상 제어 필드(630)는 현재 PCO 위상을 표시할 수 있다. 이 정보는 수정된 802.11 PCO 위상 제어 필드에서 표시될 수 있고, 표 2에 나타낸 값들 중에서 하나 이상을 포함할 수 있다.

표 2

[0057] VHT PCO 위상에 대한 값을 가진 수정된 802.11 PCO 위상 제어 필드

| 값 | 설명 |
|---|---|
| 0 | 20 MHz 위상을 표시한다 |
| 1 | 40 MHz 위상을 표시한다 |
| 256까지의 임의의 비사용 값(플렉시블) | (a) 2개의 연속적인 또는 (b) 2개의 불연속적인 20 MHz 채널에 의해 형성된 1차 채널에 대한 40 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 4개의 연속적인 20 MHz 채널에 의해 형성된 1차 채널에 대한 80 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 4개의 연속적인 20 MHz 채널에 의해 형성되지 않은 1차 채널에 대한 80 MHz 대역폭 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 256까지의 임의의 비사용 값(플렉시블) | 1차 채널에 대한 VHT 다채널 전송 구성을 표시한다. 많은 이러한 구성이 가능하고 각 구성은 그 구성과 관련된 값을 가질 수 있다. |
| 255까지의 나머지 | 사용되지 않음/리저브 |

[0058] VHT PCO 위상은 표 2에 나타낸 것처럼 VHT 80 MHz 대역폭 전송, VHT 40 MHz 대역폭 전송, 및 VHT 다채널 전송에서 지원될 수 있는 각종의 대역폭 구성 중에서 하나 이상에 대응할 수 있다. 하나의 대안예로서, 카테고리 HT의 802.11 세트 PCO 위상 프레임은 802.11 PCO 위상 제어 필드를 표 2에 나타낸 것처럼 VHT PCO 위상에 대한 값을 포함하는 수정된 PCO 위상 제어 필드로 교체함으로써 VHT PCO를 지원하도록 수정될 수 있다. 다른 대안예로서, 운용 표시의 현재 VHT PCO 위상 또는 그에 관한 정보는 독립 BSS의 AP 또는 STA에 의해 보내진 비콘, 프로브 응답, 연결 응답 및 재연결 응답 프레임에 포함될 수 있고, 또는 독립 BSS의 AP 또는 STA에 의해 보내진 프레임에 포함된 VHT 운용 IE에 포함될 수 있다.

[0059] 제4의 예로서, 하기의 것, 즉, 1) 1~32 범위의 채널 상태 정보 및/또는 전송 빔포밍(beamforming) 피드백 매트릭스에 대한 다수의 열; 2) 1~32 범위의 채널 상태 정보/전송 빔포밍 피드백 매트릭스에 대한 다수의 행; 3) 표 1에 나타낸 20/40/80 MHz에 대한 각종 대역폭 구성의 경우를 망라하는 MIMO 제어 채널 폭 표시; 4) 1~16 범위의 하나 이상의 부반송파 집합으로 그룹화된 다수의 OFDM 부반송파; 5) 4~6 범위의 채널 상태 정보/전송 빔포밍 피드백 매트릭스 내 각 요소의 실수부와 허수부 표시의 다수의 비트; 6) 압축된 빔포밍 매트릭스에 대한 코드북 정보의 사이즈; 7) 관련 측정 리포트의 세그멘트에 대한 0~31 범위의 나머지 세그멘트 번호; 및 8) 사운딩 패킷의 수신의 끝에 대응하는 사운딩 타임스탬프 중의 하나 이상을 포함하도록, 802.11 MIMO 제어 필드가 수정되거나 또는 VHT MIMO 제어 필드가 생성될 수 있고, 이 경우 사운딩 패킷은 MIMO 제어 필드를 포함하는 프레임에 포함될 피드백 정보를 발생하기 위해 사용될 수 있다. 수정된 MIMO 제어 필드와 VHT MIMO 제어 필드는 802.11 HT 채널 상태 정보(CSI) 동작 프레임, VHT CSI 동작 프레임, 802.11 HT 비압축 빔포밍 동작 프레임, VHT 비압축 빔포밍 동작 프레임, 802.11 HT 압축 빔포밍 동작 프레임, 또는 VHT 압축 빔포밍 동작 프레임에 포함될 수 있다.

[0060] 도 7은 VHT 압축 빔포밍 리포트 동작 프레임(700)의 예시적인 프레임 바디를 보인 것이다. VHT 압축 빔포밍 리포트 동작 프레임(700)은 카테고리 필드(710), 동작 필드(720), VHT MIMO 제어 필드(730) 및 압축 빔포밍 리포트(740)를 포함할 수 있다.

[0061] 제5 예로서, 20/40/80 MHz에 대한 수정된 802.11 압축 빔포밍 리포트 필드, 또는 VHT를 지원하도록 구성된 압축 빔포밍 리포트 필드(740)는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 각각의 공간-시간 스트림에 대한 리포트를 보내는 STA의 평균 신호대 잡음비(이 경우 스트림의 수는 매트릭스의 다수의 열로서 대응하는 MIMO 제어 필드에 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 압축 빔포밍 리포트 필드와 VHT를 지원하도록 구성된 압축 빔포밍 리포트 필드는 802.11 HT 압축 빔포밍 동작 프레임 또는 VHT 압축 빔포밍 동작 프레임에 포함될 수 있다. 802.11 HT 압축 빔포밍 동작 프레임과 VHT 압축 빔포밍 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 압축 빔포밍 피드백 요청 표시에 응답하여 STA/AP에 의해 보내질 수 있다.

[0062] 제6 예로서, 20/40/80 MHz에 대한 수정된 802.11 비압축 빔포밍 리포트 필드, 또는 VHT를 지원하도록 구성된 비압축 빔포밍 리포트 필드는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 각각의 공간-시간 스트림에 대한 리포트를 보내는 STA의 평균 신호대 잡음비(이 경우 스트림의 수는 매트릭스의 다수의 열로서 대응하는 MIMO 제어 필드에 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 빔포밍 피드백 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 비압축 빔포밍 리포트 필드 및 VHT를 지원하도록 구성된 비압축 빔포밍 리포트 필드는 802.11 HT 비압축 빔포밍 동작 프레임 또는 VHT 비압축 빔포밍 동작 프레임에 포함될 수 있다. 802.11 HT 비압축 빔포밍 동작 프레임과 VHT 비압축 빔포밍 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 비압축 빔포밍 피드백 요청 표시에 응답하여 STA/AP에 의해 보내질 수 있다.

[0063] 제7 예로서, 20/40/80 MHz에 대한 수정된 802.11 CSI 리포트 필드, 또는 VHT를 지원하도록 구성된 CSI 리포트 필드는 하기의 것, 즉, 1) 8 비트 내지 16 비트 범위일 수 있는 해상도를 가진 리포트를 보내는 STA의 각 수신 체인에 대한 신호대 잡음비(SNR)(이 경우 수신 체인의 수는 매트릭스의 다수의 행으로서 대응하는 MIMO 제어 필드에서 특정될 수 있음); 2) 80 MHz에 대하여 -128~128 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스; 3) 40 MHz에 대하여 -58~58 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스; 4) 20 MHz에 대하여 -28~28 범위의 지수를 가진 OFDM 부반송파에 대한 CSI 매트릭스 중의 하나 이상을 포함할 수 있다. 20/40/80 MHz에 대한 수정된 802.11 CSI 리포트 필드 및 VHT를 지원하도록 구성된 CSI 리포트 필드는 802.11 HT CSI 동작 프레임 또는 VHT CSI 동작 프레임에 포함될 수 있다. 802.11 HT CSI 동작 프레임과 VHT CSI 동작 프레임은 요청측 STA/AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 CSI 피드백 요청 표시에 응답하여 STA 또는 AP에 의해 보내질 수 있다.

[0064] 제8 예로서, 802.11 동작 프레임은 VHT 능력 IE를 포함하도록 수정될 수 있다. 예를 들면, VHT 능력 IE는 802.11 DLS 요청 프레임, 802.11 DLS 응답 프레임, 802.11 터널형 직접 링크 설정(TDLS) 셋업 요청 프레임,

및 802.11 TDLS 셋업 응답 프레임의 프레임 바디에 추가될 수 있다. VHT 능력 IE는 VHT STA/AP에 의해 802.11 DLS 요청 및 응답 프레임에 추가될 수 있다. VHT 능력 IE는 VHT STA에 의해 802.11 TDLS 셋업 요청 및 TDLS 셋업 응답 프레임에 추가될 수 있다.

[0065] 제9 예로서, 20/40/80 공존 관리 프레임은 퍼블릭의 카테고리를 가진 동작 프레임일 수 있고, 80 MHz의 VHT 증가형 채널 대역폭 전송 모드를 지원하기 위해 사용될 수 있다. 20/40/80 BSS 공존 프레임은 20/40/80 BSS 공존을 위한 정보를 교환하기 위해 STA 또는 AP에 의해 사용될 수 있다.

[0066] 도 8은 예시적인 20/40/80 BSS 공존 관리 프레임(800)을 보인 것이다. 20/40/80 BSS 공존 관리 프레임(800)은 카테고리 필드(810), 동작 필드(820), 20/40/80 BSS 공존 필드(830), 및 20/40/80 BSS 편협(intolerant) 채널 리포트 필드(840)를 포함할 수 있다. 카테고리 필드(810)는 퍼블릭을 표시하는 값으로 설정될 수 있다. 동작 필드(820)는 20/40/80 BSS 공존 관리를 위해 규정된 값으로 설정될 수 있다.

[0067] 20/40/80 BSS 공존 필드(830)는 20/40/80 BSS 공존에 관련된 정보를 포함할 수 있다. 20/40/80 BSS 공존 필드(830)는 도 9에 도시된 바와 같은 20/40/80 BSS 공존 IE(900)를 포함할 수 있다. 20/40/80 BSS 공존 IE(900)는 20/40/80 BSS 공존을 위한 정보를 교환하기 위해 STA 또는 AP에 의해 사용될 수 있다. 20/40/80 BSS 공존 관리 프레임(800) 외에, STA 또는 AP는 20/40/80 BSS 공존 IE(900)를 비콘, 프로브 요청, 프로브 응답, 연결 요청, 연결 응답, 재연결 요청 및 재연결 응답 프레임에 포함시킬 수 있다.

[0068] 20/40/80 BSS 공존 IE(900)는 엘리먼트 ID 필드(910), 길이 필드(920), 정보 요청 표시 필드(930), 40 MHz 편협 표시 필드(940), 80 MHz 편협 표시 필드(950), 20 MHz BSS 폭 요청 필드(960), 중첩 BSS(OBSS) 스캐닝 면제 요청 필드(970), 및 OBSS 스캐닝 면제 허가 필드(980)를 포함할 수 있다. 엘리먼트 ID 필드(910)는 특히 20/40/80 BSS 공존 IE(900)에 대한 값을 표시할 수 있다. 길이 필드(920)는 길이 필드(920) 다음에 20/40/80 BSS 공존 IE(900)의 길이를 내포할 수 있다. 정보 요청 표시 필드(930)는 응답으로 20/40/80 BSS 공존 관리 프레임(800)을 보낸다는 것을 수신자에게 표시하기 위해 전송측 STA 또는 AP에 의해 사용될 수 있다.

[0069] 40 MHz 편협 표시 필드(940)는, 소정의 값으로 설정된 때, 이 정보를 수신하거나 리포팅하는 AP가 20/40 MHz BSS를 운용하는 것이 금지된다는 것을 표시할 수 있다. 이 필드가 상기 특정 값으로 설정되지 않은 때, 이 필드는 수신측 AP가 20/40 MHz BSS로서 운용하는 것을 금지하지 않을 수 있다. 80 MHz 편협 표시 필드(950)는, 소정의 값으로 설정된 때, 이 정보를 수신하거나 리포팅하는 AP가 20/40/80 MHz BSS를 운용하는 것이 금지된다는 것을 표시할 수 있다. 이 필드가 상기 특정 값으로 설정되지 않은 때, 이 필드는 수신측 AP가 20/40/80 MHz BSS로서 운용하는 것을 금지하지 않을 수 있다. 20 MHz BSS 폭 요청 필드(960)는, 소정의 값으로 설정된 때, 수신측 AP가 20/40/80 MHz BSS 또는 20/40 MHz BSS로서 운용하는 것이 금지된다는 것을 표시할 수 있다.

[0070] OBSS 스캐닝 면제 요청 필드(970)는, 소정의 값으로 설정된 때, 전송측 STA가 수신측 AP에 의한 OBSS 스캐닝으로부터 면제될 것을 요청한다는 것을 표시할 수 있다. OBSS 스캐닝 면제 허가 필드(980)는, 소정의 값으로 설정된 때, 수신측 STA가 전송측 AP에 의해 OBSS 스캐닝을 수행하는 것으로부터 면제된다는 것을 표시할 수 있다. 대안적인 실시형태로서, 20/40/80 BSS 공존 IE(900)는 80 MHz 편협 필드(950)를 추가함으로써 802.11 20/40 BSS 공존 엘리먼트를 수정하여 생성될 수 있다.

[0071] 20/40/80 BSS 편협 채널 리포트(840)는 20/40/80 MHz BSS 운용을 허용하지 않는 채널에 대한 정보를 내포할 수 있다. 예를 들면, 20/40/80 BSS 편협 채널 리포트 필드(840)는 도 10에 도시된 바와 같은 20/40/80 BSS 편협 채널 리포트 IE(1000)를 내포할 수 있다.

[0072] 20/40/80 BSS 편협 채널 리포트 IE(1000)는 엘리먼트 ID 필드(1010), 길이 필드(1020), 단속 분류 정보 필드(1030) 및 채널 리스트 필드(1040)를 포함할 수 있다. 엘리먼트 ID 필드(1010)는 특히 20/40/80 BSS 편협 채널 리포트 IE(1000)에 대한 값을 표시할 수 있다. 길이 필드(1020)는 길이 필드(1020) 다음에 20/40/80 BSS 편협 채널 리포트 IE(1000)의 길이를 내포할 수 있다. 단속 분류 정보 필드(1030)는 채널 리스트 필드(1040) 내의 채널 리스트가 유효인 단속 분류를 특정하는 정보를 내포할 수 있다. 채널 리스트 필드(1040)는 20/40/80 MHz BSS 운용이 허용되지 않는 채널들의 리스트를 내포할 수 있다.

[0073] 제10 예로서, 16개까지의 안테나를 지원하도록 802.11 안테나 선택 지수 필드가 수정되거나, 또는 VHT 안테나 선택 지수 필드가 생성될 수 있다. 802.11 안테나 선택 지수 필드는 길이가 8 비트이고 8개의 안테나만을 지원할 수 있으며, 이 경우, 필드 내의 각 비트는 대응하는 안테나의 선택을 표시하기 위해 사용될 수 있다. 수정된 802.11 안테나 선택 지수 필드 및 VHT 안테나 선택 지수 필드는 16 비트일 수 있고, 이 경우, 각 비트는 안테나 지수에 대응할 수 있으며 대응하는 안테나의 선택을 표시하기 위해 사용될 수 있다. 수정된 802.11 안

테나 선택 지수 필드 및 VHT 안테나 선택 지수 필드는 802.11 HT 안테나 선택 지수 피드백 동작 프레임 또는 VHT 안테나 선택 지수 피드백 동작 프레임에 포함될 수 있고, 요청측 STA 또는 AP로부터 수신된 프레임의 HT 제어 필드 또는 VHT 제어 필드에 포함된 안테나 선택 지수 피드백 요청 표시에 응답하여 STA 또는 AP에 의해 보내질 수 있다.

[0074] 도 11은 VHT 통신의 관리 동작을 지원하는 예시적인 방법(1100)의 흐름도이다. STA/AP(1110)는 관리 동작 프레임(1120)을 다른 STA2(1130)에게 전송할 수 있다. 관리 동작 프레임(1120)은 VHT 동작 프레임일 수 있고, 카테고리 및/또는 서브타입이 지정될 수 있다. STA2(1130)는 운용 파라미터(1140)를 관리 동작 프레임(1120) 내의 필드에 기초하여 변경할 수 있다.

[0075] 각각의 VHT 동작 프레임에 대한 카테고리의 지정은 VHT 동작 프레임이 "VHT" 또는 임의의 802.11 카테고리와 같은 새로운 카테고리가 지정되도록 플렉시블할 수 있다. 또한, VHT 동작 프레임은 서브타입 "동작" 또는 "ACK 있는 동작", 및 "ACK 없는 동작"을 가질 수 있다. 더욱이, "ACK 없는 동작" 서브타입 VHT 동작 프레임은 집성된 패킷 데이터 유닛의 전송을 위해 데이터 프레임, 제어 프레임 및 관리 프레임 중 하나 이상과 STA/AP에 의해 집성될 수 있다. 예를 들면, STA2(1130) 또는 AP는, 만일 서브타입 "동작"의 VHT 동작 프레임을 수신하면, ACK(1150)를 전송할 수 있다. STA2(1130) 또는 AP는, 만일 서브타입 "ACK 없는 동작"의 VHT 동작 프레임을 수신하면, ACK(1150)를 전송하지 않을 수 있다.

[0076] 실시형태

[0077] 1. 무선 통신에서 사용하는 방법에 있어서,

[0078] 관리 동작 프레임을 수신하는 단계와;

[0079] 수신된 관리 동작 프레임 내의 표시에 따라 운용 파라미터를 변경하는 단계를 포함한 방법.

[0080] 2. 실시형태 1에 있어서, 관리 동작 프레임은 VHT 관리 기능을 지원하는 필드를 포함한 것인 방법.

[0081] 3. 실시형태 2에 있어서, VHT 관리 기능은 다채널 전송과 관련된 것인 방법.

[0082] 4. 실시형태 2에 있어서, VHT 관리 기능은 불연속 스펙트럼 전송과 관련된 것인 방법.

[0083] 5. 실시형태 2~4 중 어느 하나에 있어서, 상기 필드는 VHT 다중입력 다중출력(MIMO) 제어 필드인 방법.

[0084] 6. 실시형태 5에 있어서, VHT MIMO 제어 필드는 대역폭 구성을 표시하는 MIMO 제어 채널 폭 표시자를 포함한 것인 방법.

[0085] 7. 실시형태 6에 있어서, 대역폭 구성은 VHT 다채널 전송을 위한 복수의 2차 채널을 포함한 것인 방법.

[0086] 8. 실시형태 7에 있어서, 복수의 2차 채널은 1차 채널과 관계있는 것인 방법.

[0087] 9. 실시형태 5~8 중 어느 하나에 있어서, VHT MIMO 제어 필드는 복수의 직교 주파수 분할 다중화(OFDM) 부반송파를 포함한 것인 방법.

[0088] 10. 실시형태 10에 있어서, 복수의 OFDM 부반송파는 세트로 그룹화된 것인 방법.

[0089] 11. 실시형태 5~10 중 어느 하나에 있어서, VHT MIMO 제어 필드는 채널 상태 정보(CSI) 요소 내의 각 요소의 실수부와 허수부를 표시하는 복수의 비트를 포함한 것인 방법.

[0090] 12. 실시형태 5~11 중 어느 하나에 있어서, VHT MIMO 제어 필드는 전송 빔포밍 피드백 매트릭스 내의 각 요소의 실수부와 허수부를 표시하는 복수의 비트를 포함한 것인 방법.

[0091] 13. 실시형태 5~12 중 어느 하나에 있어서, VHT MIMO 제어 필드는 압축 빔포밍 매트릭스 코드북 정보 사이즈를 포함한 것인 방법.

[0092] 14. 실시형태 5~13 중 어느 하나에 있어서, VHT MIMO 제어 필드는 관련 측정 리포트의 나머지 세그멘트 번호를 표시하는 것인 방법.

[0093] 15. 실시형태 1~14 중 어느 하나에 있어서, 사운딩 패킷을 수신하는 단계와;

[0094] 관리 동작 프레임 내의 사운딩 패킷에 기초하여 피드백을 전송하는 단계를 더 포함한 방법.

[0095] 16. 실시형태 15에 있어서, VHT 다중입력 다중출력(MIMO) 제어 필드는 사운딩 타임스탬프를 포함한 것인 방법.

[0096] 17. 실시형태 16에 있어서, 사운딩 타임스탬프는 사운딩 패킷의 수신의 끝에 대응하는 것인 방법.

[0097] 18. 실시형태 1~17 중 어느 하나에 있어서, 관리 프레임은 압축 빔포밍 리포트 필드를 포함한 것인 방법.

[0098] 19. 실시형태 18에 있어서, 압축 빔포밍 리포트 필드는 스테이션(STA)의 평균 신호대 잡음비(SNR)를 포함한 것인 방법.

[0099] 20. 실시형태 18 또는 19에 있어서, 압축 빔포밍 리포트 필드는 접근점(AP)의 평균 신호대 잡음비(SNR)를 포함한 것인 방법.

[0100] 21. 실시형태 18~20 중 어느 하나에 있어서, 압축 빔포밍 리포트 필드는 빔포밍 피드백 매트릭스를 포함한 것인 방법.

[0101] 22. 실시형태 21에 있어서, 빔포밍 피드백 매트릭스는 복수의 직교 주파수 분할 다중화(OFDM) 부반송파용인 방법.

[0102] 23. 실시형태 2~22 중 어느 하나에 있어서, 상기 필드는 VHT 2차 채널 옵셋 필드인 방법.

[0103] 24. 실시형태 23에 있어서, VHT 2차 채널 옵셋 필드는 하나 이상의 2차 채널 구성의 지원을 표시하는 값을 포함한 것인 방법.

[0104] 25. 실시형태 24에 있어서, 2차 채널 구성은 VHT 80 MHz 대역폭 전송을 포함한 것인 방법.

[0105] 26. 실시형태 24 또는 25에 있어서, 2차 채널 구성은 VHT 20 MHz 대역폭 전송을 포함한 것인 방법.

[0106] 27. 실시형태 24~26 중 어느 하나에 있어서, 2차 채널 구성은 VHT 다채널 전송을 포함한 것인 방법.

[0107] 28. 실시형태 23~27 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 비콘 프레임에 포함된 것인 방법.

[0108] 29. 실시형태 23~28 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 프로브 응답 프레임에 포함된 것인 방법.

[0109] 30. 실시형태 23~29 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 연결 응답 프레임에 포함된 것인 방법.

[0110] 31. 실시형태 23~30 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 독립 기본 서비스 세트(BSS)의 재연결 응답 프레임에 포함된 것인 방법.

[0111] 32. 실시형태 23~31 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 독립 기본 서비스 세트(BSS)의 VHT 운용 IE에 포함된 것인 방법.

[0112] 33. 실시형태 23~32 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 독립 기본 서비스 세트(BSS)의 채널 스위치 고지 동작 프레임에 포함된 것인 방법.

[0113] 34. 실시형태 23~33 중 어느 하나에 있어서, 2차 채널 옵셋 필드는 VHT 능력 정보 요소(IE)에 포함된 것인 방법.

[0114] 35. 실시형태 1~34 중 어느 하나에 있어서, 관리 프레임은 VHT 통지 대역폭 구성 프레임인 방법.

[0115] 36. 실시형태 35에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 20 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

[0116] 37. 실시형태 35 또는 36에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 40 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

[0117] 38. 실시형태 35~37 중 어느 하나에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 무선 로컬 영역 네트워크(WLAN)에서 80 MHz 대역폭을 지원하기 위해 사용되는 것인 방법.

[0118] 39. 실시형태 35~38 중 어느 하나에 있어서, VHT 통지 대역폭 구성 프레임은 VHT 대역폭 구성 필드를 포함한 것인 방법.

[0119] 40. 실시형태 35~39 중 어느 하나에 있어서, 스테이션(STA) 또는 접근점(AP)에 보내진 프레임의 대역폭 구성을 변경하도록 VHT 통지 대역폭 구성 프레임을 전송하는 단계를 더 포함한 방법.

[0120] 41. 실시형태 39 또는 40에 있어서, VHT 대역폭 구성 필드는 VHT 80 MHz 대역폭 전송의 지원을 표시하는 것인 방법.

[0121] 42. 실시형태 39~41 중 어느 하나에 있어서, VHT 대역폭 구성 필드는 VHT 40 MHz 대역폭 전송의 지원을 표시

하는 것인 방법.

[0122] 43. 실시형태 39~42 중 어느 하나에 있어서, VHT 대역폭 구성 필드는 VHT 다채널 전송의 지원을 표시하는 것인 방법.

[0123] 44. 실시형태 1~43 중 어느 하나에 있어서, 관리 동작 프레임은 서브타입 '확인응답(ACK) 있는 동작'의 것인 방법.

[0124] 45. 실시형태 44에 있어서, ACK를 전송하는 단계를 더 포함한 방법.

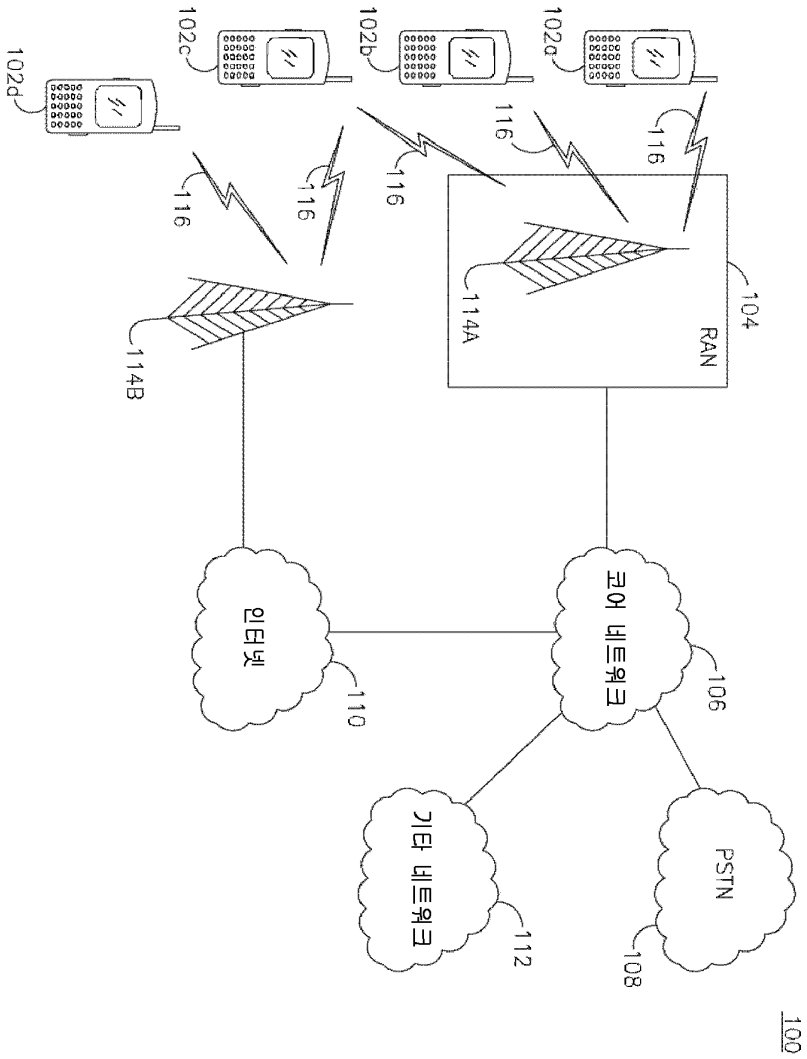
[0125] 46. 실시형태 1~43 중 어느 하나에 있어서, 관리 동작 프레임은 서브타입 '확인응답(ACK) 없는 동작'의 것인 방법.

[0126] 47. 실시형태 1~46의 방법들 중 임의의 하나를 구현하도록 구성된 스테이션(STA).

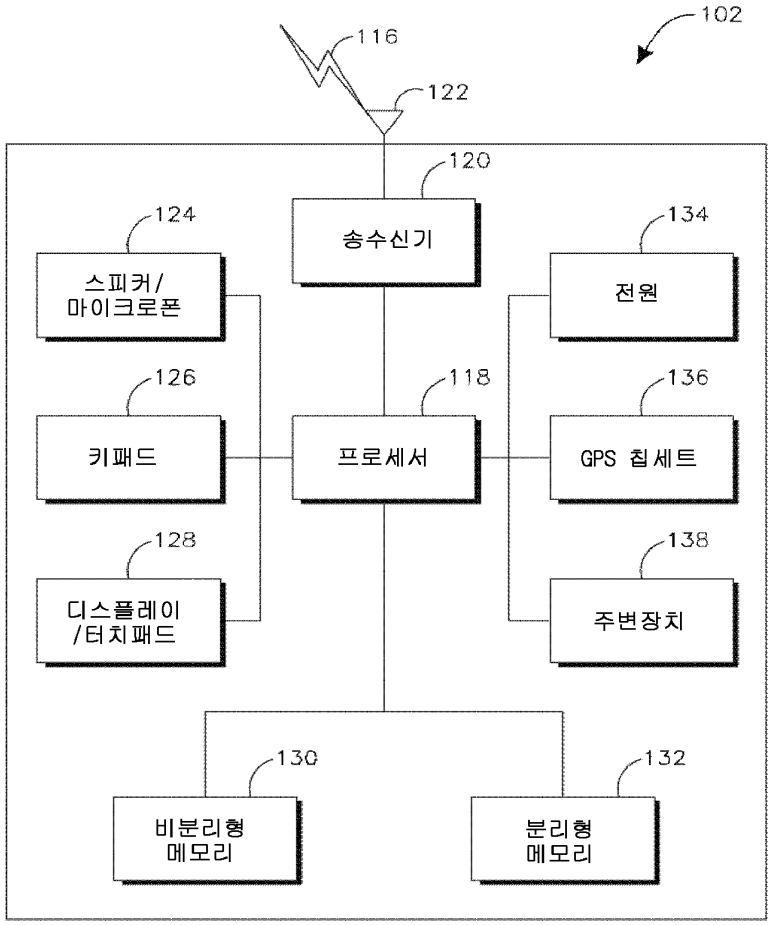
[0127] 48. 실시형태 1~46의 방법들 중 임의의 하나를 구현하도록 구성된 접근점(AP).

[0128] 지금까지 특징 및 요소들을 특수한 조합으로 설명하였지만, 이 기술에 통상의 지식을 가진 사람이라면 각 특징 또는 요소는 단독으로 또는 다른 특징 및 요소와 함께 임의의 조합으로 사용될 수 있다는 것을 이해할 것이다. 또한, 여기에서 설명한 방법들은 컴퓨터 또는 프로세서에 의해 실행되는 컴퓨터 판독가능 매체에 통합된 컴퓨터 프로그램, 소프트웨어 또는 펌웨어로 구현될 수 있다. 컴퓨터 판독가능 매체의 예로는 전자 신호(유선 또는 무선 접속을 통해 전송된 것) 및 컴퓨터 판독가능 기억 매체가 있다. 컴퓨터 판독가능 기억 매체의 비제한적인 예로는 읽기 전용 메모리(ROM), 랜덤 액세스 메모리(RAM), 레지스터, 캐시 메모리, 반도체 메모리 소자, 내부 하드 디스크 및 착탈식 디스크와 같은 자기 매체, 자기 광학 매체, 및 CD-ROM 디스크 및 디지털 다기능 디스크(DVD)와 같은 광학 매체가 있다. 프로세서는 소프트웨어와 연결해서 WTRU, UE, 단말기, 기지국, RNC, 또는 임의의 호스트 컴퓨터에서 사용되는 라디오 주파수 송수신기를 구현하기 위해 사용될 수 있다.

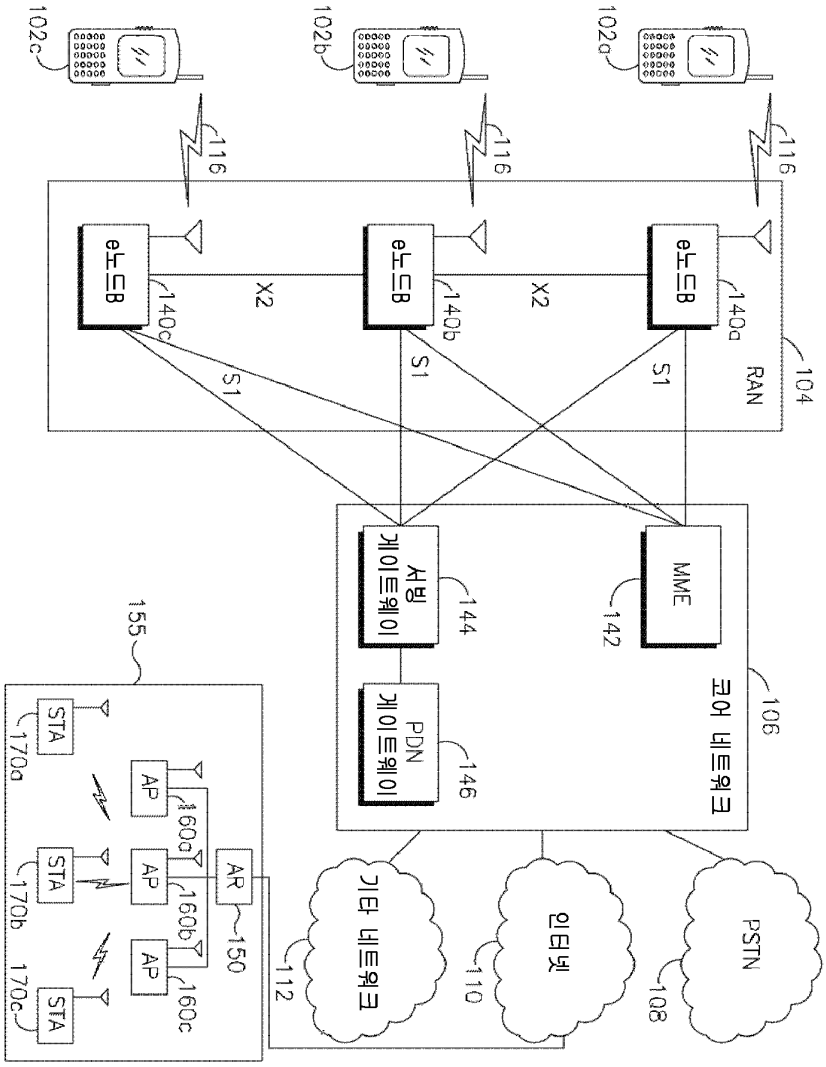
도면1a


102a
102b
102c
102d
116
114A
114B
RAN
104
코어 네트워크
106
인터넷
110
기타 네트워크
112
PSTN
108
100

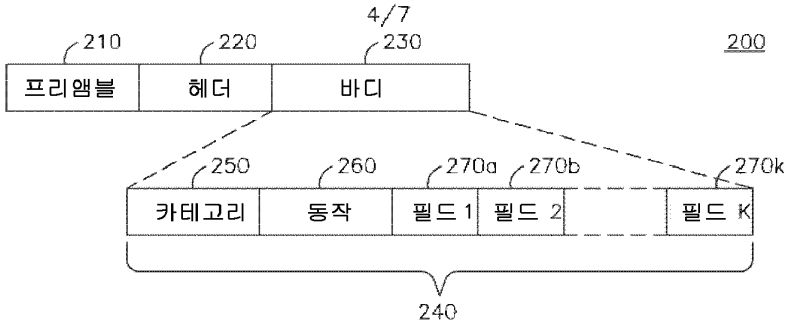
도면1b


102
116
122
120
송수신기
124
스피커/
마이크로폰
134
전원
126
키패드
118
프로세서
136
GPS 칩세트
128
디스플레이
/터치패드
138
주변장치
130
비분리형
메모리
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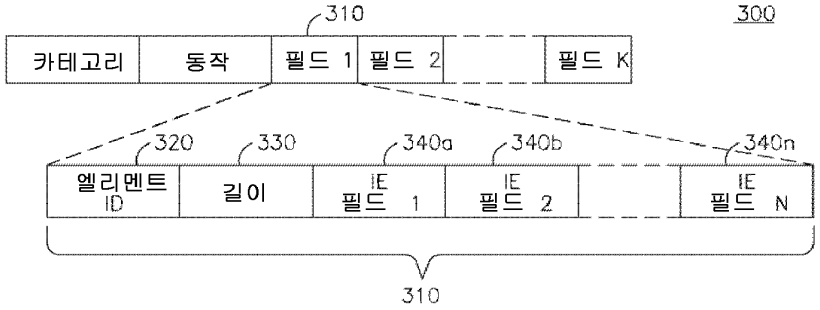
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S1
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MME
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PDN 게이트웨이
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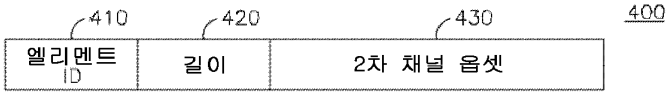
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카테고리
동작
필드 1
필드 2
필드 K
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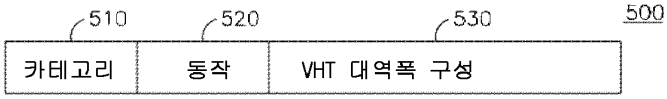
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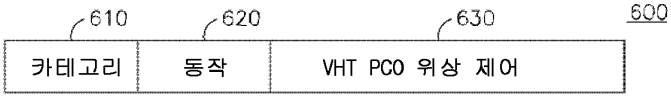

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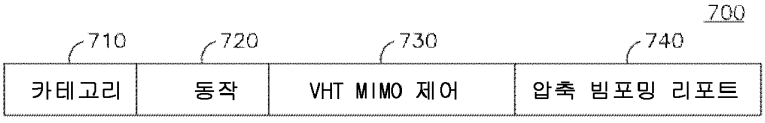

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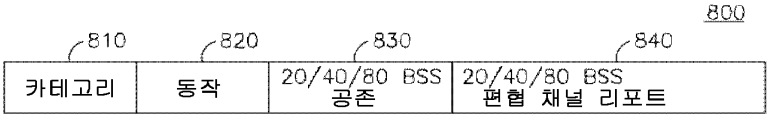

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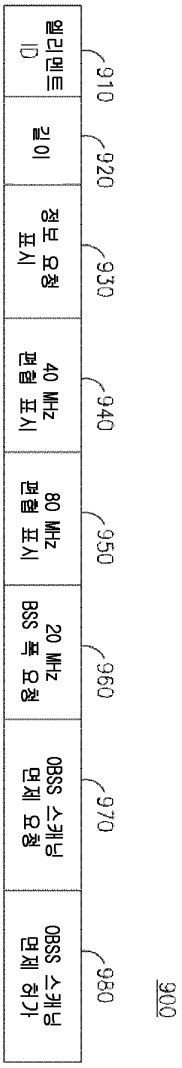

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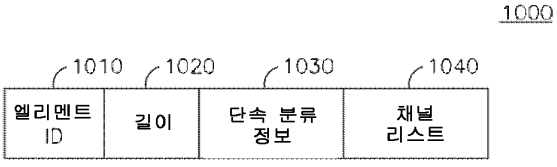

도면8



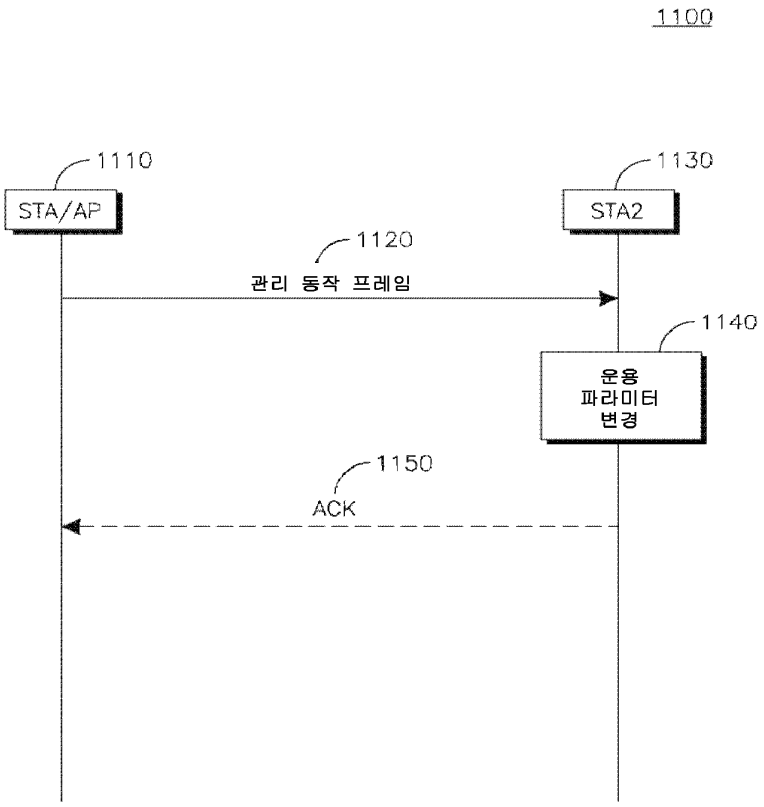
도 9


엘리멘트 ID
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920
정보 요청
930
40 MHz 폐쇄 표시
940
80 MHz 폐쇄 표시
950
20 MHz BSS 폭 요청
960
OBSS 스캐닝 면제 요청
970
OBSS 스캐닝 면제 허가
980
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도 10


1000
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엘리멘트 ID
길이
단속 분류 정보
채널 리스트

도면11


1100
1110
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1120
관리 동작 프레임
1140
운용
파라미터
변경
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Espacenet

# Bibliographic data: WO2017111567 (A2) — 2017-06-29

## WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

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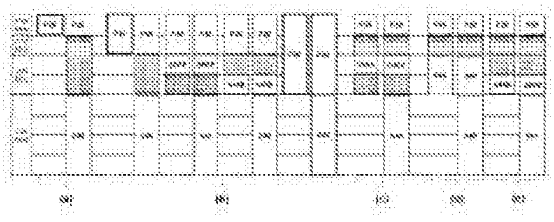
**Classification:** - international: ***H04L1/00; H04L27/26; H04L29/08; H04L5/00; H04W74/00; H04W74/08; H04W84/12***
- cooperative: **H04L1/00; H04L27/26; H04L29/08; H04L5/00; H04W74/00; H04W74/08; H04W84/12**

**Application number:** WO2016KR15297 20161226 Global Dossier

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**Also published as:** WO2017111567 (A3)

### Abstract of WO2017111567 (A2)



The present invention relates to a wireless communication method and a wireless communication terminal, which use a discontinuous channel. To this end, the present invention provides a wireless communication terminal and a wireless communication method using the same, the terminal comprising: a processor; and a transmission and reception unit, wherein the processor receives a wireless packet through a communication unit, acquires discontinuous channel allocation information of the received packet, and decodes the received packet on the basis of the acquired discontinuous channel allocation information.

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# CLAIMS WO2017111567

1.
1. A wireless communication terminal, comprising: a processor; And a communication unit, wherein the processor is configured to receive the wireless packet through the communication unit, obtain non- contiguous channel allocation information of the received packet, and receive the non- contiguous channel allocation information based on the obtained discontinuous channel allocation information. A wireless communication terminal for decoding a packet.

2.
The wireless communication terminal of claim 1, wherein the discontinuous channel assignment information is indicated through at least one of a sub- field of HE- SIG- A and a sub- field of HE- SIG- B of the received packet.

3.
The wireless communication terminal according to claim 2, wherein the discontinuous channel allocation information indicates unassigned channel information in units of 20 MHz.

4.
4. The method of claim 3, wherein the discontinuous channel assignment information is indicated via a bandwidth field of the HE- SIG- A, wherein the bandwidth field comprises

a total bandwidth information to which the packet is to be transmitted, A wireless communication terminal for indicating channel information.

5.
5. The wireless communications terminal of claim 4, wherein the bandwidth field indexes puncturing of at least one of two 20 MHz channels of a 40 MHz subchannel and puncturing of a 20 MHz subchannel.

6.
4. The wireless communication terminal of claim 3, wherein the discontinuous channel allocation information is indicated through a predetermined index of a resource unit allocation field of the HE- SIG- B.

7.
The wireless communication terminal of claim 6, wherein the resource unit allocation field indicates a specific resource unit (RU) not assigned to a user through a predetermined index.

8.
8. The wireless communications terminal of claim 7, wherein the particular resource unit not assigned to the user is at least one of a 242- tone resource unit, a 484- tone resource unit, and a 996- tone resource unit.

9.
2. The method of claim 1, wherein the discontinuous channel assignment information includes resource unit arrangement information indicated by the resource unit allocation field of the HE- SIG- B, and null (Null) inserted into a user field corresponding to a specific resource unit in the resource unit arrangement. ) A wireless communication terminal obtained through an STA ID.

10.
10. The wireless communication terminal of claim 9, wherein the specific resource unit is at least one of a 26- tone resource unit, a 52- tone resource unit, and a 106- tone resource unit.

11.
The wireless communication terminal of claim 1, wherein the discontinuous channel allocation information is indicated through a combination of a bandwidth field of the HE-SIG- A and a resource unit allocation field of the HE- SIG- B.

12.
12. The method of claim 11, wherein the bandwidth field indicates total bandwidth information to which the packet is to be transmitted and channel information to be punctured within the total bandwidth, and wherein the resource unit allocation field includes additional puncturing information within the total bandwidth The wireless communication terminal.

13.
13. The method of claim 12, wherein if the bandwidth field indicates puncturing of one of two 20 MHz channels of a 40 MHz subchannel at a total bandwidth of 80 MHz, The wireless communication terminal indicating whether to be choked.

14.
13. The method of claim 12, wherein if the bandwidth field indicates puncturing of a 20 MHz subchannel at a total bandwidth of 160 MHz or 80 + 80 MHz, then the resource unit allocation field may include a radio communication terminal .

15.
13. The method of claim 12, wherein if the bandwidth field indicates puncturing of at least one of two 20 MHz channels of a 40 MHz subchannel at a total bandwidth of 160 MHz or 80 + 80 MHz, A wireless communications terminal that indicates which 20 MHz channel is to be punctured.

16.
13. The method of claim 12, wherein if the bandwidth field indicates at least one puncturing of two 20MHz channels of a 40MHz subchannel at a total bandwidth of 160MHz or 80 + 80MHz, A wireless communications terminal that directs additional puncturing.

17.
The method of claim 1, wherein when the packet is transmitted at a total bandwidth of 80 MHz or more, the discontinuous channel assignment information includes information of a field (C26 field) indicating whether a central 26- tone resource unit at 80 MHz is allocated to a user Further comprising:

18.
18. The method of claim 17, wherein the HE- SIG- B field of the packet comprises a HE- SIG- B content channel 1 and a HE- SIG- B content channel 2 in units of 20 MHz, A wireless communication terminal carried on both the content channel 1 and the HE- SIG- B content channel 2.

19.
19. The method of claim 18, wherein when the packet is transmitted at a total bandwidth of 80 MHz, the C26 field carried on the HE- SIG- B content channel 1 and the C26 field carried on the HE- SIG- All indicating that the central 26- tone resource unit of the 80 MHz total bandwidth has been allocated to the user.

20.
20. The method of claim 19, wherein if the C26 field indicates assignment of the central 26- tone resource unit, a user field corresponding to the central 26- tone resource unit is associated with a user specific field of the HE- SIG- To the wireless communication terminal.

21.
19. The method of claim 18, wherein when the packet is transmitted at a total bandwidth of 160 MHz or 80 + 80 MHz, the total bandwidth is comprised of a first 80 MHz bandwidth and a second 80 MHz bandwidth, The first C26 field indicating whether the first central 26- tone resource unit of the first 80MHz bandwidth is allocated to the user and the second C26 field carried over the HE- SIG- B content channel 2 indicates the 2 A wireless communications terminal that indicates whether a second central 26- tone resource unit of 80 MHz bandwidth is allocated to a user.

22.
22. The method of claim 21, wherein if the first C26 field indicates assignment of the first central 26- tone resource unit, the user field corresponding to the first central 26-

Tone resource unit is conveyed via a user specific field of channel 1 and the second C26 field indicates assignment of the second central 26- tone resource unit, the user field corresponding to the second central 26- - SIG- B A wireless communication terminal carried on a user- specific field of content channel 2.

23.

A wireless communication method of a wireless communication terminal, comprising: receiving a wireless packet; Obtaining discontinuous channel allocation information of the received packet; And decoding the received packet based on the obtained discontinuous channel assignment information. Lt; / RTI & gt;

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# DESCRIPTION WO2017111567

Wireless communication method using discontinuous channel and wireless communication terminal

The present invention relates to a wireless communication method and a wireless communication terminal using a discontinuous channel, and more particularly, to a wireless communication method and a wireless communication terminal for efficiently signaling discontinuous channel allocation information.

Recently, with the spread of mobile devices, wireless LAN technology capable of providing a fast wireless Internet service has attracted much attention. Wireless LAN technology is a technology that enables mobile devices such as smart phones, smart pads, laptop computers, portable multimedia players, and embedded devices to be connected to the Internet wirelessly at home, at a company or at a specific service area, to be.

Since IEEE 802.11 supports the initial wireless LAN technology using 2.4 GHz frequency, a variety of technology standards are being put into practical use or under development. First, IEEE 802.11b supports a communication speed of up to 11 Mbps using a frequency of 2.4 GHz band. IEEE 802.11a, which has been commercialized since IEEE 802.11b, uses the frequency of the 5GHz band instead of the 2.4GHz band, thereby reducing the influence on the interference compared to the frequency of the highly congested 2.4GHz band. Using OFDM technology, To 54 Mbps. However, IEEE 802.11a has a short communication distance compared to IEEE 802.11b. IEEE 802.11g, like IEEE

802.11b, uses a frequency of 2.4GHz band to achieve a communication speed of up to 54Mbps and has received considerable attention because it meets backward compatibility. It is superior.

IEEE 802.11n is a technical standard established to overcome the limitation of communication speed which is pointed out as a vulnerability in wireless LAN. IEEE 802.11n aims to increase the speed and reliability of the network and to extend the operating distance of the wireless network. More specifically, IEEE 802.11n supports high throughput (HT) with data rates of up to 540 Mbps or higher, and uses multiple antennas at both ends of the transmitter and receiver to minimize transmission errors and optimize data rate. It is based on Multiple Inputs and Multiple Outputs (MIMO) technology. In addition, the specification can use a coding scheme that transfers multiple duplicate copies to improve data reliability.

As the spread of the wireless LAN is activated and the applications using it are diversified, there is a need for a new wireless LAN system to support a very high throughput (VHT) higher than the data processing speed supported by IEEE 802.11n . Among them, IEEE 802.11ac supports wide bandwidth (80MHz ~ 160MHz) at 5GHz frequency. The IEEE 802.11ac standard is defined only in the 5GHz band, but for backward compatibility with existing 2.4GHz band products, early 11ac chipsets will also support operation in the 2.4GHz band. Theoretically, according to this standard, the wireless LAN speed of multiple stations is at least 1Gbps, and the maximum single link speed is at least 500Mbps. This is accomplished by extending the concept of wireless interfaces received in 802.11n, including wider radio frequency bandwidth (up to 160 MHz), more MIMO spatial streams (up to 8), multiuser MIMO, and high density modulation (up to 256 QAM). In addition, IEEE 802.11ad is a method of transmitting data using a 60 GHz band instead of the existing 2.4 GHz / 5 GHz. IEEE 802.11ad is a transmission specification that uses a beamforming technique to provide speeds of up to 7 Gbps and is suitable for high bitrate video streaming, such as large amounts of data or uncompressed HD video. However, the 60 GHz frequency band has a disadvantage in that it is difficult to pass through obstacles, so that it can be used only between devices in a near space.

Recently, as a next generation wireless LAN standard after 802.11ac and 802.11ad, discussions for providing high- efficiency and high- performance wireless LAN communication technology in a high density environment have been continuing. That is, in the next generation wireless LAN environment, communication with high frequency efficiency should be provided in the presence of a high density station and an access

point (AP), and various techniques are required to realize this.

The present invention has an object to provide high- efficiency / high- performance wireless LAN communication in a high- density environment as described above.

In order to solve the above problems, the present invention provides a wireless communication method and a wireless communication terminal of a terminal as follows.

First, according to an embodiment of the present invention, there is provided a wireless communication terminal, comprising: a processor ; And a communication unit, wherein the processor is configured to receive the wireless packet through the communication unit, obtain non- contiguous channel allocation information of the received packet, and receive the non- contiguous channel allocation information based on the obtained discontinuous channel allocation information. A wireless communication terminal for decoding a packet is provided.

According to another aspect of the present invention, there is provided a wireless communication method for a wireless communication terminal, comprising: receiving a wireless packet; Obtaining discontinuous channel allocation information of the received packet; And decoding the received packet based on the obtained discontinuous channel assignment information. A wireless communication method is provided.

According to another embodiment of the present invention, there is provided a base wireless communication terminal, comprising: a processor ; And a communication unit, wherein the processor performs multi- channel CCA for broadband packet transmission, and transmits a packet to at least one channel in an idle state based on a result of the multi- channel CCA, Channel to the base station through the non- legacy preamble of the packet when the base station transmits the discontinuous channel allocation information.

According to another embodiment of the present invention, there is provided a wireless communication method of a base wireless communication terminal, comprising: performing multi- channel CCA for broadband packet transmission; Transmitting a packet to at least one channel in an idle state based on a result of performing the CCA of the multiple channels; Wherein when the packet is transmitted on a discontinuous channel, discontinuous channel allocation information is signaled through a non- legacy

preamble of the packet.

The discontinuous channel assignment information is indicated through at least one of a sub- field of HE- SIG- A and a sub- field of HE- SIG- B of the received packet.

The discontinuous channel allocation information indicates unassigned channel information in units of 20 MHz.

The discontinuous channel assignment information is indicated through a bandwidth field of the HE- SIG- A, and the bandwidth field indicates total bandwidth information on which the packet is transmitted and channel information punctured within the total bandwidth.

The bandwidth field indexes puncturing of the 20 MHz subchannel and puncturing of at least one of the two 20 MHz channels of the 40 MHz subchannel.

The discontinuous channel assignment information is indicated through a predetermined index of the resource unit allocation field of the HE- SIG- B.

The resource unit allocation field indicates a specific resource unit (RU) not allocated to the user through a predetermined index.

The specific resource unit not assigned to the user is at least one of a 242- tone resource unit, a 484- tone resource unit, and a 996- tone resource unit.

The discontinuous channel allocation information is acquired through the Null STA ID inserted in the user field corresponding to the specific resource unit in the resource unit array and the resource unit array information indicated by the resource unit allocation field of the HE- SIG- B do.

The specific resource unit is at least one of a 26- tone resource unit, a 52- tone resource unit, and a 106- tone resource unit.

The discontinuous channel assignment information is indicated through a combination of the bandwidth field of the HE- SIG- A and the resource unit assignment field of the HE- SIG- B.

The bandwidth field indicates total bandwidth information to which the packet is to be transmitted and channel information to be punctured within the total bandwidth, and the resource unit allocation field indicates additional puncturing information within the total bandwidth.

If the bandwidth field indicates puncturing of one of two 20 MHz channels of a 40 MHz subchannel at a total bandwidth of 80 MHz, the resource unit allocation field indicates which 20 MHz channel of the 40 MHz subchannel is evaluated.

If the bandwidth field indicates puncturing of a 20 MHz subchannel at a total bandwidth of 160 MHz or 80 + 80 MHz, the resource unit allocation field indicates an additional puncturing in the 80 MHz subchannel.

If the bandwidth field indicates puncturing of at least one of two 20 MHz channels of a 40 MHz subchannel at a total bandwidth of 160 MHz or 80 + 80 MHz, then the resource unit allocation field may be set to any of the 40 MHz subchannels, .

If the bandwidth field indicates at least one puncturing of two 20MHz channels of a 40MHz subchannel at a total bandwidth of 160MHz or 80 + 80MHz, the resource unit allocation field indicates additional puncturing in the 80MHz subchannel .

When the packet is transmitted with a total bandwidth of 80 MHz or more, the discontinuous channel allocation information further includes information of a field (C26 field) indicating whether a central 26- tone resource unit at 80 MHz has been allocated to the user.

The HE- SIG- B field of the packet is composed of a HE- SIG- B content channel 1 and a HE- SIG- B content channel 2 in units of 20 MHz, SIG- B content channel 2.

When the packet is transmitted with a total bandwidth of 80 MHz, the C26 field carried on the HE- SIG- B content channel 1 and the C26 field carried on the HE- SIG- B content channel 2 all have the 80 MHz total bandwidth Tone resource unit is assigned to the user.

When the C26 field indicates the allocation of the central 26- tone resource unit, the user field corresponding to the central 26- tone resource unit is carried through the user specific field of the HE- SIG- B content channel 1. {

When the packet is transmitted at a total bandwidth of 160 MHz or 80 + 80 MHz, the total bandwidth is comprised of a first 80 MHz bandwidth and a second 80 MHz bandwidth, and the first C26 field carried over the HE- SIG- Wherein the second C26 field carried over the HE- SIG- B content channel 2 indicates whether a first central 26- tone resource unit of the first 80 MHz bandwidth is allocated to the user, Tone resource unit is assigned to the user.

When the first C26 field indicates the allocation of the first central 26- tone resource unit, the user field corresponding to the first central 26- tone resource unit is assigned to the user specific field of the HE- SIG- B content channel 1 And if the second C26 field indicates assignment of the second central 26- tone resource unit, the user field corresponding to the second central 26- tone resource unit is conveyed via the HE- SIG- B content channel 2 & lt; / RTI & gt; user- specific field.

According to an embodiment of the present invention, discontinuous channel assignment information can be efficiently signaled.

According to the embodiment of the present invention, it is possible to increase the overall resource utilization rate and improve the performance of the WLAN system in the contention- based channel access system.

1 shows a wireless LAN system according to an embodiment of the present invention.

2 shows a wireless LAN system according to another embodiment of the present invention.

3 shows a configuration of a station according to an embodiment of the present invention.

4 shows a configuration of an access point according to an embodiment of the present invention.

Figure 5 schematically illustrates the process by which the STA establishes a link with an AP.

6 shows a CSMA (Collision Avoidance) / CA (Collision Avoidance) method used in wireless LAN communication.

7 shows a method of performing DCF (Distributed Coordination Function) using a Request to Send (RTS) frame and a CTS (Clear to Send) frame.

8 and 9 illustrate a multi- user transmission method according to an embodiment of the present invention.

Figure 10 illustrates one embodiment of a legacy PPDU format and a non- legacy PPDU format.

FIG. 11 illustrates various HE PPDU formats and a method of indicating the HE PPDU format according to an embodiment of the present invention.

Figure 12 illustrates HE PPDU formats in accordance with a further embodiment of the present invention.

Figure 13 illustrates a power save operation scenario based on a PPDU format in

accordance with an embodiment of the present invention.

Fig. 14 shows an embodiment of the configuration of the HE- SIG- A field according to the HE PPDU format.

15 shows a configuration of an HE- SIG- B field according to an embodiment of the present invention.

FIG. 16 illustrates an encoding structure and transmission method of an HE- SIG- B according to an embodiment of the present invention.

FIG. 17 shows a sub- field structure of HE- SIG- B when the SIG- B compressed field indicates the compression mode of the HE- SIG- B field.

18 to 20 show channel expansion methods according to an embodiment of the present invention.

Figures 21 to 23 illustrate a transmission sequence of a discontinuous PPDU according to an embodiment of the present invention.

24 shows a method of setting the TXOP of the MU transmission procedure as a further embodiment of the present invention.

25 to 31 illustrate a method of signaling discontinuous channel assignment information according to various embodiments of the present invention.

32- 34 illustrate a method of discontinuous channel allocation according to various embodiments of the present invention.

35- 37 illustrate an embodiment of resource unit filtering according to a further embodiment of the present invention.

Figures 38 and 42 illustrate signaling methods of an HE MU PPDU in accordance with a further embodiment of the present invention.

43 and 44 show an embodiment in which transmission using an HE MU PPDU is performed between a single STA and an AP.

45 and 46 illustrate discontinuous channel allocation and signaling methods therefor according to a further embodiment of the present invention.

As used herein, terms used in the present invention are selected from general terms that are widely used in the present invention while considering the functions of the present invention, but these may vary depending on the intention of the artisan, custom or the emergence of new technology. Also, in certain cases, there may be a term selected arbitrarily by the applicant, and in this case, the meaning thereof will be described in the description of the corresponding invention. Therefore, it is intended that the terminology used herein should be interpreted relative to the actual meaning of the term, rather than the nomenclature, and its scope throughout this specification.

Throughout the specification, when a configuration is referred to as being & quot; coupled & quot; with another configuration, this includes not only & quot; directly connected & quot; do. Also, when an element is referred to as & quot; including & quot; an element, it is understood that the element may include other elements as well, without departing from the other elements unless specifically stated otherwise. In addition, the limitations of & quot; above & quot; or & quot; below & quot ;, respectively, based on a certain threshold value may be appropriately replaced with & quot;

This application is related to Korean Patent Application Nos. 10- 2015- 0186871, 10- 2016- 0004471, 10- 2016- 0005835, 10- 2016- 0026683, 10- 2016- 0030006, 10- 2016 - 0059182, 10- 2016- 0062422, and 10- 2016- 0083756, the disclosures of which are incorporated herein by reference, and the examples and descriptions described in each of the above applications which are the basis of priority are incorporated herein by reference, It shall be included in the explanation.

FIG. 1 illustrates a wireless LAN system according to an embodiment of the present invention. A WLAN system includes one or more Basic Service Sets (BSSs), which represent a collection of devices that can successfully communicate and communicate with one another. Generally, a BSS can be divided into an infrastructure BSS (infrastructure BSS) and an independent BSS (IBSS). FIG. 1 shows the infrastructure BSS.

1, an infrastructure BSS (BSS1, BSS2) includes one or more stations (STA1, STA2, STA3, STA4, STA5), an access point (PCP / 1, PCP / AP- 2), and a distribution system (DS) connecting a plurality of access points (PCP / AP- 1, PCP / AP- 2).

A station (STA) is any device including a medium access control (MAC) conforming to the IEEE 802.11 standard and a physical layer interface for a wireless medium, and is broadly referred to as a non- access point non- AP) station as well as an access point (AP). Also, in this specification, the term 'terminal' may refer to a non- AP STA or an AP, or may be used to refer to both. The station for wireless communication includes a processor and a communication unit, and may further include a user interface unit, a display unit, and the like according to an embodiment. The processor may create a frame to be transmitted over the wireless network, or may process the received frame over the wireless network, and may perform various processes for controlling the station. The communication unit is functionally connected to the processor and transmits and receives a frame through the wireless network for the station. In the present invention, a terminal can be used as a term including user equipment (UE).

An access point (AP) is an entity that provides a connection to a distribution system (DS) via a wireless medium for its associated station. Communication between non- AP stations in the infrastructure BSS is performed via an AP. However, when a direct link is established, direct communication is possible between non- AP stations. In the present invention, the AP is used as a concept including a PCP (Personal BSS Coordination Point), and broadly includes a central controller, a base station (BS), a node- B, a base transceiver system (BTS) Controller, and the like. In the present invention, an AP may also be referred to as a base radio communication terminal, and the base radio communication terminal is broadly referred to as an AP, a base station, an eNode (eNodeB), and a transmission point (TP) Lt; / RTI & gt; In addition, the base wireless communication terminal may include various types of wireless communication terminals that allocate communication medium resources in communication with a plurality of wireless communication terminals and perform scheduling.

A plurality of infrastructure BSSs may be interconnected via a distribution system (DS). At this time, a plurality of BSSs connected through a distribution system is called an extended service set (ESS).

FIG. 2 illustrates an independent BSS that is a wireless LAN system according to another embodiment of the present invention. In the embodiment of FIG. 2, the same or corresponding parts as those of the embodiment of FIG. 1 are not described.

Since the BSS3 shown in FIG. 2 is an independent BSS and does not include an AP, all the stations STA6 and STA7 are not connected to the AP. An independent BSS is not allowed to connect to the distribution system and forms a self- contained network. In the independent BSS, each of the stations STA6 and STA7 can be directly connected to each other.

3 is a block diagram illustrating a configuration of a station 100 according to an embodiment of the present invention. The station 100 according to the embodiment of the present invention may include a processor 110, a communication unit 120, a user interface unit 140, a display unit 150, and a memory 160.

First, the communication unit 120 transmits and receives radio signals such as a wireless LAN packet, and may be embedded in the station 100 or externally. According to the embodiment, the communication unit 120 may include at least one communication module using different frequency bands. For example, the communication unit 120 may include communication modules of different frequency bands such as 2.4 GHz, 5 GHz, and 60 GHz. According to one embodiment, the station 100 may include a communication module using a frequency band of 6 GHz or higher and a communication module using a frequency band of 6 GHz or lower. Each communication module can perform wireless communication with an AP or an external station according to a wireless LAN standard of a frequency band supported by the communication module. The communication unit 120 can operate only one communication module at a time or operate a plurality of communication modules at the same time according to the performance and requirements of the station 100. [ When the station 100 includes a plurality of communication modules, each of the communication modules may be provided in an independent form, or a plurality of modules may be integrated into one chip. In the embodiment of the present invention, the communication unit 120 may represent an RF communication module that processes an RF (Radio Frequency) signal.

Next, the user interface unit 140 includes various types of input / output means provided in the station 100. That is, the user interface unit 140 can receive user input using various input means, and the processor 110 can control the station 100 based on the received user input. In addition, the user interface unit 140 may perform output based on instructions of the processor 110 using various output means.

Next, the display unit 150 outputs an image on the display screen. The display unit 150 may output various display objects such as a content executed by the processor 110 or a user interface based on a control command of the processor 110. { In addition, the memory 160 stores a control program used in the station 100 and various types of data. Such a control program may include an access program required for the station 100 to make an access to an AP or an external station.

The processor 110 of the present invention can execute various commands or programs and process data within the station 100. { In addition, the processor 110 controls each unit of the above- described station 100 and can control data transmission / reception between the units. According to an embodiment of the present invention, the processor 110 may execute a program for connection with an AP stored in the memory 160, and may receive a communication setup message transmitted by the AP. In addition, the processor 110 can read the information on the priority condition of the station 100 included in the communication setup message, and can request a connection to the AP based on the information on the priority condition of the station 100. { The processor 110 of the present invention may refer to a main control unit of the station 100 and may be a control unit for individually controlling a part of the station 100 such as the communication unit 120, It is possible. That is, the processor 110 may be a modem or a modulator and / or a demodulator for modulating and demodulating radio signals transmitted and received from the communication unit 120. The processor 110 controls various operations of transmitting and receiving radio signals of the station 100 according to the embodiment of the present invention. A specific embodiment will be described later.

The station 100 shown in FIG. 3 is a block diagram according to an exemplary embodiment of the present invention. Blocks that are separately displayed are logically distinguished from elements of a device. Thus, the elements of the device described above can be mounted as one chip or as a plurality of chips depending on the design of the device. For example, the processor 110 and the communication unit 120 may be

integrated into one chip or may be implemented as a separate chip. In some embodiments of the present invention, some of the components of the station 100, such as the user interface 140 and the display unit 150, may be optionally provided in the station 100.

4 is a block diagram illustrating a configuration of an AP 200 according to an embodiment of the present invention. As shown, the AP 200 according to the embodiment of the present invention may include a processor 210, a communication unit 220, and a memory 260. In FIG. 4, the same or corresponding parts of the configuration of the AP 200 as those of the station 100 in FIG. 3 will be omitted.

Referring to FIG. 4, the AP 200 according to the present invention includes a communication unit 220 for operating a BSS in at least one frequency band. 3, the communication unit 220 of the AP 200 may also include a plurality of communication modules using different frequency bands. That is, the AP 200 according to the embodiment of the present invention may include two or more communication modules of different frequency bands, for example, 2.4 GHz, 5 GHz, and 60 GHz. Preferably, the AP 200 may include a communication module using a frequency band of 6 GHz or more and a communication module using a frequency band of 6 GHz or less. Each communication module can perform wireless communication with the station according to the wireless LAN standard of the frequency band supported by the communication module. The communication unit 220 may operate only one communication module at a time or may operate a plurality of communication modules at the same time according to the performance and requirements of the AP 200. { In an embodiment of the present invention, the communication unit 220 may represent an RF communication module that processes an RF (Radio Frequency) signal.

Next, the memory 260 stores a control program used in the AP 200 and various data corresponding thereto. Such a control program may include an access program for managing the connection of the station. In addition, the processor 210 controls each unit of the AP 200 and can control data transmission / reception between the units. According to an embodiment of the present invention, the processor 210 may execute a program for connection with a station stored in the memory 260, and may transmit a communication setup message for one or more stations. At this time, the communication setup message may include information on the connection preference condition of each station. In addition, the processor 210 performs connection setup according to a connection request of the station. According to one embodiment, the processor 210 may be a modem or a modulator and / or demodulator for modulating and demodulating radio

signals transmitted and received from the communication unit 220. The processor 210 controls various operations of transmitting and receiving radio signals of the AP 200 according to an embodiment of the present invention. A specific embodiment will be described later.

FIG. 5 schematically shows a process in which the STA establishes a link with an AP.

Referring to FIG. 5, the link between the STA 100 and the AP 200 is established through three steps of scanning, authentication, and association. First, the scanning step is a step in which the STA 100 acquires access information of a BSS operated by the AP 200. As a method for performing scanning, a passive scanning method in which information is acquired using only a beacon message (S101) periodically transmitted by the AP 200 and a passive scanning method in which the STA 100 transmits a probe request there is an active scanning method of transmitting a probe request (S103), receiving a probe response from the AP (S105), and acquiring access information.

The STA 100 that has successfully received the wireless access information in the scanning step transmits an authentication request (S107a), receives an authentication response from the AP 200 (S107b), and performs an authentication step do. After the authentication step is performed, the STA 100 transmits an association request (S109a), receives an association response from the AP 200 (S109b), and performs an association step. In this specification, an association means basically a wireless connection, but the present invention is not limited thereto, and the connection in a broad sense may include both wireless connection and wire connection.

In addition, an 802.1X- based authentication step S111 and an IP address acquisition step S113 through DHCP may be performed. 5, the authentication server 300 is a server for processing STA 100 and 802.1X- based authentication, and may be physically coupled to the AP 200 or exist as a separate server.

FIG. 6 shows a CSMA (Collision Avoidance) / CA (Collision Avoidance) method used in wireless LAN communication.

A terminal performing wireless LAN communication carries out carrier sensing before transmitting data to check whether a channel is busy or not. If a radio signal of a

predetermined intensity or more is detected, it is determined that the corresponding channel is occupied (busy), and the terminal delays access to the corresponding channel. This process is called Clear Channel Assessment (CCA), and the level for determining whether to detect the signal is called CCA threshold (CCA threshold). If a radio signal exceeding the CCA threshold value received by the terminal makes the terminal a recipient, the terminal processes the received radio signal. On the other hand, when a radio signal is not detected in the corresponding channel or a radio signal having an intensity lower than the CCA threshold is detected, the channel is determined to be idle.

If it is determined that the channel is idle, each terminal having data to be transmitted performs a backoff procedure after an IFS (Inter Frame Space) according to a situation of each terminal, such as AIFS (Arbitration IFS), PIFS (PCF IFS) do. According to the embodiment, the AIFS can be used as a substitute for the existing DIFS (DCF IFS). Each terminal waits for a slot time equal to a random number determined by the terminal during an idle interval of the channel and attempts to access the channel when the terminal has exhausted its slot time do. The interval in which each terminal performs the backoff procedure is referred to as a contention window period.

If a specific terminal successfully accesses the channel, the terminal can transmit data through the channel. However, if the terminal attempting to access collides with another terminal, the collided terminals are each assigned a new random number, and perform the backoff procedure again. According to an exemplary embodiment, a random number newly allocated to each terminal can be determined within a range (2 * CW) twice the random number range (a contention window, CW) previously allocated to the terminal. Meanwhile, each terminal attempts access again by performing a backoff procedure in the next contention window period, and each terminal performs a backoff procedure from the slot time remaining in the previous contention window period. Each terminal that performs wireless LAN communication in this way can avoid collision with each other for a specific channel. 7 is a diagram illustrating a method of performing DCF (Distributed Coordination Function) using a RTS (Request to Send) frame and a CTS (Clear to Send) frame. ; APs and STAs in the BSS compete to gain the right to transmit data. When the data transmission in the previous step is completed, each terminal having data to be transmitted performs a backoff procedure by decreasing a backoff counter (or a backoff timer) of a random number assigned to each terminal after the AIFS time elapses. The transmission terminal whose backoff counter has expired transmits a request to send (RTS) frame to notify that the corresponding terminal has data to be transmitted. According to the embodiment of FIG. 7, the STA1 having superiority in the minimum backoff competition can transmit the RTS frame after the backoff counter

expires. The RTS frame includes information such as a receiver address, a transmitter address, and a duration. Upon receiving the RTS frame, the receiving terminal (i.e., the AP in FIG. 7) waits for a time of SIFS (Short IFS) and then transmits a CTS (Clear to Send) frame to inform the transmitting terminal STA1 that data transmission is possible.

The CTS frame includes information such as receiver address and duration. At this time, the receiver address of the CTS frame may be set equal to the transmitter address of the corresponding RTS frame, that is, the address of the transmission terminal STA1. The transmitting terminal STA1 receiving the CTS frame transmits data after the SIFS time. When the data transmission is completed, the receiving terminal (AP) transmits a response (ACK) frame after the SIFS time to inform that the data transmission is completed. If a response frame is received within a predetermined time, the transmitting terminal considers the data transmission successful. However, if the response frame is not received within the preset time, the transmitting terminal considers the data transmission to be unsuccessful. Meanwhile, neighboring terminals that have received at least one of the RTS frame and the CTS frame during the transmission process set a Network Allocation Vector (NAV) and do not perform data transmission until the set NAV expires. At this time, the NAV of each terminal can be set based on the duration field of the received RTS frame or CTS frame. If the RTS frame or the CTS frame of the UEs is not normally transmitted to the target terminal (i.e., the terminal of the receiver address) in a state of interference or collision in the above- mentioned data transmission process, the following process is suspended. The transmitting terminal (STA1) transmitting the RTS frame considers that data transmission is impossible, and receives a new random number to participate in the next competition. At this time, the newly assigned random number can be determined within a range (2 * CW) twice the previous predetermined random number range (the contention window, CW) as described above.

8 and 9 illustrate a multi- user transmission method according to an embodiment of the present invention. When using Orthogonal Frequency Division Multiple Access (OFDMA) or Multi Input Multiple Output (MIMO), one wireless communication terminal can simultaneously transmit data to a plurality of wireless communication terminals. Further, one wireless communication terminal can simultaneously receive data from a plurality of wireless communication terminals. For example, a downlink multi- user (DL- MU) transmission in which an AP transmits data to a plurality of STAs at the same time, an uplink multi- user UL- MU) transmission can be performed.

8 illustrates a UL- MU transmission process according to an embodiment of the present

invention. In order for the UL- MU transmission to be performed, the use channel and the transmission start time of each STA performing the uplink transmission should be adjusted. For efficient scheduling of UL- MU transmission, state information of each STA needs to be transmitted to the AP. According to an embodiment of the present invention, information for scheduling of UL- MU transmissions may be indicated through a pre- determined packet preamble and / or a predetermined field in the MAC header. For example, the STA indicates information for UL- MU transmission scheduling through a predetermined field of a preamble of an uplink transport packet or a MAC header, and may transmit the information to an AP. At this time, the information for UL- MU transmission scheduling may include at least one of buffer status information of each STA and channel status information measured in each STA. The buffer status information of the STA may indicate at least one of whether or not the STA has uplink data to be transmitted, the access category (AC category) of the uplink data, and the size of the uplink data (or the transmission time).

According to the embodiment of the present invention, the UL- MU transmission process can be managed by the AP. The UL- MU transmission may be performed in response to a trigger frame transmitted by the AP. STAs simultaneously transmit uplink data after a predetermined IFS time (e.g., SIFS) after reception of the trigger frame. The trigger frame requests UL- MU transmission of the STAs and informs the channel (or subchannel) information allocated to the uplink STAs. Upon receipt of the trigger frame from the AP, a plurality of STAs transmit corresponding upstream data through each assigned channel (or subchannel). After the uplink data transmission is completed, the AP transmits an ACK to the STAs that have successfully transmitted the uplink data. At this time, the AP can transmit a predetermined multi- STA Block ACK (M- BA) as an ACK for a plurality of STAs.

In the non- legacy wireless LAN system, a specific number of subcarriers such as 26, 52, or 106 tones in a 20 MHz band can be used as a resource unit (RU) for connection on a subchannel basis . Accordingly, the trigger frame can indicate the identification information of each STA participating in the UL- MU transmission and the information of the allocated resource unit. The identification information of the STA includes at least one of an AID (Association ID), a partial AID, and a MAC address of the STA. Further, the information of the resource unit includes the size and position information of the resource unit.

On the other hand, in the non- legacy WLAN system, UL- MU transmission can be performed based on competition of a plurality of STAs for a specific resource unit. For

example, if the AID field value for a particular resource unit is set to a particular value (e.g., 0) that is not assigned to the STA, a plurality of STAs may attempt random access (RA) for that resource unit .

FIG. 9 shows a DL- MU transmission process according to an embodiment of the present invention. According to an embodiment of the present invention, RTS and / or CTS frames of a predetermined format may be used for NAV setting in the DL- MU transmission process. First, the AP transmits a multi- user RTS (MU- RTS) frame for NAV setting in the DL- MU transmission process. The duration field of the MU- RTS frame is set until the end of the DL- MU transmission session. That is, the duration field of the MU- RTS frame is set based on the period until the downlink data transmission of the AP and the transmission of the ACK frame of the STAs are completed. The neighboring APs set the NAV until the end of the DL- MU transmission session based on the duration field of the MU- RTS frame transmitted by the AP. According to one embodiment, the MU- RTS frame may be configured in the format of a trigger frame and requests the simultaneous CTS (sCTS) frame transmission of the STAs.

The STAs (STA1 and STA2) receiving the MU- RTS frame from the AP transmit the sCTS frame. The sCTS frames transmitted by a plurality of STAs have the same waveform. That is, the sCTS frame transmitted by the STA1 on the first channel has the same waveform as the sCTS frame transmitted by the STA2 on the first channel. According to one embodiment, the sCTS frame is transmitted on the channel indicated by the MU- RTS frame. The duration field of the sCTS frame is set up to the time when the DL- MU transmission session is ended based on the information of the duration field of the MU- RTS frame. That is, the duration field of the sCTS frame is set based on the period until the downlink data transmission of the AP and the ACK frame transmission of the STAs are completed. In FIG. 9, the neighboring terminals STA1 and STA2 set the NAV until the end of the DL- MU transmission session based on the duration field of the sCTS frame.

According to an embodiment of the present invention, the MU- RTS frame and the sCTS frame may be transmitted on a 20 MHz channel basis. Accordingly, the neighboring terminals including the legacy terminal can set the NAV by receiving the MU- RTS frame and / or the sCTS frame. When the transmission of the MU- RTS frame and the sCTS frame is completed, the AP performs downlink transmission. 9 shows an embodiment in which the AP transmits DL- MU data to STA1 and STA2, respectively. The STAs receive the downlink data transmitted by the AP and transmit the uplink ACK in response thereto.

Figure 10 illustrates one embodiment of a legacy PPPU (PLCP Protocol Data Unit) format and a non- legacy PPDU format. More specifically, FIG. 10 (a) illustrates one embodiment of a legacy PPDU format based on 802.11a / g, and FIG. 10 (b) illustrates one embodiment of non- legacy PPDU Fig. 10 (c) shows the detailed field configuration of L- SIG and RL- SIG commonly used in the PPDU formats.

Referring to FIG. 10A, the preamble of the legacy PPDU includes an L- STF (Legacy Short Training field), an L- LTF (Legacy Long Training field), and an L- SIG (Legacy Signal field). In an embodiment of the present invention, the L- STF, L- LTF and L- SIG may be referred to as a legacy preamble. Referring to FIG. 10B, the preamble of the HE PPDU includes a Repeated Legacy Short Training field (RL- SIG), a High Efficiency Signal A field (HE- SIG- A), a High Efficiency Signal B field, a High Efficiency Short Training field (HE- STF), and a High Efficiency Long Training field (HE- LTF). In an embodiment of the present invention, the RL- SIG, HE- SIG- A, HE- SIG- B, HE- STF and HE- LTF may be referred to as non- legacy preambles. The specific configuration of the non- legacy preamble can be modified according to the HE PPDU format. For example, HE- SIG- B may only be used in some of the HE PPDU formats.

The L- SIG included in the preamble of the PPDU is 64 FFT OFDM, and is composed of 64 subcarriers in total. Of these, 48 subcarriers excluding the guard sub- carrier, the DC sub- carrier and the pilot sub- carrier are used for data transmission of the L- SIG. If a Modulation and Coding Scheme (MCS) of BPSK, Rate = 1/2 is applied, the L- SIG may include a total of 24 bits of information. 10 (c) shows a 24- bit information structure of the L- SIG.

Referring to FIG. 10C, the L- SIG includes an L_RATE field and an L_LENGTH field. The L_RATE field consists of 4 bits and represents the MCS used for data transmission. Specifically, the L_RATE field is set to 6/9/12/18/24/24, which is a combination of a modulation scheme such as BPSK / QPSK / 16- QAM / 64- It represents one of the transmission rates of 36/48 / 54Mbps. Combining the information of the L_RATE field and the L_LENGTH field can indicate the total length of the corresponding PPDU. The non- legacy PPDU sets the L_RATE field to a minimum rate of 6 Mbps.

The L_LENGTH field is composed of 12 bits, and the length of the corresponding PPDU can be represented by a combination with the L_RATE field. At this time, the legacy

terminal and the non- legacy terminal can interpret the L_LENGTH field in different ways.

First, a method of analyzing the length of a PPDU using a L_LENGTH field by a legacy terminal or a non- legacy terminal is as follows. When the L_RATE field is set to 6 Mbps, 3 bytes (i.e., 24 bits) can be transmitted for 4 us, which is one symbol duration of 64 FFT. Therefore, by adding 3 bytes corresponding to the SVC field and the Tail field to the value of the L_LENGTH field and dividing it by 3 bytes, which is the transmission amount of one symbol, the number of 64FFT reference symbols after the L- SIG is obtained. The length of the corresponding PPDU, that is, the reception time (RXTIME) is obtained by multiplying the number of acquired symbols by 4us, which is one symbol duration, and then adding 20us for transmission of L- STF, L- LTF and L- SIG. This can be expressed by the following equation (1).

At this time, 〈 img class = "EMIRef" id = "448583550- i02" /〉 represents the minimum natural number equal to or greater than x. Since the maximum value of the L_LENGTH field is 4095, the length of the PPDU can be set up to 5.464 ms. However, since the allowed value of the L_LENGTH field in the legacy terminal is maximum 2340, the length of the PPDU is set up to 3.144 ms. The non- legacy terminal transmitting the PPDU must set the L_LENGTH field as shown in Equation 2 below.

Here, TXTIME is the total transmission time constituting the corresponding PPDU, and is expressed by Equation 3 below. At this time, TX represents the transmission time of X.

With reference to the above equations, the length of the PPDU is calculated based on the round- up of L_LENGTH / 3. Therefore, for any k value, three different values of L_LENGTH = {3k + 1, 3k + 2, 3 (k + 1)} indicate the same PPDU length. According to an embodiment of the present invention, the non- legacy terminal can perform additional signaling using three different L_LENGTH values indicating the same PPDU length information. More specifically, values corresponding to 3k + 1 and 3k + 2 of the three different L_LENGTH values may be used to indicate the HE PPDU format.

FIG. 11 illustrates various HE PPDU formats and a method of indicating the HE PPDU format according to an embodiment of the present invention. According to an embodiment of the present invention, the HE PPDU format may be indicated based on

the L_LENGTH field of the corresponding PPDU and HE- SIG- A. More specifically, the HE PPDU format is indicated based on at least one of the value of the L_LENGTH field and the modulation technique applied to the HE- SIG- A symbol.

11A, when the value of the L_LENGTH field is 3k + 1 (that is, when mod3 = 1), the corresponding PPDU is the HE SU PPDU or the HE Trigger- based PPDU. The HE SU PPDU is a PPDU used for single- user transmission between an AP and a single STA, and the HE Trigger- based PPDU is an upstream PPDU used for transmission in response to a trigger frame. HE SU PPDU and HE Trigger- based PPDU have the same preamble format. For HE SU PPDU and HE Trigger- based PPDU, the two symbols of HE- SIG- A are modulated with BPSK and BPSK, respectively.

According to a further embodiment of the present invention shown in FIG. 11 (b), two symbols of HE- SIG- A are modulated into BPSK and QBPSK, respectively, when the value of the L_LENGTH field is 3k + The corresponding PPDU is an extended PPDU. The extended PPDU is used in a new PPDU format other than the PPDU format supported by 802.11ax.

Next, when the value of the L_LENGTH field is 3k + 2 (i.e., when mod3 = 2), the corresponding PPDU is the HE MU PPDU or the HE Extended Range (ER) SU PPDU. The HE MU PPDU is a PPDU used for transmission to one or more terminals. The HE MU PPDU format is shown in Fig. 11 (c) and additionally includes HE- SIG- B in the non- legacy preamble. For HE MU PPDU, the two symbols of HE- SIG- A are modulated with BPSK and BPSK, respectively. On the other hand, HE ER SU PPDU is used for single user transmission with extended range terminals. The HE ER SU PPDU format is shown in Fig. 11 (d), where HE- SIG- A of the non- legacy preamble is repeated on the time axis. For HE ER SU PPDU, the first two symbols of HE- SIG- A are modulated with BPSK and QBPSK, respectively. Thus, the non- legacy terminal can signal the PPDU format through the modulation scheme used for the two symbols of HE- SIG- A in addition to the value of the L_LENGTH field.

The HE MU PPDU shown in FIG. 11 (c) can be used by the AP to perform downlink transmission to a plurality of STAs. At this time, the HE MU PPDU may include scheduling information for a plurality of STAs to simultaneously receive the PPDUs. In addition, the HE MU PPDU may be used by a single STA to perform an uplink to the AP. At this time, the HE MU PPDU can transmit the AID information of the receiver and / or the sender of the corresponding PPDU through the user specific field of the HE- SIG- B.

Therefore, the UEs receiving the HE MU PPDU can perform a spatial reuse operation based on the AID information obtained in the preamble of the corresponding PPDU. Also, data transmission over some narrowband can be performed using the HE MU PPDU. Here, the narrow band may be a frequency band of less than 20 MHz. According to one embodiment, the HE MU PPDU may indicate through the HE- SIG- B allocation information of the resource units to be used for the narrowband transmission.

More specifically, the resource unit allocation (RA) field of HE- SIG- B contains information on the type of resource unit division at a specific bandwidth (for example, 20 MHz) in the frequency domain. Further, the information of the STA assigned to each divided resource unit can be transmitted through the user- specific field of the HE- SIG- B. The user specific field includes one or more user fields corresponding to each divided resource unit.

When a narrow band transmission using a part of the divided resource units is performed, the resource unit to be transmitted may be indicated through a user specific field of the HE- SIG- B. According to an embodiment, AID of a receiver or a sender is inserted into a user field corresponding to a resource unit (s) to which data transmission is performed among a plurality of divided resource units, and the remaining resource units ) May be inserted in the user field corresponding to a predetermined STA ID. According to another embodiment of the present invention, a narrowband transmission may be signaled through a first user field corresponding to a resource unit in which data transmission is not performed and a second user field corresponding to a resource unit in which data transmission is performed . More specifically, a predetermined null STA ID is inserted in the first user field, and the location information of the resource unit (s) on which data transmission is performed can be indicated through the remaining subfields of the corresponding user field. Next, the AID of the receiver or sender may be inserted into the second user field. Thus, the UE can signal the narrowband transmission through the location information included in the first user field and the AID information included in the second user field. At this time, since only few user fields are used than the number of divided resource units, the signaling overhead can be reduced.

Figure 12 illustrates HE PPDU formats in accordance with a further embodiment of the present invention. 12, the HE PPDU is shown to have the L_LENGTH field value of 3k + 1 (ie, mod3 = 1) and the two symbols of HE- SIG- A modulated with BPSK and QBPSK, respectively, But is not limited thereto. That is, in each embodiment, the HE PPDU may be modulated into two symbols of HE- SIG- A by BPSK and BPSK, respectively, if the value of the L_LENGTH field is of the form 3k + 2 (i.e., mod3 = 2).

12 (a) shows an HE ER PPDU format according to an embodiment of the present invention. In the PPDU format, HE- SIG- A and HE- SIG- B are repeated in the time domain. In this case, the repetitive transmission of HE- SIG- A and HE- SIG- B in the time domain can obtain a reception gain of 3 dB or more, thereby enabling signal reception at a long distance. The PPDU format according to the embodiment of FIG. 12 (a) can additionally signal HE- SIG- B and thus can be used for extended range (ER) multi- user transmission. In addition, the PPDU format may be used for narrowband transmission of data in uplink / downlink ER single user transmissions. More specifically, the PPDU format can signal transmission using HE- SIG- B using a part of the resource units of the data area transmitted on the basis of 256 FFT / 20 MHz. Therefore, transmission using only 26- tone RU, 52- tone RU, or 106- tone RU of less than 20 MHz band can be performed even in an up / down single user transmission situation. Through such narrowband transmission, the UE can perform transmission by concentrating the entire allowable transmission power in the ISM band on a narrow RU. That is, in addition to the transmission distance expansion due to repetitive transmission of the HE- SIG- A / B in the 64 FFT / 20 MHz region, the transmission distance can be extended even in the data transmission in the 256 FFT / 20 MHz region. The PPDU format may also be used for narrowband transmission of data in a downlink multi- user transmission. For example, as shown in FIG. 12 (a), the AP indicates division information of the 20 MHz band through the HE- SIG- B of the PPDU, and allocates some resource units including at least two of the divided resource units It can be used for band transmission. At this time, the transmission distance can be increased by concentrating the entire allowable transmission power in the ISM band to a certain resource unit and transmitting it.

Next, FIG. 12 (b) shows an HE ER PPDU format according to another embodiment of the present invention. In the PPDU format, HE- SIG- A is repeated in the time domain, and HE- SIG- B is not transmitted in order to reduce the preamble overhead. In this case, it is possible to obtain a reception gain of 3 dB or more due to repetitive transmission of HE- SIG- A in the time domain, thereby enabling signal reception at a long distance. According to one embodiment, the distinction between the PPDU format according to FIG. 12 (a) and the PPDU format according to FIG. 12 (b) can be indicated through a predetermined field of the HE- SIG- A. The PPDU format according to the embodiment of FIG. 12 (b) can be used for narrowband transmission of data in an uplink / downlink ER single user transmission. At this time, the PPDU format can instruct transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling through HE- SIG- B. For example, transmission using only some resource units preset within the 20 MHz bandwidth may be indicated via a specific field (e.g., Bandwidth field) of HE- SIG- A. At this time, some predetermined resource units

may be at least one of 26- tone RU, 52- tone RU, and 106- tone RU in a specific position. A predetermined field of the HE- SIG- A in the HE ER PPDU may indicate whether transmission using some predetermined resource units is performed or transmission using a 20 MHz full band (i.e., 242- tone RU) is performed. As described above, according to the embodiment of FIG. 12B, the predetermined narrowband transmission can be instructed only by simple signaling of HE- SIG- A without using HE- SIG- B in the HE ER PPDU.

Next, FIG. 12 (c) shows an HE ER PPDU format according to another embodiment of the present invention. In the PPDU format, HE- SIG- A is repeated in the time domain, and HE- SIG- B is not transmitted in order to reduce the preamble overhead. Instead, a HE- SIG- C transmitted in the 256 FFT / 20 MHz region may additionally be used. In this case, it is possible to obtain a reception gain of 3 dB or more due to repetitive transmission of HE- SIG- A in the time domain, thereby enabling signal reception at a long distance. The PPDU format can direct transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling through HE- SIG- B. A concrete example of this is as described in Fig. 12 (b). The HE- SIG- C includes information for decoding data transmitted through the corresponding resource unit, for example, MCS, TxBF (Transmit Beamforming), Binary Convolutional Code (BCC) / Low Density Parity Check Directives, and so on.

Finally, FIG. 12 (d) shows the HE PPDU format according to another embodiment of the present invention. In the PPDU format, HE- SIG- A is not repeated in the time domain, and HE- SIG- B is not transmitted. Instead, a HE- SIG- C transmitted in the 256 FFT / 20 MHz region may additionally be used. The PPDU according to the embodiment of FIG. 12 (d) can be used to allow the STAs around the AP to set the NAV using the TXOP (Transmission Opportunity) duration information included in the HE- SIG- A. The PPDU format can direct transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling through HE- SIG- B. A concrete example of this is as described in Fig. 12 (b). The HE- SIG- C can transmit information for decoding the data transmitted through the corresponding resource unit by the terminal as described above.

Figure 13 illustrates a power save operation scenario based on a PPDU format in accordance with an embodiment of the present invention. A BSS operated by a non-legacy AP may have a STA (i.e., ER STA) that supports an ER (Extended Range) mode and a STA that does not support the ER mode (i.e., a non- ER STA). In the embodiment of FIG. 13, STA "A" represents non- ER STA, and STA "B" represents ER STA.

According to the embodiment of the present invention, when the non- ER STA receives the ER PPDU of the same BSS (intra- BSS), it can enter the power save mode. In Fig. 13, the AP exchanges the STA "B " and the ER SU PPDU, and the STA "A " receiving the PPDU enters the power save mode for the length of the received PPDU. The STA negotiates whether or not to support the ER mode when performing an association with the AP. Therefore, when the non- ER STA receives the ER PPDU of the same BSS, it can enter the power saving mode without additional processing because the PPDU is not the PPDU transmitted to itself.

Fig. 14 shows an embodiment of the configuration of the HE- SIG- A field according to the HE PPDU format. HE- SIG- A consists of two symbols of 64 FFT, indicating common information for reception of HE PPDUs. The first symbol of HE- SIG- A is modulated with BPSK, and the second symbol is modulated with BPSK or QBPSK. In the HE ER SU PPDU, two symbols of HE- SIG- A can be repeatedly transmitted. That is, the HE- SIG- A of the HE ER SU PPDU consists of four symbols, the first symbol and the second symbol of which have the same data bit, and the third symbol and the fourth symbol have the same data bit.

14 (a) shows a sub- field configuration of the HE- SIG- A field of the HE SU PPDU. According to one embodiment, the HE- SIG- A field of the HE ER SU PPDU may be configured similarly. The function of each field included in HE- SIG- A will be described as follows.

The up / down field indicates the transmission direction of the corresponding field. That is, the field indicates whether the corresponding PPDU is transmitted upwardly or downwardly. The format field is used to distinguish HE SU PPDU from HE Trigger-based PPDU. The BSS color field is composed of 6 bits and indicates the identifier of the BSS corresponding to the terminal that transmitted the corresponding PPDU. The spatial reuse field conveys information such as SINR (Signal to Interference plus Noise Ratio), transmission power, etc., which can be referred to by the UEs to perform spatial reuse transmission during the transmission of the corresponding PPDU.

The TXOP duration field indicates duration information for TXOP protection and NAV setting. The field sets the duration of the TXOP interval in which continuous transmission is to be performed after the corresponding PPDU, so that the neighboring

terminals set the NAV for the corresponding period. The bandwidth field indicates the total bandwidth in which the corresponding PPDU is transmitted. According to one embodiment, the bandwidth field is comprised of two bits and can indicate either 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80 + 80 MHz). The MCS field indicates the MCS value applied to the data field of the corresponding PPDU. The CP + LTF size field indicates the duration of the CP (Cyclic Prefix) or GI (Guard Interval) and the size of the HE- LTF. More specifically, the field represents the HE- LTF size used in 1x, 2x, 4x HE- LTF, and CP (or GI) values used in the data field among 0.8us, 1.6us, and 3.2us.

The coding field can indicate which coding scheme, Binary Convolutional Code (BCC) and Low Density Parity Check (LDPC), is used. In addition, the field may indicate the presence or absence of additional OFDM symbols for LDPC. The Number of Space Time Streams (NSTS) field indicates the number of space- time streams used for MIMO transmission. The Space Time Block Coding (STBC) field indicates whether space- time block coding is used. A Transmit Beamforming (TxBF) field indicates whether beamforming is applied to the transmission of the corresponding PPDU. The Dual Carrier Modulation (DCM) field indicates whether dual carrier modulation is applied to the data field. Dual carrier modulation transmits the same information to two subcarriers in order to cope with narrowband interference. The Packet Extension field indicates what level of packet extension is applied to the PPDU. The Beam Exchange field indicates whether the part before the HE- STF of the corresponding PPDU is mapped spatially different from the HE- LTF. The CRC field and the tail field are used to determine the authenticity of the HE- SIG- A field information and to initialize the BCC decoder, respectively.

14 (b) shows a sub- field configuration of the HE- SIG- A field of the HE MU PPDU. Among the subfields shown in FIG. 14B, the same subfields as those shown in FIG. 14A will not be described.

The up / down field indicates the transmission direction of the corresponding field. That is, the field indicates whether the corresponding PPDU is transmitted upwardly or downwardly. HE MU The bandwidth field of the PPDU can indicate additional bandwidth in addition to the bandwidth of the HE SU PPDU. That is, the bandwidth field of the HE MU PPDU is composed of 3 bits and indicates either 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80 + 80 MHz), and predetermined discontinuous bands. A specific embodiment of the predetermined discontinuous bands will be described later.

The SIG- B MCS field indicates the MCS applied to the HE- SIG- B field. The HE- SIG- B can apply the variable MCS between MSC0 and MSC5 according to the amount of information requiring signaling. The CP + LTF size field indicates the duration of the CP or GI and the size of the HE- LTF. The field indicates the HE- LTF size used in 2x, 4x HE- LTF, and the CP (or GI) value used in the data field among 0.8us, 1.6us, and 3.2us.

The SIG- B compression field indicates whether to use the compression mode of the HE- SIG- B field. When the HE MU PPDU is transmitted using the MU- MIMO in the full bandwidth, the resource unit allocation information for each 20 MHz band becomes unnecessary. Therefore, in the full bandwidth MU- MIMO transmission, the SIG- B compressed field indicates the compression mode of the HE- SIG- B field, where the common block field containing the resource unit allocation field is not present in the HE- SIG- B field . The SIG- B DCM field indicates whether the corresponding field is modulated by the DCM for reliable transmission of the HE- SIG- B field. The number field of the HE- SIG- B symbol indicates the number of OFDM symbols in the HE- SIG- B field.

On the other hand, when the HE MU PPDU is transmitted in a band of 40 MHz or more as described later, the HE- SIG- B can be composed of two kinds of content channels in units of 20 MHz. This is referred to as HE- SIG- B content channel 1 and HE- SIG- B content channel 2, respectively. According to an embodiment of the present invention, the HE- SIG- B content channel 1 and the MCS applied to the HE- SIG- B content channel 2 are made different from each other so that the number of HE- SIG-  have. The HE- SIG- A field of the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 may include the SIG- B dual MCS field, Is indicated.

According to the embodiment of the present invention, when the SIG- B compression field indicates the compression mode of the HE- SIG- B field (i.e., when the full bandwidth MU-  Field may indicate the number information of the MU- MIMO users. For example, when full bandwidth MU- MIMO transmission is performed, the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 do not need to distribute the amount of information through different MCSs. Therefore, when the SIG- B compressed field indicates the compression mode of the HE- SIG- B field, the SIG- B dual MCS field of the HE- SIG- A can indicate the number information of the MU- MIMO user. Likewise, when full bandwidth MU- MIMO transmission is performed, the number information of symbols of each HE- SIG- B content channel need not be delivered separately. Therefore, when the SIG- B compressed field indicates the compression mode of the

HE- SIG- B field, the number field of the HE- SIG- B symbol of the HE- SIG- A can indicate the number information of the MU- . Thus, in the compression mode in which the resource unit allocation field of the HE- SIG- B is omitted, the number information of the MU- MIMO users can be indicated through the specific subfield of the HE- SIG- A.

According to an embodiment of the present invention, the HE MU PPDU may be used for DL- MU transmission. However, in the following additional situations, the HE MU PPDU can be used for both downlink and uplink transmissions.

According to one embodiment, an HE MU PPDU may be used for OFDMA based transmission in downlink / uplink transmission between an AP and a single STA. More specifically, transmission between an AP and a single STA can be performed using only some contiguous or non- contiguous channels of the entire band. For example, if the STA performs CCA to transmit an 80 MHz PPDU to the AP and the STA only occupies a 20 MHz subchannel, the STA may transmit the PPDU over the 20 MHz main channel and the 40 MHz subchannel. In addition, narrowband transmission using only a few resource units within 20 MHz may be performed between the AP and a single STA. In the case where the transmission using the discontinuous channel or the narrow band transmission is performed, the resource unit allocation information is additionally transmitted through the HE- SIG- B field in the transmitted PPDU. Therefore, the terminal can perform such transmission using the HE MU PPDU. Specific embodiments of the transmission using the discontinuous channel and the narrow band transmission will be described later.

According to another embodiment, an HE MU PPDU may be used when transmission of the HE- SIG- B field is required for the sake of spatial reuse operation enhancement. HE MU PPDU, unlike HE SU PPDU, can indicate AID of recipient through user field of HE- SIG- B. However, according to an exemplary embodiment of the present invention, when the HE MU PPDU is used for uplink transmission, the recipient of the corresponding PPDU is an AP, so that the user field of the HE- SIG- B can indicate the AID of the sender. The neighboring terminals that have received the HE MU PPDU can perform the spatial reuse operation.

For example, assume that there are any BSS1 and BSS2, and that STA1 of BSS1 transmits an HE UL MU PPDU. The STA of the BSS2 overhearing the PPDU can estimate the distance from the BSS1 AP, which is the recipient of the PPDU, through the DL PPDU of the BSS1 AP that has previously received the PPDU. Therefore, the STA of the BSS2 can perform the spatial reuse operation considering the interference of the AP

of the receiver BSS1. Also, when a DL PPDU transmitted by the AP of the BSS1 to the STA1 of the BSS1 is received, the STA of the BSS2 is also able to transmit the DL PPDU to the STA1 of the BSS1, which is the recipient of the corresponding PPDU, based on the signal strength measured from the HE UL MU PPDU of the STA1 The spatial reuse operation can be performed in consideration of interference. In the spatial reuse operation, the STA may attempt to transmit if the received PPDU is an (OBSS) PPDU of another BSS and the interference to the recipient of that PPDU is below a predetermined level.

14 (c) shows a sub- field configuration of the HE- SIG- A field of the HE trigger- based PPDU. Among the subfields in FIG. 14 (c), the same subfields as those shown in FIG. 14 (a) or 14 (b) will not be described.

The format field is used to distinguish HE SU PPDU from HE Trigger- based PPDU. Also, the HE Trigger- based PPDU includes the above- described BSS color field and TXOP duration field. The spatial reuse field of the HE Trigger- based PPDU consists of 16 bits and carries information for spatial reuse operation in units of 20 MHz or 40 MHz according to the total bandwidth. The bandwidth field is composed of 2 bits and can indicate either 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80 + 80 MHz).

15 shows a configuration of an HE- SIG- B field according to an embodiment of the present invention. The HE- SIG- B field is present in the HE MU PPDU and is transmitted in units of 20 MHz. In addition, the HE- SIG- B field indicates information necessary for receiving the HE MU PPDU. As shown in Fig. 15 (a), HE- SIG- B consists of a common block field and a user specific field.

15 (b) shows an embodiment of a sub- field configuration of the common block field of HE- SIG- B. First, the common block field includes a resource unit allocation (RA) field. 15 (c) shows an embodiment of the RA field.

Referring to FIG. 15 (c), the RA field includes information on resource unit allocation of a specific bandwidth (for example, 20 MHz) in the frequency domain. More specifically, the RA field is configured in units of 8 bits, and indexes the size of the resource units constituting the specific bandwidth and their arrangement in the frequency domain. Further, the RA field can indicate the number of users in each resource unit. When the total bandwidth through which the PPDU is transmitted is greater than a predetermined

bandwidth (for example, 40 MHz), the RA field can be set to a multiple of 8 bits to transmit information in the specific bandwidth unit.

Each divided resource unit is generally assigned to one user. However, resource units of a certain bandwidth (for example, 106- tones) or more can be allocated to a plurality of users using MU- MIMO. At this time, the RA field can indicate the number of users of the corresponding resource unit. In addition, the RA field can indicate through a predetermined index a specific resource unit in which a user specific field is not transmitted, i.e., a specific resource unit (i.e., an empty RU) that is not allocated to the user. According to one embodiment, a particular resource unit includes a resource unit (RU) having a bandwidth of a multiple of 20 MHz channels, i.e., 242- tone RU, 484- tone RU, 996- tone RU, Data transfer is not performed in an empty RU indicated by the index value. In this manner, the UE can signal discontinuous channel allocation information in units of 20 MHz through a predetermined index of the RA field of the HE- SIG- B.

According to an embodiment of the present invention, when a PPDU is transmitted with a total bandwidth of 80 MHz or more, the common block field further includes a field (hereinafter referred to as C26 field) indicating whether a central 26- tone RU at 80 MHz has been allocated to the user Can be. The C26 field may consist of a 1- bit indicator located before or after the RA field in the common block field.

On the other hand, the user specific field is composed of a plurality of user fields, and transfers information for a designated STA to each allocated resource unit. The total number of user fields to be included in the user specific field may be determined based on the RA field and the C26 field. A plurality of user fields are transmitted on a user block field basis. The user block field is made up of a combination of two user fields, a CRC field and a tail field. Depending on the total number of user fields, the last user block field may contain information for one or two STAs. For example, if a total of three users (i.e., STA1, STA, and STA3) are designated, information for STA1 and STA2 is coded and transmitted with the CRC / tail field in the first user block field, Information for STA3 may be coded and transmitted along with the CRC / Tail field.

15 (d) - 1 and 15 (d) - 2 show embodiments of the subfield configuration of the user field of HE- SIG- B, respectively. FIG. 15 (d) - 1 shows a user field for OFDMA transmission, and FIG. 15 (d) - 2 shows a user field for MU- MIMO transmission. Each user field indicates the receiver AID of the corresponding resource unit. Exceptionally, when the HE MU PPDU is used for uplink transmission, the user field may indicate the

sender AID. When one user is allocated to one resource unit (i.e., non- MU- MIMO allocation), the user field is divided into a number of spatial streams (NSTS), a TxBF, an MCS, DCM and a coding field. On the other hand, when a plurality of users are allocated to one resource unit (i.e., MU- MIMO allocation), the user field may include a space configuration field (SCF), an MCS, a DCM, Coding field. Each STA that receives a PPDU through an MU- MIMO allocation must identify the location and number of spatial streams for it in its resource unit. To this end, the user field for MU- MIMO transmission includes a space configuration field (SCF).

15 (e) shows one embodiment of the SCF of HE- SIG- B. The SCF indicates the number of spatial streams for each STA and the total number of spatial streams in the MU-MIMO allocation. Each STA identifies the OFDMA and / or MIMO assignment of the corresponding PPDU through the RA field and identifies whether the STA receives data via the MU- MIMO assignment according to the order called in the user- specific field. If the STA receives data via non- MU- MIMO allocation, the user field is interpreted according to the format of FIG. 15 (d) - 1. However, when the STA receives data through the MU- MIMO allocation, the user field is interpreted according to the format of Fig. 15 (d) - 2. On the other hand, when the SIG- B compressed field indicates the entire bandwidth MU- MIMO, there is no RA field in HE- SIG- B. At this time, since all the STAs signaled in the user specific field receive data through the MU- MIMO allocation, the STAs interpret the user field according to the format of FIG. 15 (d) - 2.

FIG. 16 illustrates an encoding structure and transmission method of an HE- SIG- B according to an embodiment of the present invention. 16 (a) shows the encoding structure of HE- SIG- B, and FIG. 16 (b) shows the transmission method of HE- SIG- B over the 40 MHz bandwidth.

Referring to FIG. 16 (a), HE- SIG- B is composed of a common block field and a user specific field. The detailed configuration of the common block field and the user specific field is as described in the embodiment of FIG. Each user field of the user specific field is listed in the user order assigned in the resource unit array indicated by the RA field of the common block field.

The user- specific field is composed of a plurality of user fields, and a plurality of user fields are transmitted on a user block field basis. As described above, the user block field is made up of a combination of two user fields, a CRC field, and a tail field. If the total number of user fields is odd, the last user block field may contain one user field. At

the end of HE- SIG- B, padding may be added along the OFDM symbol boundary.

Referring to Figure 16 (b), HE- SIG- B is separately encoded in each 20 MHz band. At this time, the HE- SIG- B can be composed of a maximum of two contents in units of 20 MHz, that is, the HE- SIG- B contents channel 1 and the HE- SIG- B contents channel 2. Each box in FIG. 16 (b) represents a 20 MHz band, and "1" and "2" in the boxes represent HE- SIG- B content channel 1 and HE- SIG- B content channel 2, respectively. Each HE- SIG- B content channel in the total band is arranged in order of the physical frequency band. That is, the HE- SIG- B content channel 1 is transmitted in the lowest frequency band, and the HE- SIG- B content channel 2 is transmitted in the next higher frequency band. Such a content channel configuration is then repeated through content duplication in the higher frequency bands. For example, the HE- SIG- B content channel 1 is transmitted in the first channel and the third channel, and the HE- SIG- B content channel 1 is transmitted in the first channel to the fourth channel in the ascending frequency order constituting the entire 80 MHz band. Channel, HE- SIG- B content channel 2 is transmitted. Likewise, the HE- SIG- B contents channel 1 is transmitted in the first channel, the third channel, the fifth channel and the seventh channel for the first to eighth channels in the frequency ascending order constituting the entire 160 MHz band, And the HE- SIG- B content channel 2 is transmitted in the second channel, the fourth channel, the sixth channel and the eighth channel. If the terminal can decode the HE- SIG- B content channel 1 over at least one channel and decode the HE- SIG- B content channel 2 over the other at least one channel, information on the total bandwidth MU PPDU configuration Can be obtained. On the other hand, when the total bandwidth is 20 MHz, only one SIG- B content channel is transmitted.

FIG. 17 shows a sub- field structure of HE- SIG- B when the SIG- B compressed field indicates the compression mode of the HE- SIG- B field. As described above, when the SIG- B compressed field indicates the compression mode (i.e., the entire bandwidth MU- MIMO), there is no RA field in HE- SIG- B. Therefore, when MU- MIMO transmission is performed over a bandwidth greater than 20 MHz, the number of users to be assigned to the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2, respectively, must be separately determined. According to an embodiment of the present invention, when MU- MIMO transmission is performed over a bandwidth of more than 20 MHz, user fields can be distributed equally between the two content channels for load balancing. That is, the number of user fields transmitted in each SIG- B content channel is determined as a round up or down value of half the total number of users. For example, if the total number of user fields is k, then 1 to ceil (k / 2) th user fields are transmitted over HE- SIG- B content channel 1 and ceil (k / User fields may be transmitted over HE- SIG- B content channel 2. If k is an odd number, the number of

user fields included in HE- SIG- B content channel 1 may be one more than the number of user fields included in HE- SIG- B content channel 2.

Hereinafter, channel expansion methods according to embodiments of the present invention will be described with reference to FIGS. 18 to 20. FIG. In the embodiment of FIGS. 18- 20, CH1 through CH4 indicate each 20 MHz channel over which an 80 MHz PPDU is transmitted. Also, CH1 to CH8 indicate respective 20 MHz channels through which 160 MHz PPDU or 80 + 80 MHz PPDU are transmitted. At this time, CH3 is a 20MHz main channel (hereinafter referred to as P20 channel), CH4 is a 20MHz secondary channel (hereinafter referred to as S20 channel), CH1 and CH2 are a 40MHz secondary channel (S40 channel) Respectively. In addition, CH5 to CH8 are designated as 80MHz secondary channels (hereinafter, referred to as S80 channels).

18 illustrates a broadband access method according to an embodiment of the present invention. After the transmission of the previous PPDU is completed, the terminal having the data to be transmitted performs the backoff procedure on the P20 channel. The backoff procedure may be initiated when the P20 channel is idle for AIFS time. The terminal acquires a backoff counter within the contention window (CW) range for the backoff procedure. The terminal performs the CCA and if the channel is idle, the backoff counter is decremented by one. If the channel is occupied, the terminal stops the backoff procedure and resumes the backoff procedure after AIFS time when the channel is idle again. If the backoff counter expires through the backoff procedure, the terminal can transmit data. At this time, the UE performs the CCA for the subchannels for transmitting data for the PIFS time before the backoff counter expires. In the embodiment of FIG. 18, a terminal attempts to transmit an 80 MHz PPDU, and some sub- channels, that is, an S20 channel is detected as an occupied state in the CCA procedure.

If at least some of the sub- channels on which the CCA is performed are occupied, the PPDU transmission bandwidth of the terminal is determined based on the broadband access method. 18 (a) shows a broadband access method according to dynamic bandwidth operation. According to the dynamic bandwidth operation, since the S20 channel is occupied, the UE transmits data using only a certain bandwidth, that is, P20 channel according to the conventional channel expansion rule. Meanwhile, FIG. 18 (b) shows a broadband access method according to the static bandwidth operation. According to the static bandwidth operation, since some channels for transmission are occupied, the data transmission in the entire bandwidth is delayed. The MS performs the backoff procedure again using the new backoff counter. When all the channels for

transmission are idle in the CCA before the backoff counter expires, the MS transmits data using the entire bandwidth. As described above, in the broadband access method according to the embodiment of FIG. 18, the bandwidth of the transmission PPDU may be greatly reduced or the transmission of the PPDU may be delayed depending on the state of some sub- channels.

19 illustrates a broadband access method in accordance with another embodiment of the present invention. Figures 19 (a) through 19 (e) illustrate situations in which broadband PPDUs are transmitted based on different channel extension techniques, respectively. In each embodiment of FIG. 19, the fixed channel extension method refers to a channel extension method of a predetermined unit according to the conventional extension rule in the order of 20 MHz, 40 MHz, 80 MHz, and 160 MHz. In addition, the flexible channel expansion method means a channel expansion method of 20 MHz units in the order of 20 MHz, 40 MHz, 60 MHz, 80 MHz, 100 MHz, 120 MHz, 140 MHz and 160 MHz. In addition, the contiguous channel extension method refers to a channel extension method in which a band occupied by a transmitted PPDU is always composed of consecutive channels. Also, a non- contiguous channel extending method refers to a channel extending method in which a band occupied by a transmitted PPDU includes at least one discontinuous channel. In the embodiment of each figure, the CCAs of the subchannels may be performed for a PIFS time before the backoff counter of the main channel expires, as described above in the embodiment of FIG.

First, FIG. 19 (a) shows an embodiment in which a wideband PPDU is transmitted according to a continuous, fixed channel extending method. According to the method, the CCA obtains up to four CCA result values for each of the P20 channel, S20 channel, S40 channel and S80 channel, and reports only information on the first channel determined to be occupied among them. Since the terminal does not perform bandwidth extension from the first channel determined to be occupied to thereafter, the result of CCA for subsequent channels is not needed. Referring to FIG. 19 (a), the S40 channel, which is the first channel determined as the CCA result occupied state, is reported. Therefore, the terminal transmits the PPDU in the 40 MHz band combining the P20 channel and the S20 channel. According to this method, although the burden of CCA result value report is reduced, there is a disadvantage that channel utilization is poor.

Next, FIG. 19 (b) shows an embodiment in which a wideband PPDU is transmitted according to a continuous, flexible channel extending method. According to the present method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band. According to one embodiment, the eight obtained CCA result values may all

be reported. However, according to another embodiment, only information about both first channels determined to be in the occupied state centered on the P20 channel can be reported. The UE may not need the CCA result for the subsequent channels since it does not perform the bandwidth extension from the first two channels determined to be occupied to thereafter. Referring to FIG. 19 (b), CH1 and CH5 (not shown) determined as CCA result occupied states are reported. Therefore, the terminal transmits PPDUs in the 60 MHz band including CH2, CH3, and CH4. According to the present method, it is possible to transmit a PPDU having a wider bandwidth composed of continuous channels, but there is a disadvantage that the transmission bandwidth of a broadband PPDU can be very limited depending on the position of a subchannel occupied by OBSS terminals.

Next, FIG. 19 (c) shows an embodiment in which a wideband PPDU is transmitted according to a discontinuous, fixed channel extending method. According to the method, the CCA obtains up to four CCA result values for each of the P20 channel, S20 channel, S40 channel and S80 channel, and reports information on all the channels determined to be occupied among them. The terminal transmits PPDUs using channels that are not occupied among the reported channels. Referring to FIG. 19 (c), S20 channels and S80 channels (not shown), which are channels determined as CCA result occupied states, are reported. Therefore, the terminal transmits the PPDU in the 60 MHz band including the P20 channel and the S40 channel. According to the method, the channel usability can be improved compared to the relatively small CCA result value report burden. That is, even at a maximum of one discontinuity section even in the 160 MHz bandwidth, it is possible to transmit the wideband PPDU even when the S20 channel and / or the S40 channel is occupied by the OBSS terminals.

Next, FIG. 19 (d) shows an embodiment in which a wideband PPDU is transmitted according to a discontinuous, flexible channel extending method. According to the method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band, and reports all the eight obtained CCA result values. The terminal transmits PPDUs using channels that are not occupied among the reported channels. Referring to FIG. 19 (d), channels CH2, CH4, and CH5 (not shown) to CH8 (not shown), which are determined as CCA result occupied states, are reported. Therefore, the terminal transmits PPDUs in the 40 MHz band including CH1 and CH3. According to this method, the channel utilization is the highest, but the CCA result value report burden is large. In addition, a plurality of discontinuous sections may occur in the PPDU to be transmitted.

Finally, FIG. 19 (e) shows an embodiment in which a wideband PPDU is transmitted according to a discontinuous, limited flexible channel extension method. In the

embodiment of the present invention, the flexible channel extension method follows the flexible channel extension method described above. However, the flexible channel extension method is not limited to the channel extension method in which the band occupied by the transmitted PPDU always includes the predetermined core channels including the P20 channel . In the embodiment of FIG. 19 (e), a 40 MHz channel (i.e., P40 channel) including a P20 channel and an S20 channel is set as the center channels. According to the method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band, and reports all the eight obtained CCA result values. The terminal transmits PPDUs using channels that are not occupied among the reported channels. At this time, the terminal performs PPDU transmission only when PPDU configuration is possible in the band including the above- described center channels. According to the present method, performance similar to that of the embodiment of FIG. 19 (d) is shown, and when the P40 channel is set as the center channel, the decoding position of the HE- SIG- B can be guaranteed in the P40 channel.

Fig. 20 transmits concrete embodiments for transmitting a wideband PPDU according to the discontinuous, fixed channel extending method of Fig. 19 (c) described above. 20 (a) and 20 (b) show an embodiment in which the terminal has one RF module and supports transmission of PPDUs of up to 160 MHz. 20 (c) and 20 (d) show an embodiment in which the terminal has two RF modules and supports transmission of PPDUs of up to 80 + 80 MHz. It is assumed that the PPDU transmitted in the embodiment of FIG. 20 is an OFDMA- based HE MU PPDU.

20 (a) shows a situation in which the terminal attempts to transmit a PPDU with a bandwidth of 160 MHz but the S40 channel is occupied by the CCA. The terminal transmits PPDUs in a 140MHz band including P40 channels (P20 channels + S20 channels) and S80 channels. At this time, the UE retransmits the data allocated to the S40 channel among the PPDUs configured on the OFDMA basis. The S40 channel becomes a filtered channel in which no data is transmitted. In the embodiment of FIG. 20A, the PPDU is transmitted using the 160 MHz spectral mask. In the S40 channel determined to be occupied, filtering is performed and no data is transmitted. However, since the 40 MHz spectral mask is not applied to the signal transmitted through the P40 channel, signals of some resource units consecutive to the boundary with the S40 channel may interfere with the OBSS signal transmitted through the S40 channel. Therefore, according to the embodiment of the present invention, in some discontinuous PPDU transmission situations, some resource units of a transmission channel adjacent to an unassigned channel may be additionally filtered and data may not be transmitted.

Next, FIG. 20 (b) shows a situation where the terminal tries to transmit the PPDU with a bandwidth of 80 MHz but the S20 channel is occupied by the CCA. The terminal transmits PPDUs in the 60 MHz band including the P20 channel and the S40 channel. At this time, the UE retransmits the data allocated to the S20 channel among the PPDUs configured based on OFDMA. The S20 channel is a filtered channel where no data is transmitted. In the embodiment of FIG. 20 (b), the PPDU is transmitted using the 80 MHz spectral mask, and filtering is performed in the S20 channel determined to be in the occupied state, so that no data is transmitted. However, since the 20 MHz spectral mask is not applied to the signal transmitted through the P20 channel, signals of some resource units continuous to the boundary with the S20 channel may interfere with the OBSS signal transmitted through the S20 channel. Therefore, according to the embodiment of the present invention, in some discontinuous PPDU transmission situations, some resource units of a transmission channel adjacent to an unassigned channel may be additionally filtered and data may not be transmitted.

Next, FIG. 20 (c) shows a situation in which the terminal attempts to transmit PPDUs with a bandwidth of 80 + 80 MHz, but the S40 channel is occupied by the CCA. The terminal transmits the PPDU to the P40 channel (P20 channel + S20 channel) and the S80 channel using the two RF modules. At this time, the UE retransmits the data allocated to the S40 channel among the PPDUs configured on the OFDMA basis. The terminal transmits the PPDU to which the 40 MHz spectral mask is applied through the P40 channel using the first RF module and the PPDU to which the 80 MHz spectral mask is applied using the second RF module through the S80 channel. Therefore, in the embodiment of FIG. 20 (c), no additional filtering of the resource units included in the transmission channel is required since it does not interfere with the unassigned channel S40.

Next, FIG. 20 (d) shows a situation where the terminal tries to transmit the PPDU with a bandwidth of 80 + 80 MHz, but the S20 channel and the S80 channel are occupied by the CCA. The terminal transmits the PPDU in the 60 MHz band including the P20 channel and the S40 channel using only the first RF module. At this time, the second RF module need not be driven, and the operation in the first RF module is as described in the embodiment of FIG. 20 (b).

The PPDU transmission method according to the embodiment of FIG. 20 can be implemented more easily than the broadband access method according to the dynamic bandwidth operation illustrated in FIG. 18 (a). According to the dynamic bandwidth operation, the PPDU must be reconfigured according to the available bandwidth

according to the CCA result before the transmission of the broadband PPDU. At this time, because the PPDU is dynamically reconfigured, the implementation complexity is increased such that the length of the PPDU is limited to the length of the allocated TXOP. However, according to the embodiment of FIG. 20, since the UE preliminarily configures the OFDMA- based PPDU and then transmits only the data allocated to the idle channels and filters the data allocated to the remaining channels in the occupied state, It is easy.

Referring to FIGS. 21 to 23, a transmission sequence of a discontinuous PPDU according to an embodiment of the present invention will be described. In the embodiment of Figures 21 to 23, CH1 to CH4 refer to each 20 MHz channel constituting the 80 MHz bandwidth. 21 and 22, CH3 is assigned to the P20 channel, CH4 to the S20 channel, and CH1 and CH2 to the S40 channel. In the embodiment of Figs. 21 to 23, the same or corresponding parts as those of the above- described embodiments of Figs. 8 and 9 are omitted from redundant description.

FIG. 21 illustrates a transmission sequence of a discontinuous PPDU according to an embodiment of the present invention. 21 (a) and 21 (b) show a downlink transmission sequence of discontinuous PPDUs, and FIGS. 21 (c) and 21 (d) show uplink transmission sequences of discontinuous PPDUs.

21 (a) shows an embodiment in which the AP performs the CCA for the DL- MU transmission process but the S20 channel is in the occupied state. The AP transmits the MU- RTS frame through the idle P20 channel and the S40 channel. The STAs receiving the MU- RTS frame from the AP transmit the sCTS frame through the corresponding channel. The AP transmits the DL MU PPDU over the channel on which the sCTS frame is received. At this time, the MU- RTS frame should indicate the discontinuous channel allocation information, that is, the P20 channel and the S40 channel (or the unassigned S20 channel). According to one embodiment, the MU- RTS frame may signal the discontinuous channel allocation information via a separate bandwidth field, an RA field, or a combination thereof.

21 (b) shows that the AP transmits the MU- RTS frame in the idle P80 channel (i.e., P20 channel + S20 channel + S40 channel), but the sCTS frame of the STA is not received in the S20 channel Fig. The AP transmits the DL MU PPDU over the P20 channel and the S40 channel in which the sCTS frame is received. At this time, the MU- RTS frame should indicate channel allocation information, i.e., P80 channel. The channel

allocation information may be signaled via a separate bandwidth field. In addition, the DL MU PPDU must indicate discontinuous channel assignment information to which the corresponding PPDU is transmitted, that is, the P20 channel and the S40 channel (or the unassigned S20 channel). The discontinuous channel assignment information may be signaled via a bandwidth field, an RA field, or a combination thereof.

Next, FIG. 21 (c) shows an embodiment in which the AP performs the CCA for the UL-MU transmission process but the S20 channel is in the occupied state. The AP transmits trigger frames over the idle P20 and S40 channels. STAs receiving the trigger frame from the AP transmit the UL MU PPDU over the designated channel. At this time, the trigger frame must indicate discontinuous channel allocation information, i.e., the P20 channel and the S40 channel (or the unassigned S20 channel), for the UL MU PPDU transmission of the STAs. In addition, the trigger frame should not allocate the occupied S20 channel to the upstream transmission of the STAs. According to one embodiment, the trigger frame may signal the discontinuous channel assignment information via a separate bandwidth field, an RA field, or a combination thereof.

Finally, FIG. 21 (d) shows a sequence in which the AP transmits a trigger frame on the idle P80 channel and the STAs transmit the UL MU PPDU accordingly. At this time, Of the STAs receiving the trigger frame, the STAs allocated to the S20 channel do not perform the transmission for the reason that the corresponding channel is detected as the occupied state or the NAV is set.

22 shows a transmission sequence of a discontinuous PPDU according to another embodiment of the present invention. 22 (a) and 22 (b) show a downlink transmission sequence of discontinuous PPDUs, and FIGS. 22 (c) and 22 (d) show uplink transmission sequences of discontinuous PPDUs. 22 and in the following embodiments, the S40A channel refers to the first 20 MHz channel (i.e., CH1) that constitutes the S40 channel, and the S40B channel refers to the second 20 MHz channel (i.e., CH2) that constitutes the S40 channel.

22 (a) shows an embodiment in which the AP performs the CCA for the DL- MU transmission process but the S40B channel is in the occupied state. The AP transmits the MU- RTS frame through the idle P40 channel and the S40A channel. The STAs receiving the MU- RTS frame from the AP transmit the sCTS frame through the corresponding channel. At this time, the MU- RTS frame should indicate the discontinuous channel allocation information, that is, the P40 channel and the S40A

channel (or the unassigned S40B channel). According to one embodiment, the MU- RTS frame may signal the discontinuous channel allocation information via a separate bandwidth field, an RA field, or a combination thereof. Meanwhile, in the embodiment of FIG. 22 (a), among the STAs that have received the MU- RTS, the STAs instructed to transmit the sCTS frame through the S40A channel can not receive the sCTS frame because the channel is detected as occupied, Lt; / RTI & gt; At this time, the AP transmits the DL MU PPDU only through the P20 channel and the S20 channel on which the sCTS is received.

Next, FIG. 22 (b) shows an embodiment in which the AP transmits an MU- RTS frame on the idle P80 channel, but the sCTS frame of the STA is not received on the S40A channel. The AP transmits the DL MU PPDU over the P40 channel and the S40B channel on which the sCTS frame is received. In this case, the MU- RTS frame should indicate the P80 channel as the channel allocation information, and the DL MU PPDU should indicate the discontinuous channel allocation information, that is, the P40 channel and the S40B channel (or the unassigned S40A channel). The signaling method of the channel allocation information is as described above in the embodiment of FIG. 21 (b).

Next, FIG. 22 (c) shows an embodiment in which the AP performs the CCA for the UL-MU transmission process but the S40B channel is in the occupied state. The AP transmits trigger frames over the idle P40 and S40A channels. At this time, the trigger frame indicates discontinuous channel allocation information, i.e., the P40 channel and the S40A channel (or the unassigned S40B channel) for the UL MU PPDU transmission of the STAs. The trigger frame may signal the discontinuous channel assignment information via a separate bandwidth field, an RA field, or a combination thereof. On the other hand, among the STAs receiving the trigger frame in the embodiment of FIG. 22 (c), the STAs instructed to transmit the upstream data through the S20 channel can not receive the upstream data because the channel is detected as occupied, Lt; / RTI & gt; Thus, the AP can receive the UL MU PPDU over a band that is equal to or narrower than the band in which the trigger frame is transmitted.

22 (d) shows that the AP transmits the trigger frame to the idle P80 channel, but the STAs allocated to the S20 channel do not perform the transmission for the reason that the corresponding channel is detected as the occupied state or the NAV is set Lt; / RTI & gt;

23 shows an embodiment of an ACK frame transmission method in a PPDU transmission

sequence. In the embodiment of FIG. 23, CH1 is assigned to the P20 channel, CH2 to the S20 channel, and CH3 and CH4 to the S40 channel.

23 (a) shows an embodiment of an ACK frame transmission method in a transmission sequence of successive PPDUs. The AP transmits the DL MU PPDU using the continuous bandwidth of 80 MHz, and the receiving STAs transmit the UL MU response. At this time, the STAs transmit an immediate uplink response according to the scheduling information included in the A- MPDU of the received DL MU PPDU. The scheduling information is obtained from the UL MU response scheduling field included in the trigger frame included in the A- MPDU or the MAC header of the specific MPDU constituting the A- MPDU. Also, the uplink response transmitted by the STAs includes uplink ACK, uplink data, and the like. According to an embodiment of the present invention, the scheduling information, that is, the resource units for which the STAs perform the UL MU response, may be indicated through a separate resource unit allocation (RA) field. FIG. 23 (d) shows an embodiment in which a resource unit for uplink transmission is allocated through a separate RA field.

Referring to FIG. 23 (d), the RA field is composed of 8 bits in total, and the first bit indicates whether the corresponding resource unit is located at the primary 80 MHz or the secondary 80 MHz. The remaining 7 bits of the RA field indicate resource unit allocation within the corresponding 80 MHz band. That is, the size of the predetermined resource unit and the position of the resource unit are indicated according to the index value of the RA field. In the embodiment of FIG. 23 (a), the STAs may transmit an uplink ACK via a designated resource unit within the 80 MHz band in which the DL MU PPDU is transmitted.

However, in the transmission sequence of the discontinuous PPDU as in the embodiment of FIG. 23 (b), there may arise a problem in resource unit allocation for ACK frame transmission. More specifically, as shown in FIG. 23 (b), when there is no constraint on the resource unit to which the ACK frame for the discontinuous PPDU is transmitted, the uplink ACK is transmitted through the channel not used for DL MU PPDU transmission (i.e., CH3) Can be transmitted. This may cause interference with the OBSS signal transmitted through CH3. As described above in the embodiment of FIGS. 21 and 22, the transmission of discontinuous PPDUs may be determined immediately prior to PPDU transmission according to the CCA results for multiple channels. Thus, it may not be possible to adjust the scheduling information for the resource units on which the UL MU response of the STAs is to be performed, just before the transmission of the discontinuous PPDU.

In order to solve such a problem, as shown in FIG. 23 (c), a constraint can be applied to resource unit allocation for ACK frame transmission. According to the embodiment of the present invention, the STAs receiving the DL MU PPDU from the AP transmit the uplink ACK in the 20 MHz channel in which the corresponding resource unit is located. If the STA receives a DL MU PPDU with MU- MIMO on a 40 MHz channel or an 80 MHz channel, the STA may transmit an uplink ACK within the corresponding 40 MHz channel or 80 MHz channel. The AP signals scheduling information for the ACK frame transmission of these STAs.

Referring to FIG. 23 (c), the AP transmits DL MU PPDUs on the P40 channel and the S40B channel. At this time, the STAs receiving the PPDU through the S40B channel (i.e., the 20MHz channel) transmit the ACK frame within the S40B channel. If a full bandwidth MU- MIMO transmission is performed on a P40 channel (i.e., a 40 MHz channel), the STAs may transmit an ACK frame within the P40 channel. However, when an OFDMA transmission is performed on the P40 channel, the STAs transmit an ACK frame within the 20 MHz channel where the PPDU is located in the received resource unit.

Meanwhile, although an embodiment of the ACK frame transmission method in the DL-MU transmission process has been described with reference to FIG. 23, the present invention is not limited to this and can be similarly applied to the UL- MU transmission process. That is, corresponding to the trigger frame of the AP, the STAs can transmit the HE Trigger- based PPDU through the allocated resource unit. The AP transmits the downlink ACK in response to the HE Trigger- based PPDUs transmitted by the STAs. At this time, the AP transmits an ACK frame for the corresponding STA within a 20 MHz channel in which the resource unit in which each STA transmits the HE Trigger-based PPDU is located. Therefore, the STA that transmitted the HE Trigger- based PPDU can receive the ACK frame within the 20 MHz channel where the resource unit to which the PPDU is transmitted is located.

24 shows a method of setting the TXOP of the MU transmission procedure as a further embodiment of the present invention. According to the embodiment of the present invention, the TXOP can be set using the TXOP information of the HE- SIG- A and the duration field information of the MAC header together.

24 (a) shows an embodiment of the arrangement situation of terminals around a specific BSS. In the embodiment of FIG. 24 (a), the AP communicates with STA1 and STA2, and there are nodes L1, H1, L2 and H2 which are based on a specific terminal. Here, L1 and L2 denote the legacy STA, respectively, and H1 and H2 denote the non- legacy STA, respectively. L1 and H1 are capable of sensing messages in the AP, but can not receive messages in STA1 and STA2. Thus, L1 and H1 may interfere with the AP when the AP receives messages from STA1 and STA2. On the other hand, L2 and H2 can sense messages of STA2, but can not receive messages of AP. Thus, L2 and H2 may interfere with STA2 when STA2 receives a message from the AP. Therefore, in order to protect the MU transmission process, NAV must be set in the hidden nodes L1, H1, L2 and H2.

24 (b) shows how the TXOP of the UL- MU transmission procedure is set in the arrangement situation of the terminals of FIG. 24 (a). First, the AP transmits an MU-RTS frame on multiple channels (for example, 40 MHz). At this time, the legacy preambles such as L- STF, L- LTF, and L- SIG are repeatedly transmitted for each 20 MHz channel. If the MU- RTS frame is transmitted in the legacy format, H1 and L1 which have received the MU- RTS frame set the NAV based on the duration field of the MAC header of the MU- RTS frame.

Next, STA1 and STA2 receiving the MU- RTS frame transmit the sCTS frame after the SIFS time. At this time, the sCTS frame can be transmitted in units of 20 MHz channels. The STAs receiving the MU- RTS can restrict the transmission of the sCTS frame considering the NAV already set in the corresponding terminal. H2 and L2 receiving the sCTS frame set the NAV based on the duration field of the MAC header of the sCTS frame.

The AP receiving the sCTS frame can transmit the trigger frame in HE PPDU format. At this time, in the trigger frame, the TXOP duration field of HE- SIG- A and the duration field of the MAC header indicate duration information, respectively. The two duration fields may have different bit configurations. For example, the number of bits in the TXOP duration field may be less than the number of bits in the duration field of the MAC header. At this time, the setting method of each duration field and / or the interpretation method of each duration field must be determined in order to set the correct NAV of peripheral terminals.

According to one embodiment of the present invention, when the TXOP duration field is composed of t bits and the duration field of the MAC header is composed of m bits

(where t & lt; m), the value of the duration field of the MAC header does not exceed the value of the TXOP duration field Lt; / RTI & gt; For example, if the TXOP duration field is composed of 12 bits and the duration field of the MAC header is composed of 15 bits, the value of the duration field of the MAC header shall not exceed the maximum value that the TXOP duration field can display, that is, 2 ^ 12 = 4096us Lt; / RTI & gt; At this time, the interpretation of each duration field can be performed in the same way.

According to another embodiment of the present invention, when the number of bits of the TXOP duration field and the number of bits of the duration field of the MAC header are different from each other, a predetermined scaling factor Can be multiplied. For example, if the TXOP duration field is composed of 12 bits and the duration field of the MAC header is composed of 15 bits, the value of the TXOP duration field may be used after the scaling factor 8 is multiplied. In this way, by using the preset scaling factor, the range of the duration information indicated by the duration field of the different number of bits can be made similar.

However, if the value of the TXOP duration field is used after the scaling factor 8 is multiplied, the duration information obtained from the two duration fields may have a difference of up to 7us. According to an embodiment of the present invention, the STA analyzing all of the two duration fields may set the NAV based on the duration field of the MAC header having a larger number of bits. However, of the two duration fields, the STA, which can only interpret the TXOP duration field of HE- SIG- A, sets the NAV based on the TXOP duration field. In this situation, the value of the TXOP duration field in one PPDU may be set to a value which is larger or smaller than the value of the duration field of the MAC header by the maximum offset (for example, 7us).

In the embodiment of FIG. 24 (b), since H1 receiving the trigger frame can interpret both the TXOP duration field of the HE- SIG- A and the duration field of the MAC header, the two fields are used together to update the NAV Can be. However, L1 can not update the NAV because it can not parse the non- legacy preamble and MPDU of the HE PPDU.

On the other hand, STA1 and STA2 receiving the trigger frame transmit the HE Trigger- based PPDU. At this time, the H2 receiving the HE Trigger- based PPDU can interpret both the duration field of the HE- SIG- A TXOP and the duration field of the MAC header, so that the NAV can be updated using the two fields together. However, L2 can not update the NAV because it can not interpret the non- legacy preamble and

MPDU of the HE Trigger- based PPDU.

25 to 31 illustrate a method of signaling discontinuous channel assignment information according to various embodiments of the present invention. In an embodiment of the present invention, discrete channel allocation refers to channel allocation in which the band occupied by the transmitted packet (i. E., PPDU) includes at least one discontinuous channel (or discontinuous resource unit). However, a channel with a total bandwidth of 80 + 80 MHz is regarded as a continuous channel like a channel with a full bandwidth of 160 MHz. Thus, a discontinuous channel (or discontinuous PPDU) in an embodiment of the present invention may indicate discontinuous channels except for a full bandwidth 80 + 80 MHz channel. In the embodiments of FIGS. 25- 31, channel A through channel D indicate each 20 MHz channel over which an 80 MHz PPDU is transmitted. At this time, the channel A is assigned to the P20 channel, the channel B to the S20 channel, and the channel C and the channel D to the S40 channel. Also, in each embodiment, the S40A channel may point to channel C, and the S40B channel may point to channel D.

In an embodiment of the present invention, a sender (e.g., an AP) signals discontinuous channel assignment information through embodiments or combinations thereof illustrated in the figures. The sender can perform multi- channel CCA for broadband packet transmission. At this time, the wide band may mean a band having a total bandwidth of 40 MHz or more, but the present invention is not limited thereto. The sender transmits the packet to at least one channel in the idle state based on the result of performing the multi- channel CCA. At this time, when the packet is transmitted on the discontinuous channel, the sender signals discontinuous channel allocation information through the non- legacy preamble of the packet. In this way, the sender transmits the wireless packet with discontinuous channel assignment information signaled. The receiver (e.g., the STA) receives the wireless packet and obtains the discontinuous channel allocation information in the received packet. The receiver decodes the received packet based on the obtained discontinuous channel allocation information. At this time, the received packet may be an HE MU PPDU, but the present invention is not limited thereto.

FIG. 25 illustrates a signaling method of discontinuous channel assignment information according to an embodiment of the present invention. In the embodiment of FIG. 25, the AP performs the CCA of the channel A to the channel D to transmit the DL MU PPDU with the total bandwidth of 80 MHz, and the S40B channel is determined to be in the occupied state. The AP transmits PPDUs over the idle P40 and S40A channels. The AP nulls the data tones of the occupied S40B channel and does not transmit the signal. At

this time, discontinuous channel allocation information, that is, allocation information of the P40 channel and the S40A channel (or information of the unassigned S40B channel) should be signaled on the PPDU to be transmitted.

First, discontinuous channel assignment information may be directed through the bandwidth field of HE- SIG- A. The bandwidth field may indicate specific discontinuous channel assignment information through a predetermined index. According to one embodiment, the bandwidth field may explicitly indicate specific discontinuous channel assignment information. Therefore, the allocation information of the P40 channel and the S40A channel can be indicated through the bandwidth field.

Also, the discontinuous channel assignment information may be indicated via the RA field of HE- SIG- B. The RA field can indicate a specific resource unit not assigned to the user through a predetermined index. For example, the RA field may indicate that a resource unit of a multiple of a 20 MHz channel, i.e. 242- tone, 484- tone or 996- tone, is not allocated to the user. Data transfer is not performed in an empty resource unit indicated by a predetermined index value.

Also, the discontinuous channel assignment information may be indicated by inserting a null STA ID into the specific user field of the HE- SIG- B. That is, a predetermined null STA ID is inserted in a user field corresponding to an unassigned resource unit in which data is not transmitted. Therefore, no STA receives data through the unassigned resource unit.

26 illustrates a method of signaling discontinuous channel assignment information through a bandwidth field of HE- SIG- A according to an embodiment of the present invention. The bandwidth field of the HE MU PPDU can additionally indicate predetermined discontinuous channel bandwidths in addition to the continuous channel bandwidths of 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80 + 80 MHz). If the bandwidth field indicates a predetermined discontinuous channel bandwidth, additional allocation information of the discontinuous channel may be indicated via a sub- field of HE- SIG- B.

As described above, the HE- SIG- B can be composed of a maximum of two content channels, i.e., the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 in units of 20 MHz. Each HE- SIG- B content channel in the total band is arranged in order

of the physical frequency band. That is, the HE- SIG- B content channel 1 is transmitted in the lowest frequency band, and the HE- SIG- B content channel 2 is transmitted in the next higher frequency band. Such a content channel configuration is then repeated through content duplication in the higher frequency bands. 26, HE- SIG- B content channel 1 signals resource unit allocation information of channel A and channel C, and HE- SIG- B content channel 2 contains resource unit allocation information of channel B and channel D Signal. HE- SIG- B content channel 1 is transmitted over channel A and channel C. However, since PPDU transmission is not performed in channel D, HE- SIG- B content channel 2 is transmitted only through channel B. [ At this time, the HE- SIG- B content channel 2 transmitted through the channel B may indicate that the channel D is not used.

FIG. 27 illustrates a method of signaling discontinuous channel allocation information through an RA field of HE- SIG- B according to an embodiment of the present invention. As described above, the RA field is configured in units of 8 bits, and indexes the sizes of the resource units constituting the specific bandwidth and their arrangement in the frequency domain. Further, the RA field can indicate the number of users in each resource unit. At this time, the RA field may indicate a specific resource unit (i.e., an unassigned RU) not assigned to the user through a predetermined index. According to one embodiment, a particular resource unit includes a resource unit (RU) having a bandwidth of a multiple of 20 MHz channels, i.e., 242- tone RU, 484- tone RU, 996- tone RU, Data transmission is not performed in the unassigned RU indicated by the index value.

As shown in FIG. 27 (a), when the total bandwidth through which PPDUs are transmitted is 80 MHz, two RA fields are transmitted in each HE- SIG- B content channel. That is, the first RA field (8 bits) of the HE- SIG- B content channel 1 signals the resource unit allocation information of the channel A, and the second RA field (8 bits) of the HE- C resource unit allocation information. Similarly, the first RA field (8 bits) of HE- SIG- B content channel 2 signals resource unit allocation information of channel B, and the second RA field (8 bits) of HE- SIG- D resource unit allocation information. 27A, if the channel D is occupied, the HE- SIG- B content channel 2 is transmitted only through the channel B, and the HE- SIG- B content channel 1 is transmitted through the channel A and the channel C . Specific embodiments of signaling through the RA field of HE- SIG- B that the channel D is not allocated to the user at this time will be described with reference to Figs. 27 (b) to 27 (d).

27 (b), the RA field corresponding to the unassigned 20 MHz channel, that is, the second

RA field of the second SIG- B content channel, is a 242- tone RU It can indicate nulling. However, the second RA field of HE- SIG- B content channel 1 indicates a 242- tone RU according to the resource allocation information of channel C or indicates RUs divided into smaller sizes. Thus, the RA field can perform independent and explicit signaling for each channel. Therefore, the RA field corresponding to the unassigned channel D indicates that the corresponding resource unit is not allocated to the user (i.e. nulling).

Next, according to another embodiment of the present invention, the RA field corresponding to the unassigned 20 MHz channel, i.e., the second RA field of the HE- SIG- B contents channel 2, as shown in FIG. 27 (c) RU can be nullified. However, since the second RA field of the HE- SIG- B content channel 1 indicates the resource allocation information of the channel C, it can be identified that the unassigned channel is the channel D of the 20 MHz bandwidth.

Next, according to another embodiment of the present invention, the RA field corresponding to the unassigned 20 MHz channel as shown in FIG. 27 (d) is a specific field such as 242- tone RU, 484- tone RU, 996- It can indicate general nulling rather than nulling resource units of bandwidth. In this case, nulling indicated in the RA field may implicitly be interpreted as indicating nulling of 242- tone RU (i.e., 20 MHz channel), and information of the resource units allocated to the user may be acquired via another RA field have.

When the RA field indicates that a specific resource unit is not allocated to the user, the user specific field corresponding to the resource unit is not transmitted. Thus, the second SIG- B content channel signaling the resource unit allocation information of channel D, as shown in Figure 27 (a), does not carry the user specific field 410 corresponding to channel D. {

FIG. 28 illustrates a method of signaling discontinuous channel assignment information through a user field of HE- SIG- B according to an embodiment of the present invention. As described above, the discontinuous channel assignment information may be indicated by inserting a null STA ID into the specific user field of HE- SIG- B. The RA field of HE- SIG- B indicates resource allocation information corresponding to an unassigned resource unit, and a predetermined null STA ID may be inserted in a user field corresponding to the unassigned resource unit.

If channel D is not used as in the embodiment of FIG. 28, the second RA field of HE-SIG- B content channel 2 corresponding to channel D indicates a 242- tone resource unit and one user. Thus, the second RA field indicates that one user field 420 is carried for the corresponding 242- tone resource unit. The user- specific field of SIG- B content channel 2 carries the user fields of the total number of users indicated in the first RA field and the second RA field of HE- SIG- B content channel 2. At this time, the predetermined null STA ID is inserted in the user field 420 corresponding to the unassigned channel channel D. According to an embodiment of the present invention, the null STA ID may be an unassigned AID of AIDs from 1 to 2007 of the BSS, a reserved AID of a value greater than 2007 (e.g., 2046) AID & lt; / RTI & gt; When a null STA ID is inserted into the user field 420, discontinuous channel assignment can be performed since no STA in the BSS receives data through the corresponding resource unit.

29 illustrates a signaling method of discontinuous channel assignment information according to a further embodiment of the present invention. According to the embodiment of FIG. 29, whether the central 26- tone resource unit 502 is assigned to the user can be signaled via the user field 422 of HE- SIG- B. In an embodiment of the present invention, the central 26- tone resource unit (RU) refers to the RU 502 located at the center of the 80 MHz bandwidth. As described below, whether or not the central 26- tone RU 502 is assigned to the user can be determined according to various embodiments.

According to an embodiment of the present invention, the user field 422 corresponding to the central 26- tone RU 502 may be carried over HE- SIG- B content channel 1 as shown in FIG. At this time, the user field 422 may be carried as the last user field of HE- SIG- B content channel 1. In accordance with one embodiment of the present invention, whether a central 26- tone RU 502 is assigned to a user may be indicated via the STA ID inserted in the corresponding user field 422. { That is, if a central 26- tone RU 502 is not assigned to a user, a null STA ID may be inserted into the corresponding user field 422. A specific embodiment of the null STA ID is as described in FIG. However, if the central 26- tone RU 502 is assigned to a particular user, the STA ID of the particular user may be inserted into the corresponding user field 422.

30 shows a signaling method of discontinuous channel assignment information according to a further embodiment of the present invention. According to the embodiment of FIG. 30, whether or not any resource unit 504 is assigned to the user can be signaled via the user field 424 of HE- SIG- B. An OFDMA based DL MU PPDU includes up to nine resource units within a 20 MHz bandwidth, each of which consists of 26 subcarriers. At

this time, data is transmitted through only eight resource units out of the nine RUs, and data may not be transmitted in one resource unit. In addition, a PPDU with a total bandwidth of 80 MHz may contain up to 37 resource units, some of which may not transmit data. As described above, when some of the resource units constituting the total bandwidth are not allocated to the user, a method of indicating the unallocated resource unit is required.

According to an embodiment of the present invention, such discontinuous channel assignment information may be indicated via the RA field and the user field of HE- SIG-B. As described above, the RA field indicates the arrangement of the resource units constituting the specific bandwidth and the user number information. The user fields corresponding to each resource unit are carried in the user specific field of HE- SIG- B according to the order of resource unit allocation indicated by the RA field. According to an embodiment of the present invention, an unassigned resource unit may be indicated via a null STA ID inserted in a user field 424 corresponding to a particular resource unit 504 in the resource unit array indicated by the RA field. At this time, the unallocated resource unit that can be indicated includes at least one of 26- tone RU, 52- tone RU, and 106- tone RU, but the present invention is not limited thereto. That is, an unassigned resource unit that can be indicated via a null STA ID as described in FIG. 28 may include 242- tone RU, 484- tone RU, and 996- tone RU over a 20 MHz bandwidth. A specific embodiment of the null STA ID is as described in FIG.

Next, with reference to FIG. 31, matters that can be considered when signaling the discontinuous channel allocation information will be described. HE MU The PPDU performs signaling through HE- SIG- A and HE- SIG- B. HE- SIG- A carries the overall information including the bandwidth information of the PPDU, and HE- SIG- B carries information for simultaneous multi- user transmission. 40In a total PPDU bandwidth above MHz, HE- SIG- B may consist of HE- SIG- B content channel 1 and HE- SIG- B content channel 2. According to an embodiment of the present invention, when transmission of a discontinuous PPDU is performed, the following matters can be considered.

First, all types of discrete PPDUs must be assigned P20 channels. That is, the discontinuous PPDU may include at least one unallocated channel (or unallocated resource unit), but the P20 channel must be allocated to at least one user.

Second, the HE- SIG- A of the discontinuous PPDU must be able to indicate the channel

information over which the content channel (s) of the HE- SIG- B of the PPDU is transmitted. Referring to FIG. 31 (a), channels of 80 MHz bandwidth are composed of channel A, channel B, channel C and channel D in frequency ascending order, and channel A, channel B and channel D except occupied channel C Discontinuous PPDUs may be transmitted. At this time, the HE- SIG- B content channel 1 is transmitted through channel A, and the HE- SIG- B content channel 2 is transmitted through channel B and channel D. At this time, the bandwidth field of the HE- SIG- A may indicate information about at least which channel each of the content channels of the HE- SIG- B of the corresponding PPDU is transmitted through. As described below, the bandwidth field of the HE- SIG- A may index puncturing of the S20 channel, and puncturing of at least one of the two channels of the S40 channel, respectively. If the bandwidth field indicates puncturing of the S20 channel, at least one content channel of the two HE- SIG- B content channels may be transmitted over the S40 channel. On the other hand, if the bandwidth field indicates puncturing of at least one of the two 20 MHz channels of the S40 channel as shown in FIG. 31 (a), all of the two HE- SIG- B content channels are transmitted through at least the P40 channel .

Finally, HE- SIG- A may indicate the size information of the common block field of HE- SIG- B explicitly or implicitly in the corresponding PPDU. As shown in FIG. 31 (b), the HE- SIG- B comprises a common block field 430 and a user specific field 440, and the common block field 430 includes an RA field. If the total bandwidth of the PPDU is 20 MHz or 40 MHz, each HE- SIG- B content channel carries one RA field. However, if the total bandwidth of the PPDU is 80 MHz or 160 MHz (80 + 80 MHz), each HE- SIG- B content channel may carry a plurality of RA fields 432 as shown in Figure 31 (c) . That is, when the total bandwidth of the PPDU is 80 MHz, each HE- SIG- B content channel carries two RA fields 432, and when the total bandwidth of the PPDU is 160 MHz (or 80 + 80 MHz) The - SIG- B content channel carries four RA fields 432. Accordingly, the number of RA fields 432 carried through the common block field 430 of the HE- SIG- B varies according to the information indicated by the bandwidth field 452 of the HE- SIG- A. The bandwidth field 452 of HE- SIG- A may indicate the number of RA fields 432 carried through the common block field 430 of HE- SIG- B, Size information can be expressed explicitly or implicitly.

According to an embodiment of the present invention, the discontinuous channel assignment information may be indicated through any of a sub- field of HE- SIG- A, a sub- field of HE- SIG- B, and combinations thereof. The discontinuous channel assignment information may be signaled by the following specific embodiments.

First, the discontinuous channel assignment information can be signaled alone through a sub- field of HE- SIG- A. The bandwidth field 452 of HE- SIG- A may indicate specific discontinuous channel assignment information through a predetermined index. If the discontinuous channel assignment information is signaled through the sub- field of HE- SIG- A, the receiver can quickly obtain the entire configuration information of the PPDU. In addition, the additional signaling overhead through HE- SIG- B is reduced when the discontinuous channel assignment information is signaled with only the sub- fields of HE- SIG- A.

However, due to the limitation of the available number of bits of HE- SIG- A, various discontinuous channel allocation information may not be signaled. Thus, according to one embodiment of the present invention, the bandwidth field 452 may explicitly indicate only some of the discontinuous channel assignment information of the various discontinuous channel assignment options. According to another embodiment of the present invention, some sub- fields of HE- SIG- A that are unnecessary when discontinuous channel allocation is performed may be used for additional signaling of discontinuous channel allocation information. For example, when a discontinuous channel assignment is performed, the SIG- B compression field 454 indicating whether to use the entire bandwidth MU- MIMO is unnecessary. Thus, when discrete channel allocation is performed, the SIG- B compression field 454 may be used for other purposes. For example, HE- SIG- A may indicate discontinuous channel assignment information using the bandwidth field 452 and the SIG- B compression field 454 together.

Next, the discontinuous channel assignment information can be signaled alone through the sub- fields of HE- SIG- B. At this time, the bandwidth field of HE- SIG- A indicates the existing continuous bandwidth, and the information of the unassigned channel (or unallocated resource unit) is stored in the RA field 432 of HE- SIG- B and / & Lt; / RTI & gt; In this case, the signaling overhead of HE- SIG- A may be reduced, but the signaling overhead of HE- SIG- B may increase.

Finally, the discontinuous channel assignment information may be signaled through a combination of a sub- field of HE- SIG- A and a sub- field of HE- SIG- B. A sub- field of HE- SIG- A signals at least a portion of the discontinuous channel assignment information, and a sub- field of HE- SIG- B signals the remaining information. According to one embodiment, the sub- field of HE- SIG- A may signal the detailed information of the PPDU configuration of the P80 channel and the transmission / non- transmission information of the S80 channel. If the sub- field of HE- SIG- A indicates transmission of the S80 channel, the sub- field of HE- SIG- B can signal the details of the PPDU

configuration of the S80 channel. According to another embodiment, the sub- field of HE- SIG- A includes channel information on which the content channel (s) of the HE- SIG- B of the corresponding PPDU is transmitted and size information of the common block field 430 of HE- Lt; / RTI & gt; The sub- fields of HE- SIG- B signal additional information of the PPDU configuration. According to another embodiment, if the transmission band of the discontinuous PPDU always includes the P40 channel, the size information of the common block field 430 of HE- SIG- B in the sub- field of HE- SIG- A can be signaled .

32- 34 illustrate a method of discontinuous channel allocation according to various embodiments of the present invention. Discontinuous channel assignment information according to the embodiments of FIGS. 32- 34 may be signaled through a combination of at least one of the various embodiments described in FIGS. 25- 31.

FIG. 32 illustrates a discontinuous channel allocation method according to an embodiment of the present invention. According to an embodiment of the present invention, discontinuous channel assignment information may be signaled alone through the bandwidth field of HE- SIG- A. 32 illustrates an embodiment in which a discontinuous PPDU always allocates a P40 channel to fix the decoding position of the HE- SIG- B content channel. At this time, both the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 can be transmitted through at least the P40 channel. 32 and in the following embodiments, the S80A channel, the S80B channel, the S80C channel, and the S80D channel refer to the first, second, third and fourth 20MHz channels, respectively, constituting the S80 channel.

The bandwidth field of HE- SIG- A basically can index the information of four consecutive channels 510, namely, 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80 + 80 MHz). If the bandwidth field is composed of 3 bits, then the bandwidth field may index the information of the four additional discontinuous channels 520. First, the bandwidth field can index each puncturing of two 20 MHz channels in the S40 channel. In addition, the bandwidth field may index the allocation of the S80 channel in combination with the configuration of the S40 channel. Therefore, the bandwidth field can index four discrete channel configurations in total by combining the two configurations of P40 + S40A and P40 + S40B in the P80 channel and the two configurations according to whether the S80 channel is allocated or not.

Next, if the bandwidth field is composed of 4 bits, the bandwidth field may additionally

index the information of the eight discontinuous channels 530 in addition to the information of the four discontinuous channels 520. First, the bandwidth field can index each puncturing of two 20 MHz channels in the S40 channel. In addition, the bandwidth field may index information of six discontinuous channels in the S80 channel in combination with the configuration of the S40 channel. At this time, the information of the six discontinuous channels includes the allocation of the S80 channel, and may include four puncturing options that can allocate a continuous 40 MHz band as shown in FIG.

33 shows a method of allocating a discontinuous channel according to another embodiment of the present invention. According to the embodiment of FIG. 33, the location where at least one of the HE- SIG- B content channels are transmitted may be variable. At this time, the receiver must be able to variably set the decoding channel for receiving the HE- SIG- B content channel. In the embodiment of FIG. 33, it is assumed that the HE- SIG- B content channel 1 is transmitted on the P20 channel and the channel on which the HE- SIG- B content channel 2 is transmitted can be varied. However, depending on the physical frequency order of the P20 channel within the P40 channel, the HE- SIG- B content channel 2 may be transmitted on the P20 channel. At this time, the channel through which the HE- SIG- B content channel 1 is transmitted may vary depending on the channel configuration. The discontinuous channel assignment information according to the embodiment of the present invention may support the configuration of at least some of the channel configurations listed in FIG.

FIG. 33A shows a channel configuration in which only the P20 channel is allocated among P80 (primary 80 MHz) bands. At this time, the HE- SIG- B content channel 2 is not transmitted in the P80 band. FIG. 33 (b) shows a channel configuration in which the P40 channel is basically allocated among the P80 bands. At this time, both the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 can be transmitted through at least the P40 channel. According to the embodiment, any one of the two 20 MHz channels of the S40 channel, i.e., the S40A channel or the discontinuous channel allocated with the S40B channel, may be used. When both the S40A channel and the S40B channel are allocated, a continuous channel of 80MHz or 160MHz bandwidth is configured.

FIG. 33 (c) shows a channel configuration in which only the P20 channel and the S40A channel are allocated among the P80 bands. According to one embodiment, the HE- SIG- B content channel 1 may be transmitted on the P20 channel and the HE- SIG- B content channel 2 may be transmitted on the S40A channel. The S40A channel is the

channel through which the original HE- SIG- B content channel 1 is transmitted. However, if there is no other channel to which the HE- SIG- B content channel 2 is to be transmitted in the P80 band configuration of the discontinuous PPDU, the HE- SIG- B content channel 2 can be transmitted through the S40A channel. However, since the change of the HE- SIG- B content channel increases the burden of the PPDU configuration, the channel configuration of Fig. 33 (c) may not be used depending on the embodiment.

FIG. 33 (d) shows a channel configuration in which only the P20 channel and the S40 channel are allocated among the P80 bands. At this time, the HE- SIG- B content channel 1 can be transmitted through the P20 channel and the S40A channel, and the HE- SIG- B content channel 2 can be transmitted through the S40B channel. FIG. 33 (e) shows a channel configuration in which only the P20 channel and the S40B channel among the P80 bands are allocated. At this time, the HE- SIG- B content channel 1 can be transmitted on the P20 channel, and the HE- SIG- B content channel 2 can be transmitted on the S40B channel. The HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 are the same as the HE- SIG- B content channel transmission rule according to the embodiment of the present invention in the case of FIGS. 33 (d) Lt; / RTI & gt;

On the other hand, due to the limitation of the number of bits in the bandwidth field of HE- SIG- A, the bandwidth field may indicate the configuration of some of the channel configurations. When the bandwidth field is composed of 3 bits, the bandwidth field can index four additional discontinuous channel allocation information. According to an embodiment of the present invention, the bandwidth field may indicate the total bandwidth information to which the PPDU is transmitted and some channel information to be punctured within the total bandwidth. At this time, the total bandwidth may be either 80 MHz bandwidth or 160 MHz (or 80 + 80 MHz) bandwidth. According to one embodiment of the present invention, the bandwidth field may be determined by puncturing the S20 channel shown in FIG. 33 (d), and puncturing at least one of the two 20 MHz channels of the S40 channel shown in FIG. 33 (b) Can be indexed.

According to an embodiment of the present invention, in the channel configuration indicated by the bandwidth field of HE- SIG- A, additional puncturing information may be indicated via the RA field of HE- SIG- B. For example, if the bandwidth field indicates the puncturing of any one of the two 20 MHz channels of the S40 channel at the total bandwidth of 80 MHz (the third and fifth channel configuration in Figure 33 (b)), May indicate which 20MHz channel of S40 channels is being evaluated. Also, if the bandwidth

field indicates puncturing of at least one of the two 20 MHz channels of the S40 channel at the total bandwidth of 160 MHz or 80 + 80 MHz (second, fourth and sixth channel configurations in Figure 33 (b) , The resource unit allocation field may indicate which 20MHz channel of the S40 channel is punctured. In addition, if the bandwidth field indicates puncturing of at least one of the two 20 MHz channels of the S40 channel at a total bandwidth of 160 MHz or 80 + 80 MHz (the second, fourth and sixth channel configurations ), The resource unit allocation field may indicate an additional puncturing in the S80 channel. Further, when the bandwidth field indicates the puncturing of the S20 channel in the total bandwidth of 160 MHz or 80 + 80 MHz (the second channel configuration in FIG. 33 (d)), the resource unit allocation field indicates an additional puncturing in the S80 channel can do.

Channels for which puncturing is instructed are not assigned to the user in this manner. The terminal receiving the discontinuous PPDU can acquire the total bandwidth information on which the PPDU is transmitted and the channel information to be punctured within the total bandwidth through the bandwidth field of the HE- SIG- A of the corresponding PPDU. Further, the UE can acquire additional channel puncturing information through the RA field of the HE- SIG- B of the corresponding PPDU. The terminal decodes the PPDU based on the obtained discontinuous channel allocation information.

FIG. 34 illustrates a discontinuous channel allocation method according to another embodiment of the present invention. Also in the embodiment of FIG. 34, the location where at least one of the HE- SIG- B content channels is transmitted may be variable. At this time, the receiver must be able to variably set the decoding channel for receiving the HE- SIG- B content channel. In the embodiment of FIG. 34, it is assumed that the HE- SIG- B content channel 1 is transmitted in the P20 channel and the channel through which the HE- SIG- B content channel 2 is transmitted can be varied.

According to the embodiment of FIG. 34, the bandwidth field of HE- SIG- A indicates position information X of the HE- SIG- B contents channel and size information Y of the common block field of HE- SIG- B. Fig. 34 shows a combination of (X, Y) that can be indicated by the bandwidth field.

First, the location information X of the HE- SIG- B content channel can indicate the channel through which the HE- SIG- B content channel 2 is transmitted within the P80 channel. If the location information is composed of 2 bits, it can indicate a total of four

channels of P20, S20, S40A and S40B. If the location information is composed of 1 bit, it can indicate a total of two channels of S20 and S40B. In the latter case, even when only the P20 channel is assigned to the user, it can be signaled that the HE- SIG- B content channel is transmitted on the S20 channel. However, since no signal is actually transmitted on the S20 channel and the receiver will fail to decode the HE- SIG- B content channel on the S20 channel, there is no problem in PPDU transmission configured only on the P20 channel.

Next, the size information Y of the common block field may be different depending on the number of RA fields to be carried. When the size information is composed of 2 bits, the number of RA fields included in the common block field may be one, two, three, or four. If the size information is composed of 1 bit, the number of RA fields included in the common block field may be 2 or 4. In the latter case, an unnecessary RA field may be further transmitted. However, it is possible to prevent additional signaling overhead by causing the unnecessary RA field to point to the unassigned RU described in FIG.

The receiver can determine the channel to receive the HE- SIG- B content channel based on the location information X of the HE- SIG- B content channel. In addition, the receiver decodes the common block field of HE- SIG- B based on the size information of the common block field. The additional unassigned channel information of the transmitted PPDU can be indicated via the RA field of the common block field. According to an embodiment of the present invention, a resource unit indication field may be used that indicates which channel each of a plurality of RA fields indicates within a maximum 160 MHz bandwidth. At this time, the resource unit indication field can indicate through the bitmap indicating eight 20 MHz channels of a maximum bandwidth of 160 MHz that the subsequent RA fields sequentially indicate information on which channels.

35- 37 illustrate an embodiment of resource unit filtering according to a further embodiment of the present invention. In FIG. 20, several embodiments for transmitting discontinuous PPDUs have been described. 35 to 37 illustrate an embodiment in which additional resource units are filtered in the discontinuous PPDU transmission process described above with reference to FIG. In the embodiment of the present invention, the filtered resource unit (or channel) may mean an unassigned resource unit (or channel).

FIG. 35 shows a situation where a terminal having one RF module tries to transmit a PPDU with a bandwidth of 160 MHz, but the S40 channel 640 is occupied by the CCA. The UE transmits discontinuous PPDUs in a 140MHz band including P40 channels (P20

channels + S20 channels) and S80 channels. At this time, the discontinuous PPDU is transmitted using the 160 MHz spectral mask 610, and filtering is performed in the S40 channel 640 determined to be in the occupied state, so that data is not transmitted. However, since the 40 MHz spectral mask is not applied to the signal transmitted through the P40 channel, signals of some resource units adjacent to the boundary with the S40 channel may interfere with the OBSS signal transmitted through the S40 channel.

Therefore, according to the embodiment of the present invention, the resource units adjacent to the unassigned S40 channel 640 in the discontinuous PPDU transmission state can be additionally filtered and set as the unassigned resource units. Depending on the location of the S40 channel 640 in its entire bandwidth, there can be a maximum of two adjacent resource units on either side of the S40 channel 640, including the central 26- tone RU 650. { According to an embodiment of the present invention, when a 40 MHz bandwidth channel is set to an unassigned channel, additional filtering may be performed on a resource unit adjacent to that channel, e.g., the central 26- tone RU 650. In addition, if there is a possibility that some of the resource units of the transport channel (i.e., P20 channel) adjacent to the unassigned S40 channel 640 may interfere with the OBSS signal in the unassigned S40 channel 640, Filtering can be performed. Such additional resource unit filtering can be determined based on information such as the transmission power of the sender, the maximum transmission power per frequency band, and the strength of the received OBSS signal.

According to one embodiment of the present invention, it is possible to determine whether to filter the central 26- tone RU 650 (i.e., to set it to an unassigned resource unit) according to the CCA result of the unassigned S40 channel 640 have. First, if a legacy PPDU using 64 FFT / 20 MHz is detected in the unassigned S40 channel 640, filtering of the central 26- tone RU 650 may be performed. Second, if an HE PPDU using 256 FFT / 20 MHz is detected in the unassigned S40 channel 640, it may be determined whether to filter the central 26- tone RU 650 based on the band occupied by the HE PPDU. If the band occupied by the HE PPDU is more than a predetermined frequency interval away from the central 26- tone RU 650, the central 26- tone RU 650 may not be filtered. However, if the band occupied by the HE PPDU is less than a predetermined frequency interval from the central 26- tone RU 650, filtering of the central 26- tone RU 650 may be performed. Third, if a legacy PPDU or HE PPDU is not detected in the unassigned S40 channel 640 and any radio signal is detected, whether or not the central 26- tone RU 650 is filtered based on the band occupied by the signal Can be determined. The center 26- tone RU 650 may not be filtered if the edge of the band occupied by the signal is more than a predetermined frequency spacing from the central 26- tone RU

650.

36 shows a situation in which a terminal having one RF module tries to transmit a PPDU in a bandwidth of 80 MHz, but the S20 channel 642 is occupied by the CCA. The terminal transmits discontinuous PPDUs in a 60 MHz band including P20 channel and S40 channel. At this time, the discontinuous PPDU is transmitted using the 80 MHz spectral mask 612, and filtering is performed in the S20 channel 642 determined to be in the occupied state, so that data is not transmitted. However, since the 20 MHz spectral mask is not applied to the signal transmitted through the P20 channel, signals of some resource units adjacent to the boundary with the S20 channel may interfere with the OBSS signal transmitted through the S20 channel.

Likewise in the embodiment of FIG. 36, it can be determined whether to filter the center 26- tone RU 652 and / or the adjacent resource units according to the method described in the embodiment of FIG. In addition, if there is a possibility that some resource units of the transport channel (i.e., P20 channel) adjacent to the unassigned S20 channel 642 may interfere with the OBSS signal in the unassigned S20 channel 642, Filtering can be performed. According to an embodiment of the present invention, a sender can minimize resource waste by allocating resource units of a narrow bandwidth to a band adjacent to an unassigned channel in a transmission channel.

37 shows a situation where a terminal having two RF modules tries to transmit a PPDU with a bandwidth of 80 + 80 MHz, but the S40 channel 644 is occupied by the CCA. The terminal transmits discrete PPDUs to the P40 channel (P20 channel + S20 channel) and S80 channel using two RF modules. The terminal transmits the PPDU to which the 40 MHz spectral mask 614 is applied through the P40 channel using the first RF module and transmits the PPDU to which the 80 MHz spectral mask 616 is applied using the second RF module to the S80 channel do. Thus, in the embodiment of FIG. 37, no additional filtering of some resource units included in the transport channel (i.e., P20 channel) adjacent to the unassigned S40 channel 644 is required. However, at least half of the central 26- tone RU 654 adjacent to the unassigned S40 channel 644 should be filtered. Thus, according to an embodiment of the present invention, a central 26- tone RU 654 may be set to an unassigned resource unit.

Figures 38 and 42 illustrate signaling methods of an HE MU PPDU in accordance with a further embodiment of the present invention. In the embodiments of FIGS. 38- 42, channel A through channel D refer to each 20 MHz channel over which an 80 MHz PPDU

is transmitted. At this time, the channel A is assigned to the P20 channel, the channel B to the S20 channel, and the channel C and the channel D to the S40 channel. Also, HE- SIG- B content channel 1 is transmitted through at least one of channel A and channel C, and HE- SIG- B content channel 2 is transmitted through at least one of channel B and channel D.

FIG. 38 shows an embodiment of a method of signaling allocation information of a central 26- tone RU in an HE MU PPDU. 38 (a) shows resource units constituting a PPDU with a total bandwidth of 80 MHz, and FIG. 38 (b) shows resource units of HE- SIG- B contents channel 1 and HE- SIG- FIG. The specific way in which the RA field and the user field are carried in each HE- SIG- B content channel is as described in the previous embodiments.

80 When a PPDU is transmitted with a total bandwidth of MHz or more, a central 26- tone RU 502 as shown in FIG. 38 (a) may additionally be used. As described above, the common block field of HE- SIG- B may further include a C26 field (not shown) indicating whether a central 26- tone RU 502 has been assigned to the user. The C26 field may consist of a one bit indicator located before or after the RA field in the common block field. According to an embodiment of the present invention, the C26 field may be carried on both the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2. If the field C26 indicates assignment of the central 26- tone RU 502, then the user field 422 corresponding to the central 26- tone RU 502 must be conveyed via HE- SIG- B.

If the PPDU is transmitted at a total bandwidth of 80 MHz, the C26 field carried over HE- SIG- B content channel 1 and the C26 field carried over HE- SIG- B content channel 2 are all centered at the center of the corresponding 80 MHz total bandwidth - Indicate whether the tone RU 502 has been assigned to the user. At this time, if the C26 field indicates the allocation of the central 26- tone RU 502, the user field 422 corresponding to the central 26- tone RU 502 will contain the user specific field of HE- SIG- B content channel 1 Lt; / RTI & gt; However, if the C26 field indicates unassignment of the central 26- tone RU 502, then the user field 422 corresponding to the central 26- tone RU 502 is not carried.

On the other hand, when the PPDU is transmitted with a total bandwidth of 160 MHz or 80 + 80 MHz, the total bandwidth can be composed of the first 80 MHz bandwidth and the second 80 MHz bandwidth. Here, the first 80 MHz bandwidth may be a frequency band lower than the second 80 MHz bandwidth. For each 80 MHz bandwidth there may

be a central 26- tone RU. At this time, the first C26 field carried on the HE- SIG- B content channel 1 may indicate whether or not the first central 26- tone RU of the first 80 MHz bandwidth is allocated to the user. In addition, the second C26 field carried over HE- SIG- B content channel 2 may indicate whether a second central 26- tone RU of the second 80 MHz bandwidth has been allocated to the user. If the first C26 field indicates the allocation of the first central 26- tone RU, the user field corresponding to the first central 26- tone RU can be carried via the user- specific field of HE- SIG- B content channel 1 have. Also, if the second C26 field indicates the allocation of the second central 26- tone RU, the user field corresponding to the second central 26- tone RU will be carried over the user- specific field of HE- SIG- B content channel 2 Can be. However, if the first C26 field and / or the second C26 field indicates unassignment of the central 26- tone RU, the corresponding user field is not carried.

FIG. 39 shows a method of signaling HE- SIG- B in an HE MU PPDU transmitted over a full bandwidth MU- MIMO. When the full bandwidth MU- MIMO transmission is performed as shown in FIG. 39 (a), the RA field of HE- SIG- B need not be transmitted. Thus, the SIG- B compression field of HE- SIG- A may indicate the compression mode of the HE- SIG- B field. On the other hand, the user fields are distributed to HE- SIG- B content channel 1 and HE- SIG- B content channel 2 and carried. The receiver decodes both the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 to determine whether the user field corresponding to the corresponding terminal is transmitted.

FIG. 39 (b) shows a case where a specific sub- field of HE- SIG- A is assigned to a sub- field of M- MIMO when a full bandwidth MU- MIMO transmission is performed And indicates the number information of the MU- MIMO users. According to an embodiment of the present invention, when the entire bandwidth MU- MIMO transmission is performed, the SIG- B dual MCS field of the HE- SIG- A can indicate the number information of the MU- MIMO users. When the full bandwidth MU- MIMO transmission is performed, the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 do not need to distribute the amount of information through different MCSs. According to another embodiment of the present invention, when the full bandwidth MU- MIMO transmission is performed, the number field of the HE- SIG- B symbol of the HE- SIG- A may indicate the number information of the MU- MIMO user. When full- bandwidth MU- MIMO transmission is performed, it is easy to transmit the number information and MCS information of the MU- MIMO users because the decoding of the receiver is easier than the transmission of the number of HE- SIG- B symbols and MCS information.

FIG. 39 (c) shows the detailed configuration of the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 when full bandwidth MU- MIMO transmission is performed. When full- bandwidth MU- MIMO is performed, there is no RA field in HE- SIG- B. Therefore, when MU- MIMO transmission is performed over a bandwidth greater than 20 MHz, the number of users to be assigned to the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2, respectively, must be separately determined.

According to an embodiment of the present invention, when MU- MIMO transmission is performed over a bandwidth of more than 20 MHz, user fields can be distributed equally between the two content channels for load balancing. That is, the number of user fields transmitted in each SIG- B content channel is determined as a round up or down value of half the total number of users. For example, if the total number of user fields is n, then 1 through m (where m is ceil (n / 2)) user fields are transmitted over HE- SIG- B content channel 1, The nth user fields may be transmitted over HE- SIG- B content channel 2. If n is an odd number, then the number of user fields included in HE- SIG- B content channel 1 may be one more than the number of user fields included in HE- SIG- B content channel 2. A total of n user fields are allocated in the order of each user field of HE- SIG- B content channel 1, then each user field of HE- SIG- B content channel 2.

Figure 40 illustrates one embodiment of signaling the unassignment of a particular resource unit in a discrete PPDU. As described in the embodiment of FIGS. 35- 37, additional filtering may be performed on some resource units 506 of the transport channel adjacent to the unassigned channel in the discontinuous PPDU transmission process. Referring to FIG. 40 (a), additional filtering may be performed on the resource unit 506 of the transport channel (i.e., channel A) adjacent to channel B, which is an unassigned channel.

FIG. 40 (b) shows the configuration of HE- SIG- B indicating the unassignment of a specific resource unit 506 of this discontinuous PPDU. Referring to FIG. 40 (b), the RA field of HE- SIG- B indicates resource unit allocation information of a transport channel (i.e., channel A). Each resource unit of channel A is allocated to STA A1 to STA An. The user specific field of HE- SIG- B carries the user field corresponding to each resource unit. At this time, a null STA ID may be inserted in the user field 426 corresponding to the resource unit 506 to be filtered. The specific embodiment of the null STA ID is as described above in the embodiments of the previous figures.

41 shows another embodiment of signaling allocation information of the central 26- tone RU 502 in a discontinuous PPDU. As described above, the RA field can indicate a specific channel that is not allocated to the user through a predetermined index. That is, the RA field may indicate nulling of a multiple of a 20 MHz channel bandwidth, i. E., A 242- tone, 484- tone or 996- tone resource unit. Thus, if the bandwidth information of the unassigned channel is indicated through the RA field, the assignment of the central 26- tone RU 502 can be implicitly grasped.

First, FIG. 41 (a) shows a situation in which the S40A channel (i.e., channel C) is occupied in a total bandwidth of 80 MHz. The terminal transmits PPDUs in a 60 MHz band including P40 channel and S40B channel (i.e., channel D). At this time, the RA field corresponding to channel C indicates nulling of 242- tone RU. FIG. 41 (b) shows the configuration of the HE- SIG- B content channel 1 and the HE- SIG- B content channel 2 of the PPDU transmitted according to the embodiment of FIG. 41 (a). Since the nulling of the 242- tone RU in the RA field of HE- SIG- B content channel 1 is indicated, the receiver can identify that the central 26- tone RU 502 can be assigned to the user. Thus, HE- SIG- B content channel 1 carries a user field 422 corresponding to a central 26- tone RU 502.

On the other hand, FIG. 41 (c) shows a situation in which the S40 channel is occupied in the total bandwidth of 80 MHz. The terminal transmits the PPDU through the P40 channel. At this time, the RA fields corresponding to channel C and channel D indicate nulling of 484- tone RU. Fig. 41 (d) shows the configuration of the HE- SIG- B contents channel 1 and the HE- SIG- B contents channel 2 of the PPDUs transmitted according to the embodiment of Fig. 41 (c). Tone RU is indicated in the RA fields of HE- SIG- B content channel 1 and HE- SIG- B content channel 2, the receiver identifies that the central 26- tone RU 502 is not assigned to the user can do. That is, since the entire S40 channel is not assigned to the user, the central 26- tone RU 502 can also be set as an unassigned resource unit. Thus, HE- SIG- B content channel 1 may not carry the user field 422 corresponding to the central 26- tone RU 502.

42 illustrates a method of transmitting a preamble and data when a discontinuous PPDU is transmitted according to an embodiment of the present invention. In each of Figs. 42 (a) to 42 (c), it is assumed that the S40B channel (i.e., channel D) occupies the total bandwidth of 80 MHz. The terminal transmits PPDUs in the 60 MHz band including the P40 channel and the S40A channel (i.e., channel C).

First, according to the embodiment of FIG. 42 (a), when the discontinuous PPDU is transmitted, the terminal may not transmit not only the data but also the preamble in the unassigned channel. At this time, the UE does not transmit both the legacy preamble and the non- legacy preamble in the unassigned channel. In this case, there is an advantage that it does not interfere with the OBSS signal already transmitted in the corresponding channel. In addition, if the transmission is not performed in a specific channel, the dispersion amount of the transmission power is reduced in spite of the transmission of the broadband PPDU, and the reception ratio of the PPDU is increased. However, this method has a disadvantage in that the signaling of the HE- SIG- B becomes complicated when the S20 channel is occupied. In addition, the HE- STF has a repetitive pattern on the time axis when the PPDU is transmitted over the entire bandwidth of 80 MHz. If the HE- STF is not transmitted on some channels, it is difficult to have a repetitive pattern on the time axis.

Therefore, according to the embodiment of FIG. 42 (b), when the discontinuous PPDU is transmitted, the terminal does not transmit data on the unassigned channel, but can transmit the preamble. At this time, the UE can transmit both the legacy preamble and the non- legacy preamble in the unassigned channel. In this case, the OBSS signal already transmitted in the corresponding channel may be interfered with, but in the case of transmission of the broadband PPDU, the transmission power may be dispersed to the entire band, so that the OBSS signal may not be greatly damaged.

According to another embodiment of the present invention, the terminal can transmit only HE- STF and HE- LTF (or only HE- STF) on the unassigned channel as shown in FIG. 42 (c). That is, transmission of the legacy preamble, HE- SIG- A and HE- SIG- B, which do not require reception in the entire band, is limited and only HE- STF and HE- LTF, which require reception in the entire band, Interference can be minimized.

43 and 44 show an embodiment in which transmission using an HE MU PPDU is performed between a single STA and an AP. As described above, the HE MU PPDU can be used not only for DL- MU transmission but also for uplink transmission.

Figure 43 shows an embodiment in which an HE MU PPDU is used in an uplink transmission of a single STA. According to the embodiment of the present invention, the STA can perform transmission using a resource unit (i.e., narrow band) of 20 MHz bandwidth or less as shown in FIG. 43 (a). The STA can increase the transmission distance of data by concentrating transmission power on a specific resource unit.

Figures 43 (b) to 43 (d) illustrate embodiments for signaling such narrowband transmission.

According to one embodiment of the present invention, the narrowband transmission may be signaled via a null STA ID inserted in the user field of HE- SIG- B, as shown in Figure 43 (b). More specifically, the RA field of HE- SIG- A can indicate information on the type of resource unit division in a particular channel. For example, if a bandwidth of 20 MHz is divided into nine resource units based on OFDMA, the RA field can signal " 00000000 " as shown in Fig. 15 (c). At this time, the AID of the receiver or the sender may be inserted into the user field corresponding to the resource unit used for uplink data transmission among the nine divided resource units. On the other hand, a null STA ID may be inserted in the user fields corresponding to the remaining resource units for which data transmission is not performed.

For example, when data is transmitted only through the third 26- tone RU among the nine resource units, a null STA ID may be inserted into the first to second user fields and the fourth to ninth user fields. However, if the signaling structure of the HE- SIG- B, which is designed based on the DL- MU transmission, is directly used in the uplink narrowband transmission, the signaling overhead can be increased. Thus, other signaling methods may be used to reduce the signaling overhead. According to another embodiment of the present invention, the user fields after the user field in which the AID of the receiver or sender is inserted may be excluded from the signaling. That is, in the above embodiment, the null STA ID is inserted into the first to second user fields, and the AID of the receiver or sender may be inserted into the third user field. However, the fourth through ninth user fields may not be transmitted. The AP receiving the PPDU does not need to receive the additional user field after acquiring the information of the transmitting STA in the third user field.

According to another embodiment of the present invention, the index values of the uplink resource unit allocation may be newly defined in the RA field of HE- SIG- B for the narrowband transmission as shown in FIG. 43 (c). More specifically, the RA field of HE- SIG- B may index a particular 26- tone RU, 52- tone RU and / or 106- tone RU in which the uplink transmission is performed. In this case, since only one user field corresponding to the resource unit indicated in the RA field is carried, the signaling overhead can be greatly reduced. According to one embodiment, the index values of the uplink resource unit allocation may be used among the unassigned (i.e., TBD) indices of the RA field configuration for DL- MU transmission. According to another embodiment, the index values of the uplink resource unit allocation in the RA field can be newly

defined.

According to another embodiment of the present invention, the narrowband transmission may be signaled by recycling unnecessary fields of HE- SIG- A. For example, if the HE MU PPDU is used in the uplink transmission, the HE- LTF symbol count field and the HE- SIG- B symbol count field in HE- SIG- A may be used for other purposes. The HE- LTF symbol number field is redundant with the NSTS field of the user specific field of the HE- SIG- B, so no separate signaling is required. Also, in signaling of a single STA, since the amount of signaling information is fixed and the number of symbols can be fixed according to the design, it is not necessary to designate the number of additional symbols through the HE- SIG- B symbol number field. Accordingly, it is possible to perform signaling of the uplink HE MU PPDU using at least one of the fields. For example, in the resource unit allocation indicated by the RA field, the position of the resource unit to which the STA transmits the uplink data can be indicated using at least one of the fields. In this case, the RA field of the HE- SIG- B is set to be the same as the conventional one, and since only one user field is carried, the signaling overhead can be reduced.

According to another embodiment of the present invention, the uplink transmission using the HE MU PPDU may be performed not only over the narrow band but also over the entire bandwidth of 20 MHz, 40 MHz, 80 MHz, and 160 MHz (80 + 80 MHz). At this time, the bandwidth field of the HE- SIG- A indicates the total bandwidth of the PPDU, and the SIG- B compressed field can indicate the compression mode of the HE- SIG- B field. Therefore, the RA field of the HE- SIG- B in the upward HE MU PPDU may be omitted. On the other hand, if the SIG- B compressed field in the downlink HE MU PPDU indicates the compression mode of the HE- SIG- B field, the MU- MIMO based user specific information can be indicated. However, if the SIG- B compression field indicates the compression mode of the HE- SIG- B field in the upward HE MU PPDU, the OFDMA- based user specific information may be indicated as shown in FIG. 43 (c).

44 shows a method of configuring HE- SIG- B when a single STA transmits discontinuous PPDUs to APs. In the embodiment of FIG. 44, the S20 channel is occupied in the total bandwidth of 80 MHz. Therefore, the STA transmits the PPDU in the 60 MHz band including the P20 channel and the S40 channel.

The bandwidth field of HE- SIG- A defined in the existing HE SU PPDU format is not suitable for signaling discontinuous PPDUs. Therefore, the STA can perform the

transmission of the discontinuous PPDU using the HE MU PPDU format. At this time, the bandwidth field of HE- SIG- A indicates the puncturing of the S20 channel in the total bandwidth of 80 MHz. HE- SIG- B carries information of a single STA (i.e., SU Info) over the P20 channel and the S40 channel.

On the other hand, since the configuration information of the discontinuous PPDU is signaled through the bandwidth field, the common block field of HE- SIG- B can be omitted. Thus, the SIG- B compression field may indicate the compression mode of the HE- SIG- B field. In addition, the user specific field of HE- SIG- B may carry only one user field. At this time, the user field may be inserted with the AID of the sender, not the receiver's AID. If the HE MU PPDU is used for uplink transmission, it is obvious that the recipient of the PPDU is an AP. If the up / down field of the HE MU PPDU indicates uplink transmission, the AP can interpret the AID inserted in the user field as the AID of the sender.

45 and 46 illustrate discontinuous channel allocation and signaling methods therefor according to a further embodiment of the present invention. As described above, according to an embodiment of the present invention, a wideband PPDU can be transmitted according to a discontinuous, limited flexible channel expansion method.

Figure 45 shows a method of signaling HE- SIG- A and HE- SIG- B when a PPDU is transmitted in a discontinuous, limited flexible channel extension method. As described above with reference to FIG. 19 (e), the flexible channel expansion method refers to a channel expansion method in which a band occupied by a transmitted PPDU always includes predetermined center channels including a P20 channel. In the embodiment of FIG. 45, the P40 channel including the P20 channel and the S20 channel is set as the center channels. However, the center channels are selected bandwidths to reduce the signaling burden of the HE- SIG- B, and if the signaling burden of the HE- SIG- B is not increased according to the embodiment, the center channels can be changed.

45 (a) shows a situation in which the S40B channel and the S80 channel are occupied in a total bandwidth of 160 MHz. The terminal transmits discontinuous PPDUs in the 60 MHz band including the P40 channel and the S40A channel. At this time, the bandwidth field of the HE- SIG- A of the transmitted PPDU may indicate 160 MHz. HE- SIG- B content channel 1 carries channel A and channel C allocation information (A, C, 996- null, 996- null) and is transmitted over channel A and channel C. HE- SIG- B content channel 2 carries CH B allocation information (B, 242- Null, 996- null, 996- null) and is

transmitted over channel B.

Next, FIG. 45 (b) shows a situation in which the S40A channel and the S80 channel are occupied in the total bandwidth of 160 MHz. The terminal transmits discontinuous PPDUs in the 60MHz band including the P40 channel and the S40B channel. At this time, the bandwidth field of the HE- SIG- A of the transmitted PPDU may indicate 160 MHz. The HE- SIG- B content channel 1 carries channel A allocation information (A, 242- Null, 996- null, 996- null) HE- SIG- B content channel 2 carries CH B and channel D allocation information (B, D, 996- null, 996- null) and is transmitted over channel B and channel D.

Next, FIG. 45 (c) shows a situation in which the PPDU is transmitted only through the P20 channel in the total bandwidth of 160 MHz. At this time, the bandwidth field of the HE- SIG- A of the transmitted PPDU indicates 160 MHz, and the HE- SIG- B content channel 1 indicates the allocation information (A, 242- Null, 996- null, 996- null) Carry. In this case, since the signaling burden of the HE- SIG- B is not increased, it is possible to transmit PPDUs not occupying at least a part of the center channels.

Finally, FIG. 45 (d) shows a situation in which the S40B channel, the S80A channel, the S80C channel and the S80D channel are occupied in a total bandwidth of 160 MHz. The terminal transmits discontinuous PPDUs in the 80 MHz band including the P40 channel, the S40A channel, and the S80B channel. At this time, the bandwidth field of the HE- SIG- A of the transmitted PPDU may indicate 160 MHz. HE- SIG- B content channel 1 carries channel A and channel C allocation information (A, C, 242- null, 484- null) and is transmitted over channel A and channel C. The HE- SIG- B content channel 2 carries CH B and channel F allocation information (B, 242- Null, F, 484 - Null) and is transmitted on channel B and channel F.

A1, A2, A3 and A4 in the channel allocation information A1, A2, A3 and A4 described in the respective drawings denote the first RA field, the second RA field, and the second RA field, which are carried on the HE- SIG- 3 RA field, and 4 RA field. Thus, according to an embodiment of the present invention, various discontinuous PPDUs may be signaled through a combination of HE- SIG- A and HE- SIG- B.

46 shows a channel allocation method when a PPDU is transmitted in a discontinuous, limited flexible channel extension method. Figure 46 (a) shows discontinuous channel

allocation options at a total bandwidth of 80 MHz, and Figure 46 (b) shows discontinuous channel allocation options at a total bandwidth of 160 MHz. In Figure 46 (b), the P80 channel may be composed of any of the channels shown in Figure 46 (a).

The non- allocation information of the S80 channel shown in FIG. 46 (b) may be indicated through the RA field of the HE- SIG- B or indicated by the null STA ID of the user field, as described above. In addition, the allocation of the center 26- tone RU shown in Figs. 46 (a) and 46 (b) can be indicated through the C26 field of HE- SIG- B.

While the present invention has been described by taking the wireless LAN communication as an example, the present invention is not limited thereto and can be applied to other communication systems such as cellular communication. Also, while the method, apparatus, and system of the present invention have been described in connection with specific embodiments thereof, some or all of the elements, acts or operations of the present invention may be implemented using a computer system having a general purpose hardware architecture.

The above- described embodiments of the present invention can be implemented by various means. For example, embodiments of the present invention may be implemented by hardware, firmware, software, or a combination thereof.

In the case of hardware implementation, the method according to embodiments of the present invention may be implemented in one or more Application Specific Integrated Circuits (ASICs), Digital Signal Processors (DSPs), Digital Signal Processing Devices (DSPDs), Programmable Logic Devices (PLDs) , FPGAs (Field Programmable Gate Arrays), processors, controllers, microcontrollers, microprocessors, and the like.

In the case of an implementation by firmware or software, the method according to embodiments of the present invention may be implemented in the form of a module, a procedure or a function for performing the functions or operations described above. The software code can be stored in memory and driven by the processor. The memory can be internal or external to the processor and can exchange data with the processor by various means already known.

It will be understood by those of ordinary skill in the art that various changes in form

and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims. will be. The embodiments described above are therefore to be considered in all respects only as illustrative and not restrictive. For example, each component described as a single entity may be distributed and implemented, and components described as being distributed may also be implemented in a combined form.

The scope of the present invention is defined by the appended claims rather than the detailed description, and all changes or modifications derived from the meaning and scope of the claims and their equivalents are to be construed as being included within the scope of the present invention do.

While various embodiments of the present invention have been described with reference to the IEEE 802.11 system, the present invention can be applied to various other types of mobile communication devices, mobile communication systems, and the like.

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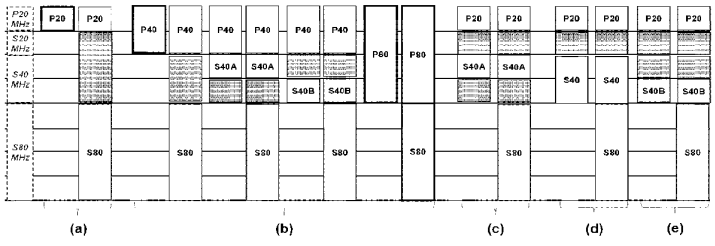
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(54) Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

(54) 발명의 명칭 : 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말




(57) Abstract: The present invention relates to a wireless communication method and a wireless communication terminal, which use a discontinuous channel. To this end, the present invention provides a wireless communication terminal and a wireless communication method using the same, the terminal comprising: a processor; and a transmission and reception unit, wherein the processor receives a wireless packet through a communication unit, acquires discontinuous channel allocation information of the received packet, and decodes the received packet on the basis of the acquired discontinuous channel allocation information.

(57) 요약서: 본 발명은 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말에 관한 것이다. 이를 위해 본 발명은, 프로세서 및 송수신부를 포함하는 무선 통신 단말로서, 상기 프로세서는, 상기 통신부를 통해 무선 패킷을 수신하고, 상기 수신된 패킷의 불연속 채널 할당 정보를 획득하고, 획득된 불연속 채널 할당 정보에 기초하여 상기 수신된 패킷을 디코딩하는 무선 통신 단말 및 이를 이용한 무선 통신 방법을 제공한다.

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# 명세서

# 발명의 명칭: 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말

## 기술분야

[1] 본 발명은 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말에 관한 것으로서, 불연속 채널 할당 정보를 효율적으로 시그널링하기 위한 무선 통신 방법 및 무선 통신 단말에 관한 것이다.

## 배경기술

[2] 최근 모바일 기기의 보급이 확대됨에 따라 이들에게 빠른 무선 인터넷 서비스를 제공할 수 있는 무선랜(Wireless LAN) 기술이 많은 각광을 받고 있다. 무선랜 기술은 근거리에서 무선 통신 기술을 바탕으로 스마트 폰, 스마트 패드, 랩탑 컴퓨터, 휴대형 멀티미디어 플레이어, 임베디드 기기 등과 같은 모바일 기기들을 가정이나 기업 또는 특정 서비스 제공지역에서 무선으로 인터넷에 접속할 수 있도록 하는 기술이다.

[3] IEEE(Institute of Electrical and Electronics Engineers) 802.11은 2.4GHz 주파수를 이용한 초기의 무선랜 기술을 지원한 이래, 다양한 기술의 표준을 실용화 또는 개발 중에 있다. 먼저, IEEE 802.11b는 2.4GHz 밴드의 주파수를 사용하면서 최고 11Mbps의 통신 속도를 지원한다. IEEE 802.11b 이후에 상용화된 IEEE 802.11a는 2.4GHz 밴드가 아닌 5GHz 밴드의 주파수를 사용함으로써 상당히 혼잡한 2.4GHz 밴드의 주파수에 비해 간섭에 대한 영향을 줄였으며, OFDM 기술을 사용하여 통신 속도를 최대 54Mbps까지 향상시켰다. 그러나 IEEE 802.11a는 IEEE 802.11b에 비해 통신 거리가 짧은 단점이 있다. 그리고 IEEE 802.11g는 IEEE 802.11b와 마찬가지로 2.4GHz 밴드의 주파수를 사용하여 최대 54Mbps의 통신속도를 구현하며, 하위 호환성(backward compatibility)을 만족하고 있어 상당한 주목을 받았는데, 통신 거리에 있어서도 IEEE 802.11a보다 우위에 있다.

[4] 그리고 무선랜에서 취약점으로 지적되어온 통신 속도에 대한 한계를 극복하기 위하여 제정된 기술 규격으로서 IEEE 802.11n이 있다. IEEE 802.11n은 네트워크의 속도와 신뢰성을 증가시키고, 무선 네트워크의 운영 거리를 확장하는데 목적을 두고 있다. 보다 구체적으로, IEEE 802.11n에서는 데이터 처리 속도가 최대 540Mbps 이상인 고처리율(High Throughput, HT)을 지원하며, 또한 전송 에러를 최소화하고 데이터 속도를 최적화하기 위해 송신부와 수신부 양단 모두에 다중 안테나를 사용하는 MIMO(Multiple Inputs and Multiple Outputs) 기술에 기반을 두고 있다. 또한, 이 규격은 데이터 신뢰성을 높이기 위해 중복되는 사본을 여러 개 전송하는 코딩 방식을 사용할 수 있다.

[5] 무선랜의 보급이 활성화되고 또한 이를 이용한 어플리케이션이 다양화됨에 따라, IEEE 802.11n이 지원하는 데이터 처리 속도보다 더 높은 처리율(Very High

Throughput, VHT)을 지원하기 위한 새로운 무선랜 시스템에 대한 필요성이 대두되었다. 이 중 IEEE 802.11ac는 5GHz 주파수에서 넓은 대역폭(80MHz~160MHz)을 지원한다. IEEE 802.11ac 표준은 5GHz 대역에서만 정의되어 있으나 기존 2.4GHz 대역 제품들과의 하위 호환성을 위해 초기 11ac 칩셋들은 2.4GHz 대역에서의 동작도 지원할 것이다. 이론적으로, 이 규격에 따르면 다중 스테이션의 무선랜 속도는 최소 1Gbps, 최대 단일 링크 속도는 최소 500Mbps까지 가능하게 된다. 이는 더 넓은 무선 주파수 대역폭(최대 160MHz), 더 많은 MIMO 공간적 스트림(최대 8개), 다중 사용자 MIMO, 그리고 높은 밀도의 변조(최대 256 QAM) 등 802.11n에서 받아들인 무선 인터페이스 개념을 확장하여 이루어진다. 또한, 기존 2.4GHz/5GHz 대신 60GHz 밴드를 사용해 데이터를 전송하는 방식으로 IEEE 802.11ad가 있다. IEEE 802.11ad는 빔포밍 기술을 이용하여 최대 7Gbps의 속도를 제공하는 전송규격으로서, 대용량의 데이터나 무압축 HD 비디오 등 높은 비트레이트 동영상 스트리밍에 적합하다. 하지만 60GHz 주파수 밴드는 장애물 통과가 어려워 근거리 공간에서의 디바이스들 간에만 이용이 가능한 단점이 있다.

[6] 한편, 최근에는 802.11ac 및 802.11ad 이후의 차세대 무선랜 표준으로서, 고밀도 환경에서의 고효율 및 고성능의 무선랜 통신 기술을 제공하기 위한 논의가 계속해서 이루어지고 있다. 즉, 차세대 무선랜 환경에서는 고밀도의 스테이션과 AP(Access Point)의 존재 하에 실내/외에서 높은 주파수 효율의 통신이 제공되어야 하며, 이를 구현하기 위한 다양한 기술들이 필요하다.

## 발명의 상세한 설명

## 기술적 과제

[7] 본 발명은 전술한 바와 같이 고밀도 환경에서의 고효율/고성능의 무선랜 통신을 제공하기 위한 목적을 가지고 있다.

## 과제 해결 수단

[8] 상기와 같은 과제를 해결하기 위해, 본 발명은 다음과 같은 단말의 무선 통신 방법 및 무선 통신 단말을 제공한다.

[9] 먼저 본 발명의 실시예에 따르면, 무선 통신 단말로서, 프로세서; 및 통신부를 포함하고, 상기 프로세서는, 상기 통신부를 통해 무선 패킷을 수신하고, 상기 수신된 패킷의 불연속(non-contiguous) 채널 할당 정보를 획득하고, 획득된 불연속 채널 할당 정보에 기초하여 상기 수신된 패킷을 디코딩하는 무선 통신 단말이 제공된다.

[10] 또한 본 발명의 실시예에 따르면, 무선 통신 단말의 무선 통신 방법으로서, 무선 패킷을 수신하는 단계; 상기 수신된 패킷의 불연속 채널 할당 정보를 획득하는 단계; 및 획득된 불연속 채널 할당 정보에 기초하여 상기 수신된 패킷을 디코딩하는 단계; 를 포함하는 무선 통신 방법이 제공된다.

[11] 본 발명의 다른 실시예에 따르면, 베이스 무선 통신 단말로서, 프로세서; 및

통신부를 포함하고, 상기 프로세서는, 광대역 패킷 전송을 위한 다중 채널의 CCA를 수행하고, 상기 다중 채널의 CCA 수행 결과에 기초하여 유휴 상태의 적어도 하나의 채널로 패킷을 전송하되, 상기 패킷이 불연속 채널로 전송될 경우 상기 패킷의 논-레거시 프리앰블을 통해 불연속 채널 할당 정보를 시그널링 하는 베이스 무선 통신 단말이 제공된다.

[12] 또한 본 발명의 다른 실시예에 따르면, 베이스 무선 통신 단말의 무선 통신 방법으로서, 광대역 패킷 전송을 위한 다중 채널의 CCA를 수행하는 단계; 상기 다중 채널의 CCA 수행 결과에 기초하여 유휴 상태의 적어도 하나의 채널로 패킷을 전송하는 단계; 를 포함하되, 상기 패킷이 불연속 채널로 전송될 경우 상기 패킷의 논-레거시 프리앰블을 통해 불연속 채널 할당 정보를 시그널링 하는 무선 통신 방법이 제공된다.

[13] 상기 불연속 채널 할당 정보는 상기 수신된 패킷의 HE-SIG-A의 서브필드 및 HE-SIG-B의 서브필드 중 적어도 하나를 통해 지시된다.

[14] 상기 불연속 채널 할당 정보는 20MHz 단위의 비할당 채널 정보를 지시한다.

[15] 상기 불연속 채널 할당 정보는 상기 HE-SIG-A의 대역폭 필드를 통해 지시되며, 상기 대역폭 필드는 상기 패킷이 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링(puncturing)되는 채널 정보를 지시한다.

[16] 상기 대역폭 필드는 20MHz 부채널의 펑처링 및 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 각각 인덱싱 한다.

[17] 상기 불연속 채널 할당 정보는 상기 HE-SIG-B의 리소스 유닛 할당 필드의 기 설정된 인덱스를 통해 지시된다.

[18] 상기 리소스 유닛 할당 필드는 사용자에게 할당되지 않는 특정 리소스 유닛(RU)을 기 설정된 인덱스를 통해 지시한다.

[19] 상기 사용자에게 할당되지 않는 특정 리소스 유닛은 242-톤(tone) 리소스 유닛, 484-톤 리소스 유닛 및 996-톤 리소스 유닛 중 적어도 하나이다.

[20] 상기 불연속 채널 할당 정보는 상기 HE-SIG-B의 리소스 유닛 할당 필드가 지시하는 리소스 유닛 배열 정보 및 상기 리소스 유닛 배열에서 특정 리소스 유닛에 대응하는 사용자 필드에 삽입된 널(Null) STA ID를 통해 획득된다.

[21] 상기 특정 리소스 유닛은 26-톤 리소스 유닛, 52-톤 리소스 유닛, 106-톤 리소스 유닛 중 적어도 하나이다.

[22] 상기 불연속 채널 할당 정보는 상기 HE-SIG-A의 대역폭 필드 및 상기 HE-SIG-B의 리소스 유닛 할당 필드의 조합을 통해 지시된다.

[23] 상기 대역폭 필드는 상기 패킷이 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링되는 채널 정보를 지시하고, 상기 리소스 유닛 할당 필드는 상기 총 대역폭 내에서의 추가적인 펑처링 정보를 지시한다.

[24] 상기 대역폭 필드가 80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 상기 40MHz 부채널 중 어느 20MHz 채널이 펑처링 되는지를 지시한다.

[25] 상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 20MHz 부채널의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 80MHz 부채널에서의 추가적인 펑처링을 지시한다.

[26] 상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 상기 40MHz 부채널 중 어느 20MHz 채널이 펑처링 되는지를 지시한다.

[27] 상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 80MHz 부채널에서의 추가적인 펑처링을 지시한다.

[28] 상기 패킷이 80MHz 이상의 총 대역폭으로 전송될 경우, 상기 불연속 채널 할당 정보는 80MHz에서의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 필드(C26 필드)의 정보를 더 포함한다.

[29] 상기 패킷의 HE-SIG-B 필드는 20MHz 단위의 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2로 구성되며, 상기 C26 필드는 상기 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 양쪽을 통해 운반된다.

[30] 상기 패킷이 80MHz의 총 대역폭으로 전송될 경우, 상기 HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 C26 필드 및 상기 HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 C26 필드는 모두 상기 80MHz 총 대역폭의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시한다.

[31] 상기 C26 필드가 상기 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반된다.

[32] 상기 패킷이 160MHz 또는 80+80MHz의 총 대역폭으로 전송될 경우 상기 총 대역폭은 제1 80MHz 대역폭 및 제2 80MHz 대역폭으로 구성되며, 상기 HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 제1 C26 필드는 상기 제1 80MHz 대역폭의 제1 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하고, 상기 HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 제2 C26 필드는 상기 제2 80MHz 대역폭의 제2 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시한다.

[33] 상기 제1 C26 필드가 상기 제1 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 제1 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반되고, 상기 제2 C26 필드가 상기 제2 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 제2 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 2의 사용자 특정 필드를 통해 운반된다.

## 발명의 효과

[34] 본 발명의 실시예에 따르면, 불연속 채널 할당 정보를 효율적으로 시그널링할 수 있다.

[35] 본 발명의 실시예에 따르면, 경쟁 기반 채널 접근 시스템에서 전체 자원 사용률을 증가시키고, 무선랜 시스템의 성능을 향상시킬 수 있다.

## 도면의 간단한 설명

[36] 도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 나타낸다.

[37] 도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템을 나타낸다.

[38] 도 3은 본 발명의 일 실시예에 따른 스테이션의 구성을 나타낸다.

[39] 도 4는 본 발명의 일 실시예에 따른 액세스 포인트의 구성을 나타낸다.

[40] 도 5는 STA가 AP와 링크를 설정하는 과정을 개략적으로 도시한다.

[41] 도 6은 무선랜 통신에서 사용되는 CSMA(Carrier Sense Multiple Access)/CA(Collision Avoidance) 방법을 나타낸다.

[42] 도 7은 RTS(Request to Send) 프레임과 CTS(Clear to Send) 프레임을 이용한 DCF(Distributed Coordination Function) 수행 방법을 나타낸다.

[43] 도 8 및 도 9는 본 발명의 실시예에 따른 다중 사용자(Multi-User) 전송 방법을 나타낸다.

[44] 도 10은 레거시 PPDU 포맷과 논-레거시 PPDU 포맷의 일 실시예를 도시한다.

[45] 도 11은 본 발명의 실시예에 따른 다양한 HE PPDU 포맷 및 이의 지시 방법을 도시한다.

[46] 도 12는 본 발명의 추가적인 실시예에 따른 HE PPDU 포맷들을 도시한다.

[47] 도 13은 본 발명의 일 실시예에 따른 PPDU 포맷에 기초한 파워 세이브 동작 시나리오를 도시한다.

[48] 도 14는 HE PPDU 포맷에 따른 HE-SIG-A 필드의 구성의 실시예를 도시한다.

[49] 도 15는 본 발명의 일 실시예에 따른 HE-SIG-B 필드의 구성을 도시한다.

[50] 도 16은 본 발명의 실시예에 따른 HE-SIG-B의 인코딩 구조 및 전송 방법을 도시한다.

[51] 도 17은 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우의 HE-SIG-B의 서브필드 구성을 도시한다.

[52] 도 18 내지 도 20은 본 발명의 실시예에 따른 채널 확장 방법들을 도시한다.

[53] 도 21 내지 도 23은 본 발명의 실시예에 따른 불연속 PPDU의 전송 시퀀스를 도시한다.

[54] 도 24는 본 발명의 추가적인 실시예로서, MU 전송 과정의 TXOP을 설정하는 방법을 도시한다.

[55] 도 25 내지 도 31은 본 발명의 다양한 실시예에 따른 불연속 채널 할당 정보의 시그널링 방법을 도시한다.

[56] 도 32 내지 도 34는 본 발명의 다양한 실시예에 따른 불연속 채널 할당 방법을 도시한다.

[57] 도 35 내지 도 37은 본 발명의 추가적인 실시예에 따른 리소스 유닛 필터링 실시예를 도시한다.

[58] 도 38 및 도 42는 본 발명의 추가적인 실시예에 따른 HE MU PPDU의 시그널링 방법들을 도시한다.

[59] 도 43 및 도 44는 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를 도시한다.

[60] 도 45 및 도 46은 본 발명의 추가적인 실시예에 따른 불연속 채널 할당 및 이에 대한 시그널링 방법들을 도시한다.

## 발명의 실시를 위한 형태

[61] 본 명세서에서 사용되는 용어는 본 발명에서의 기능을 고려하면서 가능한 현재 널리 사용되는 일반적인 용어를 선택하였으나, 이는 당 분야에 종사하는 기술자의 의도, 관례 또는 새로운 기술의 출현 등에 따라 달라질 수 있다. 또한 특정 경우는 출원인이 임의로 선정한 용어도 있으며, 이 경우 해당되는 발명의 설명 부분에서 그 의미를 기재할 것이다. 따라서 본 명세서에서 사용되는 용어는, 단순한 용어의 명칭이 아닌 그 용어가 가진 실질적인 의미와 본 명세서의 전반에 걸친 내용을 토대로 해석되어야 함을 밝혀두고자 한다.

[62] 명세서 전체에서, 어떤 구성이 다른 구성과 "연결"되어 있다고 할 때, 이는 "직접적으로 연결"되어 있는 경우뿐 아니라, 그 중간에 다른 구성요소를 사이에 두고 "전기적으로 연결"되어 있는 경우도 포함한다. 또한 어떤 구성이 특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

[63] 본 출원은 대한민국 특허 출원 제10-2015-0186871호, 제10-2016-0004471호, 제10-2016-0005835호, 제10-2016-0026683호, 제10-2016-0030006호, 제10-2016-0059182호, 제10-2016-0062422호 및 제10-2016-0083756호를 기초로 한 우선권을 주장하며, 우선권의 기초가 되는 상기 각 출원들에 서술된 실시예 및 기재 사항은 본 출원의 상세한 설명에 포함되는 것으로 한다.

[64] 도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 도시하고 있다. 무선랜 시스템은 하나 또는 그 이상의 베이직 서비스 세트(Basic Service Set, BSS)를 포함하는데, BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 기기들의 집합을 나타낸다. 일반적으로 BSS는 인프라스트럭처 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭처 BSS를 나타내고 있다.

[65] 도 1에 도시된 바와 같이 인프라스트럭처 BSS(BSS1, BSS2)는 하나 또는 그 이상의 스테이션(STA1, STA2, STA3, STA4, STA5), 분배 서비스(Distribution Service)를 제공하는 스테이션인 액세스 포인트(PCP/AP-1, PCP/AP-2), 및 다수의

액세스 포인트(PCP/AP-1, PCP/AP-2)를 연결시키는 분배 시스템(Distribution System, DS)을 포함한다.

[66] 스테이션(Station, STA)은 IEEE 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리층(Physical Layer) 인터페이스를 포함하는 임의의 디바이스로서, 광의로는 비 액세스 포인트(non-AP) 스테이션뿐만 아니라 액세스 포인트(AP)를 모두 포함한다. 또한, 본 명세서에서 '단말'은 non-AP STA 또는 AP를 가리키거나, 양 자를 모두 가리키는 용어로 사용될 수 있다. 무선 통신을 위한 스테이션은 프로세서와 통신부를 포함하고, 실시예에 따라 유저 인터페이스부와 디스플레이 유닛 등을 더 포함할 수 있다. 프로세서는 무선 네트워크를 통해 전송할 프레임을 생성하거나 또는 상기 무선 네트워크를 통해 수신된 프레임을 처리하며, 그 밖에 스테이션을 제어하기 위한 다양한 처리를 수행할 수 있다. 그리고, 통신부는 상기 프로세서와 기능적으로 연결되어 있으며 스테이션을 위하여 무선 네트워크를 통해 프레임을 송수신한다. 본 발명에서 단말은 사용자 단말기(user equipment, UE)를 포함하는 용어로 사용될 수 있다.

[67] 액세스 포인트(Access Point, AP)는 자신에게 결합된(associated) 스테이션을 위하여 무선 매체를 경유하여 분배시스템(DS)에 대한 접속을 제공하는 개체이다. 인프라스트럭쳐 BSS에서 비 AP 스테이션들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이지만, 다이렉트 링크가 설정된 경우에는 비AP 스테이션들 사이에서도 직접 통신이 가능하다. 한편, 본 발명에서 AP는 PCP(Personal BSS Coordination Point)를 포함하는 개념으로 사용되며, 광의적으로는 집중 제어기, 기지국(Base Station, BS), 노드-B, BTS(Base Transceiver System), 또는 사이트 제어기 등의 개념을 모두 포함할 수 있다. 본 발명에서 AP는 베이스 무선 통신 단말로도 지칭될 수 있으며, 베이스 무선 통신 단말은 광의의 의미로는 AP, 베이스 스테이션(base station), eNB(eNodeB) 및 트랜스미션 포인트(TP)를 모두 포함하는 용어로 사용될 수 있다. 뿐만 아니라, 베이스 무선 통신 단말은 복수의 무선 통신 단말과의 통신에서 통신 매개체(medium) 자원을 할당하고, 스케줄링(scheduling)을 수행하는 다양한 형태의 무선 통신 단말을 포함할 수 있다.

[68] 복수의 인프라스트럭쳐 BSS는 분배 시스템(DS)을 통해 상호 연결될 수 있다. 이때, 분배 시스템을 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다.

[69] 도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템인 독립 BSS를 도시하고 있다. 도 2의 실시예에서 도 1의 실시예와 동일하거나 상응하는 부분은 중복적인 설명을 생략하도록 한다.

[70] 도 2에 도시된 BSS3는 독립 BSS이며 AP를 포함하지 않기 때문에, 모든 스테이션(STA6, STA7)이 AP와 접속되지 않은 상태이다. 독립 BSS는 분배 시스템으로의 접속이 허용되지 않으며, 자기 완비적 네트워크(self-contained

network)를 이룬다. 독립 BSS에서 각각의 스테이션들(STA6, STA7)은 다이렉트로 서로 연결될 수 있다.

[71] 도 3은 본 발명의 일 실시예에 따른 스테이션(100)의 구성을 나타낸 블록도이다. 도시된 바와 같이, 본 발명의 실시예에 따른 스테이션(100)은 프로세서(110), 통신부(120), 유저 인터페이스부(140), 디스플레이 유닛(150) 및 메모리(160)를 포함할 수 있다.

[72] 먼저, 통신부(120)는 무선랜 패킷 등의 무선 신호를 송수신 하며, 스테이션(100)에 내장되거나 외장으로 구비될 수 있다. 실시예에 따르면, 통신부(120)는 서로 다른 주파수 밴드를 이용하는 적어도 하나의 통신 모듈을 포함할 수 있다. 이를 테면, 상기 통신부(120)는 2.4GHz, 5GHz 및 60GHz 등의 서로 다른 주파수 밴드의 통신 모듈을 포함할 수 있다. 일 실시예에 따르면, 스테이션(100)은 6GHz 이상의 주파수 밴드를 이용하는 통신 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 통신 모듈을 구비할 수 있다. 각각의 통신 모듈은 해당 통신 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 AP 또는 외부 스테이션과 무선 통신을 수행할 수 있다. 통신부(120)는 스테이션(100)의 성능 및 요구 사항에 따라 한 번에 하나의 통신 모듈만을 동작시키거나 동시에 다수의 통신 모듈을 함께 동작시킬 수 있다. 스테이션(100)이 복수의 통신 모듈을 포함할 경우, 각 통신 모듈은 각각 독립된 형태로 구비될 수도 있으며, 복수의 모듈이 하나의 칩으로 통합되어 구비될 수도 있다. 본 발명의 실시예에서 통신부(120)는 RF(Radio Frequency) 신호를 처리하는 RF 통신 모듈을 나타낼 수 있다.

[73] 다음으로, 유저 인터페이스부(140)는 스테이션(100)에 구비된 다양한 형태의 입/출력 수단을 포함한다. 즉, 유저 인터페이스부(140)는 다양한 입력 수단을 이용하여 유저의 입력을 수신할 수 있으며, 프로세서(110)는 수신된 유저 입력에 기초하여 스테이션(100)을 제어할 수 있다. 또한, 유저 인터페이스부(140)는 다양한 출력 수단을 이용하여 프로세서(110)의 명령에 기초한 출력을 수행할 수 있다.

[74] 다음으로, 디스플레이 유닛(150)은 디스플레이 화면에 이미지를 출력한다. 상기 디스플레이 유닛(150)은 프로세서(110)에 의해 실행되는 컨텐츠 또는 프로세서(110)의 제어 명령에 기초한 유저 인터페이스 등의 다양한 디스플레이 오브젝트를 출력할 수 있다. 또한, 메모리(160)는 스테이션(100)에서 사용되는 제어 프로그램 및 그에 따른 각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션(100)이 AP 또는 외부 스테이션과 접속을 수행하는데 필요한 접속 프로그램이 포함될 수 있다.

[75] 본 발명의 프로세서(110)는 다양한 명령 또는 프로그램을 실행하고, 스테이션(100) 내부의 데이터를 프로세싱 할 수 있다. 또한, 상기 프로세서(110)는 상술한 스테이션(100)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(110)는

메모리(160)에 저장된 AP와의 접속을 위한 프로그램을 실행하고, AP가 전송한 통신 설정 메시지를 수신할 수 있다. 또한, 프로세서(110)는 통신 설정 메시지에 포함된 스테이션(100)의 우선 조건에 대한 정보를 판독하고, 스테이션(100)의 우선 조건에 대한 정보에 기초하여 AP에 대한 접속을 요청할 수 있다. 본 발명의 프로세서(110)는 스테이션(100)의 메인 컨트롤 유닛을 가리킬 수도 있으며, 실시예에 따라 스테이션(100)의 일부 구성 이를 테면, 통신부(120) 등을 개별적으로 제어하기 위한 컨트롤 유닛을 가리킬 수도 있다. 즉, 프로세서(110)는 통신부(120)로부터 송수신되는 무선 신호를 변복조하는 모뎀 또는 변복조부(modulator and/or demodulator)일 수 있다. 프로세서(110)는 본 발명의 실시예에 따른 스테이션(100)의 무선 신호 송수신의 각종 동작을 제어한다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

[76] 도 3에 도시된 스테이션(100)은 본 발명의 일 실시예에 따른 블록도로서, 분리하여 표시한 블록들은 디바이스의 엘리먼트들을 논리적으로 구별하여 도시한 것이다. 따라서 상술한 디바이스의 엘리먼트들은 디바이스의 설계에 따라 하나의 칩으로 또는 복수의 칩으로 장착될 수 있다. 이를테면, 상기 프로세서(110) 및 통신부(120)는 하나의 칩으로 통합되어 구현될 수도 있으며 별도의 칩으로 구현될 수도 있다. 또한, 본 발명의 실시예에서 상기 스테이션(100)의 일부 구성들, 이를 테면 유저 인터페이스부(140) 및 디스플레이 유닛(150) 등은 스테이션(100)에 선택적으로 구비될 수 있다.

[77] 도 4는 본 발명의 일 실시예에 따른 AP(200)의 구성을 나타낸 블록도이다. 도시된 바와 같이, 본 발명의 실시예에 따른 AP(200)는 프로세서(210), 통신부(220) 및 메모리(260)를 포함할 수 있다. 도 4에서 AP(200)의 구성 중 도 3의 스테이션(100)의 구성과 동일하거나 상응하는 부분에 대해서는 중복적인 설명을 생략하도록 한다.

[78] 도 4를 참조하면, 본 발명에 따른 AP(200)는 적어도 하나의 주파수 밴드에서 BSS를 운영하기 위한 통신부(220)를 구비한다. 도 3의 실시예에서 전술한 바와 같이, 상기 AP(200)의 통신부(220) 또한 서로 다른 주파수 밴드를 이용하는 복수의 통신 모듈을 포함할 수 있다. 즉, 본 발명의 실시예에 따른 AP(200)는 서로 다른 주파수 밴드, 이를 테면 2.4GHz, 5GHz, 60GHz 중 두 개 이상의 통신 모듈을 함께 구비할 수 있다. 바람직하게는, AP(200)는 6GHz 이상의 주파수 밴드를 이용하는 통신 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 통신 모듈을 구비할 수 있다. 각각의 통신 모듈은 해당 통신 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 스테이션과 무선 통신을 수행할 수 있다. 상기 통신부(220)는 AP(200)의 성능 및 요구 사항에 따라 한 번에 하나의 통신 모듈만을 동작시키거나 동시에 다수의 통신 모듈을 함께 동작시킬 수 있다. 본 발명의 실시예에서 통신부(220)는 RF(Radio Frequency) 신호를 처리하는 RF 통신 모듈을 나타낼 수 있다.

[79] 다음으로, 메모리(260)는 AP(200)에서 사용되는 제어 프로그램 및 그에 따른

각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션의 접속을 관리하는 접속 프로그램이 포함될 수 있다. 또한, 프로세서(210)는 AP(200)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(210)는 메모리(260)에 저장된 스테이션과의 접속을 위한 프로그램을 실행하고, 하나 이상의 스테이션에 대한 통신 설정 메시지를 전송할 수 있다. 이때, 통신 설정 메시지에는 각 스테이션의 접속 우선 조건에 대한 정보가 포함될 수 있다. 또한, 프로세서(210)는 스테이션의 접속 요청에 따라 접속 설정을 수행한다. 일 실시예에 따르면, 프로세서(210)는 통신부(220)로부터 송수신되는 무선 신호를 변복조하는 모뎀 또는 변복조부(modulator and/or demodulator)일 수 있다. 프로세서(210)는 본 발명의 실시예에 따른 AP(200)의 무선 신호 송수신의 각종 동작을 제어한다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

[80] 도 5는 STA가 AP와 링크를 설정하는 과정을 개략적으로 도시하고 있다.

[81] 도 5를 참조하면, STA(100)와 AP(200) 간의 링크는 크게 스캐닝(scanning), 인증(authentication) 및 결합(association)의 3단계를 통해 설정된다. 먼저, 스캐닝 단계는 AP(200)가 운영하는 BSS의 접속 정보를 STA(100)가 획득하는 단계이다. 스캐닝을 수행하기 위한 방법으로는 AP(200)가 주기적으로 전송하는 비콘(beacon) 메시지(S101)만을 활용하여 정보를 획득하는 패시브 스캐닝(passive scanning) 방법과, STA(100)가 AP에 프로브 요청(probe request)을 전송하고(S103), AP로부터 프로브 응답(probe response)을 수신하여(S105) 접속 정보를 획득하는 액티브 스캐닝(active scanning) 방법이 있다.

[82] 스캐닝 단계에서 성공적으로 무선 접속 정보를 수신한 STA(100)는 인증 요청(authentication request)을 전송하고(S107a), AP(200)로부터 인증 응답(authentication response)을 수신하여(S107b) 인증 단계를 수행한다. 인증 단계가 수행된 후, STA(100)는 결합 요청(association request)를 전송하고(S109a), AP(200)로부터 결합 응답(association response)을 수신하여(S109b) 결합 단계를 수행한다. 본 명세서에서 결합(association)은 기본적으로 무선 결합을 의미하나, 본 발명은 이에 한정되지 않으며 광의의 의미로의 결합은 무선 결합 및 유선 결합을 모두 포함할 수 있다.

[83] 한편, 추가적으로 802.1X 기반의 인증 단계(S111) 및 DHCP를 통한 IP 주소 획득 단계(S113)가 수행될 수 있다. 도 5에서 인증 서버(300)는 STA(100)와 802.1X 기반의 인증을 처리하는 서버로서, AP(200)에 물리적으로 결합되어 존재하거나 별도의 서버로서 존재할 수 있다.

[84] 도 6은 무선랜 통신에서 사용되는 CSMA(Carrier Sense Multiple Access)/CA(Collision Avoidance) 방법을 나타내고 있다.

[85] 무선랜 통신을 수행하는 단말은 데이터를 전송하기 전에 캐리어 센싱(Carrier Sensing)을 수행하여 채널이 점유 상태(busy)인지 여부를 체크한다. 만약, 일정한 세기 이상의 무선 신호가 감지되는 경우 해당 채널이 점유 상태(busy)인 것으로

판별되고, 상기 단말은 해당 채널에 대한 액세스를 지연한다. 이러한 과정을 클리어 채널 할당(Clear Channel Assessment, CCA) 이라고 하며, 해당 신호 감지 유무를 결정하는 레벨을 CCA 임계값(CCA threshold)이라 한다. 만약 단말에 수신된 CCA 임계값 이상의 무선 신호가 해당 단말을 수신자로 하는 경우, 단말은 수신된 무선 신호를 처리하게 된다. 한편, 해당 채널에서 무선 신호가 감지되지 않거나 CCA 임계값보다 작은 세기의 무선 신호가 감지될 경우 상기 채널은 유휴 상태(idle)인 것으로 판별된다.

[86] 채널이 유휴 상태인 것으로 판별되면, 전송할 데이터가 있는 각 단말은 각 단말의 상황에 따른 IFS(Inter Frame Space) 이를테면, AIFS(Arbitration IFS), PIFS(PCF IFS) 등의 시간 뒤에 백오프 절차를 수행한다. 실시예에 따라, 상기 AIFS는 기존의 DIFS(DCF IFS)를 대체하는 구성으로 사용될 수 있다. 각 단말은 해당 단말에 결정된 난수(random number) 만큼의 슬롯 타임을 상기 채널의 유휴 상태의 간격(interval) 동안 감소시켜가며 대기하고, 슬롯 타임을 모두 소진한 단말이 해당 채널에 대한 액세스를 시도하게 된다. 이와 같이 각 단말들이 백오프 절차를 수행하는 구간을 경쟁 윈도우 구간이라고 한다.

[87] 만약, 특정 단말이 상기 채널에 성공적으로 액세스하게 되면, 해당 단말은 상기 채널을 통해 데이터를 전송할 수 있다. 그러나, 액세스를 시도한 단말이 다른 단말과 충돌하게 되면, 충돌된 단말들은 각각 새로운 난수를 할당 받아 다시 백오프 절차를 수행한다. 일 실시예에 따르면, 각 단말에 새로 할당되는 난수는 해당 단말이 이전에 할당 받은 난수 범위(경쟁 윈도우, CW)의 2배의 범위(2*CW) 내에서 결정될 수 있다. 한편, 각 단말은 다음 경쟁 윈도우 구간에서 다시 백오프 절차를 수행하여 액세스를 시도하며, 이때 각 단말은 이전 경쟁 윈도우 구간에서 남게 된 슬롯 타임부터 백오프 절차를 수행한다. 이와 같은 방법으로 무선랜 통신을 수행하는 각 단말들은 특정 채널에 대한 서로간의 충돌을 회피할 수 있다.

[88] 도 7은 RTS(Request to Send) 프레임과 CTS(Clear to Send) 프레임을 이용한 DCF(Distributed Coordination Function) 수행 방법을 나타낸 도면이다.

[89] BSS 내의 AP 및 STA들은 데이터를 전송하기 위한 권리를 얻기 위해 경쟁을 하게 된다. 이전 단계의 데이터 전송이 완료되면, 전송할 데이터가 있는 각 단말들은 AIFS의 시간이 지난 후에 각 단말에 할당된 난수의 백오프 카운터(또는, 백오프 타이머)를 감소해가며 백오프 절차를 수행한다. 백오프 카운터가 만료된 전송 단말은 RTS(Request to Send) 프레임을 전송하여, 해당 단말이 전송할 데이터가 있음을 알린다. 도 7의 실시예에 따르면, 최소의 백오프로 경쟁에서 우위를 점한 STA1이 백오프 카운터 만료 후 RTS 프레임을 전송할 수 있다. RTS 프레임은 리시버 어드레스(receiver address), 트랜스미터 어드레스(transmitter address) 및 듀레이션(duration) 등의 정보를 포함한다. RTS 프레임을 수신한 수신 단말(즉, 도 7에서 AP)은 SIFS(Short IFS)의 시간을 대기한 후 CTS(Clear to Send) 프레임을 전송하여 전송 단말(STA1)에게 데이터 전송이

가능함을 알린다. CTS 프레임은 리시버 어드레스와 듀레이션 등의 정보를 포함한다. 이때, CTS 프레임의 리시버 어드레스는 이에 대응하는 RTS 프레임의 트랜스미터 어드레스 즉, 전송 단말(STA1)의 어드레스와 동일하게 설정될 수 있다.

[90] CTS 프레임을 수신한 전송 단말(STA1)은 SIFS의 시간 후에 데이터를 전송한다. 데이터 전송이 완료되면, 수신 단말(AP)은 SIFS의 시간 후에 응답(ACK) 프레임을 전송하여 데이터 전송이 완료되었음을 알린다. 기 설정된 시간 이내에 응답 프레임을 수신한 경우, 전송 단말은 데이터 전송에 성공한 것으로 간주한다. 그러나 기 설정된 시간 이내에 응답 프레임이 수신되지 않은 경우, 전송 단말은 데이터 전송에 실패한 것으로 간주한다. 한편, 상기 전송 과정 동안 RTS 프레임 및 CTS 프레임 중 적어도 하나를 수신한 주변 단말들은 NAV(Network Allocation Vector)를 설정하며, 설정된 NAV가 만료될 때까지 데이터 전송을 수행하지 않는다. 이때, 각 단말의 NAV는 수신된 RTS 프레임 또는 CTS 프레임의 듀레이션 필드에 기초하여 설정될 수 있다.

[91] 전술한 데이터 전송 과정에서, 단말들의 RTS 프레임 또는 CTS 프레임이 간섭이나 충돌 등의 상황으로 목표 단말(즉, 리시버 어드레스의 단말)에게 정상적으로 전달되지 않는 경우에는 이후의 과정의 수행이 중단된다. RTS 프레임을 전송한 전송 단말(STA1)은 데이터 전송이 불가능한 것으로 간주하고, 새로운 난수를 할당 받아 다음 회의 경쟁에 참여하게 된다. 이때, 새로 할당되는 난수는 전술한 바와 같이 이전의 기 설정된 난수 범위(경쟁 윈도우, CW)의 2배의 범위(2*CW) 내에서 결정될 수 있다.

[92] 도 8 및 도 9는 본 발명의 실시예에 따른 다중 사용자(Multi-User) 전송 방법을 나타낸다. OFDMA(Orthogonal Frequency Division Multiple Access) 또는 다중 입력 다중 출력(Multi Input Multi Output, MIMO)을 이용할 경우, 하나의 무선 통신 단말이 복수의 무선 통신 단말에게 동시에 데이터를 전송할 수 있다. 또한, 하나의 무선 통신 단말은 복수의 무선 통신 단말로부터 동시에 데이터를 수신할 수 있다. 예를 들어, AP가 복수의 STA에게 동시에 데이터를 전송하는 하향 다중 사용자(Downlink Multi-User, DL-MU) 전송, 복수의 STA가 AP로 동시에 데이터를 전송하는 상향 다중 사용자(Uplink Multi-User, UL-MU) 전송이 수행될 수 있다.

[93] 도 8은 본 발명의 실시예에 따른 UL-MU 전송 과정을 나타낸다. UL-MU 전송이 수행되기 위해서는 상향 전송을 수행하는 각 STA의 사용 채널 및 전송 개시 시점이 조정되어야 한다. UL-MU 전송의 효율적인 스케쥴링을 위해서는, 각 STA의 상태 정보가 AP에게 전달될 필요가 있다. 본 발명의 실시예에 따르면, UL-MU 전송의 스케쥴링을 위한 정보는 패킷의 프리앰블 및/또는 MAC 헤더의 기 설정된 필드를 통해 지시될 수 있다. 예를 들어, STA는 상향 전송 패킷의 프리앰블 또는 MAC 헤더의 기 설정된 필드를 통해 UL-MU 전송 스케쥴링을 위한 정보를 나타내고, 이를 AP에게 전송할 수 있다. 이때, UL-MU 전송

스케쥴링을 위한 정보는 각 STA의 버퍼 상태(buffer status) 정보, 각 STA에서 측정된 채널 상태 정보 중 적어도 하나를 포함할 수 있다. STA의 버퍼 상태 정보는 해당 STA가 전송할 상향 데이터를 갖고 있는지 여부, 상향 데이터의 액세스 카테고리(Access Category, AC), 상향 데이터의 크기(또는, 전송 소요 시간) 정보 중 적어도 하나를 나타낼 수 있다.

[94] 본 발명의 실시예에 따르면, UL-MU 전송 과정은 AP에 의해 관리될 수 있다. UL-MU 전송은 AP가 전송하는 트리거(trigger) 프레임의 응답으로 수행될 수 있다. STA들은 트리거 프레임의 수신 후 기 설정된 IFS 시간(예를 들어, SIFS) 뒤에 상향 데이터를 동시에 전송한다. 트리거 프레임은 STA들의 UL-MU 전송을 요청하며, 상향 전송 STA들에 할당된 채널(또는, 서브 채널) 정보를 알려줄 수 있다. AP로부터 트리거 프레임을 수신하면 복수의 STA들은 이에 대응하여 각각의 할당된 채널(또는, 서브 채널)을 통해 상향 데이터를 전송한다. 상향 데이터 전송이 완료된 후에 AP는 상향 데이터 전송에 성공한 STA들에 대한 ACK을 전송한다. 이때, AP는 복수의 STA들에 대한 ACK으로서 기 설정된 다중-STA 블록 ACK(Multi-STA Block ACK, M-BA)을 전송할 수 있다.

[95] 논-레거시 무선랜 시스템에서는 20MHz 대역의 채널에서 특정 개수의 서브캐리어, 이를 테면 26, 52 또는 106개의 톤(tone)을 서브채널 단위의 접속을 위한 리소스 유닛(Resource Unit, RU)으로 사용할 수 있다. 따라서, 트리거 프레임은 UL-MU 전송에 참여하는 각 STA의 식별 정보와, 할당된 리소스 유닛의 정보를 나타낼 수 있다. STA의 식별 정보는 STA의 AID(Association ID), 부분 AID, MAC 어드레스 중 적어도 하나를 포함한다. 또한, 리소스 유닛의 정보는 리소스 유닛의 크기 및 위치 정보를 포함한다.

[96] 한편, 논-레거시 무선랜 시스템에서는 특정 리소스 유닛에 대한 복수의 STA들의 경쟁에 기초하여 UL-MU 전송이 수행될 수 있다. 예를 들어, 특정 리소스 유닛에 대한 AID 필드 값이 STA에게 할당되지 않는 특정 값(이를테면, 0)으로 설정된 경우 복수의 STA들은 해당 리소스 유닛에 대한 랜덤 액세스(Random Access, RA)를 시도할 수 있다.

[97] 도 9는 본 발명의 실시예에 따른 DL-MU 전송 과정을 나타낸다. 본 발명의 일 실시예에 따르면, DL-MU 전송 과정에서의 NAV 설정을 위해 기 설정된 포맷의 RTS 및/또는 CTS 프레임이 사용될 수 있다. 먼저, AP는 DL-MU 전송 과정에서의 NAV 설정을 위해 다중 사용자 RTS(MU-RTS) 프레임을 전송한다. MU-RTS 프레임의 듀레이션 필드는 DL-MU 전송 세션이 종료되는 시점까지로 설정된다. 즉, MU-RTS 프레임의 듀레이션 필드는 AP의 하향 데이터 전송 및 STA들의 ACK 프레임 전송이 완료될 때까지의 기간에 기초하여 설정된다. AP의 주변 단말들은 AP가 전송하는 MU-RTS 프레임의 듀레이션 필드에 기초하여 DL-MU 전송 세션의 종료 시점까지 NAV를 설정한다. 일 실시예에 따르면, MU-RTS 프레임은 트리거 프레임의 포맷으로 구성될 수 있으며, STA들의 동시(simultaneous) CTS(sCTS) 프레임 전송을 요청한다.

[98] AP로부터 MU-RTS 프레임을 수신한 STA들(STA1, STA2)은 sCTS 프레임을 전송한다. 복수의 STA들에 의해 전송되는 sCTS 프레임은 동일한 웨이브 폼을 갖는다. 즉, 제1 채널을 통해 STA1이 전송하는 sCTS 프레임은 제1 채널을 통해 STA2가 전송하는 sCTS 프레임과 서로 동일한 웨이브 폼을 갖는다. 일 실시예에 따르면, sCTS 프레임은 MU-RTS 프레임에 의해 지시된 채널로 전송된다. sCTS 프레임의 듀레이션 필드는 MU-RTS 프레임의 듀레이션 필드의 정보에 기초하여 DL-MU 전송 세션이 종료되는 시점까지로 설정된다. 즉, sCTS 프레임의 듀레이션 필드는 AP의 하향 데이터 전송 및 STA들의 ACK 프레임 전송이 완료될 때까지의 기간에 기초하여 설정된다. 도 9에서 STA1 및 STA2의 주변 단말들은 sCTS 프레임의 듀레이션 필드에 기초하여 DL-MU 전송 세션의 종료 시점까지 NAV를 설정한다.

[99] 본 발명의 일 실시예에 따르면, MU-RTS 프레임 및 sCTS 프레임은 20MHz 채널 단위로 전송될 수 있다. 따라서, 레거시 단말을 포함한 주변 단말들은 MU-RTS 프레임 및/또는 sCTS 프레임을 수신하여 NAV를 설정할 수 있다. MU-RTS 프레임 및 sCTS 프레임의 전송이 완료되면, AP는 하향 전송을 수행한다. 도 9에서는 AP가 STA1과 STA2에게 각각 DL-MU 데이터를 전송하는 실시예를 도시하고 있다. STA들은 AP가 전송하는 하향 데이터를 수신하고, 이에 대응하여 상향 ACK을 전송한다.

[100] 도 10은 레거시 PPDU(PLCP Protocol Data Unit) 포맷과 논-레거시 PPDU 포맷의 일 실시예를 도시한다. 더욱 구체적으로, 도 10(a)는 802.11a/g에 기초한 레거시 PPDU 포맷의 일 실시예를 도시하며, 도 10(b)는 802.11ax에 기초한 논-레거시 PPDU(즉, HE PPDU) 포맷의 일 실시예를 도시한다. 또한, 도 10(c)는 상기 PPDU 포맷들에서 공통적으로 사용되는 L-SIG 및 RL-SIG의 세부 필드 구성을 나타낸다.

[101] 도 10(a)를 참조하면 레거시 PPDU의 프리앰블은 L-STF(Legacy Short Training field), L-LTF(Legacy Long Training field) 및 L-SIG(Legacy Signal field)를 포함한다. 본 발명의 실시예에서, 상기 L-STF, L-LTF 및 L-SIG는 레거시 프리앰블로 지칭될 수 있다. 도 10(b)를 참조하면 HE PPDU의 프리앰블은 상기 레거시 프리앰블에 RL-SIG(Repeated Legacy Short Training field), HE-SIG-A(High Efficiency Signal A field), HE-SIG-B(High Efficiency Signal B field), HE-STF(High Efficiency Short Training field), HE-LTF(High Efficiency Long Training field)를 추가적으로 포함한다. 본 발명의 실시예에서, 상기 RL-SIG, HE-SIG-A, HE-SIG-B, HE-STF 및 HE-LTF는 논-레거시 프리앰블로 지칭될 수 있다. 논-레거시 프리앰블의 구체적인 구성은 HE PPDU 포맷에 따라 변형될 수 있다. 예를 들어, HE-SIG-B는 HE PPDU 포맷들 중 일부 포맷에서만 사용될 수 있다.

[102] PPDU의 프리앰블에 포함된 L-SIG는 64FFT OFDM이 적용되며, 총 64개의 서브캐리어로 구성된다. 이 중 가드 서브캐리어, DC 서브캐리어 및 파일럿 서브캐리어를 제외한 48개의 서브캐리어들이 L-SIG의 데이터 전송용으로

사용된다. 만약 BPSK, Rate=1/2의 MCS(Modulation and Coding Scheme)가 적용되는 경우, L-SIG는 총 24비트의 정보를 포함할 수 있다. 도 10(c)는 L-SIG의 24비트 정보 구성을 나타낸다.

[103] 도 10(c)를 참조하면 L-SIG는 L_RATE 필드와 L_LENGTH 필드를 포함한다. L_RATE 필드는 4비트로 구성되며, 데이터 전송에 사용된 MCS를 나타낸다. 구체적으로, L_RATE 필드는 BPSK/QPSK/16-QAM/64-QAM 등의 변조방식과 1/2, 2/3, 3/4 등의 부호율을 조합한 6/9/12/18/24/36/48/54Mbps의 전송 속도들 중 하나의 값을 나타낸다. L_RATE 필드와 L_LENGTH 필드의 정보를 조합하면 해당 PPDU의 총 길이를 나타낼 수 있다. 논-레거시 PPDU는 L_RATE 필드를 최소 속도인 6Mbps로 설정한다.

[104] L_LENGTH 필드는 12비트로 구성되며, L_RATE 필드와의 조합으로 해당 PPDU의 길이를 나타낼 수 있다. 이때, 레거시 단말과 논-레거시 단말은 L_LENGTH 필드를 서로 다른 방법으로 해석할 수 있다.

[105] 먼저, 레거시 단말 또는 논-레거시 단말이 L_LENGTH 필드를 이용하여 해당 PPDU의 길이를 해석하는 방법은 다음과 같다. L_RATE 필드가 6Mbps로 설정된 경우, 64FFT의 한 개의 심볼 듀레이션인 4us동안 3 바이트(즉, 24비트)가 전송될 수 있다. 따라서, L_LENGTH 필드 값에 SVC 필드 및 Tail 필드에 해당하는 3바이트를 더하고, 이를 한 개의 심볼의 전송량인 3바이트로 나누면 L-SIG 이후의 64FFT 기준 심볼 개수가 획득된다. 획득된 심볼 개수에 한 개의 심볼 듀레이션인 4us를 곱한 후 L-STF, L-LTF 및 L-SIG의 전송에 소요되는 20us를 더하면 해당 PPDU의 길이 즉, 수신 시간(RXTIME)이 획득된다. 이를 수식으로 표현하면 아래 수학식 1과 같다.

[106] [수식1]

$$\mathbf{RXTIME(us)} = \left(\left\lceil \frac{\mathbf{L\_LENGTH+3}}{\mathbf{3}} \right\rceil\right) \times \mathbf{4} + \mathbf{20}$$

[107] 이때,

$\lceil x \rceil$

는 x보다 크거나 같은 최소의 자연수를 나타낸다. L_LENGTH 필드의 최대값은 4095이므로 PPDU의 길이는 최대 5.464ms 까지로 설정될 수 있다. 그러나 레거시 단말에서의 L_LENGTH 필드의 허용 값은 최대 2340이므로, PPDU의 길이는 최대 3.144ms 까지로 설정 된다. 해당 PPDU를 전송하는 논-레거시 단말은 L_LENGTH 필드를 아래 수학식 2와 같이 설정해야 한다.

[108] [수식2]

$$\mathbf{L\_LENGTH(byte)} = \left(\left\lceil \frac{\mathbf{TXTIME-20}}{\mathbf{4}} \right\rceil\right) \times \mathbf{3} - \mathbf{3}$$

[109] 여기서 TXTIME은 해당 PPDU를 구성하는 전체 전송 시간으로서, 아래 수학식 3과 같다. 이때, $T_X$는 X의 전송 시간을 나타낸다.

[110] [수식3]

$$\mathbf{TXTIME(us)} = T_{\mathrm{L-STF}} + T_{\mathrm{L-LTF}} + T_{\mathrm{L-SIG}} + T_{\mathrm{RL-SIG}} + T_{\mathrm{HE-SIG-A}} + (T_{\mathrm{HE-SIG-B}}) + T_{\mathrm{HE-STF}} + N_{\mathrm{HE-LTF}} \cdot T_{\mathrm{HE-LTF}} + T_{\mathrm{Data}}$$

[111] 상기 수식들을 참고하면, PPDU의 길이는 L_LENGTH/3의 올림 값에 기초하여 계산된다. 따라서, 임의의 k 값에 대하여 L_LENGTH={3k+1, 3k+2, 3(k+1)}의 3가지 서로 다른 값들이 동일한 PPDU 길이를 지시하게 된다. 본 발명의 실시예에 따르면, 논-레거시 단말은 동일한 PPDU 길이 정보를 나타내는 3개의 서로 다른 L_LENGTH 값들을 이용하여 추가적인 시그널링을 수행할 수 있다. 더욱 구체적으로, 3개의 서로 다른 L_LENGTH 값들 중 3k+1 및 3k+2에 해당하는 값들은 HE PPDU 포맷을 지시하는데 사용될 수 있다.

[112] 도 11은 본 발명의 실시예에 따른 다양한 HE PPDU 포맷 및 이의 지시 방법을 도시한다. 본 발명의 실시예에 따르면, HE PPDU 포맷은 해당 PPDU의 L_LENGTH 필드와 HE-SIG-A에 의해 기초하여 지시될 수 있다. 더욱 구체적으로, HE PPDU 포맷은 L_LENGTH 필드의 값과 HE-SIG-A 심볼에 적용된 변조 기법 중 적어도 하나에 기초하여 지시된다.

[113] 먼저, 도 11(a)을 참조하면 L_LENGTH 필드의 값이 3k+1 형태인 경우(즉, mod3=1인 경우), 해당 PPDU는 HE SU PPDU 또는 HE Trigger-based PPDU이다. HE SU PPDU는 AP와 단일 STA간의 단일 사용자(Single-User) 전송을 위해 사용되는 PPDU이며, HE Trigger-based PPDU는 트리거 프레임에 대한 응답인 전송을 위해 사용되는 상향 PPDU이다. HE SU PPDU와 HE Trigger-based PPDU는 동일한 프리앰블 포맷을 갖는다. HE SU PPDU 및 HE Trigger-based PPDU의 경우, HE-SIG-A의 2개의 심볼은 각각 BPSK 및 BPSK로 변조된다.

[114] 도 11(b)에 도시된 본 발명의 추가적인 실시예에 따르면, L_LENGTH 필드의 값이 3k+1 형태이고(즉, mod3=1) HE-SIG-A의 2개의 심볼이 각각 BPSK, QBPSK로 변조된 경우, 해당 PPDU는 확장 PPDU이다. 확장 PPDU는 802.11ax에서 지원하는 PPDU 포맷 이외의 새로운 PPDU 포맷으로 사용된다.

[115] 다음으로, L_LENGTH 필드의 값이 3k+2 형태인 경우(즉, mod3=2인 경우), 해당 PPDU는 HE MU PPDU 또는 HE Extended Range(ER) SU PPDU이다. HE MU PPDU는 하나 이상의 단말들로의 전송을 위해 사용되는 PPDU이다. HE MU PPDU 포맷은 도 11(c)에 도시되어 있으며, 논-레거시 프리앰블에 HE-SIG-B를 추가적으로 포함한다. HE MU PPDU의 경우 HE-SIG-A의 2개의 심볼은 각각 BPSK 및 BPSK로 변조된다. 한편, HE ER SU PPDU는 확장된 범위에 있는 단말과의 단일 사용자 전송을 위해 사용된다. HE ER SU PPDU 포맷은 도 11(d)에 도시되어 있으며, 논-레거시 프리앰블의 HE-SIG-A가 시간 축에서 반복된다. HE ER SU PPDU의 경우 HE-SIG-A의 처음 2개의 심볼은 각각 BPSK 및 QBPSK로 변조된다. 이와 같이, 논-레거시 단말은 L_LENGTH 필드의 값에 추가적으로 HE-SIG-A의 2개의 심볼에 사용된 변조 기법을 통해 PPDU 포맷을 시그널링 할 수 있다.

[116] 도 11(c)에 도시된 HE MU PPDU는 AP가 복수의 STA들에게 하향 전송을 수행하기 위해 사용될 수 있다. 이때, HE MU PPDU는 복수의 STA들이 해당 PPDU를 동시에 수신하기 위한 스케쥴링 정보를 포함할 수 있다. 뿐만 아니라, HE MU PPDU는 단일 STA가 AP에게 상향 전송을 수행하기 위해 사용될 수도 있다. 이때, HE MU PPDU는 HE-SIG-B의 사용자 특정(user specific) 필드를 통해 해당 PPDU의 수신자 및/또는 송신자의 AID 정보를 전달할 수 있다. 따라서, HE MU PPDU를 수신한 단말들은 해당 PPDU의 프리앰블에서 획득된 AID 정보에 기초하여 공간적 재사용(spatial reuse) 동작을 수행할 수 있다. 또한, HE MU PPDU를 사용하여 일부 협대역을 통한 데이터 전송이 수행될 수 있다. 여기서, 협대역은 20MHz 미만의 주파수 대역일 수 있다. 일 실시예에 따르면, HE MU PPDU는 협대역 전송에 사용될 리소스 유닛의 할당 정보를 HE-SIG-B를 통해 지시할 수 있다.

[117] 더욱 구체적으로, HE-SIG-B의 리소스 유닛 할당(resource unit allocation, RA) 필드는 주파수 도메인에서 특정 대역폭(예를 들어, 20MHz)에서의 리소스 유닛 분할 형태에 대한 정보를 포함한다. 또한, 분할된 각 리소스 유닛에 지정된 STA의 정보는 HE-SIG-B의 사용자 특정 필드를 통해 전달될 수 있다. 사용자 특정 필드는 분할된 각 리소스 유닛에 대응하는 하나 이상의 사용자 필드를 포함한다.

[118] 분할된 리소스 유닛들 중 일부를 이용한 협대역 전송이 수행될 경우, 전송이 수행될 리소스 유닛은 HE-SIG-B의 사용자 특정 필드를 통해 지시될 수 있다. 일 실시예에 따르면, 분할된 복수의 리소스 유닛들 중에서 데이터 전송이 수행되는 리소스 유닛(들)에 대응하는 사용자 필드에 수신자 또는 송신자의 AID가 삽입되고, 데이터 전송이 수행되지 않는 나머지 리소스 유닛(들)에 대응하는 사용자 필드에는 기 설정된 널(Null) STA ID가 삽입될 수 있다. 본 발명의 다른 실시예에 따르면, 데이터 전송이 수행되지 않는 리소스 유닛에 대응하는 제1 사용자 필드와, 데이터 전송이 수행되는 리소스 유닛에 대응하는 제2 사용자 필드를 통해 협대역 전송이 시그널링 될 수 있다. 더욱 구체적으로, 제1 사용자 필드에는 기 설정된 널 STA ID가 삽입되고, 데이터 전송이 수행되는 리소스 유닛(들)의 위치 정보가 해당 사용자 필드의 나머지 서브 필드를 통해 지시될 수 있다. 다음으로, 제2 사용자 필드에는 수신자 또는 송신자의 AID가 삽입될 수 있다. 이와 같이, 단말은 제1 사용자 필드에 포함되는 위치 정보 및 제2 사용자 필드에 포함되는 AID 정보를 통해 협대역 전송을 시그널링 할 수 있다. 이때, 분할된 리소스 유닛 개수보다 적은 수의 사용자 필드만 이용되므로, 시그널링 오버헤드가 줄어들 수 있다.

[119] 도 12는 본 발명의 추가적인 실시예에 따른 HE PPDU 포맷들을 도시한다. 도 12의 각각의 실시예에서 HE PPDU는 L_LENGTH 필드의 값이 3k+1 형태이고(즉, mod3=1) HE-SIG-A의 2개의 심볼이 각각 BPSK, QBPSK로 변조된 것으로 도시되었으나 본 발명은 이에 한정하지 않는다. 즉, 각각의 실시예에서 HE

PPDU는 L_LENGTH 필드의 값이 3k+2 형태이거나(즉, mod3=2), HE-SIG-A의 2개의 심볼이 각각 BPSK, BPSK로 변조될 수도 있다.

[120] 먼저, 도 12(a)는 본 발명의 일 실시예에 따른 HE ER PPDU 포맷을 나타낸다. 해당 PPDU 포맷에서 HE-SIG-A와 HE-SIG-B는 각각 시간 도메인에서 반복된다. 이 경우, 시간 도메인에서의 HE-SIG-A 및 HE-SIG-B의 반복 전송으로 인해 3dB 이상의 수신 이득을 얻을 수 있게 되어 장거리에서도 신호 수신이 가능해진다. 도 12(a)의 실시예에 따른 PPDU 포맷은 HE-SIG-B를 추가적으로 시그널링 할 수 있으므로, 하향 ER(extended range) 다중 사용자 전송에 사용될 수 있다. 뿐만 아니라, 해당 PPDU 포맷은 상향/하향 ER 단일 사용자 전송에서 데이터의 협대역 전송을 위해 사용될 수도 있다. 더욱 구체적으로, 상기 PPDU 포맷은 256FFT/20MHz 기반으로 전송되는 데이터 영역의 일부 리소스 유닛을 이용한 전송을 HE-SIG-B를 통해 시그널링 할 수 있다. 따라서, 상향/하향 단일 사용자 전송 상황에서도 20MHz 대역 미만의 26-톤 RU, 52-톤 RU 또는 106-톤 RU 만을 이용한 전송이 수행될 수 있다. 이와 같은 협대역 전송을 통해, 단말은 ISM 대역에서 허용 가능한 전체 전송 파워를 좁은 RU에 집중하여 전송을 수행할 수 있다. 즉, 64FFT/20MHz 영역의 HE-SIG-A/B의 반복 전송으로 인한 전송 거리 확장에 더하여, 후반부 256FFT/20MHz 영역의 데이터 전송에서도 전송 거리가 확장될 수 있다. 또한, 해당 PPDU 포맷은 하향 다중 사용자 전송에서 데이터의 협대역 전송을 위해 사용될 수도 있다. 예를 들어 도 12(a)에 도시된 바와 같이, AP는 PPDU의 HE-SIG-B를 통해 20MHz 대역의 분할 정보를 지시하고, 분할된 리소스 유닛들 중 적어도 2개를 포함한 일부 리소스 유닛을 협대역 전송에 사용할 수 있다. 이때, ISM 대역에서 허용 가능한 전체 전송 파워를 일부의 리소스 유닛에 집중하여 전송함으로 전송 거리가 증가될 수 있다.

[121] 다음으로, 도 12(b)는 본 발명의 다른 실시예에 따른 HE ER PPDU 포맷을 나타낸다. 해당 PPDU 포맷에서 HE-SIG-A는 시간 도메인에서 반복되며, 프리앰블 오버헤드를 줄이기 위해 HE-SIG-B는 전송되지 않는다. 이 경우, 시간 도메인에서의 HE-SIG-A 의 반복 전송으로 인해 3dB 이상의 수신 이득을 얻을 수 있게 되어 장거리에서도 신호 수신이 가능해진다. 일 실시예에 따르면, 도 12(a)에 따른 PPDU 포맷과 도 12(b)에 따른 PPDU 포맷의 구분은 HE-SIG-A의 기 설정된 필드를 통해 지시될 수 있다. 도 12(b)의 실시예에 따른 PPDU 포맷은 상향/하향 ER 단일 사용자 전송에서 데이터의 협대역 전송을 위해 사용될 수 있다. 이때, 해당 PPDU 포맷은 HE-SIG-B를 통한 시그널링 없이도 256FFT/20MHz 기반으로 전송되는 데이터 영역의 특정 리소스 유닛을 이용한 전송을 지시할 수 있다. 예를 들어, 20MHz 대역폭 내에서 기 설정된 일부 리소스 유닛 만을 이용한 전송이 HE-SIG-A의 특정 필드(예를 들어, Bandwidth 필드)를 통해 지시될 수 있다. 이때, 기 설정된 일부 리소스 유닛은 특정 위치의 26-톤 RU, 52-톤 RU 및 106-톤 RU 중 적어도 하나일 수 있다. HE ER PPDU에서 HE-SIG-A의 기 설정된 필드는 기 설정된 일부 리소스 유닛을 이용한 전송이 수행되는지 또는

20MHz 전체 대역(즉, 242-톤 RU)을 이용한 전송이 수행되는지를 지시할 수 있다. 이와 같이, 도 12(b)의 실시예에 따르면 HE ER PPDU에서 HE-SIG-B의 사용 없이 HE-SIG-A의 간단한 시그널링 만으로 기 설정된 협대역 전송이 지시될 수 있다.

[122] 다음으로, 도 12(c)는 본 발명의 또 다른 실시예에 따른 HE ER PPDU 포맷을 나타낸다. 해당 PPDU 포맷에서 HE-SIG-A는 시간 도메인에서 반복되며, 프리앰블 오버헤드를 줄이기 위해 HE-SIG-B는 전송되지 않는다. 대신, 256FFT/20MHz 영역에서 전송되는 HE-SIG-C가 추가적으로 사용될 수 있다. 이 경우, 시간 도메인에서의 HE-SIG-A 의 반복 전송으로 인해 3dB 이상의 수신 이득을 얻을 수 있게 되어 장거리에서도 신호 수신이 가능해진다. 해당 PPDU 포맷은 HE-SIG-B를 통한 시그널링 없이도 256FFT/20MHz 기반으로 전송되는 데이터 영역의 특정 리소스 유닛을 이용한 전송을 지시할 수 있다. 이에 대한 구체적인 실시예는 도 12(b)에서 서술한 바와 같다. HE-SIG-C는 단말이 해당 리소스 유닛을 통해 전송되는 데이터를 디코딩하기 위한 정보 예를 들어, MCS, TxBF(Transmit Beamforming) 적용 여부, BCC(Binary Convolutional Code)/LDPC(Low Density Parity Check) 코딩 지시자 등을 전달할 수 있다.

[123] 마지막으로, 도 12(d)는 본 발명의 또 다른 실시예에 따른 HE PPDU 포맷을 나타낸다. 해당 PPDU 포맷에서 HE-SIG-A는 시간 도메인에서 반복되지 않으며, HE-SIG-B는 전송되지 않는다. 대신, 256FFT/20MHz 영역에서 전송되는 HE-SIG-C가 추가적으로 사용될 수 있다. 도 12(d)의 실시예에 따른 PPDU는 AP 주변의 STA들이 HE-SIG-A에 포함된 TXOP(Transmission Opportunity) 듀레이션 정보를 이용하여 NAV를 설정하도록 하기 위해 사용될 수 있다. 해당 PPDU 포맷은 HE-SIG-B를 통한 시그널링 없이도 256FFT/20MHz 기반으로 전송되는 데이터 영역의 특정 리소스 유닛을 이용한 전송을 지시할 수 있다. 이에 대한 구체적인 실시예는 도 12(b)에서 서술한 바와 같다. HE-SIG-C는 전술한 바와 같이 단말이 해당 리소스 유닛을 통해 전송되는 데이터를 디코딩하기 위한 정보를 전달할 수 있다.

[124] 도 13은 본 발명의 일 실시예에 따른 PPDU 포맷에 기초한 파워 세이브 동작 시나리오를 도시한다. 논-레거시 AP가 운영하는 BSS에서는 ER(Extended Range) 모드를 지원하는 STA(즉, ER STA)와 ER 모드를 지원하지 않는 STA(즉, non-ER STA)가 혼재해 있을 수 있다. 도 13의 실시예에서, STA “A”는 non-ER STA를, STA “B”는 ER STA를 나타낸다.

[125] 본 발명의 실시예에 따르면, non-ER STA가 동일 BSS(intra-BSS)의 ER PPDU를 수신하면 파워 세이브 모드에 진입할 수 있다. 도 13에서 AP는 STA “B”와 ER SU PPDU를 교환하며, 해당 PPDU를 수신한 STA “A”는 수신된 PPDU의 길이 동안 파워 세이브 모드에 진입한다. STA는 AP와 결합(association)을 수행할 때 ER 모드 지원 여부를 협상한다. 따라서, non-ER STA가 동일 BSS의 ER PPDU를 수신하면, 해당 PPDU가 자신에게 전송된 PPDU가 아님이 자명하므로 추가적인 프로세싱 없이 파워 세이브 모드에 진입할 수 있다.

[126] 도 14는 HE PPDU 포맷에 따른 HE-SIG-A 필드의 구성의 실시예를 도시한다. HE-SIG-A는 64FFT의 2개의 심볼로 구성되며, HE PPDU의 수신을 위한 공통 정보를 지시한다. HE-SIG-A의 첫 번째 심볼은 BPSK로 변조되고, 두 번째 심볼은 BPSK 또는 QBPSK로 변조된다. HE ER SU PPDU에서는 HE-SIG-A의 2개의 심볼이 반복하여 전송될 수 있다. 즉, HE ER SU PPDU의 HE-SIG-A는 4개의 심볼로 구성되는데, 이들 중 첫 번째 심볼과 두 번째 심볼이 동일한 데이터 비트를 갖고 세 번째 심볼과 네 번째 심볼이 동일한 데이터 비트를 갖는다.

[127] 먼저, 도 14(a)는 HE SU PPDU의 HE-SIG-A 필드의 서브필드 구성을 도시한다. 일 실시예에 따르면, HE ER SU PPDU의 HE-SIG-A 필드도 이와 동일하게 구성될 수 있다. HE-SIG-A에 포함된 각 필드의 기능을 설명하면 다음과 같다.

[128] 상향/하향 필드는 해당 필드의 전송 방향을 지시한다. 즉, 상기 필드는 해당 PPDU가 상향으로 전송되는지 또는 하향으로 전송되는지를 지시한다. 포맷 필드는 HE SU PPDU와 HE Trigger-based PPDU를 구분하는데 사용된다. BSS 컬러 필드는 6비트로 구성되며, 해당 PPDU를 전송한 단말에 대응하는 BSS의 식별자를 지시한다. 공간적 재사용(spatial reuse) 필드는 해당 PPDU가 전송되는 동안 공간적 재사용 전송을 수행하고자 하는 단말들이 참조할 수 있는 SINR(Signal to Interference plus Noise Ratio), 전송 파워 등의 정보를 전달한다.

[129] TXOP 듀레이션 필드는 TXOP 보호 및 NAV 설정을 위한 듀레이션 정보를 나타낸다. 상기 필드는 해당 PPDU 이후에 계속적인 전송이 수행될 TXOP 구간의 듀레이션을 설정하여 주변 단말들이 해당 기간 동안 NAV를 설정하도록 한다. 대역폭 필드는 해당 PPDU가 전송되는 총 대역의 폭을 나타낸다. 일 실시예에 따르면, 대역폭 필드는 2비트로 구성되어 20MHz, 40MHz, 80MHz 및 160MHz(80+80MHz 포함) 중 어느 하나를 지시할 수 있다. MCS 필드는 해당 PPDU의 데이터 필드에 적용된 MCS 값을 지시한다. CP+LTF 사이즈 필드는 CP(Cyclic Prefix) 또는 GI(Guard Interval)의 듀레이션과 HE-LTF의 사이즈를 지시한다. 더욱 구체적으로, 상기 필드는 1x, 2x, 4x HE-LTF 중에서 사용된 HE-LTF 사이즈, 그리고 0.8us, 1.6us, 3.2us 중에서 데이터 필드에 사용된 CP(또는, GI) 값의 조합을 나타낸다.

[130] 코딩 필드는 BCC(Binary Convolutional Code) 및 LDPC(Low Density Parity Check) 중 어떤 코딩 기법이 사용되었는지를 지시할 수 있다. 또한, 상기 필드는 LDPC를 위한 추가적인 OFDM 심볼의 존재 여부를 지시할 수 있다. NSTS(Number of Space Time Streams) 필드는 MIMO 전송에 사용되는 공간-시간 스트림 개수를 지시한다. STBC(Space Time Block Coding) 필드는 공간-시간 블록 코딩이 사용되었는지 여부를 지시한다. TxBF(Transmit Beamforming) 필드는 해당 PPDU의 전송에 빔포밍이 적용되었는지 여부를 나타낸다. DCM(Dual Carrier Modulation) 필드는 데이터 필드에 듀얼 캐리어 모듈레이션이 적용되었는지 여부를 지시한다. 듀얼 캐리어 모듈레이션은 협대역 간섭에 대비하기 위해 2개의 서브캐리어에 동일한 정보를 전송한다. 패킷 확장 필드는

해당 PPDU에 어떤 레벨의 패킷 확장이 적용되었는지를 지시한다. 빔 교환 필드는 해당 PPDU의 HE-STF 이전의 부분이 HE-LTF와 공간적으로 다르게 매핑되는지 여부를 지시한다. CRC 필드 및 테일 필드는 각각 상기 HE-SIG-A 필드 정보의 진위성을 판별하고, BCC 디코더를 초기화 하는데 사용된다.

[131] 다음으로, 도 14(b)는 HE MU PPDU의 HE-SIG-A 필드의 서브필드 구성을 도시한다. 도 14(b)의 서브필드들 중 도 14(a)에서 설명된 서브필드와 동일한 서브필드에 대해서는 중복적인 설명을 생략하도록 한다.

[132] 상향/하향 필드는 해당 필드의 전송 방향을 지시한다. 즉, 상기 필드는 해당 PPDU가 상향으로 전송되는지 또는 하향으로 전송되는지를 지시한다. HE MU PPDU의 대역폭 필드는 HE SU PPDU의 대역폭에 더하여 추가적인 대역폭들을 지시할 수 있다. 즉, HE MU PPDU의 대역폭 필드는 3비트로 구성되며, 20MHz, 40MHz, 80MHz, 160MHz(80+80MHz 포함) 및 기 설정된 불연속 대역들 중 어느 하나를 지시한다. 기 설정된 불연속 대역들의 구체적인 실시예는 후술하도록 한다.

[133] SIG-B MCS 필드는 HE-SIG-B 필드에 적용된 MCS를 지시한다. HE-SIG-B는 시그널링이 필요한 정보량에 따라 MSC0부터 MSC5 사이의 가변 MCS가 적용될 수 있다. CP+LTF 사이즈 필드는 CP 또는 GI의 듀레이션과 HE-LTF의 사이즈를 지시한다. 상기 필드는 2x, 4x HE-LTF 중에서 사용된 HE-LTF 사이즈, 그리고 0.8us, 1.6us, 3.2us 중에서 데이터 필드에 사용된 CP(또는, GI) 값의 조합을 나타낸다.

[134] SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드 사용 여부를 지시한다. HE MU PPDU가 전체 대역폭(full bandwidth)에서 MU-MIMO를 이용하여 전송되는 경우, 각 20MHz 대역 별 리소스 유닛 할당 정보는 불필요하게 된다. 그러므로, 전체 대역폭 MU-MIMO 전송에서 SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시하고, 이때 리소스 유닛 할당 필드를 포함하는 공통 블록 필드는 HE-SIG-B 필드에 존재하지 않는다. SIG-B DCM 필드는 HE-SIG-B 필드의 안정적인 전송을 위해 해당 필드가 DCM으로 변조되었는지 여부를 지시한다. HE-SIG-B 심볼의 개수 필드는 HE-SIG-B 필드에서의 OFDM 심볼의 개수 정보를 지시한다.

[135] 한편, 후술하는 바와 같이 HE MU PPDU가 40MHz 이상의 대역으로 전송될 경우 HE-SIG-B는 20MHz 단위로 2가지 종류의 콘텐츠 채널로 구성될 수 있다. 이를 각각 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2라고 한다. 본 발명의 일 실시예에 따르면, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2에 적용되는 MCS를 서로 다르게 하여, 각 채널에서의 HE-SIG-B 심볼 수가 비슷하게 유지될 수 있다. HE MU PPDU의 HE-SIG-A 필드는 SIG-B 듀얼 MCS 필드를 포함할 수 있으며, 해당 필드를 통해 HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2에 적용된 MCS가 서로 다른지 여부가 지시된다.

[136] 본 발명의 실시예에 따르면, SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우(즉, 전체 대역폭 MU-MIMO 전송을 지시할 경우), HE-SIG-A의 특정

서브필드는 MU-MIMO 사용자의 개수 정보를 지시할 수 있다. 예를 들어, 전체 대역폭 MU-MIMO 전송이 수행될 경우, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2는 서로 다른 MCS를 통해 정보량을 분산할 필요가 없다. 따라서, SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, HE-SIG-A의 SIG-B 듀얼 MCS 필드는 MU-MIMO 사용자의 개수 정보를 지시할 수 있다. 마찬가지로, 전체 대역폭 MU-MIMO 전송이 수행될 경우, 각각의 HE-SIG-B 콘텐츠 채널의 심볼의 개수 정보가 개별적으로 전달될 필요가 없다. 따라서, SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, HE-SIG-A의 HE-SIG-B 심볼의 개수 필드는 MU-MIMO 사용자의 개수 정보를 지시할 수 있다. 이와 같이, HE-SIG-B의 리소스 유닛 할당 필드가 생략된 압축 모드에서, HE-SIG-A의 특정 서브필드를 통해 MU-MIMO 사용자의 개수 정보가 지시될 수 있다.

[137] 본 발명의 실시예에 따르면, HE MU PPDU는 DL-MU 전송에 사용될 수 있다. 그러나 다음과 같은 추가적인 상황들에서 HE MU PPDU는 하향 전송과 상향 전송 모두에서 사용될 수 있다.

[138] 일 실시예에 따르면, AP와 단일 STA간의 하향/상향 전송에서 OFDMA 기반의 전송을 위해 HE MU PPDU가 사용될 수 있다. 더욱 구체적으로, 전체 대역 중 일부 연속(contiguous) 또는 불연속(non-contiguous) 채널만을 이용하여 AP와 단일 STA 간의 전송이 수행될 수 있다. 예를 들어, STA가 AP에게 80MHz PPDU를 전송하기 위해 CCA를 수행한 결과 20MHz 부채널만 점유 상태인 경우, STA는 20MHz 주채널 및 40MHz 부채널을 통해 PPDU를 전송할 수 있다. 또한, 20MHz 내에서 일부 리소스 유닛 만을 이용한 협대역 전송이 AP와 단일 STA 간에 수행될 수도 있다. 이와 같이 불연속 채널을 이용한 전송 또는 협대역 전송이 수행되는 경우, 전송되는 PPDU에서는 HE-SIG-B 필드를 통해 추가적으로 리소스 유닛 할당 정보가 전달되어야 한다. 따라서, 단말은 HE MU PPDU를 사용하여 이와 같은 전송을 수행할 수 있다. 불연속 채널을 이용한 전송 및 협대역 전송의 구체적인 실시예들은 후술하도록 한다.

[139] 다른 실시예에 따르면, 공간적 재사용 동작의 고도화를 위해 HE-SIG-B 필드의 전송이 필요한 경우 HE MU PPDU가 사용될 수 있다. HE MU PPDU는 HE SU PPDU와 달리 HE-SIG-B의 사용자 필드를 통해 수신자의 AID를 지시할 수 있다. 그러나 본 발명의 일 실시예에 따르면, HE MU PPDU가 상향 전송에 사용될 경우 해당 PPDU의 수신자는 AP인 것이 자명하므로, HE-SIG-B의 사용자 필드는 송신자의 AID를 지시할 수 있다. 상기 HE MU PPDU를 수신한 주변 단말들은 공간적 재사용 동작을 수행할 수 있다.

[140] 예를 들어, 임의의 BSS1과 BSS2가 존재하고, BSS1의 STA1이 HE UL MU PPDU를 전송한다고 가정한다. 상기 PPDU를 오버히어링(overhearing)한 BSS2의 STA는 해당 PPDU의 수신자인 BSS1 AP와의 거리를 이전에 수신한 BSS1 AP의 DL PPDU를 통해 추정할 수 있다. 따라서, BSS2의 STA는 수신자인 BSS1의 AP에

대한 간섭을 고려하여 공간적 재사용 동작을 수행할 수 있다. 또한, BSS1의 AP가 BSS1의 STA1에게 전송하는 DL PPDU가 수신되는 경우에도, BSS2의 STA는 이전에 STA1의 HE UL MU PPDU로부터 측정된 신호 세기에 기초해서 해당 PPDU의 수신자인 BSS1의 STA1에 대한 간섭을 고려하여 공간적 재사용 동작을 수행할 수 있다. 공간적 재사용 동작에서, STA는 수신된 PPDU가 다른 BSS의(OBSS) PPDU이며, 해당 PPDU의 수신자에 대한 간섭이 기 설정된 레벨 미만이면 전송을 시도할 수 있다.

[141] 다음으로, 도 14(c)는 HE Trigger-based PPDU의 HE-SIG-A 필드의 서브필드 구성을 도시한다. 도 14(c)의 서브필드들 중 도 14(a) 또는 도 14(b)에서 설명된 서브필드와 동일한 서브필드에 대해서는 중복적인 설명을 생략하도록 한다.

[142] 포맷 필드는 HE SU PPDU와 HE Trigger-based PPDU를 구분하는데 사용된다. 또한, HE Trigger-based PPDU는 전술한 BSS 컬러 필드, TXOP 듀레이션 필드를 포함한다. HE Trigger-based PPDU의 공간적 재사용 필드는 16비트로 구성되며, 총 대역폭(total bandwidth)에 따라 20MHz 또는 40MHz 단위로 공간적 재사용 동작을 위한 정보를 전달한다. 대역폭 필드는 2비트로 구성되어 20MHz, 40MHz, 80MHz 및 160MHz(80+80MHz 포함) 중 어느 하나를 지시할 수 있다.

[143] 도 15는 본 발명의 일 실시예에 따른 HE-SIG-B 필드의 구성을 도시한다. HE-SIG-B 필드는 HE MU PPDU에 존재하며, 20MHz 단위로 전송된다. 또한, HE-SIG-B 필드는 HE MU PPDU를 수신하기 위해 필요한 정보를 지시한다. 도 15(a)에 도시된 바와 같이, HE-SIG-B는 공통 블록 필드와 사용자 특정 필드로 구성된다.

[144] 도 15(b)는 HE-SIG-B의 공통 블록 필드의 서브필드 구성의 일 실시예를 도시한다. 먼저, 공통 블록 필드는 리소스 유닛 할당(RA) 필드를 포함한다. 도 15(c)는 RA 필드의 일 실시예를 도시한다.

[145] 도 15(c)를 참조하면, RA 필드는 주파수 도메인에서 특정 대역폭(예를 들어, 20MHz)의 리소스 유닛 할당에 대한 정보를 포함한다. 더욱 구체적으로, RA 필드는 8비트 단위로 구성되며, 특정 대역폭을 구성하는 리소스 유닛들의 크기와 주파수 도메인에서의 그들의 배열을 인덱싱한다. 또한, RA 필드는 각 리소스 유닛에서의 사용자 수를 지시할 수 있다. PPDU가 전송되는 총 대역폭이 기 설정된 대역폭 (예를 들어, 40MHz) 보다 클 경우, RA 필드는 8비트의 배수의 크기로 설정되어 상기 특정 대역폭 단위로 정보를 전달할 수 있다.

[146] 분할된 각 리소스 유닛은 일반적으로 하나의 사용자에게 할당된다. 그러나 일정 대역폭(예를 들어, 106-톤) 이상의 리소스 유닛은 MU-MIMO를 이용하여 복수의 사용자에게 할당될 수 있다. 이때, RA 필드는 해당 리소스 유닛의 사용자 수 정보를 지시할 수 있다. 뿐만 아니라, RA 필드는 사용자 특정 필드가 전송되지 않는 특정 리소스 유닛 즉, 사용자에게 할당되지 않는 특정 리소스 유닛(즉, 빈 RU)을 기 설정된 인덱스를 통해 지시할 수 있다. 일 실시예에 따르면, 특정 리소스 유닛은 20MHz 채널의 배수의 대역폭을 갖는 리소스 유닛(RU) 즉, 242-톤

RU, 484-톤 RU, 996-톤 RU 등을 포함한다. 상기 인덱스 값이 지시하는 빈(empty) RU에서는 데이터 전송이 수행되지 않는다. 이와 같이, 단말은 HE-SIG-B의 RA 필드의 기 설정된 인덱스를 통해 20MHz 단위의 불연속 채널 할당 정보를 시그널링 할 수 있다.

[147] 본 발명의 실시예에 따르면, 80MHz 이상의 총 대역폭으로 PPDU가 전송될 경우, 공통 블록 필드는 80MHz에서의 중앙 26-톤 RU가 사용자에게 할당되었는지 여부를 나타내는 필드(이하, C26 필드)를 더 포함할 수 있다. 상기 C26 필드는 공통 블록 필드 내에서 RA 필드 이전 또는 이후에 위치하는 1비트 지시자로 구성될 수 있다.

[148] 한편, 사용자 특정 필드는 복수의 사용자 필드들로 구성되며, 할당된 각 리소스 유닛에 지정된 STA를 위한 정보를 전달한다. 사용자 특정 필드에 포함될 사용자 필드의 총 개수는 RA 필드 및 C26 필드에 기초하여 결정될 수 있다. 복수의 사용자 필드들은 사용자 블록 필드 단위로 전송된다. 사용자 블록 필드는 2개의 사용자 필드와 CRC 필드 및 테일 필드의 결합으로 만들어진다. 사용자 필드들의 총 개수에 따라 마지막 사용자 블록 필드는 1개 또는 2개의 STA를 위한 정보를 포함할 수 있다. 예를 들어, 총 3개의 사용자(즉, STA1, STA 및 STA3)가 지정된 경우, 첫 번째 사용자 블록 필드에서는 STA1 및 STA2를 위한 정보가 코딩 되어 CRC/테일 필드와 함께 전송되고, 마지막 사용자 블록 필드에서는 STA3를 위한 정보가 코딩 되어 CRC/테일 필드와 함께 전송 될 수 있다.

[149] 도 15(d)-1 및 도 15(d)-2는 각각 HE-SIG-B의 사용자 필드의 서브필드 구성의 실시예들을 도시한다. 도 15(d)-1은 OFDMA 전송을 위한 사용자 필드를 나타내며, 도 15(d)-2는 MU-MIMO 전송을 위한 사용자 필드를 나타낸다. 각각의 사용자 필드는 대응하는 리소스 유닛의 수신자 AID를 지시한다. 예외적으로, HE MU PPDU가 상향 전송에 사용될 경우, 사용자 필드는 송신자 AID를 지시할 수 있다. 하나의 리소스 유닛에 하나의 사용자가 할당된 경우(즉, non-MU-MIMO 할당), 사용자 필드는 도 15(d)-1에 도시된 바와 같이 NSTS(Number of Spatial Streams), TxBF, MCS, DCM 및 코딩 필드를 포함한다. 반면에, 하나의 리소스 유닛에 다수의 사용자가 할당된 경우(즉, MU-MIMO 할당), 사용자 필드는 도 15(d)-2에 도시된 바와 같이 공간 구성 필드(SCF), MCS, DCM 및 코딩 필드를 포함한다. MU-MIMO 할당을 통해 PPDU를 수신하는 각 STA는 해당 리소스 유닛에서 자신을 위한 공간적 스트림의 위치와 개수를 식별해야 한다. 이를 위해, MU-MIMO 전송을 위한 사용자 필드는 공간 구성 필드(SCF)를 포함한다.

[150] 도 15(e)는 HE-SIG-B의 SCF의 일 실시예를 도시한다. SCF는 각 STA를 위한 공간적 스트림 개수와 MU-MIMO 할당에서의 공간적 스트림 총 개수를 지시한다. 각 STA는 RA 필드를 통해 해당 PPDU의 OFDMA 및/또는 MIMO 할당을 식별하고, 사용자 특정 필드 상에서 호출된 순서에 따라 해당 STA가 MU-MIMO 할당을 통해 데이터를 수신하는지 여부를 식별한다. 만약 STA가 non-MU-MIMO 할당을 통해 데이터를 수신하는 경우, 사용자 필드를 도

15(d)-1의 포맷에 따라 해석한다. 그러나 STA가 MU-MIMO 할당을 통해 데이터를 수신하는 경우, 사용자 필드를 도 15(d)-2의 포맷에 따라 해석한다. 한편, SIG-B 압축 필드가 전체 대역폭 MU-MIMO를 지시할 경우, HE-SIG-B에는 RA 필드가 존재하지 않는다. 이때, 사용자 특정 필드에서 시그널링 되는 모든 STA들은 MU-MIMO 할당을 통해 데이터를 수신하므로, 상기 STA들은 사용자 필드를 도 15(d)-2의 포맷에 따라 해석한다.

[151] 도 16은 본 발명의 실시예에 따른 HE-SIG-B의 인코딩 구조 및 전송 방법을 도시한다. 도 16(a)는 HE-SIG-B의 인코딩 구조를 도시하며, 도 16(b)는 40MHz 대역폭 이상에서 HE-SIG-B의 전송 방법을 도시한다.

[152] 도 16(a)를 참조하면, HE-SIG-B는 공통 블록 필드와 사용자 특정 필드로 구성된다. 공통 블록 필드와 사용자 특정 필드의 세부적인 구성은 도 15의 실시예에서 설명된 바와 같다. 사용자 특정 필드의 각 사용자 필드는 공통 블록 필드의 RA 필드가 지시하는 리소스 유닛 배열에서 할당된 사용자 순서대로 나열된다.

[153] 사용자 특정 필드는 복수의 사용자 필드들로 구성되며, 복수의 사용자 필드들은 사용자 블록 필드 단위로 전송된다. 전술한 바와 같이, 사용자 블록 필드는 2개의 사용자 필드와 CRC 필드 및 테일 필드의 결합으로 만들어진다. 사용자 필드들의 총 개수가 홀수인 경우, 마지막 사용자 블록 필드는 1개의 사용자 필드를 포함할 수 있다. HE-SIG-B의 마지막에는 OFDM 심볼 경계에 따라 패딩이 추가될 수 있다.

[154] 도 16(b)를 참조하면, HE-SIG-B는 각 20MHz 대역에서 별도로 인코딩된다. 이때, HE-SIG-B는 20MHz 단위로 최대 2개의 콘텐츠 즉, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2로 구성될 수 있다. 도 16(b)에서 각각의 박스는 20MHz 대역을 나타내며, 박스 안의 “1” 및 “2”는 각각 HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2를 나타낸다. 총 대역에서 각각의 HE-SIG-B 콘텐츠 채널은 물리적 주파수 대역의 순서에 따라 배열된다. 즉, 가장 낮은 주파수 대역에서는 HE-SIG-B 콘텐츠 채널 1이 전송되고, 그 다음 높은 주파수 대역에서는 HE-SIG-B 콘텐츠 채널 2가 전송된다. 이와 같은 콘텐츠 채널 구성은 그 다음으로 높은 주파수 대역들에서 콘텐츠 복제를 통해 반복된다. 예를 들어, 전체 80MHz 대역을 구성하는 주파수 오름 차순의 제1 채널 내지 제4 채널에 대해서, 제1 채널 및 제3 채널에서는 HE-SIG-B 콘텐츠 채널 1이 전송되고, 제2 채널 및 제4 채널에서는 HE-SIG-B 콘텐츠 채널 2가 전송된다. 마찬가지로, 전체 160MHz 대역을 구성하는 주파수 오름 차순의 제1 채널 내지 제8 채널에 대해서, 제1 채널, 제3 채널, 제5 채널 및 제7 채널에서는 HE-SIG-B 콘텐츠 채널 1이 전송되고, 제2 채널, 제4 채널, 제6 채널 및 제8 채널에서는 HE-SIG-B 콘텐츠 채널 2가 전송된다. 단말은 적어도 하나의 채널을 통해 HE-SIG-B 콘텐츠 채널 1을 디코딩하고, 다른 적어도 하나의 채널을 통해 HE-SIG-B 콘텐츠 채널 2를 디코딩할 수 있으면, 총 대역폭의 MU PPDU 구성에 대한 정보를 획득할 수 있다.

한편, 총 대역폭이 20MHz인 경우에는 하나의 SIG-B 콘텐츠 채널만 전송된다.

[155] 도 17은 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우의 HE-SIG-B의 서브필드 구성을 도시한다. 전술한 바와 같이, SIG-B 압축 필드가 압축 모드(즉, 전체 대역폭 MU-MIMO)를 지시할 경우, HE-SIG-B에는 RA 필드가 존재하지 않는다. 따라서, 20MHz보다 큰 대역폭을 통해 MU-MIMO 전송이 수행될 경우, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2에 각각 지정되는 사용자 개수가 별도로 결정되어야 한다. 본 발명의 실시예에 따르면, 20MHz보다 큰 대역폭을 통해 MU-MIMO 전송이 수행될 경우, 사용자 필드들은 로드 밸런싱을 위해 2개의 콘텐츠 채널간에 공평하게 분배될 수 있다. 즉, 각각의 SIG-B 콘텐츠 채널에서 전송되는 사용자 필드의 개수는 전체 유저 개수의 절반의 올림값 또는 내림값으로 결정된다. 예를 들어, 사용자 필드의 전체 개수가 k인 경우, 1~ceil(k/2)번째 사용자 필드들은 HE-SIG-B 콘텐츠 채널 1을 통해 전송되고, ceil(k/2)+1~k번째 사용자 필드들은 HE-SIG-B 콘텐츠 채널 2를 통해 전송될 수 있다. 만약 k가 홀수인 경우, HE-SIG-B 콘텐츠 채널 1에 포함된 사용자 필드들의 개수는 HE-SIG-B 콘텐츠 채널 2에 포함된 사용자 필드들의 개수보다 1개 많게 될 수 있다.

[156] 이하 도 18 내지 도 20을 참조로, 본 발명의 실시예에 따른 채널 확장 방법들을 설명한다. 도 18 내지 도 20의 실시예에서, CH1 내지 CH4는 80MHz PPDU가 전송되는 각각의 20MHz 채널을 가리킨다. 또한, CH1 내지 CH8은 160MHz PPDU 또는 80+80MHz PPDU가 전송되는 각각의 20MHz 채널을 가리킨다. 이때, CH3는 20MHz 주채널(Primary 20MHz channel, 이하 P20 채널)로, CH4는 20MHz 부채널(Secondary 20MHz channel, 이하 S20 채널)로, CH1 및 CH2는 40MHz 부채널(Secondary 40MHz channel, 이하 S40 채널)로 각각 지정된다. 또한, CH5 내지 CH8은 80MHz 부채널(Secondary 80MHz channel, 이하 S80 채널)로 지정된다.

[157] 먼저, 도 18은 본 발명의 일 실시예에 따른 광대역 접근 방법을 도시한다. 이전 PPDU의 전송이 종료된 후, 전송할 데이터가 있는 단말은 P20 채널에서 백오프 절차를 수행한다. 상기 백오프 절차는 P20 채널이 AIFS 시간 동안 유휴 상태인 경우 시작될 수 있다. 단말은 백오프 절차를 위해 경쟁 윈도우(CW) 범위 내에서 백오프 카운터를 획득한다. 단말은 CCA를 수행하여 채널이 유휴 상태이면 백오프 카운터를 1씩 줄여 나간다. 만약 채널이 점유 상태이면 단말은 백오프 절차를 중단하고, 채널이 다시 유휴 상태일 때 AIFS 시간 후에 백오프 절차를 재개한다. 상기 백오프 절차를 통해 백오프 카운터가 만료되면, 단말은 데이터를 전송할 수 있다. 이때, 단말은 백오프 카운터가 만료되기 전 PIFS 시간 동안 데이터를 전송하기 위한 부채널들에 대한 CCA를 수행한다. 도 18의 실시예에서는 단말이 80MHz PPDU를 전송하려 하고, 상기 CCA 절차에서 일부 부채널 즉, S20 채널이 점유 상태로 감지된 상황을 도시한다.

[158] CCA가 수행된 부채널들 중 적어도 일부가 점유 상태일 경우, 단말의 PPDU

전송 대역은 광대역 접근 방법에 기초하여 결정된다. 먼저, 도 18(a)는 동적 대역폭 동작에 따른 광대역 접근 방법을 도시한다. 동적 대역폭 동작에 따르면, S20 채널이 점유 상태이므로 단말은 종래의 채널 확장 규칙에 따라 일부 대역폭 즉, P20 채널만을 이용하여 데이터를 전송한다. 한편, 도 18(b)는 정적 대역폭 동작에 따른 광대역 접근 방법을 도시한다. 정적 대역폭 동작에 따르면, 전송을 위한 일부 채널이 점유 상태이므로 전체 대역폭에서의 데이터 전송이 연기된다. 단말은 새로운 백오프 카운터를 이용하여 백오프 절차를 다시 수행하며, 백오프 카운터 만료 전의 CCA에서 전송을 위한 모든 채널들이 유휴 상태인 경우 전체 대역폭을 이용하여 데이터를 전송한다. 이와 같이, 도 18의 실시예에 따른 광대역 접근 방법의 경우 일부 부채널의 상태에 따라 전송 PPDU의 대역폭이 크게 감소하거나, PPDU 전송이 지연되는 문제가 발생할 수 있다.

[159] 도 19는 본 발명의 다른 실시예에 따른 광대역 접근 방법을 도시한다. 도 19(a) 내지 도 19(e)는 각각 서로 다른 채널 확장 기법에 기초하여 광대역 PPDU가 전송되는 상황을 도시한다. 도 19의 각각의 실시예에서, 고정식(fixed) 채널 확장 방법은 20MHz, 40MHz, 80MHz, 160MHz의 순서와 같이 종래의 확장 규칙에 따른 기 설정된 단위의 채널 확장 방법을 의미한다. 또한, 유연한(flexible) 채널 확장 방법은 20MHz, 40MHz, 60MHz, 80MHz, 100MHz, 120MHz, 140MHz, 160MHz의 순서와 같이 20MHz 단위의 채널 확장 방법을 의미한다. 이에 더하여, 연속한(contiguous) 채널 확장 방법은 전송되는 PPDU가 점유하는 대역이 항상 연속한 채널들로 구성되는 채널 확장 방법을 의미한다. 또한, 불연속(non-contiguous) 채널 확장 방법은 전송되는 PPDU가 점유하는 대역이 적어도 하나의 불연속 채널을 포함하여 구성되는 채널 확장 방법을 의미한다. 각 도면의 실시예에서 부채널들의 CCA는 도 18의 실시예에서 전술한 바와 같이 주채널의 백오프 카운터가 만료되기 전 PIFS 시간 동안 수행될 수 있다.

[160] 먼저, 도 19(a)는 연속한, 고정식 채널 확장 방법에 따라 광대역 PPDU가 전송되는 실시예를 도시한다. 본 방법에 따르면, CCA는 P20 채널, S20 채널, S40 채널 및 S80 채널 각각에 대한 최대 4개의 CCA 결과값들을 획득하며, 이들 중 점유 상태로 판별된 첫 번째 채널에 대한 정보만을 리포트 한다. 단말은 점유 상태로 판별된 첫 번째 채널부터 그 이후로는 대역폭 확장을 수행하지 않기 때문에, 이후의 채널들에 대한 CCA 결과값이 필요하지 않다. 도 19(a)를 참조하면, CCA 결과 점유 상태로 판별된 첫 번째 채널인 S40 채널이 리포트 된다. 따라서, 단말은 P20 채널과 S20 채널이 결합된 40MHz 대역으로 PPDU를 전송한다. 본 방법에 따르면, CCA 결과값 리포트의 부담이 줄어들지만 채널 활용성이 떨어지는 단점이 있다.

[161] 다음으로, 도 19(b)는 연속한, 유연한 채널 확장 방법에 따라 광대역 PPDU가 전송되는 실시예를 도시한다. 본 방법에 따르면, CCA는 160MHz 대역을 구성하는 각 채널에 대한 8개의 CCA 결과값들을 획득한다. 일 실시예에 따르면, 상기 획득된 8개의 CCA 결과값이 모두 리포트 될 수 있다. 그러나, 다른

실시예에 따르면 P20 채널을 중심으로 하여 점유 상태로 판별된 양쪽 첫 번째 채널들에 대한 정보만 리포트 될 수 있다. 단말은 점유 상태로 판별된 양쪽 첫 번째 채널들부터 그 이후로는 대역폭 확장을 수행하지 않기 때문에 이후의 채널들에 대한 CCA 결과값이 필요하지 않을 수 있다. 도 19(b)를 참조하면 CCA 결과 점유 상태로 판별된 CH1 및 CH5(미도시)가 리포트 된다. 따라서, 단말은 CH2, CH3 및 CH4을 포함하는 60MHz 대역으로 PPDU를 전송한다. 본 방법에 따르면, 연속한 채널들로 구성된 더 넓은 대역폭의 PPDU를 전송할 수 있지만, OBSS 단말들이 점유하는 부채널의 위치에 따라 광대역 PPDU의 전송 대역폭이 매우 제한될 수 있는 단점이 있다.

[162] 다음으로, 도 19(c)는 불연속, 고정식 채널 확장 방법에 따라 광대역 PPDU가 전송되는 실시예를 도시한다. 본 방법에 따르면, CCA는 P20 채널, S20 채널, S40 채널 및 S80 채널 각각에 대한 최대 4개의 CCA 결과값들을 획득하며, 이들 중 점유 상태로 판별된 모든 채널들에 대한 정보를 리포트 한다. 단말은 리포트 된 채널들 중 점유 상태가 아닌 채널들을 이용하여 PPDU를 전송한다. 도 19(c)를 참조하면, CCA 결과 점유 상태로 판별된 채널들인 S20 채널 및 S80 채널(미도시)이 리포트 된다. 따라서, 단말은 P20 채널과 S40 채널을 포함하는 60MHz 대역으로 PPDU를 전송한다. 본 방법에 따르면, 비교적 적은 CCA 결과값 리포트 부담에 비해 채널 활용성을 높일 수 있다. 즉, 160MHz 대역폭 내에서도 최대 1개의 불연속 구간만 발생하며, S20 채널 및/또는 S40 채널이 OBSS 단말들에 의해 점유된 상태에서도 광대역 PPDU의 전송이 가능하다.

[163] 다음으로, 도 19(d)는 불연속, 유연한 채널 확장 방법에 따라 광대역 PPDU가 전송되는 실시예를 도시한다. 본 방법에 따르면, CCA는 160MHz 대역을 구성하는 각 채널에 대한 8개의 CCA 결과값들을 획득하고, 획득된 8개의 CCA 결과값을 모두 리포트 한다. 단말은 리포트 된 채널들 중 점유 상태가 아닌 채널들을 이용하여 PPDU를 전송한다. 도 19(d)를 참조하면, CCA 결과 점유 상태로 판별된 채널들인 CH2, CH4 및 CH5(미도시) 내지 CH8(미도시)이 리포트 된다. 따라서, 단말은 CH1과 CH3을 포함하는 40MHz 대역으로 PPDU를 전송한다. 본 방법에 따르면, 채널 활용성은 가장 높지만 CCA 결과값 리포트 부담이 큰 단점이 있다. 또한, 전송되는 PPDU 내에서 복수의 불연속 구간이 발생할 수 있다.

[164] 마지막으로, 도 19(e)는 불연속, 제한된 유연한 채널 확장 방법에 따라 광대역 PPDU가 전송되는 실시예를 도시한다. 본 발명의 실시예에서 유연한 채널 확장 방법은 전술한 유연한 채널 확장 방법을 따르되, 전송되는 PPDU가 점유하는 대역이 P20 채널을 포함하는 기 설정된 중심 채널들(core channels)을 항상 포함하여 구성되는 채널 확장 방법을 의미한다. 도 19(e)의 실시예에서는 P20 채널 및 S20 채널을 포함하는 40MHz 채널(즉, P40 채널)이 중심 채널들로 설정되어 있다. 본 방법에 따르면, CCA는 160MHz 대역을 구성하는 각 채널에 대한 8개의 CCA 결과값들을 획득하고, 획득된 8개의 CCA 결과값을 모두 리포트

한다. 단말은 리포트 된 채널들 중 점유 상태가 아닌 채널들을 이용하여 PPDU를 전송한다. 이때, 단말은 전술한 중심 채널들을 포함하는 대역으로 PPDU 구성이 가능할 때에만 PPDU 전송을 수행한다. 본 방법에 따르면, 도 19(d)의 실시예와 유사한 성능을 발휘하며, P40 채널이 중심 채널들로 설정된 경우 HE-SIG-B의 디코딩 위치가 P40 채널에서 보장될 수 있는 장점이 있다.

[165] 도 20은 전술한 도 19(c)의 불연속, 고정식 채널 확장 방법에 따라 광대역 PPDU를 전송하는 구체적인 실시예들을 전송한다. 도 20(a) 및 도 20(b)는 단말이 1개의 RF 모듈을 구비하고, 최대 160MHz의 PPDU 전송을 지원하는 실시예를 도시한다. 또한, 도 20(c) 및 도 20(d)는 단말이 2개의 RF 모듈들을 구비하고, 최대 80+80MHz의 PPDU 전송을 지원하는 실시예를 도시한다. 도 20의 실시예에서 전송되는 PPDU는 OFDMA 기반의 HE MU PPDU라고 가정한다.

[166] 먼저, 도 20(a)는 단말이 160MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S40 채널이 점유 상태인 상황을 도시한다. 단말은 P40 채널(P20 채널 + S20 채널) 및 S80 채널을 포함하는 140MHz 대역으로 PPDU를 전송한다. 이때, 단말은 OFDMA 기반으로 구성된 PPDU 중 S40 채널에 할당된 데이터의 전송을 보류한다. S40 채널은 데이터가 전송되지 않는 필터링된 채널이 된다. 도 20(a)의 실시예에서는 160MHz 스펙트럴 마스크를 이용하여 PPDU가 전송되며, 점유 상태로 판별된 S40 채널에서는 필터링이 수행되어 데이터가 전송되지 않는다. 그러나 P40 채널을 통해 전송되는 신호에는 40MHz 스펙트럴 마스크가 적용되지 않으므로, S40 채널과의 경계에 연속한 일부 리소스 유닛의 신호들은 S40 채널을 통해 전송되는 OBSS 신호에 간섭을 줄 수 있다. 따라서, 본 발명의 실시예에 따르면 불연속 PPDU 전송 상황에서 비할당 채널에 인접한 전송 채널의 일부 리소스 유닛에서는 추가적으로 필터링이 수행되어 데이터가 전송되지 않을 수 있다.

[167] 다음으로, 도 20(b)는 단말이 80MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S20 채널이 점유 상태인 상황을 도시한다. 단말은 P20 채널 및 S40 채널을 포함하는 60MHz 대역으로 PPDU를 전송한다. 이때, 단말은 OFDMA 기반으로 구성된 PPDU 중 S20 채널에 할당된 데이터의 전송을 보류한다. S20 채널은 데이터가 전송되지 않는 필터링된 채널이 된다. 도 20(b)의 실시예에서는 80MHz 스펙트럴 마스크를 이용하여 PPDU가 전송되며, 점유 상태로 판별된 S20 채널에서는 필터링이 수행되어 데이터가 전송되지 않는다. 그러나 P20 채널을 통해 전송되는 신호에는 20MHz 스펙트럴 마스크가 적용되지 않으므로, S20 채널과의 경계에 연속한 일부 리소스 유닛의 신호들은 S20 채널을 통해 전송되는 OBSS 신호에 간섭을 줄 수 있다. 따라서, 본 발명의 실시예에 따르면 불연속 PPDU 전송 상황에서 비할당 채널에 인접한 전송 채널의 일부 리소스 유닛에서는 추가적으로 필터링이 수행되어 데이터가 전송되지 않을 수 있다.

[168] 다음으로, 도 20(c)는 단말이 80+80MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S40 채널이 점유 상태인 상황을 도시한다. 단말은 2개의 RF

모듈을 이용하여 P40 채널(P20 채널 + S20 채널) 및 S80 채널로 각각 PPDU를 전송한다. 이때, 단말은 OFDMA 기반으로 구성된 PPDU 중 S40 채널에 할당된 데이터의 전송을 보류한다. 단말은 제1 RF 모듈을 이용하여 40MHz 스펙트럴 마스크가 적용된 PPDU를 P40 채널을 통해 전송하고, 제2 RF 모듈을 이용하여 80MHz 스펙트럴 마스크가 적용된 PPDU를 S80 채널을 통해 전송한다. 따라서, 도 20(c)의 실시예에서는 비할당 채널인 S40 채널에 간섭을 주지 않으므로 전송 채널에 포함된 리소스 유닛의 추가적인 필터링이 필요하지 않다.

[169] 다음으로, 도 20(d)는 단말이 80+80MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S20 채널 및 S80 채널이 점유 상태인 상황을 도시한다. 단말은 제1 RF 모듈만을 이용하여 P20 채널 및 S40 채널을 포함하는 60MHz 대역으로 PPDU를 전송한다. 이때, 제2 RF 모듈은 구동될 필요가 없으며, 제1 RF 모듈에서의 동작은 도 20(b)의 실시예에서 설명된 바와 같다.

[170] 도 20의 실시예에 따른 PPDU 전송 방법은 도 18(a)에서 설명된 동적 대역폭 동작에 따른 광대역 접근 방법에 비해 구현이 용이할 수 있다. 동적 대역폭 동작에 따르면, 광대역 PPDU의 전송 전에 CCA 결과에 따라 가용한 대역폭에 맞추어 PPDU가 재구성되어야 한다. 이때, 동적으로 PPDU가 재구성되므로, 할당된 TXOP 길이에 맞게 PPDU 길이를 제한해야 하는 등 구현 복잡도가 높게 된다. 그러나 도 20의 실시예에 따르면, 단말은 OFDMA 기반의 PPDU를 미리 구성한 뒤 유휴 상태의 채널들에 할당된 데이터만 전송하고, 점유 상태의 나머지 채널들에 할당된 데이터는 필터링 하기 때문에 구현이 상대적으로 용이하다.

[171] 이하 도 21 내지 도 23을 참조로, 본 발명의 실시예에 따른 불연속 PPDU의 전송 시퀀스를 설명한다. 도 21 내지 도 23의 실시예에서, CH1 내지 CH4는 80MHz 대역폭을 구성하는 각각의 20MHz 채널을 가리킨다. 또한, 도 21 및 도 22의 실시예에서 CH3는 P20 채널로, CH4는 S20 채널로, CH1 및 CH2는 S40 채널로 각각 지정된다. 도 21 내지 도 23의 실시예에서, 전술한 도 8 및 도 9의 실시예와 동일하거나 상응하는 부분은 중복적인 설명을 생략하도록 한다.

[172] 도 21은 본 발명의 일 실시예에 따른 불연속 PPDU의 전송 시퀀스를 도시한다. 도 21(a) 및 도 21(b)는 불연속 PPDU의 하향 전송 시퀀스를 도시하며, 도 21(c) 및 도 21(d)는 불연속 PPDU의 상향 전송 시퀀스를 도시한다.

[173] 먼저, 도 21(a)는 AP가 DL-MU 전송 과정을 위해 CCA를 수행하지만 S20 채널이 점유 상태인 실시예를 도시한다. AP는 유휴 상태인 P20 채널 및 S40 채널을 통해 MU-RTS 프레임을 전송한다. AP로부터 MU-RTS 프레임을 수신한 STA들은 해당 채널을 통해 sCTS 프레임을 전송한다. AP는 sCTS 프레임이 수신된 채널을 통해 DL MU PPDU를 전송한다. 이때, MU-RTS 프레임은 불연속 채널 할당 정보 즉, P20 채널 및 S40 채널(또는, 비할당 S20 채널)을 지시해 주어야 한다. 일 실시예에 따르면, MU-RTS 프레임은 별도의 대역폭 필드, RA 필드, 또는 이들의 조합을 통해 상기 불연속 채널 할당 정보를 시그널링 할 수 있다.

[174] 다음으로, 도 21(b)는 AP가 유휴 상태의 P80 채널(즉, P20 채널 + S20 채널 + S40 채널)로 MU-RTS 프레임을 전송하지만, 이후 STA들의 sCTS 프레임이 S20 채널에서 수신되지 않는 실시예를 도시한다. AP는 sCTS 프레임이 수신된 P20 채널 및 S40 채널을 통해 DL MU PPDU를 전송한다. 이때, MU-RTS 프레임은 채널 할당 정보 즉, P80 채널을 지시해 주어야 한다. 상기 채널 할당 정보는 별도의 대역폭 필드를 통해 시그널링 될 수 있다. 또한, DL MU PPDU는 해당 PPDU가 전송되는 불연속 채널 할당 정보 즉, P20 채널 및 S40 채널(또는, 비할당 S20 채널)을 지시해 주어야 한다. 상기 불연속 채널 할당 정보는 대역폭 필드, RA 필드, 또는 이들의 조합을 통해 시그널링 될 수 있다.

[175] 다음으로, 도 21(c)는 AP가 UL-MU 전송 과정을 위해 CCA를 수행하지만 S20 채널이 점유 상태인 실시예를 도시한다. AP는 유휴 상태인 P20 채널 및 S40 채널을 통해 트리거 프레임을 전송한다. AP로부터 트리거 프레임을 수신한 STA들은 지정된 채널을 통해 UL MU PPDU를 전송한다. 이때, 트리거 프레임은 STA들의 UL MU PPDU 전송을 위해 불연속 채널 할당 정보 즉, P20 채널 및 S40 채널(또는, 비할당 S20 채널)을 지시해 주어야 한다. 또한, 트리거 프레임은 점유 상태의 S20 채널을 STA들의 상향 전송에 할당하지 않아야 한다. 일 실시예에 따르면, 트리거 프레임은 별도의 대역폭 필드, RA 필드, 또는 이들의 조합을 통해 상기 불연속 채널 할당 정보를 시그널링 할 수 있다.

[176] 마지막으로, 도 21(d)는 AP가 유휴 상태의 P80 채널로 트리거 프레임을 전송하고 STA들이 이에 대응하여 UL MU PPDU를 전송하는 시퀀스를 도시한다. 이때, 트리거 프레임을 수신한 STA들 중 S20 채널을 할당 받은 STA들은 해당 채널이 점유 상태로 감지되거나 NAV가 설정되어 있는 등의 이유로 전송을 수행하지 않는다.

[177] 도 22는 본 발명의 다른 실시예에 따른 불연속 PPDU의 전송 시퀀스를 도시한다. 도 22(a) 및 도 22(b)는 불연속 PPDU의 하향 전송 시퀀스를 도시하며, 도 22(c) 및 도 22(d)는 불연속 PPDU의 상향 전송 시퀀스를 도시한다. 도 22 및 이하의 실시예들에서 S40A 채널은 S40 채널을 구성하는 첫 번째 20MHz 채널(즉, CH1)을 가리키며, S40B 채널은 S40 채널을 구성하는 두 번째 20MHz 채널(즉, CH2)을 가리킨다.

[178] 먼저, 도 22(a)는 AP가 DL-MU 전송 과정을 위해 CCA를 수행하지만 S40B 채널이 점유 상태인 실시예를 도시한다. AP는 유휴 상태인 P40 채널 및 S40A 채널을 통해 MU-RTS 프레임을 전송한다. AP로부터 MU-RTS 프레임을 수신한 STA들은 해당 채널을 통해 sCTS 프레임을 전송한다. 이때, MU-RTS 프레임은 불연속 채널 할당 정보 즉, P40 채널 및 S40A 채널(또는, 비할당 S40B 채널)을 지시해 주어야 한다. 일 실시예에 따르면, MU-RTS 프레임은 별도의 대역폭 필드, RA 필드, 또는 이들의 조합을 통해 상기 불연속 채널 할당 정보를 시그널링 할 수 있다. 한편, 도 22(a)의 실시예에서 MU-RTS를 수신한 STA들 중 S40A 채널을 통해 sCTS 프레임을 전송하도록 지시 받은 STA들은 해당 채널이 점유

상태로 감지되거나 NAV가 설정되어 있는 등의 이유로 sCTS의 전송을 수행하지 않는다. 이때, AP는 sCTS가 수신된 P20 채널 및 S20 채널을 통해서만 DL MU PPDU를 전송한다.

[179] 다음으로, 도 22(b)는 AP가 유휴 상태의 P80 채널로 MU-RTS 프레임을 전송하지만, 이후 STA들의 sCTS 프레임이 S40A 채널에서 수신되지 않는 실시예를 도시한다. AP는 sCTS 프레임이 수신된 P40 채널 및 S40B 채널을 통해 DL MU PPDU를 전송한다. 이때, MU-RTS 프레임은 채널 할당 정보로 P80 채널을 지시해 주어야 하며, DL MU PPDU는 불연속 채널 할당 정보 즉, P40 채널 및 S40B 채널(또는, 비할당 S40A 채널)을 지시해 주어야 한다. 상기 채널 할당 정보의 시그널링 방법은 도 21(b)의 실시예에서 전술한 바와 같다.

[180] 다음으로, 도 22(c)는 AP가 UL-MU 전송 과정을 위해 CCA를 수행하지만 S40B 채널이 점유 상태인 실시예를 도시한다. AP는 유휴 상태인 P40 채널 및 S40A 채널을 통해 트리거 프레임을 전송한다. 이때, 트리거 프레임은 STA들의 UL MU PPDU 전송을 위해 불연속 채널 할당 정보 즉, P40 채널 및 S40A 채널(또는, 비할당 S40B 채널)을 지시해 준다. 트리거 프레임은 별도의 대역폭 필드, RA 필드, 또는 이들의 조합을 통해 상기 불연속 채널 할당 정보를 시그널링 할 수 있다. 한편, 도 22(c)의 실시예에서 트리거 프레임을 수신한 STA들 중 S20 채널을 통해 상향 데이터를 전송하도록 지시 받은 STA들은 해당 채널이 점유 상태로 감지되거나 NAV가 설정되어 있는 등의 이유로 상향 데이터의 전송을 수행하지 않는다. 이와 같이, AP는 트리거 프레임이 전송된 대역과 같거나 좁은 대역을 통해 UL MU PPDU를 수신할 수 있다.

[181] 마지막으로, 도 22(d)는 AP가 유휴 상태의 P80 채널로 트리거 프레임을 전송하지만, S20 채널을 할당 받은 STA들은 해당 채널이 점유 상태로 감지되거나 NAV가 설정되어 있는 등의 이유로 전송을 수행하지 않는 실시예를 도시한다.

[182] 도 23는 PPDU 전송 시퀀스에서의 ACK 프레임 전송 방법의 일 실시예를 도시한다. 도 23의 실시예에서 CH1은 P20 채널로, CH2는 S20 채널로, CH3 및 CH4는 S40 채널로 각각 지정된다.

[183] 먼저, 도 23(a)는 연속 PPDU의 전송 시퀀스에서의 ACK 프레임 전송 방법의 일 실시예를 도시한다. AP는 80MHz의 연속 대역폭을 이용하여 DL MU PPDU를 전송하고, 이를 수신한 STA들은 UL MU 응답을 전송한다. 이때, STA들은 수신된 DL MU PPDU의 A-MPDU에 포함된 스케쥴링 정보에 따라서 즉각적인 상향 응답을 전송한다. 상기 스케쥴링 정보는 A-MPDU에 포함된 트리거 프레임, 또는 A-MPDU를 구성하는 특정 MPDU의 MAC 헤더에 포함된 UL MU 응답 스케쥴링 필드로부터 획득된다. 또한, STA들이 전송하는 상향 응답은 상향 ACK, 상향 데이터 등을 포함한다. 본 발명의 실시예에 따르면, 상기 스케쥴링 정보 즉, STA들이 UL MU 응답을 수행할 리소스 유닛은 별도의 리소스 유닛 할당(RA) 필드를 통해 지시될 수 있다. 도 23(d)는 상향 전송을 위한 리소스

유닛을 별도의 RA 필드를 통해 할당하는 일 실시예를 도시하고 있다.

[184] 도 23(d)를 참조하면, RA 필드는 총 8비트로 구성되며 첫 번째 비트는 해당 리소스 유닛이 주(primary) 80MHz에 위치하는지 또는 부(secondary) 80MHz에 위치하는지를 지시한다. RA 필드의 나머지 7비트는 해당 80MHz 대역 내에서의 리소스 유닛 할당을 지시한다. 즉, RA 필드의 인덱스 값에 따라 기 설정된 리소스 유닛 크기 및 해당 리소스 유닛의 위치가 지시된다. 도 23(a)의 실시예에서, STA들은 DL MU PPDU가 전송된 80MHz 대역 내에서 지정된 리소스 유닛을 통해 상향 ACK을 전송할 수 있다.

[185] 그러나 도 23(b)의 실시예와 같이, 불연속 PPDU의 전송 시퀀스에서는 ACK 프레임 전송을 위한 리소스 유닛 할당에 문제가 발생할 수 있다. 더욱 구체적으로, 도 23(b)에 도시된 바와 같이 불연속 PPDU에 대한 ACK 프레임이 전송되는 리소스 유닛에 별다른 제약이 없을 경우, DL MU PPDU 전송에 사용되지 않은 채널(즉, CH3)을 통해 상향 ACK이 전송될 수 있다. 이로 인해, CH3을 통해 전송되는 OBSS 신호와 간섭이 발생할 수 있다. 도 21 및 도 22의 실시예에서 전술한 바와 같이, 불연속 PPDU의 전송은 다중 채널에 대한 CCA 결과에 따라 PPDU 전송 직전에 결정될 수 있다. 따라서, STA들의 UL MU 응답이 수행될 리소스 유닛에 대한 스케쥴링 정보를 불연속 PPDU의 전송 직전에 조정하는 것은 불가능할 수 있다.

[186] 이와 같은 문제를 해결하기 위해, 도 23(c)에 도시된 바와 같이 ACK 프레임 전송을 위한 리소스 유닛 할당에 제약이 적용될 수 있다. 본 발명의 실시예에 따르면, AP로부터 DL MU PPDU를 수신한 STA들은 해당 PPDU가 수신된 리소스 유닛이 위치한 20MHz 채널 내에서 상향 ACK을 전송한다. 만약 STA가 40MHz 채널 또는 80MHz 채널에서 MU-MIMO로 DL MU PPDU를 수신하는 경우, STA는 해당 40MHz 채널 또는 80MHz 채널 내에서 상향 ACK을 전송할 수 있다. AP는 이와 같은 STA들의 ACK 프레임 전송에 대한 스케쥴링 정보를 시그널링한다.

[187] 도 23(c)를 참조하면, AP는 P40 채널 및 S40B 채널을 통해 DL MU PPDU를 전송한다. 이때, S40B 채널(즉, 20MHz 채널)을 통해 PPDU를 수신한 STA들은 S40B 채널 내에서 ACK 프레임을 전송한다. 만약 P40 채널(즉, 40MHz 채널)에서 전체 대역폭 MU-MIMO 전송이 수행된 경우, STA들은 P40 채널 내에서 ACK 프레임을 전송할 수 있다. 그러나 P40 채널에서 OFDMA 전송이 수행된 경우, STA들은 PPDU가 수신된 리소스 유닛이 위치한 20MHz 채널 내에서 ACK 프레임을 전송한다.

[188] 한편, 도 23을 참조로 DL-MU 전송 과정에서의 ACK 프레임 전송 방법의 실시예가 설명되었지만, 본 발명은 이에 한정되지 않으며 UL-MU 전송 과정에도 동일하게 적용될 수 있다. 즉, AP의 트리거 프레임에 대응하여, STA들은 할당된 리소스 유닛을 통해 HE Trigger-based PPDU를 전송할 수 있다. AP는 STA들이 전송한 HE Trigger-based PPDU에 대한 응답으로 하향 ACK을 전송한다. 이때, AP는 각 STA가 HE Trigger-based PPDU를 전송한 리소스 유닛이 위치하는

20MHz 채널 내에서 해당 STA에 대한 ACK 프레임을 전송한다. 따라서, HE Trigger-based PPDU를 전송한 STA는 해당 PPDU가 전송된 리소스 유닛이 위치하는 20MHz 채널 내에서 ACK 프레임을 수신할 수 있다.

[189] 도 24는 본 발명의 추가적인 실시예로서, MU 전송 과정의 TXOP을 설정하는 방법을 도시한다. 본 발명의 실시예에 따르면, HE-SIG-A의 TXOP 정보와 MAC 헤더의 듀레이션 필드 정보를 함께 이용하여 TXOP이 설정될 수 있다.

[190] 도 24(a)는 특정 BSS 주변의 단말들의 배치 상황의 일 실시예를 도시한다. 도 24(a)의 실시예에서 AP는 STA1 및 STA2와 통신을 수행하며, 특정 단말을 기준으로 히든 노드 L1, H1, L2 및 H2이 존재한다. 여기서, L1 및 L2는 각각 레거시 STA를 나타내며, H1 및 H2는 각각 논-레거시 STA를 나타낸다. L1 및 H1은 AP의 메시지는 센싱 가능하지만, STA1과 STA2의 메시지는 수신할 수 없다. 따라서, L1 및 H1은 AP가 STA1 및 STA2로부터 메시지를 수신할 때 AP를 방해할 수 있다. 한편, L2 및 H2는 STA2의 메시지는 센싱 가능하지만, AP의 메시지는 수신할 수 없다. 따라서, L2 및 H2는 STA2가 AP로부터 메시지를 수신할 때 STA2를 방해할 수 있다. 따라서, MU 전송 과정의 보호를 위해, 히든 노드 L1, H1, L2 및 H2에 NAV가 설정되어야 한다.

[191] 도 24(b)는 도 24(a)의 단말들의 배치 상황에서 UL-MU 전송 과정의 TXOP이 설정되는 방법을 도시한다. 먼저, AP는 다중 채널(예를 들어, 40MHz)로 MU-RTS 프레임을 전송한다. 이때, L-STF, L-LTF, L-SIG 등의 레거시 프리앰블은 20MHz 채널 별로 반복되어 전송된다. 만약 MU-RTS 프레임이 레거시 포맷으로 전송되는 경우, 이를 수신한 H1 및 L1은 MU-RTS 프레임의 MAC 헤더의 듀레이션 필드에 기초하여 NAV를 설정한다.

[192] 다음으로, MU-RTS 프레임을 수신한 STA1 및 STA2는 SIFS의 시간 뒤에 sCTS 프레임을 전송한다. 이때, sCTS 프레임은 20MHz 채널 단위로 전송될 수 있다. MU-RTS를 수신한 STA들은 해당 단말에 이미 설정된 NAV를 고려하여 sCTS 프레임의 전송을 제한할 수 있다. sCTS 프레임을 수신한 H2 및 L2는 sCTS 프레임의 MAC 헤더의 듀레이션 필드에 기초하여 NAV를 설정한다.

[193] sCTS 프레임을 수신한 AP는 HE PPDU 포맷으로 트리거 프레임을 전송할 수 있다. 이때, 트리거 프레임에서는 HE-SIG-A의 TXOP 듀레이션 필드와 MAC 헤더의 듀레이션 필드가 각각 듀레이션 정보를 지시한다. 상기 2개의 듀레이션 필드는 비트 구성이 서로 다를 수 있다. 예를 들어 TXOP 듀레이션 필드의 비트 개수가 MAC 헤더의 듀레이션 필드의 비트 개수보다 적을 수 있다. 이때, 주변 단말들의 올바른 NAV 설정을 위해서는 각각의 듀레이션 필드의 설정 방법 및/또는 각각의 듀레이션 필드의 해석 방법이 결정되어야 한다.

[194] 본 발명의 일 실시예에 따르면, TXOP 듀레이션 필드가 t비트로 구성되고 MAC 헤더의 듀레이션 필드가 m비트로 구성된 경우(여기서, t<m), MAC 헤더의 듀레이션 필드의 값은 TXOP 듀레이션 필드의 값을 넘지 않도록 설정될 수 있다. 예를 들어, TXOP 듀레이션 필드가 12비트로 구성되고 MAC 헤더의 듀레이션

필드가 15비트로 구성된 경우, MAC 헤더의 듀레이션 필드의 값은 TXOP 듀레이션 필드가 표시할 수 있는 최대 값 즉, 2^12=4096us를 넘지 않도록 설정될 수 있다. 이때, 각각의 듀레이션 필드의 해석은 동일한 방법으로 수행될 수 있다.

[195] 본 발명의 다른 실시예에 따르면, TXOP 듀레이션 필드의 비트 개수와 MAC 헤더의 듀레이션 필드의 비트 개수가 서로 다를 경우, 상기 필드들 중 어느 하나의 필드의 해석 시에는 기 설정된 스케일링 팩터(scaling factor)가 곱해질 수 있다. 예를 들어, TXOP 듀레이션 필드가 12비트로 구성되고 MAC 헤더의 듀레이션 필드가 15비트로 구성된 경우, TXOP 듀레이션 필드의 값은 스케일링 팩터 8이 곱해진 후 사용될 수 있다. 이와 같이, 기 설정된 스케일링 팩터를 사용함으로 서로 다른 비트 개수의 듀레이션 필드가 가리키는 듀레이션 정보의 범위가 유사해지도록 할 수 있다.

[196] 그러나 TXOP 듀레이션 필드의 값에 스케일링 팩터 8이 곱해진 후 사용될 경우, 2개의 듀레이션 필드로부터 획득된 듀레이션 정보는 최대 7us의 차이를 가질 수 있다. 본 발명의 일 실시예에 따르면, 상기 2개의 듀레이션 필드를 모두 해석한 STA는 더 많은 비트 개수를 갖는 MAC 헤더의 듀레이션 필드에 기초하여 NAV를 설정할 수 있다. 그러나 2개의 듀레이션 필드 중 HE-SIG-A의 TXOP 듀레이션 필드만 해석 가능한 STA는 TXOP 듀레이션 필드에 기초하여 NAV를 설정한다. 이러한 상황을 대비하여, 하나의 PPDU 내에서 TXOP 듀레이션 필드의 값은 MAC 헤더의 듀레이션 필드의 값보다 최대 상기 오프셋(예를 들어, 7us)만큼 크거나 작은 수로 설정될 수 있다.

[197] 도 24(b)의 실시예에서, 트리거 프레임을 수신한 H1은 HE-SIG-A의 TXOP 듀레이션 필드와 MAC 헤더의 듀레이션 필드를 모두 해석할 수 있으므로, 2개의 필드를 함께 이용하여 NAV를 업데이트할 수 있다. 그러나 L1은 HE PPDU의 논-레거시 프리앰블 및 MPDU를 해석할 수 없으므로 NAV를 업데이트할 수 없다.

[198] 한편, 트리거 프레임을 수신한 STA1 및 STA2는 HE Trigger-based PPDU를 전송한다. 이때, HE Trigger-based PPDU를 수신한 H2는 HE-SIG-A의 TXOP 듀레이션 필드와 MAC 헤더의 듀레이션 필드를 모두 해석할 수 있으므로, 2개의 필드를 함께 이용하여 NAV를 업데이트할 수 있다. 그러나 L2는 HE Trigger-based PPDU의 논-레거시 프리앰블 및 MPDU를 해석할 수 없으므로 NAV를 업데이트할 수 없다.

[199] 도 25 내지 도 31은 본 발명의 다양한 실시예에 따른 불연속 채널 할당 정보의 시그널링 방법을 도시한다. 본 발명의 실시예에서, 불연속 채널 할당이란 전송되는 패킷(즉, PPDU)이 점유하는 대역이 적어도 하나의 불연속 채널(또는, 불연속 리소스 유닛)을 포함하는 채널 할당을 의미한다. 다만, 전체 대역폭 80+80MHz의 채널은 전체 대역폭 160MHz의 채널과 동일하게 연속 채널로 간주된다. 따라서, 본 발명의 실시예에서의 불연속 채널(또는, 불연속 PPDU)은 전체 대역폭 80+80MHz 채널을 제외한 불연속 채널들을 가리킬 수 있다. 도 25

내지 도 31의 실시예들에서, 채널 A 내지 채널 D는 80MHz PPDU가 전송되는 각각의 20MHz 채널을 가리킨다. 이때, 채널 A는 P20 채널로, 채널 B는 S20 채널로, 채널 C 및 채널 D는 S40 채널로 각각 지정된다. 또한, 각각의 실시예에서 S40A 채널은 채널 C를 가리키고, S40B 채널은 채널 D를 가리킬 수 있다.

[200] 본 발명의 실시예에서 송신자(예를 들어, AP)는 각 도면을 통해 설명되는 실시예 또는 이들의 조합을 통해 불연속 채널 할당 정보를 시그널링한다. 송신자는 광대역 패킷 전송을 위한 다중 채널의 CCA를 수행할 수 있다. 이때, 광대역은 총 대역폭 40MHz 이상의 대역을 의미할 수 있으나, 본 발명은 이에 한정되지 않는다. 송신자는 다중 채널의 CCA 수행 결과에 기초하여 유휴 상태의 적어도 하나의 채널로 패킷을 전송한다. 이때, 패킷이 불연속 채널로 전송될 경우, 송신자는 해당 패킷의 논-레거시 프리앰블을 통해 불연속 채널 할당 정보를 시그널링한다. 이와 같이, 송신자는 불연속 채널 할당 정보가 시그널링 된 무선 패킷을 전송한다. 수신자(예를 들어, STA)는 무선 패킷을 수신하고, 수신된 패킷에서 불연속 채널 할당 정보를 획득한다. 수신자는 수신된 패킷을 획득된 불연속 채널 할당 정보에 기초하여 디코딩한다. 이때, 수신되는 패킷은 HE MU PPDU일 수 있으나, 본 발명은 이에 한정되지 않는다.

[201] 도 25는 본 발명의 실시예에 따른 불연속 채널 할당 정보의 시그널링 방법을 도시한다. 도 25의 실시예에서 AP는 총 대역폭 80MHz의 DL MU PPDU를 전송하기 위해 채널 A 내지 채널 D의 CCA를 수행하며, S40B 채널이 점유 상태로 판별된다. AP는 유휴 상태인 P40 채널 및 S40A 채널을 통해 PPDU를 전송한다. AP는 점유 상태인 S40B 채널의 데이터 톤(tone)들은 널링(nulling)하여 신호를 전송하지 않는다. 이때, 전송되는 PPDU 상에서 불연속 채널 할당 정보 즉, P40 채널 및 S40A 채널의 할당 정보(또는, 비할당 S40B 채널의 정보)가 시그널링 되어야 한다.

[202] 먼저, 불연속 채널 할당 정보는 HE-SIG-A의 대역폭 필드를 통해 지시될 수 있다. 대역폭 필드는 특정 불연속 채널 할당 정보를 기 설정된 인덱스를 통해 지시할 수 있다. 일 실시예에 따르면, 대역폭 필드는 특정 불연속 채널 할당 정보를 명시적으로 지시할 수 있다. 따라서, P40 채널 및 S40A 채널의 할당 정보는 대역폭 필드를 통해 지시될 수 있다.

[203] 또한, 불연속 채널 할당 정보는 HE-SIG-B의 RA 필드를 통해 지시될 수 있다. RA 필드는 사용자에게 할당되지 않는 특정 리소스 유닛을 기 설정된 인덱스를 통해 지시할 수 있다. 예를 들어, RA 필드는 20MHz 채널의 배수의 대역폭 즉, 242-톤, 484-톤 또는 996-톤의 리소스 유닛이 사용자에게 할당되지 않음을 지시할 수 있다. 기 설정된 인덱스 값이 지시하는 빈(empty) 리소스 유닛에서는 데이터 전송이 수행되지 않는다.

[204] 또한, 불연속 채널 할당 정보는 HE-SIG-B의 특정 사용자 필드에 널(Null) STA ID를 삽입하여 지시될 수 있다. 즉, 데이터가 전송되지 않는 비할당 리소스 유닛에 대응하는 사용자 필드에는 기 설정된 널 STA ID가 삽입된다. 따라서,

어떠한 STA도 비할당 리소스 유닛을 통해 데이터를 수신하지 않는다.

[205] 도 26은 본 발명의 일 실시예에 따라 HE-SIG-A의 대역폭 필드를 통해 불연속 채널 할당 정보를 시그널링하는 방법을 도시한다. HE MU PPDU의 대역폭 필드는 연속 채널 대역폭들인 20MHz, 40MHz, 80MHz, 160MHz(80+80MHz 포함)에 더하여 기 설정된 불연속 채널 대역폭들을 추가적으로 지시할 수 있다. 대역폭 필드가 기 설정된 불연속 채널 대역폭을 지시할 경우, 불연속 채널의 추가적인 할당 정보는 HE-SIG-B의 서브필드를 통해 지시될 수 있다.

[206] 전술한 바와 같이, HE-SIG-B는 20MHz 단위로 최대 2개의 콘텐츠 채널 즉, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2로 구성될 수 있다. 총 대역에서 각각의 HE-SIG-B 콘텐츠 채널은 물리적 주파수 대역의 순서에 따라 배열된다. 즉, 가장 낮은 주파수 대역에서는 HE-SIG-B 콘텐츠 채널 1이 전송되고, 그 다음 높은 주파수 대역에서는 HE-SIG-B 콘텐츠 채널 2가 전송된다. 이와 같은 콘텐츠 채널 구성은 그 다음으로 높은 주파수 대역들에서 콘텐츠 복제를 통해 반복된다. 도 26의 실시예에서, HE-SIG-B 콘텐츠 채널 1은 채널 A 및 채널 C의 리소스 유닛 할당 정보를 시그널링하고, HE-SIG-B 콘텐츠 채널 2는 채널 B 및 채널 D의 리소스 유닛 할당 정보를 시그널링한다. HE-SIG-B 콘텐츠 채널 1은 채널 A 및 채널 C를 통해 전송된다. 그러나 채널 D에서는 PPDU 전송이 수행되지 않으므로, HE-SIG-B 콘텐츠 채널 2는 채널 B를 통해서만 전송된다. 이때, 채널 B를 통해 전송되는 HE-SIG-B 콘텐츠 채널 2는 채널 D가 사용되지 않음을 지시할 수 있다.

[207] 도 27은 본 발명의 일 실시예에 따라 HE-SIG-B의 RA 필드를 통해 불연속 채널 할당 정보를 시그널링하는 방법을 도시한다. 전술한 바와 같이, RA 필드는 8비트 단위로 구성되며, 특정 대역폭을 구성하는 리소스 유닛들의 크기와 주파수 도메인에서의 그들의 배열을 인덱싱한다. 또한, RA 필드는 각 리소스 유닛에서의 사용자 수를 지시할 수 있다. 이때, RA 필드는 사용자에게 할당되지 않는 특정 리소스 유닛(즉, 비할당 RU)을 기 설정된 인덱스를 통해 지시할 수 있다. 일 실시예에 따르면, 특정 리소스 유닛은 20MHz 채널의 배수의 대역폭을 갖는 리소스 유닛(RU) 즉, 242-톤 RU, 484-톤 RU, 996-톤 RU 등을 포함한다. 상기 인덱스 값이 지시하는 비할당 RU에서는 데이터 전송이 수행되지 않는다.

[208] 도 27(a)에 도시된 바와 같이, PPDU가 전송되는 총 대역폭이 80MHz일 경우 RA 필드는 각각의 HE-SIG-B 콘텐츠 채널에서 2개씩 전송된다. 즉, HE-SIG-B 콘텐츠 채널 1의 제1 RA 필드(8비트)는 채널 A의 리소스 유닛 할당 정보를 시그널링하고, HE-SIG-B 콘텐츠 채널 1의 제2 RA 필드(8비트)는 채널 C의 리소스 유닛 할당 정보를 시그널링한다. 마찬가지로, HE-SIG-B 콘텐츠 채널 2의 제1 RA 필드(8비트)는 채널 B의 리소스 유닛 할당 정보를 시그널링하고, HE-SIG-B 콘텐츠 채널 2의 제2 RA 필드(8비트)는 채널 D의 리소스 유닛 할당 정보를 시그널링한다. 도 27(a)의 실시예와 같이 채널 D가 점유 상태이면 HE-SIG-B 콘텐츠 채널 2는 채널 B를 통해서만 전송되고, HE-SIG-B 콘텐츠 채널

1은 채널 A 및 채널 C를 통해 전송된다. 이때, 채널 D가 사용자에게 할당되지 않음을 HE-SIG-B의 RA 필드를 통해 시그널링하는 구체적인 실시예들은 도 27(b) 내지 도 27(d)을 통해 설명된다.

[209] 먼저, 본 발명의 일 실시예에 따르면, 도 27(b)에 도시된 바와 같이 비할당 20MHz 채널에 대응하는 RA 필드 즉, 제2 SIG-B 콘텐츠 채널의 제2 RA 필드는 242-톤 RU의 널링(nulling)을 지시할 수 있다. 그러나 HE-SIG-B 콘텐츠 채널 1의 제2 RA 필드는 채널 C의 리소스 할당 정보에 따라 242-톤 RU를 지시하거나 그 이하의 크기로 분할된 RU들을 지시한다. 이와 같이, RA 필드는 각 채널 별로 독립적이고 명시적인 시그널링을 수행할 수 있다. 따라서, 비할당 채널 채널 D에 대응하는 RA 필드는 해당 리소스 유닛이 사용자에게 할당되지 않음(즉, 널링)을 지시한다.

[210] 다음으로, 본 발명의 다른 실시예에 따르면, 도 27(c)에 도시된 바와 같이 비할당 20MHz 채널에 대응하는 RA 필드 즉, HE-SIG-B 콘텐츠 채널 2의 제2 RA 필드는 484-톤 RU의 널링을 지시할 수 있다. 그러나 HE-SIG-B 콘텐츠 채널 1의 제2 RA 필드가 채널 C의 리소스 할당 정보를 지시함으로, 비할당 채널이 20MHz 대역폭의 채널 D인 것이 식별될 수 있다.

[211] 다음으로, 본 발명의 또 다른 실시예에 따르면, 도 27(d)에 도시된 바와 같이 비할당 20MHz 채널에 대응하는 RA 필드는 242-톤 RU, 484-톤 RU, 996-톤 RU 등의 특정 대역폭의 리소스 유닛의 널링이 아닌 일반적인 널링을 지시할 수 있다. 이 경우, RA 필드에서 지시하는 널링은 묵시적으로 242-톤 RU(즉, 20MHz 채널)의 널링을 지시하는 것으로 해석될 수 있으며, 사용자에게 할당된 리소스 유닛들의 정보는 다른 RA 필드를 통해 획득될 수 있다.

[212] 이와 같이 특정 리소스 유닛이 사용자에게 할당되지 않음을 RA 필드가 지시할 경우, 해당 리소스 유닛에 대응하는 사용자 특정 필드는 전송되지 않는다. 따라서, 도 27(a)에 도시된 바와 같이 채널 D의 리소스 유닛 할당 정보를 시그널링하는 제2 SIG-B 콘텐츠 채널은 채널 D에 대응하는 사용자 특정 필드(410)를 운반하지 않는다.

[213] 도 28은 본 발명의 일 실시예에 따라 HE-SIG-B의 사용자 필드를 통해 불연속 채널 할당 정보를 시그널링하는 방법을 도시한다. 전술한 바와 같이, 불연속 채널 할당 정보는 HE-SIG-B의 특정 사용자 필드에 널(Null) STA ID를 삽입하여 지시될 수 있다. HE-SIG-B의 RA 필드는 비할당 리소스 유닛에 대응하는 리소스 할당 정보를 지시하고, 상기 비할당 리소스 유닛에 대응하는 사용자 필드에는 기 설정된 널 STA ID가 삽입될 수 있다.

[214] 도 28의 실시예와 같이 채널 D가 사용되지 않을 경우, 채널 D에 대응하는 HE-SIG-B 콘텐츠 채널 2의 제2 RA 필드는 242-톤 리소스 유닛 및 하나의 사용자를 지시한다. 따라서, 상기 제2 RA 필드는 해당 242-톤 리소스 유닛을 위하여 하나의 사용자 필드(420)가 운반됨을 지시한다. SIG-B 콘텐츠 채널 2의 사용자 특정 필드는 HE-SIG-B 콘텐츠 채널 2의 제1 RA 필드 및 제2 RA 필드에서

지시된 총 사용자 수의 사용자 필드들을 운반한다. 이때, 비할당 채널 채널 D에 대응하는 사용자 필드(420)에는 기 설정된 널 STA ID가 삽입된다. 본 발명의 실시예에 따르면, 널 STA ID는 해당 BSS의 1 내지 2007까지의 AID들 중 비할당 AID 이거나, 2007 보다 큰 값의 예약된 AID(예를 들면, 2046)이거나, 1 내지 2007까지의 AID들 중 기 설정된 AID일 수 있다. 사용자 필드(420)에 널 STA ID가 삽입되면, BSS 내의 어떠한 STA도 해당 리소스 유닛을 통해 데이터를 수신하지 않으므로 불연속 채널 할당이 수행될 수 있다.

[215] 도 29는 본 발명의 추가적인 실시예에 따른 불연속 채널 할당 정보의 시그널링 방법을 도시한다. 도 29의 실시예에 따르면, 중앙 26-톤 리소스 유닛(502)이 사용자에게 할당되는지 여부는 HE-SIG-B의 사용자 필드(422)를 통해 시그널링 될 수 있다. 본 발명의 실시예에서, 중앙 26-톤 리소스 유닛(RU)은 80MHz 대역폭의 중앙에 위치하는 RU(502)를 가리킨다. 후술하는 바와 같이, 중앙 26-톤 RU(502)가 사용자에게 할당되는지 여부는 다양한 실시예에 따라 결정될 수 있다.

[216] 본 발명의 실시예에 따르면, 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)는 도 29에 도시된 바와 같이 HE-SIG-B 콘텐츠 채널 1을 통해 운반될 수 있다. 이때, 사용자 필드(422)는 HE-SIG-B 콘텐츠 채널 1의 마지막 사용자 필드로서 운반될 수 있다. 본 발명의 일 실시예에 따르면, 중앙 26-톤 RU(502)가 사용자에게 할당되는지 여부는, 이에 대응하는 사용자 필드(422)에 삽입된 STA ID를 통해 지시될 수 있다. 즉, 중앙 26-톤 RU(502)가 사용자에게 할당되지 않을 경우, 이에 대응하는 사용자 필드(422)에는 널 STA ID가 삽입될 수 있다. 널 STA ID의 구체적인 실시예는 도 28에서 설명된 바와 같다. 그러나 중앙 26-톤 RU(502)가 특정 사용자에게 할당될 경우, 이에 대응하는 사용자 필드(422)에는 상기 특정 사용자의 STA ID가 삽입될 수 있다.

[217] 도 30은 본 발명의 추가적인 실시예에 따른 불연속 채널 할당 정보의 시그널링 방법을 도시한다. 도 30의 실시예에 따르면, 임의의 리소스 유닛(504)이 사용자에게 할당되는지 여부는 HE-SIG-B의 사용자 필드(424)를 통해 시그널링 될 수 있다. OFDMA 기반의 DL MU PPDU는 20MHz 대역폭 내에서 최대 9개의 리소스 유닛들을 포함하며, 이들 각각은 26개의 서브캐리어들로 이루어져 있다. 이때, 9개의 RU들 중 8개의 리소스 유닛만을 통해 데이터가 전송되고, 1개의 리소스 유닛에서는 데이터가 전송되지 않을 수 있다. 또한, 총 대역폭 80MHz의 PPDU는 최대 37개의 리소스 유닛들을 포함할 수 있는데, 이들 중 일부 리소스 유닛에서 데이터가 전송되지 않을 수 있다. 이와 같이, 총 대역폭을 구성하는 리소스 유닛들 중에서 일부 리소스 유닛이 사용자에게 할당되지 않을 경우, 비할당 리소스 유닛을 지시하는 방법이 필요하다.

[218] 본 발명의 실시예에 따르면, 이와 같은 불연속 채널 할당 정보는 HE-SIG-B의 RA 필드 및 사용자 필드를 통해 지시될 수 있다. 전술한 바와 같이, RA 필드는 특정 대역폭을 구성하는 리소스 유닛의 배열 및 사용자 수 정보를 지시한다.

각각의 리소스 유닛에 대응하는 사용자 필드들은 RA 필드가 지시하는 리소스 유닛 할당의 순서에 따라 HE-SIG-B의 사용자 특정 필드를 통해 운반된다. 본 발명의 실시예에 따르면, 비할당 리소스 유닛은 RA 필드가 지시하는 리소스 유닛 배열에서 특정 리소스 유닛(504)에 대응하는 사용자 필드(424)에 삽입된 널 STA ID를 통해 지시될 수 있다. 이때, 지시될 수 있는 비할당 리소스 유닛은 26-톤 RU, 52-톤 RU, 106-톤 RU 중 적어도 하나를 포함하지만, 본 발명은 이에 한정되지 않는다. 즉, 도 28에서 설명된 바와 같이 널 STA ID를 통해 지시될 수 있는 비할당 리소스 유닛은 20MHz 대역폭 이상의 242-톤 RU, 484-톤 RU 및 996-톤 RU를 포함할 수 있다. 널 STA ID의 구체적인 실시예는 도 28에서 설명된 바와 같다.

[219] 다음으로, 도 31을 참조로 불연속 채널 할당 정보를 시그널링할 때 고려될 수 있는 사항들을 설명한다. HE MU PPDU는 HE-SIG-A 및 HE-SIG-B를 통해 시그널링을 수행한다. HE-SIG-A는 PPDU의 대역폭 정보를 포함한 전체적인 정보를 운반하며, HE-SIG-B는 다중 사용자 동시 전송을 위한 정보를 운반한다. 40MHz 이상의 총 PPDU 대역폭에서, HE-SIG-B는 HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2로 구성될 수 있다. 본 발명의 실시예에 따르면, 불연속 PPDU의 전송이 수행될 때 다음과 같은 사항들이 고려될 수 있다.

[220] 첫째로, 모든 타입의 불연속 PPDU는 P20 채널을 할당해야 한다. 즉, 불연속 PPDU는 적어도 하나의 미할당 채널(또는, 미할당 리소스 유닛)을 포함할 수 있지만, P20 채널은 반드시 적어도 하나의 사용자에게 할당되어야 한다.

[221] 둘째로, 불연속 PPDU의 HE-SIG-A는 해당 PPDU의 HE-SIG-B의 콘텐츠 채널(들)이 전송되는 채널 정보를 나타낼 수 있어야 한다. 도 31(a)을 참조하면, 80MHz 대역폭의 채널들이 주파수 오름차순으로 채널 A, 채널 B, 채널 C 및 채널 D로 구성되어 있고, 점유 상태의 채널 C를 제외한 채널 A, 채널 B 및 채널 D를 통해 불연속 PPDU가 전송될 수 있다. 이때, HE-SIG-B 콘텐츠 채널 1은 채널 A를 통해 전송되고, HE-SIG-B 콘텐츠 채널 2는 채널 B 및 채널 D를 통해 전송된다. 이때, HE-SIG-A의 대역폭 필드는 해당 PPDU의 HE-SIG-B의 콘텐츠 채널들 각각이 적어도 어느 채널을 통해 전송되는지에 대한 정보를 나타낼 수 있다. 후술하는 바와 같이, HE-SIG-A의 대역폭 필드는 S20 채널의 펑처링(puncturing), S40 채널의 2개의 채널들 중 적어도 하나의 펑처링을 각각 인덱싱 할 수 있다. 만약 대역폭 필드가 S20 채널의 펑처링을 지시할 경우, 2개의 HE-SIG-B 콘텐츠 채널들 중 적어도 하나의 콘텐츠 채널은 S40 채널을 통해 전송될 수 있다. 반면에, 대역폭 필드가 도 31(a)와 같이 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우, 2개의 HE-SIG-B 콘텐츠 채널들 모두는 적어도 P40 채널을 통해 전송될 수 있다.

[222] 마지막으로, HE-SIG-A는 해당 PPDU에서 HE-SIG-B의 공통 블록 필드의 크기 정보를 명시적 또는 묵시적으로 나타낼 수 있다. 도 31(b)에 도시된 바와 같이, HE-SIG-B는 공통 블록 필드(430)와 사용자 특정 필드(440)로 구성되며, 공통

블록 필드(430)는 RA 필드를 포함한다. PPDU의 총 대역폭이 20MHz 또는 40MHz일 경우, 각각의 HE-SIG-B 콘텐츠 채널은 1개의 RA 필드를 운반한다. 그러나 PPDU의 총 대역폭이 80MHz 또는 160MHz(80+80MHz)인 경우, 각각의 HE-SIG-B 콘텐츠 채널은 도 31(c)에 도시된 바와 같이 복수의 RA 필드들(432)을 운반할 수 있다. 즉, PPDU의 총 대역폭이 80MHz인 경우 각각의 HE-SIG-B 콘텐츠 채널은 2개의 RA 필드들(432)을 운반하며, PPDU의 총 대역폭이 160MHz(또는, 80+80MHz)인 경우 각각의 HE-SIG-B 콘텐츠 채널은 4개의 RA 필드들(432)을 운반한다. 따라서, HE-SIG-A의 대역폭 필드(452)가 지시하는 정보에 따라 HE-SIG-B의 공통 블록 필드(430)를 통해 운반되는 RA 필드들(432)의 개수가 다르게 된다. HE-SIG-A의 대역폭 필드(452)는 HE-SIG-B의 공통 블록 필드(430)를 통해 운반되는 RA 필드(432)의 개수를 지시할 수 있으며, 이를 통해 공통 블록 필드(430)의 크기 정보를 명시적 또는 묵시적으로 나타낼 수 있다.

[223] 본 발명의 실시예에 따르면, 불연속 채널 할당 정보는 HE-SIG-A의 서브필드, HE-SIG-B의 서브필드 및 이들의 조합 중 어느 하나를 통해 지시될 수 있다. 불연속 채널 할당 정보는 다음과 같은 구체적인 실시예들에 의해 시그널링 될 수 있다.

[224] 먼저, 불연속 채널 할당 정보는 HE-SIG-A의 서브필드를 통해 단독으로 시그널링 될 수 있다. HE-SIG-A의 대역폭 필드(452)는 특정 불연속 채널 할당 정보를 기 설정된 인덱스를 통해 지시할 수 있다. HE-SIG-A의 서브필드를 통해 불연속 채널 할당 정보가 시그널링 되면, 수신자는 PPDU의 전체 구성 정보를 빠르게 획득할 수 있다. 또한, 불연속 채널 할당 정보가 HE-SIG-A의 서브필드만으로 시그널링 될 경우 HE-SIG-B를 통한 추가적인 시그널링 오버헤드가 줄어들게 된다.

[225] 그러나 HE-SIG-A의 가용한 비트 수의 제약으로 인해, 다양한 불연속 채널 할당 정보가 시그널링 되지 못할 수 있다. 따라서, 본 발명의 일 실시예에 따르면 대역폭 필드(452)는 다양한 불연속 채널 할당 옵션들 중 일부의 불연속 채널 할당 정보만을 명시적으로 지시할 수 있다. 본 발명의 다른 실시예에 따르면, 불연속 채널 할당이 수행될 경우 불필요하게 되는 HE-SIG-A의 일부 서브필드가 불연속 채널 할당 정보의 추가적인 시그널링에 사용될 수 있다. 예를 들어, 불연속 채널 할당이 수행될 경우, 전체 대역폭 MU-MIMO의 이용 여부를 지시하는 SIG-B 압축 필드(454)는 불필요하게 된다. 따라서, 불연속 채널 할당이 수행될 경우, SIG-B 압축 필드(454)는 다른 용도로 사용될 수 있다. 예를 들어, HE-SIG-A는 대역폭 필드(452)와 SIG-B 압축 필드(454)를 함께 이용하여 불연속 채널 할당 정보를 지시할 수 있다.

[226] 다음으로, 불연속 채널 할당 정보는 HE-SIG-B의 서브필드를 통해 단독으로 시그널링 될 수 있다. 이때, HE-SIG-A의 대역폭 필드는 기존의 연속 대역폭을 지시하며, 비할당 채널(또는, 비할당 리소스 유닛)의 정보는 HE-SIG-B의 RA

필드(432) 및/또는 사용자 필드를 통해 지시될 수 있다. 이 경우 HE-SIG-A의 시그널링 오버헤드가 줄어들 수 있지만, HE-SIG-B의 시그널링 오버헤드가 증가할 수 있다.

[227] 마지막으로, 불연속 채널 할당 정보는 HE-SIG-A의 서브필드 및 HE-SIG-B의 서브필드의 조합을 통해 시그널링 될 수 있다. HE-SIG-A의 서브필드는 불연속 채널 할당 정보의 적어도 일부를 시그널링하고, HE-SIG-B의 서브필드는 나머지 정보를 시그널링할 수 있다. 일 실시예에 따르면, HE-SIG-A의 서브필드는 P80 채널의 PPDU 구성의 상세 정보와, S80 채널의 전송 여부 정보를 시그널링할 수 있다. 만약 HE-SIG-A의 서브필드가 S80 채널의 전송을 지시할 경우, HE-SIG-B의 서브필드는 S80 채널의 PPDU 구성의 상세 정보를 시그널링 할 수 있다. 다른 실시예에 따르면, HE-SIG-A의 서브필드는 해당 PPDU의 HE-SIG-B의 콘텐츠 채널(들)이 전송되는 채널 정보 및 HE-SIG-B의 공통 블록 필드(430)의 크기 정보를 시그널링할 수 있다. HE-SIG-B의 서브필드는 해당 PPDU 구성의 추가적인 정보를 시그널링한다. 또 다른 실시예에 따르면, 불연속 PPDU의 전송 대역이 P40 채널을 항상 포함하는 경우, HE-SIG-A의 서브필드에서 HE-SIG-B의 공통 블록 필드(430)의 크기 정보를 시그널링할 수 있다.

[228] 도 32 내지 도 34는 본 발명의 다양한 실시예에 따른 불연속 채널 할당 방법을 도시한다. 도 32 내지 도 34의 실시예들에 따른 불연속 채널 할당 정보는 도 25 내지 도 31에서 설명된 다양한 실시예들 중 적어도 하나의 조합을 통해 시그널링 될 수 있다.

[229] 도 32는 본 발명의 일 실시예에 따른 불연속 채널 할당 방법을 도시한다. 본 발명의 일 실시예에 따르면, 불연속 채널 할당 정보는 HE-SIG-A의 대역폭 필드를 통해 단독으로 시그널링 될 수 있다. 도 32는 HE-SIG-B 콘텐츠 채널의 디코딩 위치를 고정시키기 위해 불연속 PPDU가 항상 P40 채널을 할당하는 실시예를 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 모두는 적어도 P40 채널을 통해 전송될 수 있다. 도 32 및 이하의 실시예들에서, S80A 채널, S80B 채널, S80C 채널 및 S80D 채널은 각각 S80 채널을 구성하는 첫 번째, 두 번째, 세 번째 및 네 번째 20MHz 채널을 가리킨다.

[230] HE-SIG-A의 대역폭 필드는 기본적으로 4가지 연속 채널들(510)의 정보 즉, 20MHz, 40MHz, 80MHz 및 160MHz(80+80MHz 포함)를 각각 인덱싱 할 수 있다. 만약 대역폭 필드가 3비트로 구성된 경우, 대역폭 필드는 4가지 추가적인 불연속 채널들(520)의 정보를 인덱싱 할 수 있다. 먼저, 대역폭 필드는 S40 채널에서 2개의 20MHz 채널들 중 어느 하나의 펑처링을 각각 인덱싱 할 수 있다. 또한, 대역폭 필드는 상기 S40 채널의 구성과 조합하여 S80 채널의 할당 여부를 인덱싱 할 수 있다. 따라서, 대역폭 필드는 P80 채널 내에서 P40+S40A 및 P40+S40B의 2가지 구성과 S80 채널의 할당 여부에 따른 2가지 구성을 조합하여 총 4가지 불연속 채널 구성을 인덱싱 할 수 있다.

[231] 다음으로, 대역폭 필드가 4비트로 구성된 경우, 대역폭 필드는 4가지 불연속

채널들(520)의 정보에 더하여 8가지 불연속 채널들(530)의 정보를 추가적으로 인덱싱 할 수 있다. 먼저, 대역폭 필드는 S40 채널에서 2개의 20MHz 채널들 중 어느 하나의 펑처링을 각각 인덱싱 할 수 있다. 또한, 대역폭 필드는 상기 S40 채널의 구성과 조합하여 S80 채널에서의 6가지 불연속 채널들의 정보를 인덱싱 할 수 있다. 이때, 6가지 불연속 채널들의 정보는 S80 채널의 할당 여부를 포함하며, 도 32에 도시된 바와 같이 연속적인 40MHz 대역을 할당할 수 있는 4가지 펑처링 옵션들을 포함할 수 있다.

[232] 도 33은 본 발명의 다른 실시예에 따른 불연속 채널 할당 방법을 도시한다. 도 33의 실시예에 따르면, HE-SIG-B 콘텐츠 채널들 중 적어도 하나가 전송되는 위치는 가변적일 수 있다. 이때, 수신자는 HE-SIG-B 콘텐츠 채널을 수신하기 위한 디코딩 채널을 가변적으로 설정할 수 있어야 한다. 도 33의 실시예에서는, P20 채널에서 HE-SIG-B 콘텐츠 채널 1이 전송되고, HE-SIG-B 콘텐츠 채널 2가 전송되는 채널이 가변 될 수 있다고 가정한다. 그러나 P40 채널 내에서의 P20 채널의 물리적 주파수 순서에 따라, P20 채널에서 HE-SIG-B 콘텐츠 채널 2가 전송될 수도 있다. 이때에는, 채널 구성에 따라 HE-SIG-B 콘텐츠 채널 1이 전송되는 채널이 가변 될 수 있다. 본 발명의 실시예에 따른 불연속 채널 할당 정보는 도 33에 나열된 채널 구성들 중 적어도 일부의 구성을 지원할 수 있다.

[233] 도 33(a)는 P80(Primary 80MHz) 대역 중 P20 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 2는 P80 대역에서 전송되지 않는다. 도 33(b)는 P80 대역 중 P40 채널이 기본적으로 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 모두는 적어도 P40 채널을 통해 전송될 수 있다. 실시예에 따라, S40 채널의 2개의 20MHz 채널들 중 어느 하나 즉, S40A 채널 또는 S40B 채널이 할당된 불연속 채널이 사용될 수 있다. S40A 채널 및 S40B 채널이 모두 할당되면 80MHz 또는 160MHz 대역폭의 연속 채널이 구성된다.

[234] 도 33(c)는 P80 대역 중 P20 채널과 S40A 채널만 할당되는 채널 구성을 도시한다. 일 실시예에 따르면, HE-SIG-B 콘텐츠 채널 1은 P20 채널을 통해 전송되고, HE-SIG-B 콘텐츠 채널 2는 S40A 채널을 통해 전송될 수 있다. S40A 채널은 원래 HE-SIG-B 콘텐츠 채널 1이 전송되는 채널이다. 하지만 불연속 PPDU의 P80 대역 구성에서 HE-SIG-B 콘텐츠 채널 2가 전송될 다른 채널이 존재하지 않을 경우, S40A 채널을 통해 HE-SIG-B 콘텐츠 채널 2가 전송될 수 있다. 그러나 이러한 HE-SIG-B 콘텐츠 채널의 변경은 PPDU 구성의 부담을 증가시키므로, 실시예에 따라 도 33(c)의 채널 구성은 사용되지 않을 수 있다.

[235] 도 33(d)는 P80 대역 중 P20 채널과 S40 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1은 P20 채널 및 S40A 채널을 통해 전송되고, HE-SIG-B 콘텐츠 채널 2는 S40B 채널을 통해 전송될 수 있다. 또한, 도 33(e)는 P80 대역 중 P20 채널 채널과 S40B 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1은 P20 채널을 통해 전송되고, HE-SIG-B 콘텐츠 채널

2는 S40B 채널을 통해 전송될 수 있다. 도 33(d) 및 도 33(e)의 실시예의 경우, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2는 본 발명의 실시예에 따른 HE-SIG-B 콘텐츠 채널 전송 규칙에 맞게 전송될 수 있다.

[236] 한편, HE-SIG-A의 대역폭 필드의 비트 수 제한으로 인해, 대역폭 필드는 상기 채널 구성들 중 일부의 구성을 지시할 수 있다. 대역폭 필드가 3비트로 구성될 경우, 대역폭 필드는 4가지 추가적인 불연속 채널 할당 정보를 인덱싱 할 수 있다. 본 발명의 실시예에 따르면, 대역폭 필드는 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링 되는 일부 채널 정보를 지시할 수 있다. 이때, 총 대역폭은 80MHz 대역폭과 160MHz(또는, 80+80MHz) 대역폭 중 어느 하나일 수 있다. 본 발명의 일 실시예에 따르면, 대역폭 필드는 도 33(d)에 도시된 S20 채널의 펑처링, 도 33(b)에 도시된 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 각각 인덱싱할 수 있다.

[237] 본 발명의 실시예에 따르면, HE-SIG-A의 대역폭 필드가 지시하는 채널 구성에서, 추가적인 펑처링 정보는 HE-SIG-B의 RA 필드를 통해 지시될 수 있다. 예를 들어, 대역폭 필드가 80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 어느 하나의 펑처링을 지시할 경우(도 33(b)의 3번째 및 5번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑처링 되는지를 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우(도 33(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑처링 되는지를 지시할 수 있다. 이에 더하여, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우(도 33(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑처링을 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S20 채널의 펑처링을 지시할 경우(도 33(d)의 2번째 채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑처링을 지시할 수 있다.

[238] 이와 같이 펑처링이 지시된 채널들은 사용자에게 할당되지 않는다. 불연속 PPDU를 수신한 단말은 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링 되는 채널 정보를 해당 PPDU의 HE-SIG-A의 대역폭 필드를 통해 획득할 수 있다. 또한, 단말은 추가적인 채널 펑처링 정보를 해당 PPDU의 HE-SIG-B의 RA 필드를 통해 획득할 수 있다. 단말은 이와 같이 획득된 불연속 채널 할당 정보에 기초하여 PPDU를 디코딩한다.

[239] 도 34는 본 발명의 또 다른 실시예에 따른 불연속 채널 할당 방법을 도시한다. 도 34의 실시예에서도, HE-SIG-B 콘텐츠 채널들 중 적어도 하나가 전송되는 위치는 가변적일 수 있다. 이때, 수신자는 HE-SIG-B 콘텐츠 채널을 수신하기 위한 디코딩 채널을 가변적으로 설정할 수 있어야 한다. 도 34의 실시예에서는 P20 채널에서 HE-SIG-B 콘텐츠 채널 1이 전송되고, HE-SIG-B 콘텐츠 채널 2이

전송되는 채널이 가변 될 수 있다고 가정한다.

[240] 도 34의 실시예에 따르면, HE-SIG-A의 대역폭 필드는 HE-SIG-B 콘텐츠 채널의 위치 정보 X와 HE-SIG-B의 공통 블록 필드의 크기 정보 Y를 지시한다. 도 34에서는 대역폭 필드가 지시할 수 있는 (X, Y)의 조합이 도시되어 있다.

[241] 먼저, HE-SIG-B 콘텐츠 채널의 위치 정보 X는 P80 채널 내에서 HE-SIG-B 콘텐츠 채널 2가 전송되는 채널을 지시할 수 있다. 상기 위치 정보가 2비트로 구성된 경우, P20, S20, S40A 및 S40B의 총 4개의 채널들을 지시할 수 있다. 만약 위치 정보가 1비트로 구성된 경우, S20, S40B의 총 2개의 채널들을 지시할 수 있다. 후자의 경우, P20 채널만 사용자에게 할당될 때에도 S20 채널로 HE-SIG-B 콘텐츠 채널이 전송되는 것으로 시그널링 될 수 있다. 그러나 S20 채널에서는 실제로 신호가 전송되지 않으며 수신자는 S20 채널에서의 HE-SIG-B 콘텐츠 채널 디코딩에 실패할 것이므로, P20 채널로만 구성된 PPDU 전송에 문제가 발생되지 않는다.

[242] 다음으로, 공통 블록 필드의 크기 정보 Y는 운반되는 RA 필드들의 개수에 따라 다르게 될 수 있다. 상기 크기 정보가 2비트로 구성된 경우, 공통 블록 필드에 포함된 RA 필드의 개수는 1개, 2개, 3개 또는 4개로 지시될 수 있다. 만약 상기 크기 정보가 1비트로 구성된 경우, 공통 블록 필드에 포함된 RA 필드의 개수는 2개 또는 4개로 지시될 수 있다. 후자의 경우, 불필요한 RA 필드가 추가로 전송될 수 있다. 그러나 불필요한 RA 필드가 도 27에서 설명된 비할당 RU를 지시하도록 함으로 추가적인 시그널링 오버헤드를 방지할 수 있다.

[243] 수신자는 HE-SIG-B 콘텐츠 채널의 위치 정보 X에 기초하여 HE-SIG-B 콘텐츠 채널을 수신할 채널을 결정할 수 있다. 또한, 수신자는 공통 블록 필드의 크기 정보에 기초하여 HE-SIG-B의 공통 블록 필드를 디코딩한다. 전송되는 PPDU의 추가적인 비할당 채널 정보는 공통 블록 필드의 RA 필드를 통해 지시될 수 있다. 본 발명의 일 실시예에 따르면, 복수의 RA 필드들이 최대 160MHz 대역폭 내에서 각각 어느 채널을 지시하는지를 나타내는 리소스 유닛 지시 필드가 사용될 수 있다. 이때, 리소스 유닛 지시 필드는 최대 160MHz 대역폭의 8개의 20MHz 채널들을 나타내는 비트맵을 통해, 이후의 RA 필드들이 순차적으로 어떤 채널들에 대한 정보를 나타내는지 지시할 수 있다.

[244] 도 35 내지 도 37은 본 발명의 추가적인 실시예에 따른 리소스 유닛 필터링 실시예를 도시한다. 도 20에서는 불연속 PPDU를 전송하는 몇 가지 실시예들을 설명하였다. 도 35 내지 도 37은 도 20에서 전술한 불연속 PPDU 전송 과정에서 추가적인 리소스 유닛이 필터링 되는 실시예를 도시한다. 본 발명의 실시예에서 필터링 된 리소스 유닛(또는, 채널)은 비할당 리소스 유닛(또는, 채널)을 의미할 수 있다.

[245] 도 35는 1개의 RF 모듈을 구비한 단말이 160MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S40 채널(640)이 점유 상태인 상황을 도시한다. 단말은 P40 채널(P20 채널 + S20 채널) 및 S80 채널을 포함하는 140MHz

대역으로 불연속 PPDU를 전송한다. 이때, 불연속 PPDU는 160MHz 스펙트럴 마스크(610)를 이용하여 전송되며, 점유 상태로 판별된 S40 채널(640)에서는 필터링이 수행되어 데이터가 전송되지 않는다. 그러나 P40 채널을 통해 전송되는 신호에는 40MHz 스펙트럴 마스크가 적용되지 않으므로, S40 채널과의 경계에 인접한 일부 리소스 유닛의 신호들은 S40 채널을 통해 전송되는 OBSS 신호에 간섭을 줄 수 있다.

[246] 따라서, 본 발명의 실시예에 따르면 불연속 PPDU 전송 상황에서 비할당 S40 채널(640)에 인접한 리소스 유닛은 추가적으로 필터링이 수행되어 비할당 리소스 유닛으로 설정될 수 있다. 전체 대역폭에서 S40 채널(640)의 위치에 따라, 중앙 26-톤 RU(650)를 포함하여 S40 채널(640)의 양쪽에 최대 2개의 인접한 리소스 유닛이 존재할 수 있다. 본 발명의 실시예에 따르면, 40MHz 대역폭의 채널이 비할당 채널로 설정될 경우 해당 채널에 인접한 리소스 유닛, 예를 들면 중앙 26-톤 RU(650)에는 추가적인 필터링이 수행될 수 있다. 뿐만 아니라, 비할당 S40 채널(640)에 인접한 전송 채널(즉, P20 채널)의 일부 리소스 유닛이 비할당 S40 채널(640)에서의 OBSS 신호에 간섭을 미칠 가능성이 있다면, 상기 일부 리소스 유닛에도 추가적인 필터링이 수행될 수 있다. 이와 같은 추가적인 리소스 유닛 필터링 여부는 송신자의 전송 파워, 주파수 대역 별 최대 전송 파워, 수신된 OBSS 신호의 세기 등의 정보에 기초하여 결정될 수 있다.

[247] 본 발명의 일 실시예에 따르면, 비할당 S40 채널(640)의 CCA 결과에 따라 다음과 같이 중앙 26-톤 RU(650)의 필터링 여부(즉, 비할당 리소스 유닛으로의 설정 여부)를 결정할 수 있다. 첫째로, 비할당 S40 채널(640)에서 64FFT/20MHz를 사용하는 레거시 PPDU가 검출된 경우, 중앙 26-톤 RU(650)의 필터링이 수행될 수 있다. 둘째로, 비할당 S40 채널(640)에서 256FFT/20MHz를 사용하는 HE PPDU가 검출될 경우, 해당 HE PPDU가 점유하는 대역에 기초하여 중앙 26-톤 RU(650)의 필터링 여부가 결정될 수 있다. 만약 HE PPDU가 점유하는 대역이 중앙 26-톤 RU(650)로부터 기 설정된 주파수 간격 이상 떨어져 있는 경우, 중앙 26-톤 RU(650)는 필터링 되지 않을 수 있다. 그러나 HE PPDU가 점유하는 대역이 중앙 26-톤 RU(650)로부터 기 설정된 주파수 간격 미만으로 떨어져 있는 경우, 중앙 26-톤 RU(650)의 필터링이 수행될 수 있다. 셋째로, 비할당 S40 채널(640)에서 레거시 PPDU 또는 HE PPDU가 검출되지 않고 임의의 무선 신호가 검출된 경우, 해당 신호가 점유하는 대역에 기초하여 중앙 26-톤 RU(650)의 필터링 여부가 결정될 수 있다. 만약 해당 신호가 점유하는 대역의 가장자리가 중앙 26-톤 RU(650)로부터 기 설정된 주파수 간격 이상 떨어져 있는 경우, 중앙 26-톤 RU(650)는 필터링 되지 않을 수 있다.

[248] 다음으로, 도 36은 1개의 RF 모듈을 구비한 단말이 80MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S20 채널(642)이 점유 상태인 상황을 도시한다. 단말은 P20 채널 및 S40 채널을 포함하는 60MHz 대역으로 불연속 PPDU를 전송한다. 이때, 불연속 PPDU는 80MHz 스펙트럴 마스크(612)를 이용하여

전송되며, 점유 상태로 판별된 S20 채널(642)에서는 필터링이 수행되어 데이터가 전송되지 않는다. 그러나 P20 채널을 통해 전송되는 신호에는 20MHz 스펙트럴 마스크가 적용되지 않으므로, S20 채널과의 경계에 인접한 일부 리소스 유닛의 신호들은 S20 채널을 통해 전송되는 OBSS 신호에 간섭을 줄 수 있다.

[249] 도 36의 실시예에서도 마찬가지로, 도 35의 실시예에서 설명된 방법에 따라 중앙 26-톤 RU(652) 및/또는 인접 리소스 유닛의 필터링 여부가 결정될 수 있다. 뿐만 아니라, 비할당 S20 채널(642)에 인접한 전송 채널(즉, P20 채널)의 일부 리소스 유닛이 비할당 S20 채널(642)에서의 OBSS 신호에 간섭을 미칠 가능성이 있다면, 상기 일부 리소스 유닛에도 추가적인 필터링이 수행될 수 있다. 본 발명의 일 실시예에 따르면, 송신자는 전송 채널에서 비할당 채널에 인접한 대역에는 좁은 대역폭의 리소스 유닛들을 할당하여 리소스 낭비를 최소화할 수 있다.

[250] 다음으로, 도 37은 2개의 RF 모듈을 구비한 단말이 80+80MHz 대역폭으로 PPDU를 전송하려고 하지만, CCA 결과 S40 채널(644)이 점유 상태인 상황을 도시한다. 단말은 2개의 RF 모듈을 이용하여 P40 채널(P20 채널 + S20 채널) 및 S80 채널로 각각 불연속 PPDU를 전송한다. 단말은 제1 RF 모듈을 이용하여 40MHz 스펙트럴 마스크(614)가 적용된 PPDU를 P40 채널을 통해 전송하고, 제2 RF 모듈을 이용하여 80MHz 스펙트럴 마스크(616)가 적용된 PPDU를 S80 채널을 통해 전송한다. 따라서, 도 37의 실시예에서는 비할당 S40 채널(644)에 인접한 전송 채널(즉, P20 채널)에 포함된 일부 리소스 유닛의 추가적인 필터링이 필요하지 않다. 그러나, 비할당 S40 채널(644)에 인접한 중앙 26-톤 RU(654)의 최소 절반은 필터링이 수행되어야 한다. 따라서, 본 발명의 실시예에 따르면 중앙 26-톤 RU(654)이 비할당 리소스 유닛으로 설정될 수 있다.

[251] 도 38 및 도 42는 본 발명의 추가적인 실시예에 따른 HE MU PPDU의 시그널링 방법들을 도시한다. 도 38 내지 도 42의 실시예들에서, 채널 A 내지 채널 D는 80MHz PPDU가 전송되는 각각의 20MHz 채널을 가리킨다. 이때, 채널 A는 P20 채널로, 채널 B는 S20 채널로, 채널 C 및 채널 D는 S40 채널로 각각 지정된다. 또한, HE-SIG-B 콘텐츠 채널 1은 채널 A 및 채널 C 중 적어도 하나를 통해 전송되며, HE-SIG-B 콘텐츠 채널 2는 채널 B 및 채널 D 중 적어도 하나를 통해 전송된다.

[252] 도 38은 HE MU PPDU에서 중앙 26-톤 RU의 할당 정보를 시그널링 하는 방법의 일 실시예를 도시한다. 도 38(a)는 총 대역폭 80MHz의 PPDU를 구성하는 리소스 유닛들을 도시하며, 도 38(b)는 해당 PPDU를 통해 운반되는 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2의 구성을 도시한다. 각각의 HE-SIG-B 콘텐츠 채널에서 RA 필드 및 사용자 필드가 운반되는 구체적인 방법은 이전의 실시예들에서 서술된 바와 같다.

[253] 80MHz 이상의 총 대역폭으로 PPDU가 전송될 경우, 도 38(a)에 도시된 바와

같이 중앙 26-톤 RU(502)가 추가적으로 사용될 수 있다. 전술한 바와 같이, HE-SIG-B의 공통 블록 필드에는 중앙 26-톤 RU(502)가 사용자에게 할당되었는지 여부를 나타내는 C26 필드(미도시)가 더 포함될 수 있다. 상기 C26 필드는 공통 블록 필드 내에서 RA 필드의 이전 또는 이후에 위치하는 1비트 지시자로 구성될 수 있다. 본 발명의 실시예에 따르면, C26 필드는 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 양쪽을 통해 운반될 수 있다. 만약 C26 필드가 중앙 26-톤 RU(502)의 할당을 지시할 경우, 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)가 HE-SIG-B를 통해 운반되어야 한다.

[254] 만약 80MHz의 총 대역폭으로 PPDU가 전송될 경우, HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 C26 필드 및 HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 C26 필드는 모두 해당 80MHz 총 대역폭의 중앙 26-톤 RU(502)가 사용자에게 할당되었는지 여부를 지시할 수 있다. 이때, C26 필드가 중앙 26-톤 RU(502)의 할당을 지시할 경우, 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)는 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반될 수 있다. 그러나 C26 필드가 중앙 26-톤 RU(502)의 비할당을 지시할 경우, 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)는 운반되지 않는다.

[255] 한편, 160MHz 또는 80+80MHz의 총 대역폭으로 PPDU가 전송될 경우, 총 대역폭은 제1 80MHz 대역폭 및 제2 80MHz 대역폭으로 구성될 수 있다. 여기서, 제1 80MHz 대역폭은 제2 80MHz 대역폭보다 낮은 주파수의 대역일 수 있다. 각각의 80MHz 대역폭에는 중앙 26-톤 RU가 존재할 수 있다. 이때, HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 제1 C26 필드는 제1 80MHz 대역폭의 제1 중앙 26-톤 RU가 사용자에게 할당되었는지 여부를 지시할 수 있다. 또한, HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 제2 C26 필드는 제2 80MHz 대역폭의 제2 중앙 26-톤 RU가 사용자에게 할당되었는지 여부를 지시할 수 있다. 만약 제1 C26 필드가 제1 중앙 26-톤 RU의 할당을 지시할 경우, 제1 중앙 26-톤 RU에 대응하는 사용자 필드는 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반될 수 있다. 또한, 제2 C26 필드가 제2 중앙 26-톤 RU의 할당을 지시할 경우, 제2 중앙 26-톤 RU에 대응하는 사용자 필드는 HE-SIG-B 콘텐츠 채널 2의 사용자 특정 필드를 통해 운반될 수 있다. 그러나 상기 제1 C26 필드 및/또는 제2 C26 필드가 중앙 26-톤 RU의 비할당을 지시할 경우, 이에 대응하는 사용자 필드는 운반되지 않는다.

[256] 도 39는 전체 대역폭 MU-MIMO로 전송되는 HE MU PPDU에서 HE-SIG-B를 시그널링하는 방법을 도시한다. 도 39(a)에 도시된 바와 같이 전체 대역폭 MU-MIMO 전송이 수행될 경우, HE-SIG-B의 RA 필드는 전송될 필요가 없다. 따라서, HE-SIG-A의 SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시할 수 있다. 한편, 사용자 필드들은 HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2에 분배되어 운반된다. 수신자는 HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2를 모두 디코딩하여, 해당 단말에 대응하는 사용자 필드가 전송되는지

여부를 확인한다.

[257] 도 39(b)는 전체 대역폭 MU-MIMO 전송이 수행될 경우(즉, SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우), HE-SIG-A의 특정 서브필드가 MU-MIMO 사용자의 개수 정보를 지시하는 실시예를 도시한다. 본 발명의 일 실시예에 따르면, 전체 대역폭 MU-MIMO 전송이 수행될 경우 HE-SIG-A의 SIG-B 듀얼 MCS 필드는 MU-MIMO 사용자의 개수 정보를 지시할 수 있다. 전체 대역폭 MU-MIMO 전송이 수행될 경우, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2는 서로 다른 MCS를 통해 정보량을 분산할 필요가 없기 때문이다. 본 발명의 다른 실시예에 따르면, 전체 대역폭 MU-MIMO 전송이 수행될 경우 HE-SIG-A의 HE-SIG-B 심볼의 개수 필드는 MU-MIMO 사용자의 개수 정보를 지시할 수 있다. 전체 대역폭 MU-MIMO 전송이 수행될 경우, MU-MIMO 사용자의 개수 정보와 MCS 정보를 전달하는 것이 HE-SIG-B 심볼의 개수와 MCS 정보를 전달하는 것보다 수신자의 디코딩을 간편하게 때문이다.

[258] 도 39(c)는 전체 대역폭 MU-MIMO 전송이 수행될 경우, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2의 상세 구성을 도시한다. 전체 대역폭 MU-MIMO가 수행되는 경우, HE-SIG-B에는 RA 필드가 존재하지 않는다. 따라서, 20MHz보다 큰 대역폭을 통해 MU-MIMO 전송이 수행될 경우, HE-SIG-B 콘텐츠 채널 1과 HE-SIG-B 콘텐츠 채널 2에 각각 지정되는 사용자 개수가 별도로 결정되어야 한다.

[259] 본 발명의 실시예에 따르면, 20MHz보다 큰 대역폭을 통해 MU-MIMO 전송이 수행될 경우, 사용자 필드들은 로드 밸런싱을 위해 2개의 콘텐츠 채널간에 공평하게 분배될 수 있다. 즉, 각각의 SIG-B 콘텐츠 채널에서 전송되는 사용자 필드의 개수는 전체 유저 개수의 절반의 올림값 또는 내림값으로 결정된다. 예를 들어, 사용자 필드의 전체 개수가 n인 경우, 1부터 m(여기서, m은 ceil(n/2))번째 사용자 필드들은 HE-SIG-B 콘텐츠 채널 1을 통해 전송되고, m+1~n번째 사용자 필드들은 HE-SIG-B 콘텐츠 채널 2를 통해 전송될 수 있다. 만약 n이 홀수인 경우, HE-SIG-B 콘텐츠 채널 1에 포함된 사용자 필드들의 개수는 HE-SIG-B 콘텐츠 채널 2에 포함된 사용자 필드들의 개수보다 1개 많게 될 수 있다. 총 n개의 사용자 필드들은 HE-SIG-B 콘텐츠 채널 1의 각 사용자 필드, 그 다음 HE-SIG-B 콘텐츠 채널 2의 각 사용자 필드의 순서로 할당된다.

[260] 도 40은 불연속 PPDU에서 특정 리소스 유닛의 비할당을 시그널링하는 일 실시예를 도시한다. 도 35 내지 도 37의 실시예에서 설명된 바와 같이, 불연속 PPDU 전송 과정에서는 비할당 채널에 인접한 전송 채널의 일부 리소스 유닛(506)에 추가적인 필터링이 수행될 수 있다. 도 40(a)를 참조하면, 비할당 채널인 채널 B에 인접한 전송 채널(즉, 채널 A)의 리소스 유닛(506)에는 추가적인 필터링이 수행될 수 있다.

[261] 도 40(b)는 이러한 불연속 PPDU의 특정 리소스 유닛(506)의 비할당을 지시하는 HE-SIG-B의 구성을 도시한다. 도 40(b)를 참조하면, HE-SIG-B의 RA 필드는 전송

채널(즉, 채널 A)의 리소스 유닛 할당 정보를 지시한다. 채널 A의 각 리소스 유닛은 STA A1 내지 STA An에게 할당된다. HE-SIG-B의 사용자 특정 필드는 각각의 리소스 유닛에 대응하는 사용자 필드를 운반한다. 이때, 필터링 되는 리소스 유닛(506)에 대응하는 사용자 필드(426)에는 널 STA ID가 삽입될 수 있다. 널 STA ID의 구체적인 실시예는 이전 도면의 실시예들에서 전술한 바와 같다.

[262] 도 41은 불연속 PPDU에서 중앙 26-톤 RU(502)의 할당 정보를 시그널링하는 다른 실시예를 도시한다. 전술한 바와 같이, RA 필드는 사용자에게 할당되지 않는 특정 채널을 기 설정된 인덱스를 통해 지시할 수 있다. 즉, RA 필드는 20MHz 채널의 배수의 대역폭 즉, 242-톤, 484-톤 또는 996-톤의 리소스 유닛의 널링을 지시할 수 있다. 이와 같이, 비할당 채널의 대역폭 정보가 RA 필드를 통해 지시되면, 중앙 26-톤 RU(502)의 할당 여부가 묵시적으로 파악될 수 있다.

[263] 먼저, 도 41(a)는 80MHz의 총 대역폭에서 S40A 채널(즉, 채널 C)이 점유 상태인 상황을 도시한다. 단말은 P40 채널 및 S40B 채널(즉, 채널 D)을 포함하는 60MHz 대역으로 PPDU를 전송한다. 이때, 채널 C에 대응하는 RA 필드는 242-톤 RU의 널링을 지시한다. 도 41(b)는 도 41(a)의 실시예에 따라 전송되는 PPDU의 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2의 구성을 도시한다. HE-SIG-B 콘텐츠 채널 1의 RA 필드에서 242-톤 RU의 널링이 지시되므로, 수신자는 중앙 26-톤 RU(502)가 사용자에게 할당될 수 있음을 식별할 수 있다. 따라서, HE-SIG-B 콘텐츠 채널 1은 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)를 운반한다.

[264] 한편, 도 41(c)는 80MHz의 총 대역폭에서 S40 채널이 점유 상태인 상황을 도시한다. 단말은 P40 채널을 통해 PPDU를 전송한다. 이때, 채널 C 및 채널 D에 대응하는 RA 필드들은 484-톤 RU의 널링을 지시한다. 도 41(d)는 도 41(c)의 실시예에 따라 전송되는 PPDU의 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2의 구성을 도시한다. HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2의 RA 필드들에서 484-톤 RU의 널링이 지시되므로, 수신자는 중앙 26-톤 RU(502)가 사용자에게 할당되지 않음을 식별할 수 있다. 즉, S40 채널 전체가 사용자에게 할당되지 않으므로 중앙 26-톤 RU(502) 역시 비할당 리소스 유닛으로 설정될 수 있다. 따라서, HE-SIG-B 콘텐츠 채널 1은 중앙 26-톤 RU(502)에 대응하는 사용자 필드(422)를 운반하지 않을 수 있다.

[265] 도 42는 본 발명의 실시예에 따라 불연속 PPDU가 전송될 때 프리앰블 및 데이터의 전송 방법을 도시한다. 도 42(a) 내지 도 42(c)의 각각의 실시예에서는 80MHz의 총 대역폭에서 S40B 채널(즉, 채널 D)이 점유 상태인 상황을 가정한다. 단말은 P40 채널 및 S40A 채널(즉, 채널 C)을 포함하는 60MHz 대역으로 PPDU를 전송한다.

[266] 먼저 도 42(a)의 실시예에 따르면, 불연속 PPDU의 전송 시 단말은 비할당 채널에서 데이터뿐만 아니라 프리앰블도 전송하지 않을 수 있다. 이때, 단말은

비할당 채널에서 레거시 프리앰블과 논-레거시 프리앰블을 모두 전송하지 않는다. 이러한 경우, 해당 채널에서 이미 전송되고 있는 OBSS 신호에 간섭을 주지 않는 장점이 있다. 또한, 특정 채널에서 전송을 수행하지 않게 되면, 광대역 PPDU 전송임에도 불구하고 전송 파워의 분산 량이 줄어들게 되어 PPDU의 수신율이 높아지는 장점이 있다. 그러나 이러한 방법은 S20 채널이 점유 상태인 경우 HE-SIG-B의 시그널링이 복잡해지는 단점이 있다. 또한, HE-STF는 전체 대역폭 80MHz를 통해 PPDU가 전송될 때 시간 축에서 반복되는 패턴을 갖는데, HE-STF가 일부 채널에서 전송되지 않으면 시간 축에서 반복되는 패턴을 가지기 어렵게 된다.

[267] 따라서 도 42(b)의 실시예에 따르면, 불연속 PPDU의 전송 시 단말은 비할당 채널에서 데이터를 전송하지 않지만 프리앰블은 전송할 수 있다. 이때, 단말은 비할당 채널에서 레거시 프리앰블과 논-레거시 프리앰블을 모두 전송할 수 있다. 이러한 경우, 해당 채널에서 이미 전송되고 있는 OBSS 신호에 간섭을 줄 수도 있지만, 광대역 PPDU의 전송의 경우 전송 파워가 전체 대역으로 분산되므로 OBSS 신호에 큰 피해를 주지 않을 수 있다.

[268] 본 발명의 또 다른 실시예에 따르면, 도 42(c)에 도시된 바와 같이 단말은 비할당 채널에서 HE-STF 및 HE-LTF만(또는, HE-STF만) 전송할 수 있다. 즉, 전체 대역에서 수신이 필요하지 않은 레거시 프리앰블, HE-SIG-A 및 HE-SIG-B의 전송은 제한되고, 전체 대역에서 수신이 필요한 HE-STF 및 HE-LTF만 전송되므로 OBSS 신호에 대한 간섭을 최소화할 수 있다.

[269] 도 43 및 도 44는 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를 도시한다. 전술한 바와 같이, HE MU PPDU는 DL-MU 전송뿐만 아니라 상향 전송에서도 사용될 수 있다.

[270] 도 43은 단일 STA의 상향 전송에서 HE MU PPDU가 사용되는 일 실시예를 도시한다. 본 발명의 실시예에 따르면, STA는 도 43(a)에 도시된 바와 같이 20MHz 대역폭 이하의 리소스 유닛(즉, 협대역)을 이용하여 전송을 수행할 수 있다. STA는 특정 리소스 유닛에 전송 파워를 집중함으로 데이터의 전송 거리를 증가시킬 수 있다. 도 43(b) 내지 도 43(d)는 이러한 협대역 전송을 시그널링하는 실시예들을 도시한다.

[271] 본 발명의 일 실시예에 따르면, 협대역 전송은 도 43(b)에 도시된 바와 같이 HE-SIG-B의 사용자 필드에 삽입되는 널 STA ID를 통해 시그널링 될 수 있다. 더욱 구체적으로, HE-SIG-A의 RA 필드는 특정 채널에서의 리소스 유닛 분할 형태에 대한 정보를 지시할 수 있다. 예를 들어, 20MHz의 대역폭이 OFDMA에 기반하여 9개의 리소스 유닛들로 분할되는 경우, RA 필드는 도 15(c)에 도시된 바와 같이 “00000000”을 시그널링할 수 있다. 이때, 분할된 9개의 리소스 유닛들 중 상향 데이터 전송에 사용되는 리소스 유닛에 대응하는 사용자 필드에 수신자 또는 송신자의 AID가 삽입될 수 있다. 반면에, 데이터 전송이 수행되지 않는 나머지 리소스 유닛들에 대응하는 사용자 필드들에는 널 STA ID가 삽입될 수

있다.

[272] 예를 들어, 9개의 리소스 유닛들 중 3번째 26-톤 RU를 통해서만 데이터가 전송되는 경우, 1~2번째 사용자 필드들 및 4~9번째 사용자 필드들에는 널 STA ID가 삽입될 수 있다. 그러나 이와 같이 DL-MU 전송을 기반으로 설계된 HE-SIG-B의 시그널링 구조를 그대로 상향 협대역 전송에서 사용하게 되면, 시그널링 오버헤드가 커질 수 있다. 따라서, 시그널링 오버헤드를 줄이기 위해 다른 시그널링 방법이 사용될 수 있다. 본 발명의 다른 실시예에 따르면, 수신자 또는 송신자의 AID가 삽입된 사용자 필드 이후의 사용자 필드들은 시그널링에서 제외될 수 있다. 즉, 앞선 실시예에서 1~2번째 사용자 필드들에는 널 STA ID가 삽입되고, 3번째 사용자 필드에는 수신자 또는 송신자의 AID가 삽입될 수 있다. 그러나 4~9번째 사용자 필드들은 전송되지 않을 수 있다. 해당 PPDU를 수신한 AP는 3번째 사용자 필드에서 송신 STA의 정보를 획득한 이후 추가적인 사용자 필드를 수신할 필요가 없기 때문이다.

[273] 본 발명의 다른 실시예에 따르면, 도 43(c)에 도시된 바와 같이 협대역 전송을 위해 HE-SIG-B의 RA 필드에 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다. 더욱 구체적으로, HE-SIG-B의 RA 필드는 상향 전송이 수행되는 특정 26-톤 RU, 52-톤 RU 및/또는 106-톤 RU를 인덱싱할 수 있다. 이 경우, RA 필드에서 지시하는 리소스 유닛에 대응하는 하나의 사용자 필드만 운반되므로 시그널링 오버헤드가 크게 줄어들 수 있다. 일 실시예에 따르면, 상향 리소스 유닛 할당의 인덱스 값들은 DL-MU 전송을 위한 RA 필드 구성의 미 할당된(즉, TBD) 인덱스들 중에서 사용될 수 있다. 다른 실시예에 따르면, RA 필드 내에서 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다.

[274] 본 발명의 또 다른 실시예에 따르면, 협대역 전송은 HE-SIG-A의 불필요한 필드들을 재활용하여 시그널링 될 수 있다. 예를 들어, 상향 전송에서 HE MU PPDU가 사용될 경우, HE-SIG-A에서 HE-LTF 심볼의 개수 필드와 HE-SIG-B 심볼의 개수 필드는 다른 용도로 사용될 수 있다. HE-LTF 심볼의 개수 필드는 HE-SIG-B의 사용자 특정 필드의 NSTS 필드와 기능이 중복되므로 별도의 시그널링이 필요하지 않다. 또한, 단일 STA의 시그널링에서는 시그널링 정보량이 고정되어 설계에 따라 심볼 수를 고정할 수 있으므로, HE-SIG-B 심볼의 개수 필드를 통해 별도의 심볼 수를 지시할 필요가 없다. 따라서, 상기 필드들 중 적어도 하나를 이용하여 상향 HE MU PPDU의 시그널링을 수행할 수 있다. 예를 들면, RA 필드가 지시하는 리소스 유닛 할당에서 해당 STA이 상향 데이터를 전송하는 리소스 유닛의 위치를 상기 필드들 중 적어도 하나를 이용하여 지시할 수 있다. 이 경우 HE-SIG-B의 RA 필드는 기존과 동일하게 설정되며, 하나의 사용자 필드만 운반되므로 시그널링 오버헤드가 줄어들 수 있다.

[275] 한편 본 발명의 또 다른 실시예에 따르면, HE MU PPDU를 이용한 상향 전송은 협대역 뿐만 아니라 20MHz, 40MHz, 80MHz, 160MHz(80+80MHz)의 전체

대역폭을 통해서도 수행될 수 있다. 이때, HE-SIG-A의 대역폭 필드는 PPDU의 총 대역폭을 지시하며, SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시할 수 있다. 따라서, 상향 HE MU PPDU에서 HE-SIG-B의 RA 필드는 생략될 수 있다. 한편, 하향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, MU-MIMO 기반의 사용자 특정 정보가 지시될 수 있었다. 그러나 상향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, 도 43(c)에 도시된 바와 같이 OFDMA 기반의 사용자 특정 정보가 지시될 수 있다.

[276] 도 44는 단일 STA가 AP에게 불연속 PPDU를 전송할 때의 HE-SIG-B 구성 방법을 도시한다. 도 44의 실시예에서는 80MHz의 총 대역폭에서 S20 채널이 점유 상태인 상황을 도시한다. 따라서, STA는 P20 채널 및 S40 채널을 포함하는 60MHz 대역으로 PPDU를 전송한다.

[277] 기존의 HE SU PPDU 포맷에서 정의된 HE-SIG-A의 대역폭 필드는 불연속 PPDU를 시그널링 하는데 적합하지 않다. 따라서, STA는 HE MU PPDU 포맷을 이용하여 불연속 PPDU의 전송을 수행할 수 있다. 이때, HE-SIG-A의 대역폭 필드는 80MHz의 총 대역폭에서 S20 채널의 펑처링을 지시한다. HE-SIG-B는 단일 STA의 정보(즉, SU Info)를 P20 채널 및 S40 채널을 통해 운반한다.

[278] 한편, 불연속 PPDU의 구성 정보가 대역폭 필드를 통해 시그널링 되었으므로, HE-SIG-B의 공통 블록 필드는 생략될 수 있다. 따라서, SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시할 수 있다. 또한, HE-SIG-B의 사용자 특정 필드는 하나의 사용자 필드만을 운반할 수 있다. 이때, 사용자 필드는 수신자의 AID가 아닌 송신자의 AID가 삽입될 수 있다. HE MU PPDU가 상향 전송에 사용될 경우 해당 PPDU의 수신자는 AP인 것이 자명하기 때문이다. HE MU PPDU의 상향/하향 필드가 상향 전송을 지시할 경우, AP는 사용자 필드에 삽입된 AID를 송신자의 AID로 해석할 수 있다.

[279] 도 45 및 도 46은 본 발명의 추가적인 실시예에 따른 불연속 채널 할당 및 이에 대한 시그널링 방법들을 도시한다. 전술한 바와 같이, 본 발명의 일 실시예에 따르면 광대역 PPDU는 불연속, 제한된 유연한 채널 확장 방법에 따라 전송될 수 있다.

[280] 도 45는 불연속, 제한된 유연한 채널 확장 방법으로 PPDU가 전송될 때 HE-SIG-A 및 HE-SIG-B를 시그널링하는 방법을 도시한다. 도 19(e)에서 전술한 바와 같이, 유연한 채널 확장 방법은 전송되는 PPDU가 점유하는 대역이 P20 채널을 포함하는 기 설정된 중심 채널들을 항상 포함하여 구성되는 채널 확장 방법을 의미한다. 도 45의 실시예에서는 P20 채널 및 S20 채널을 포함하는 P40 채널이 중심 채널들로 설정되어 있다. 다만, 상기 중심 채널들은 HE-SIG-B의 시그널링 부담을 줄이기 위해 선정된 대역폭이며, 실시예에 따라 HE-SIG-B의 시그널링 부담이 가중되지 않는 경우 중심 채널들은 변경될 수 있다.

[281] 먼저, 도 45(a)는 160MHz의 총 대역폭에서 S40B 채널 및 S80 채널이 점유

상태인 상황을 도시한다. 단말은 P40 채널 및 S40A 채널을 포함하는 60MHz 대역으로 불연속 PPDU를 전송한다. 이때, 전송되는 PPDU의 HE-SIG-A의 대역폭 필드는 160MHz를 지시할 수 있다. HE-SIG-B 콘텐츠 채널 1은 채널 A 및 채널 C의 할당 정보(A, C, 996-Null, 996-Null)를 운반하며, 채널 A 및 채널 C를 통해 전송된다. HE-SIG-B 콘텐츠 채널 2는 CH B의 할당 정보(B, 242-Null, 996-Null, 996-Null)를 운반하며, 채널 B를 통해 전송된다.

[282] 다음으로, 도 45(b)는 160MHz의 총 대역폭에서 S40A 채널 및 S80 채널이 점유 상태인 상황을 도시한다. 단말은 P40 채널 및 S40B 채널을 포함하는 60MHz 대역으로 불연속 PPDU를 전송한다. 이때, 전송되는 PPDU의 HE-SIG-A의 대역폭 필드는 160MHz를 지시할 수 있다. HE-SIG-B 콘텐츠 채널 1은 채널 A의 할당 정보(A, 242-Null, 996-Null, 996-Null)를 운반하며, 채널 A를 통해 전송된다. HE-SIG-B 콘텐츠 채널 2는 CH B 및 채널 D의 할당 정보(B, D, 996-Null, 996-Null)를 운반하며, 채널 B 및 채널 D를 통해 전송된다.

[283] 다음으로, 도 45(c)는 160MHz의 총 대역폭에서 P20 채널만을 통해서 PPDU가 전송되는 상황을 도시한다. 이때, 전송되는 PPDU의 HE-SIG-A의 대역폭 필드는 160MHz를 지시하고, HE-SIG-B 콘텐츠 채널 1은 채널 A의 할당 정보(A, 242-Null, 996-Null, 996-Null)를 운반한다. 이 경우, HE-SIG-B의 시그널링 부담이 가중되지 않으므로 중심 채널들 중 적어도 일부를 점유하지 않은 PPDU의 전송이 가능하다.

[284] 마지막으로, 도 45(d)는 160MHz의 총 대역폭에서 S40B 채널, S80A 채널, S80C 채널 및 S80D 채널이 점유 상태인 상황을 도시한다. 단말은 P40 채널, S40A 채널 및 S80B 채널을 포함하는 80MHz 대역으로 불연속 PPDU를 전송한다. 이때, 전송되는 PPDU의 HE-SIG-A의 대역폭 필드는 160MHz를 지시할 수 있다. HE-SIG-B 콘텐츠 채널 1은 채널 A 및 채널 C의 할당 정보(A, C, 242-Null, 484-Null)를 운반하며, 채널 A 및 채널 C를 통해 전송된다. HE-SIG-B 콘텐츠 채널 2는 CH B 및 채널 F의 할당 정보(B, 242-Null, F, 484-Null)를 운반하며, 채널 B 및 채널 F를 통해 전송된다.

[285] 각 도면을 통해 설명된 채널 할당 정보(A1, A2, A3, A4)에서 A1, A2, A3 및 A4는 각각 HE-SIG-B 콘텐츠 채널을 통해 운반되는 제1 RA 필드, 제2 RA 필드, 제3 RA 필드 및 제4 RA 필드를 나타낸다. 이와 같이 본 발명의 실시예에 따르면, HE-SIG-A 및 HE-SIG-B의 조합을 통해 다양한 불연속 PPDU가 시그널링 될 수 있다.

[286] 도 46은 불연속, 제한된 유연한 채널 확장 방법으로 PPDU가 전송될 때의 채널 할당 방법을 도시한다. 도 46(a)는 80MHz의 총 대역폭에서의 불연속 채널 할당 옵션들을 도시하며, 도 46(b)는 160MHz의 총 대역폭에서의 불연속 채널 할당 옵션들을 도시한다. 도 46(b)에서 P80 채널은 도 46(a)에 도시된 채널들 중 어느 하나로 구성될 수 있다.

[287] 도 46(b)에 도시된 S80 채널의 비할당 정보는 전술한 바와 같이 HE-SIG-B의 RA

필드를 통해 지시되거나, 사용자 필드의 널 STA ID를 통해 지시될 수 있다. 또한, 도 46(a) 및 도 46(b)에 도시된 중앙 26-톤 RU의 할당 여부는 HE-SIG-B의 C26 필드를 통해 지시될 수 있다.

[288] 상기와 같이 무선랜 통신을 예로 들어 본 발명을 설명하였지만, 본 발명은 이에 한정하지 않으며 셀룰러 통신 등 다른 통신 시스템에서도 동일하게 적용될 수 있다. 또한 본 발명의 방법, 장치 및 시스템은 특정 실시예와 관련하여 설명되었지만, 본 발명의 구성 요소, 동작의 일부 또는 전부는 범용 하드웨어 아키텍처를 갖는 컴퓨터 시스템을 사용하여 구현될 수 있다.

[289] 상술한 본 발명의 실시예들은 다양한 수단을 통해 구현될 수 있다. 예를 들어, 본 발명의 실시예들은 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다.

[290] 하드웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 하나 또는 그 이상의 ASICs(Application Specific Integrated Circuits), DSPs(Digital Signal Processors), DSPDs(Digital Signal Processing Devices), PLDs(Programmable Logic Devices), FPGAs(Field Programmable Gate Arrays), 프로세서, 컨트롤러, 마이크로 컨트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

[291] 펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 실시예들에 따른 방법은 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차 또는 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리는 프로세서의 내부 또는 외부에 위치할 수 있으며, 이미 공지된 다양한 수단에 의해 프로세서와 데이터를 주고 받을 수 있다.

[292] 전술한 본 발명의 설명은 예시를 위한 것이며, 본 발명이 속하는 기술분야의 통상의 지식을 가진 자는 본 발명의 기술적 사상이나 필수적인 특징을 변경하지 않고서 다른 구체적인 형태로 쉽게 변형이 가능하다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시예들은 모든 면에서 예시적인 것이며 한정적인 것이 아는 것으로 해석해야 한다. 예를 들어, 단일형으로 설명되어 있는 각 구성 요소는 분산되어 실시될 수도 있으며, 마찬가지로 분산된 것으로 설명되어 있는 구성 요소들도 결합된 형태로 실시될 수 있다.

[293] 본 발명의 범위는 상기 상세한 설명보다는 후술하는 특허청구범위에 의하여 나타내어지며, 특허청구범위의 의미 및 범위 그리고 그 균등 개념으로부터 도출되는 모든 변경 또는 변형된 형태가 본 발명의 범위에 포함되는 것으로 해석되어야 한다.

## 산업상 이용가능성

[294] 본 발명의 다양한 실시예들은 IEEE 802.11 시스템을 중심으로 설명되었으나, 그 밖의 다양한 형태의 이동통신 장치, 이동통신 시스템 등에 적용될 수 있다.

# 청구범위

[청구항 1] 무선 통신 단말로서,
프로세서; 및
통신부를 포함하고,
상기 프로세서는,
상기 통신부를 통해 무선 패킷을 수신하고, 상기 수신된 패킷의 불연속(non-contiguous) 채널 할당 정보를 획득하고, 획득된 불연속 채널 할당 정보에 기초하여 상기 수신된 패킷을 디코딩하는 무선 통신 단말.

[청구항 2] 제1 항에 있어서,
상기 불연속 채널 할당 정보는 상기 수신된 패킷의 HE-SIG-A의 서브필드 및 HE-SIG-B의 서브필드 중 적어도 하나를 통해 지시되는 무선 통신 단말.

[청구항 3] 제2 항에 있어서,
상기 불연속 채널 할당 정보는 20MHz 단위의 비할당 채널 정보를 지시하는 무선 통신 단말.

[청구항 4] 제3 항에 있어서,
상기 불연속 채널 할당 정보는 상기 HE-SIG-A의 대역폭 필드를 통해 지시되며, 상기 대역폭 필드는 상기 패킷이 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링(puncturing)되는 채널 정보를 지시하는 무선 통신 단말.

[청구항 5] 제4 항에 있어서,
상기 대역폭 필드는 20MHz 부채널의 펑처링 및 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 각각 인덱싱 하는 무선 통신 단말.

[청구항 6] 제3 항에 있어서,
상기 불연속 채널 할당 정보는 상기 HE-SIG-B의 리소스 유닛 할당 필드의 기 설정된 인덱스를 통해 지시되는 무선 통신 단말.

[청구항 7] 제6 항에 있어서,
상기 리소스 유닛 할당 필드는 사용자에게 할당되지 않는 특정 리소스 유닛(RU)을 기 설정된 인덱스를 통해 지시하는 무선 통신 단말.

[청구항 8] 제7 항에 있어서,
상기 사용자에게 할당되지 않는 특정 리소스 유닛은 242-톤(tone) 리소스 유닛, 484-톤 리소스 유닛 및 996-톤 리소스 유닛 중 적어도 하나인 무선 통신 단말.

[청구항 9] 제1 항에 있어서,
상기 불연속 채널 할당 정보는 상기 HE-SIG-B의 리소스 유닛 할당 필드가 지시하는 리소스 유닛 배열 정보 및 상기 리소스 유닛 배열에서 특정

리소스 유닛에 대응하는 사용자 필드에 삽입된 널(Null) STA ID를 통해 획득되는 무선 통신 단말.

[청구항 10] 제9 항에 있어서,
상기 특정 리소스 유닛은 26-톤 리소스 유닛, 52-톤 리소스 유닛, 106-톤 리소스 유닛 중 적어도 하나인 무선 통신 단말.

[청구항 11] 제1 항에 있어서,
상기 불연속 채널 할당 정보는 상기 HE-SIG-A의 대역폭 필드 및 상기 HE-SIG-B의 리소스 유닛 할당 필드의 조합을 통해 지시되는 무선 통신 단말.

[청구항 12] 제11 항에 있어서,
상기 대역폭 필드는 상기 패킷이 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링되는 채널 정보를 지시하고, 상기 리소스 유닛 할당 필드는 상기 총 대역폭 내에서의 추가적인 펑처링 정보를 지시하는 무선 통신 단말.

[청구항 13] 제12 항에 있어서,
상기 대역폭 필드가 80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 상기 40MHz 부채널 중 어느 20MHz 채널이 펑처링 되는지를 지시하는 무선 통신 단말.

[청구항 14] 제12 항에 있어서,
상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 20MHz 부채널의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 80MHz 부채널에서의 추가적인 펑처링을 지시하는 무선 통신 단말.

[청구항 15] 제12 항에 있어서,
상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 상기 40MHz 부채널 중 어느 20MHz 채널이 펑처링 되는지를 지시하는 무선 통신 단말.

[청구항 16] 제12 항에 있어서,
상기 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 40MHz 부채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우, 상기 리소스 유닛 할당 필드는 80MHz 부채널에서의 추가적인 펑처링을 지시하는 무선 통신 단말.

[청구항 17] 제1 항에 있어서,
상기 패킷이 80MHz 이상의 총 대역폭으로 전송될 경우, 상기 불연속 채널 할당 정보는 80MHz에서의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 필드(C26 필드)의 정보를 더 포함하는 무선 통신 단말.

[청구항 18] 제17 항에 있어서,
상기 패킷의 HE-SIG-B 필드는 20MHz 단위의 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2로 구성되며, 상기 C26 필드는 상기 HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 양쪽을 통해 운반되는 무선 통신 단말.

[청구항 19] 제18 항에 있어서,
상기 패킷이 80MHz의 총 대역폭으로 전송될 경우, 상기 HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 C26 필드 및 상기 HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 C26 필드는 모두 상기 80MHz 총 대역폭의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 무선 통신 단말.

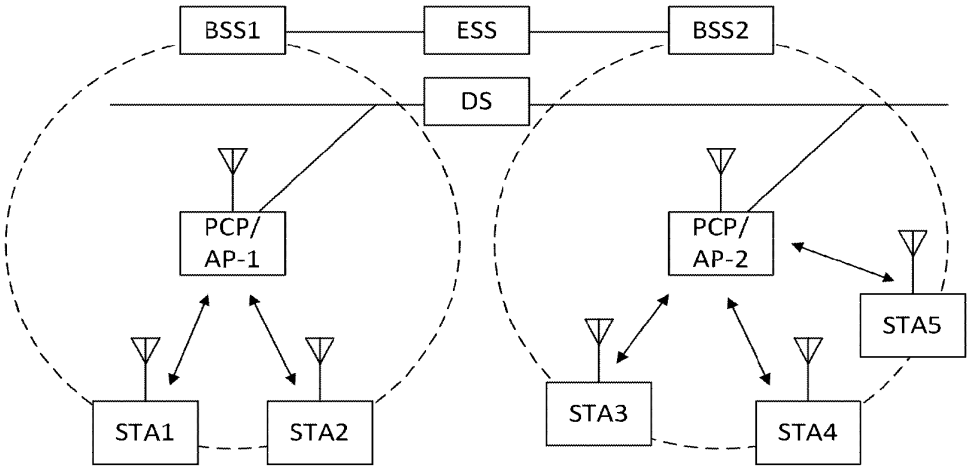
[청구항 20] 제19 항에 있어서,
상기 C26 필드가 상기 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반되는 무선 통신 단말.

[청구항 21] 제18 항에 있어서,
상기 패킷이 160MHz 또는 80+80MHz의 총 대역폭으로 전송될 경우 상기 총 대역폭은 제1 80MHz 대역폭 및 제2 80MHz 대역폭으로 구성되며,
상기 HE-SIG-B 콘텐츠 채널 1을 통해 운반되는 제1 C26 필드는 상기 제1 80MHz 대역폭의 제1 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하고, 상기 HE-SIG-B 콘텐츠 채널 2를 통해 운반되는 제2 C26 필드는 상기 제2 80MHz 대역폭의 제2 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 무선 통신 단말.

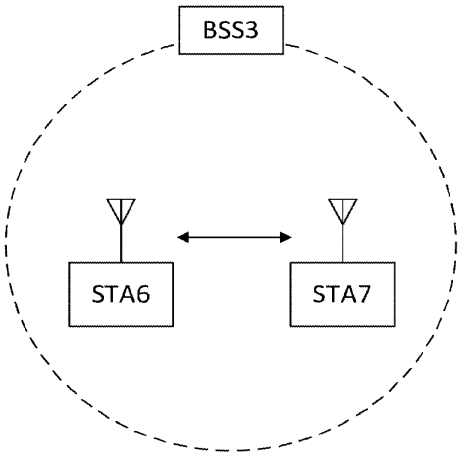
[청구항 22] 제21 항에 있어서,
상기 제1 C26 필드가 상기 제1 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 제1 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 1의 사용자 특정 필드를 통해 운반되고,
상기 제2 C26 필드가 상기 제2 중앙 26-톤 리소스 유닛의 할당을 지시할 경우, 상기 제2 중앙 26-톤 리소스 유닛에 대응하는 사용자 필드는 상기 HE-SIG-B 콘텐츠 채널 2의 사용자 특정 필드를 통해 운반되는 무선 통신 단말.

[청구항 23] 무선 통신 단말의 무선 통신 방법으로서,
무선 패킷을 수신하는 단계;
상기 수신된 패킷의 불연속 채널 할당 정보를 획득하는 단계; 및
획득된 불연속 채널 할당 정보에 기초하여 상기 수신된 패킷을 디코딩하는 단계;
를 포함하는 무선 통신 방법.

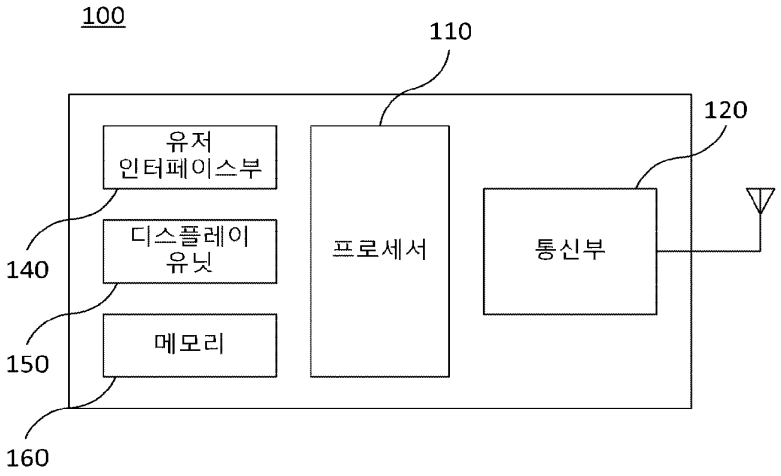
[도1]


BSS1
ESS
BSS2
DS
PCP/
AP-1
PCP/
AP-2
STA5
STA1
STA2
STA3
STA4

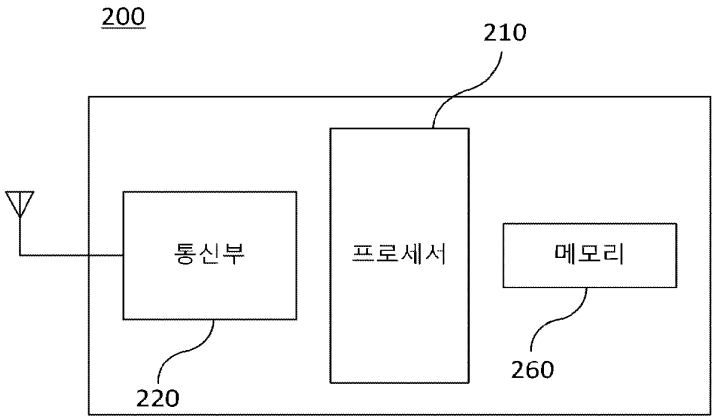
[도2]


BSS3
STA6
STA7

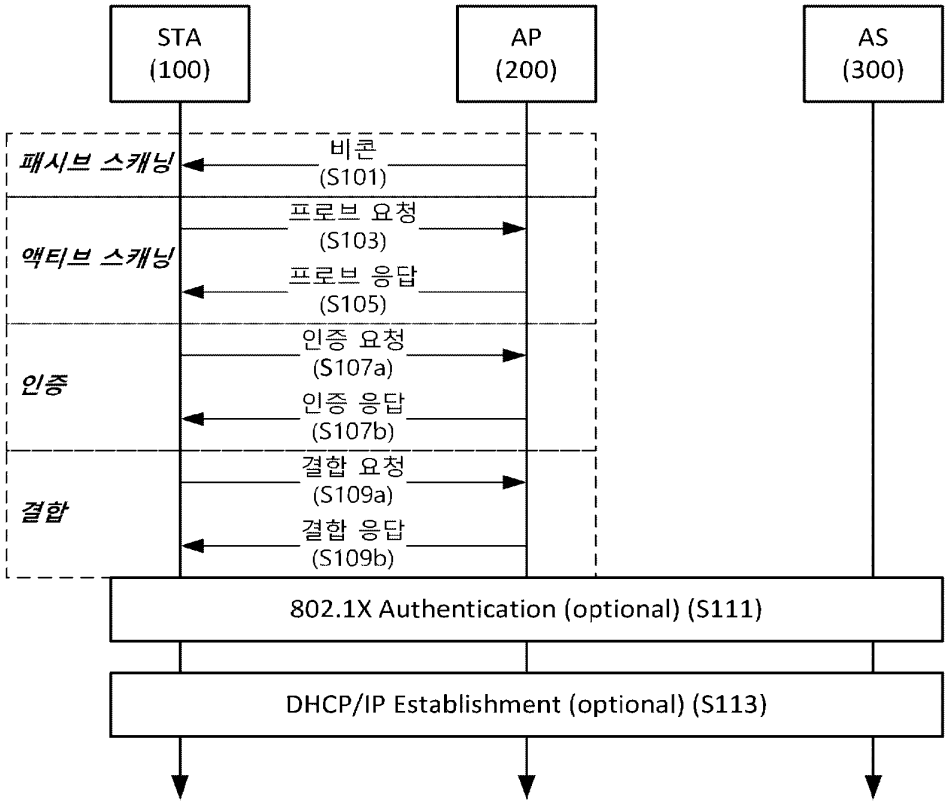
[도3]


100
110
120
유저
인터페이스부
디스플레이
유닛
프로세서
통신부
메모리
140
150
160

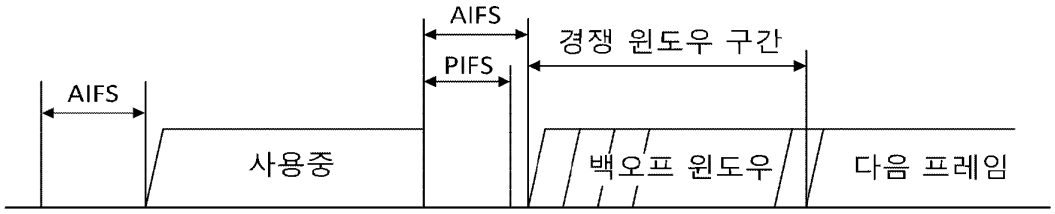
[도4]


200
210
통신부
프로세서
메모리
220
260

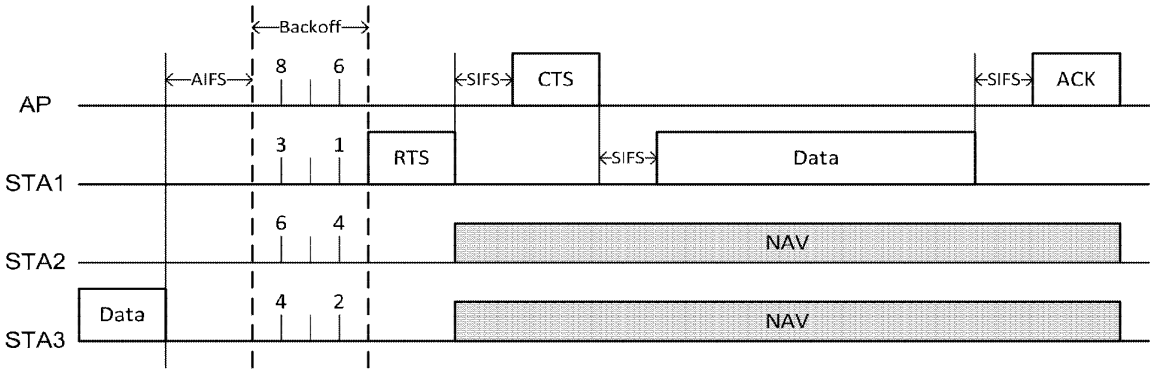
[도5]


STA
(100)
AP
(200)
AS
(300)
패시브 스캐닝
비콘
(S101)
액티브 스캐닝
프로브 요청
(S103)
프로브 응답
(S105)
인증
인증 요청
(S107a)
인증 응답
(S107b)
결합
결합 요청
(S109a)
결합 응답
(S109b)
802.1X Authentication (optional) (S111)
DHCP/IP Establishment (optional) (S113)

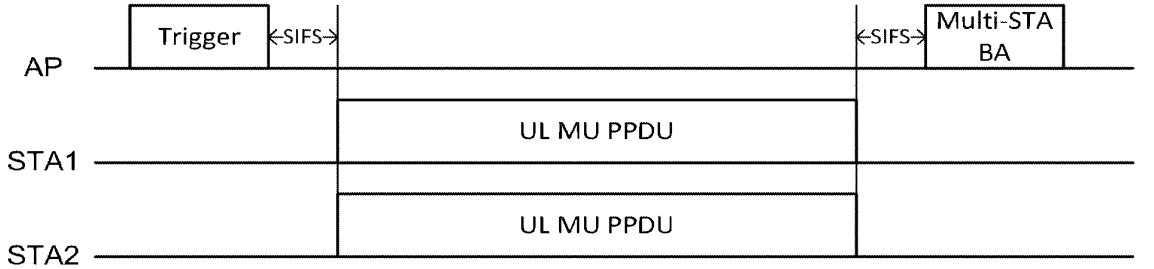
[도6]


AIFS
PIFS
경쟁 윈도우 구간
AIFS
사용중
백오프 윈도우
다음 프레임

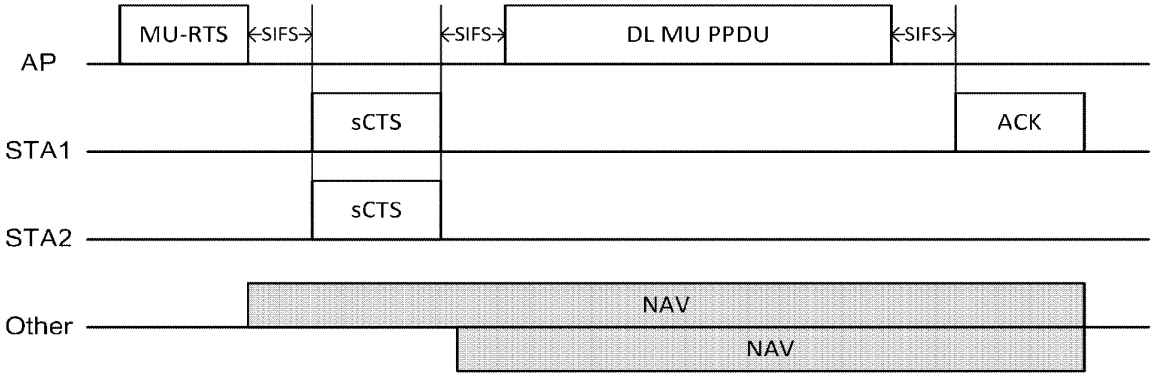
[도7]


Backoff
AIFS
8
6
SIFS
CTS
SIFS
ACK
AP
3
1
RTS
SIFS
Data
STA1
6
4
NAV
STA2
Data
4
2
NAV
STA3

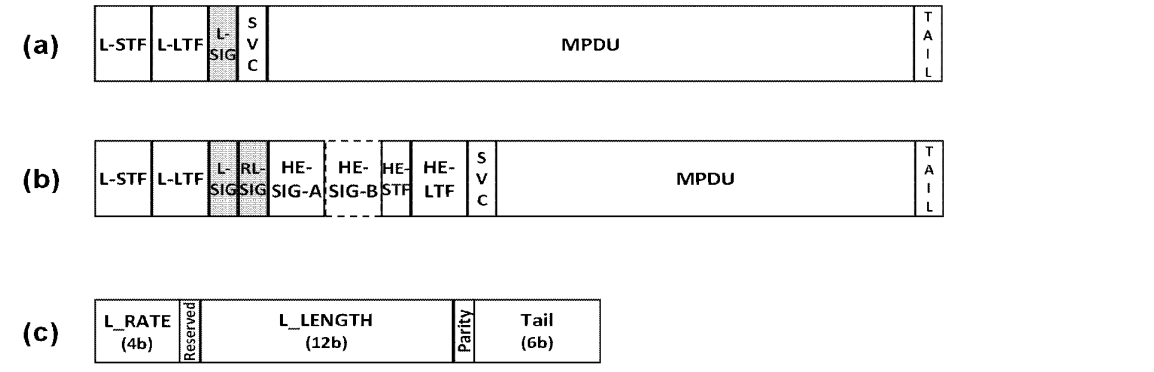
[도8]


Trigger
SIFS
SIFS
Multi-STA BA
AP
UL MU PPDU
STA1
UL MU PPDU
STA2

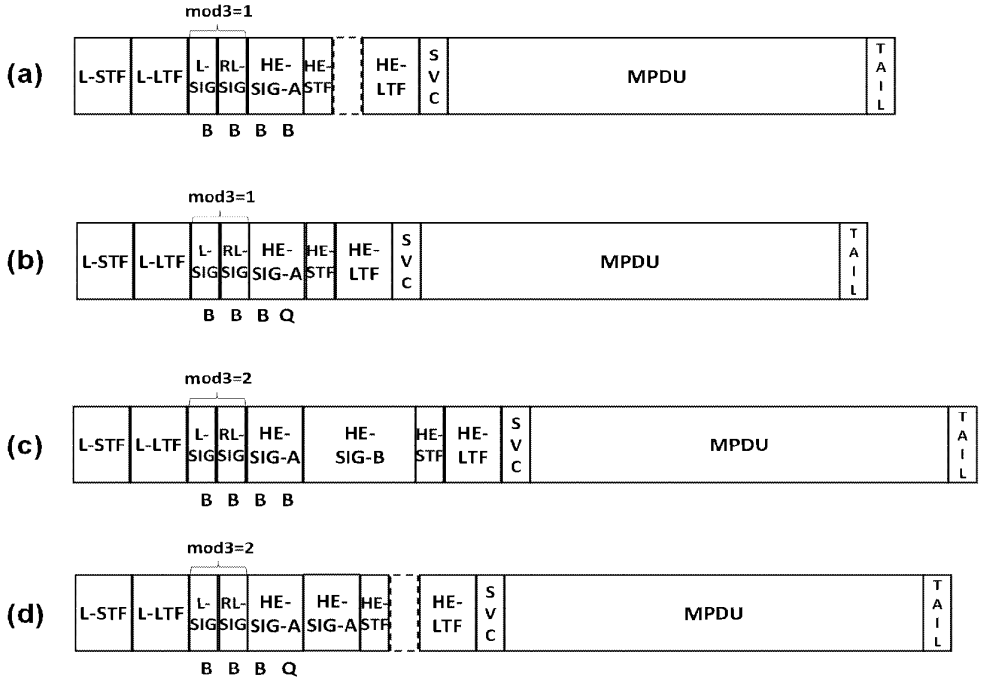
[도9]


MU-RTS
SIFS
SIFS
DL MU PPDU
SIFS
AP
sCTS
ACK
STA1
sCTS
STA2
NAV
Other
NAV

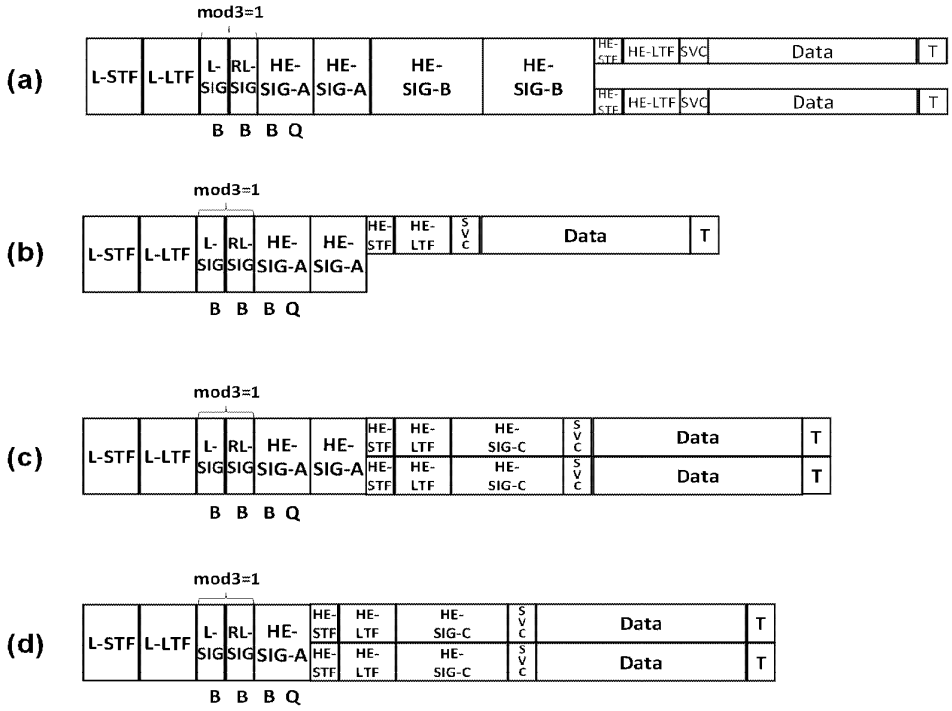
[도10]


(a)
L-STF
L-LTF
L-SIG
SVC
MPDU
TAIL
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
(c)
L_RATE (4b)
Reserved
L_LENGTH (12b)
Parity
Tail (6b)

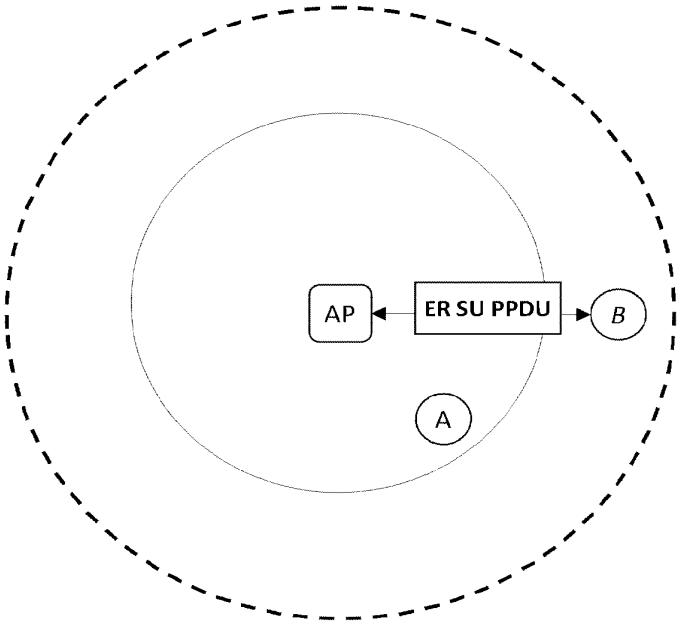
[도11]


mod3=1
(a)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=1
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q
mod3=2
(c)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=2
(d)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q

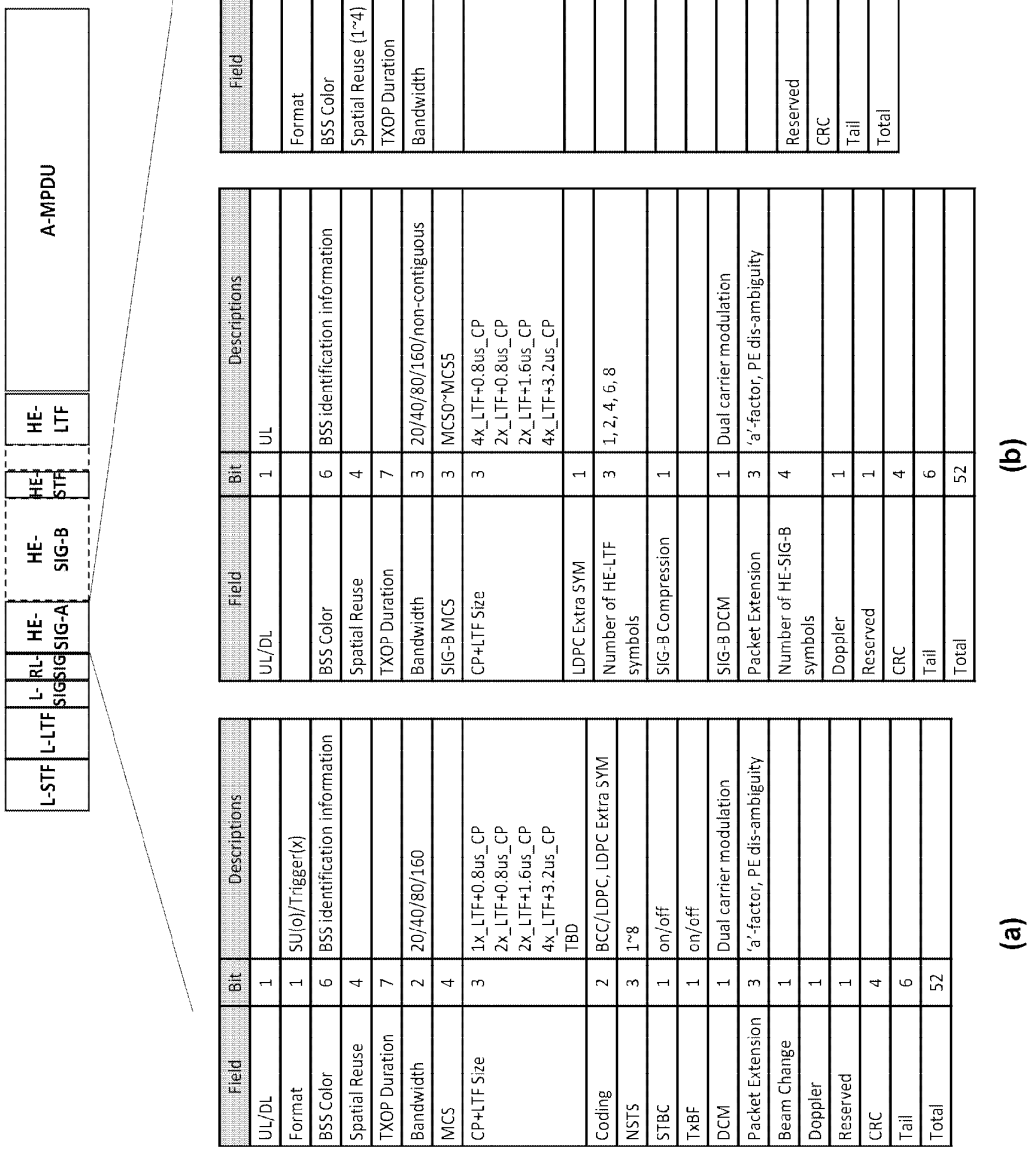
[도12]


mod3=1
(a)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-SIG-B
HE-SIG-B
HE-STF
HE-LTF
SVC
Data
T
B B B Q
mod3=1
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
SVC
Data
T
B B B Q
mod3=1
(c)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
HE-SIG-C
SVC
Data
T
B B B Q
mod3=1
(d)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
HE-SIG-C
SVC
Data
T
B B B Q

[도13]



[도14]




| Field | Bit | Descriptions |
|---|---|---|
| UL/DL | 1 | |
| Format | 1 | SU(o)/Trigger(x) |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse | 4 | |
| TXOP Duration | 7 | |
| Bandwidth | 2 | 20/40/80/160 |
| MCS | 4 | |
| CP+LTF Size | 3 | 1x_LTF+0.8us_CP<br>2x_LTF+0.8us_CP<br>2x_LTF+1.6us_CP<br>4x_LTF+3.2us_CP<br>TBD |
| Coding | 2 | BCC/LDPC, LDPC Extra SYM |
| NSTS | 3 | 1~8 |
| STBC | 1 | on/off |
| TxBF | 1 | on/off |
| DCM | 1 | Dual carrier modulation |
| Packet Extension | 3 | 'a'-factor, PE dis-ambiguity |
| Beam Change | 1 | |
| Doppler | 1 | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 52 | |

(a)

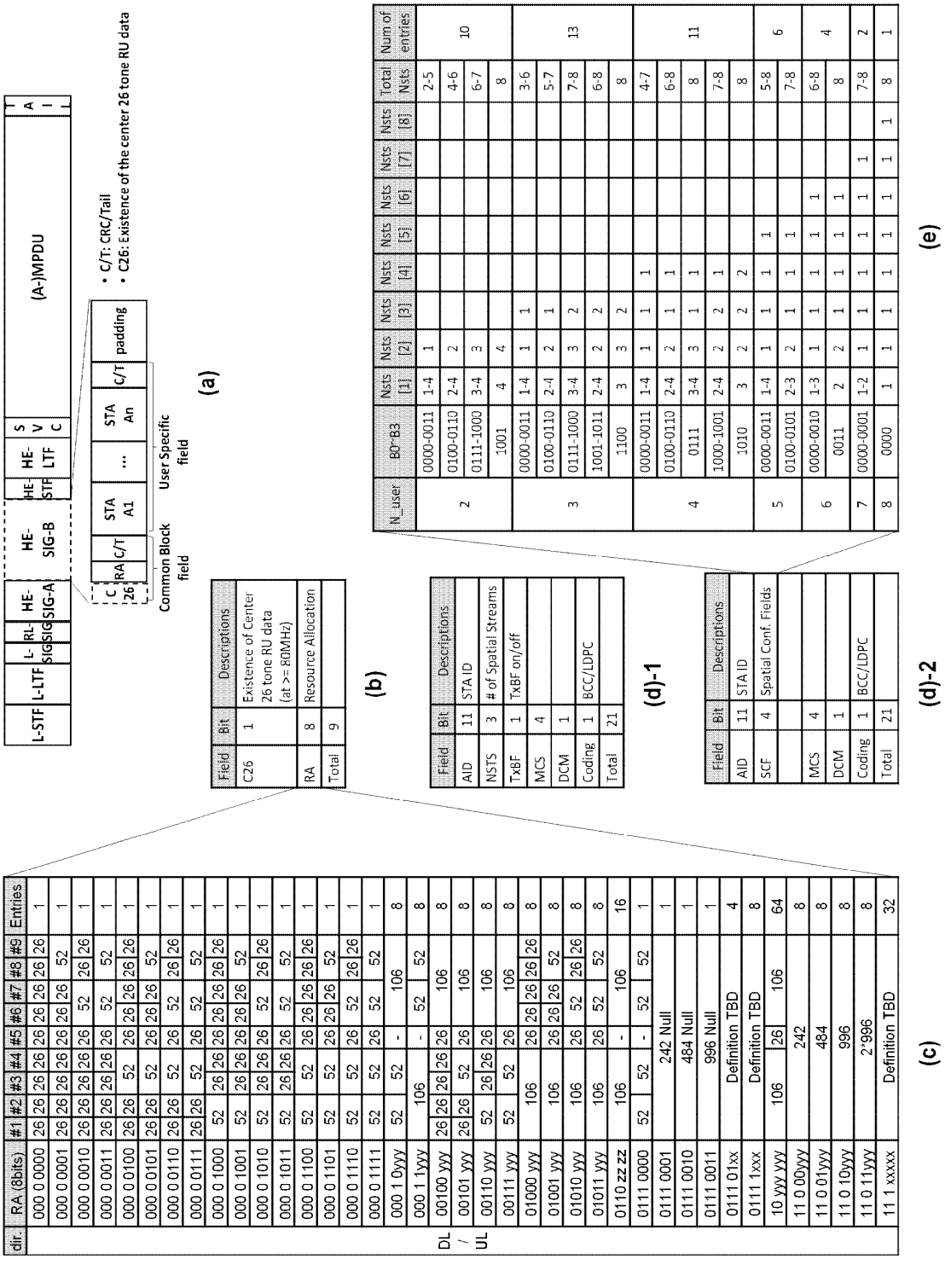
| Field | Bit | Descriptions |
|---|---|---|
| UL/DL | 1 | UL |
| | | |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse | 4 | |
| TXOP Duration | 7 | |
| Bandwidth | 3 | 20/40/80/160/non-contiguous |
| SIG-B MCS | 3 | MCS0~MCS5 |
| CP+LTF Size | 3 | 4x_LTF+0.8us_CP<br>2x_LTF+0.8us_CP<br>2x_LTF+1.6us_CP<br>4x_LTF+3.2us_CP |
| LDPC Extra SYM | 1 | |
| Number of HE-LTF symbols | 3 | 1, 2, 4, 6, 8 |
| SIG-B Compression | 1 | |
| | | |
| SIG-B DCM | 1 | Dual carrier modulation |
| Packet Extension | 3 | 'a'-factor, PE dis-ambiguity |
| Number of HE-SIG-B symbols | 4 | |
| Doppler | 1 | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 52 | |

(b)

| Field | Bit | Descriptions |
|---|---|---|
| | | |
| Format | 1 | SU(x)/Trigger(o) |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse (1~4) | 16 | Per 20 MHz |
| TXOP Duration | 7 | |
| Bandwidth | 2 | 20/40/80/160 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 43 | |

(c)

[도15]




| Field | Bit | Descriptions |
|---|---|---|
| C26 | 1 | Existence of Center 26 tone RU data (at >= 80MHz) |
| RA | 8 | Resource Allocation |
| Total | 9 | |

| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| NSTS | 3 | # of Spatial Streams |
| TxBF | 1 | TxBF on/off |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

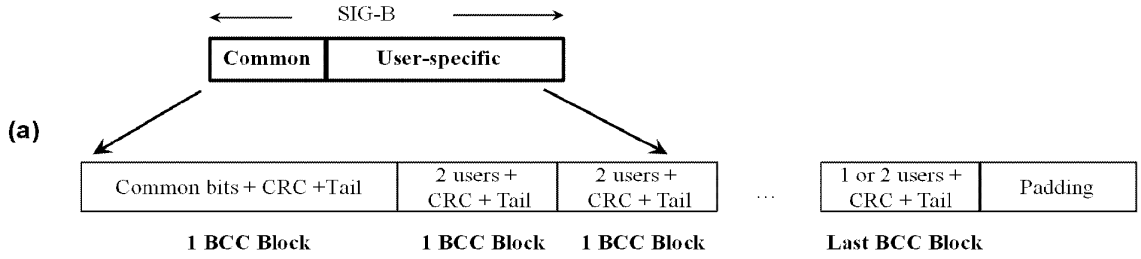
| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| SCF | 4 | Spatial Conf. Fields |
| | | |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

| N_user | B0~B3 | Nsts [1] | Nsts [2] | Nsts [3] | Nsts [4] | Nsts [5] | Nsts [6] | Nsts [7] | Nsts [8] | Total Nsts | Num of entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0000-0011 | 1-4 | 1 | | | | | | | 2-5 | 10 |
| | 0100-0110 | 2-4 | 2 | | | | | | | 4-6 | |
| | 0111-1000 | 3-4 | 3 | | | | | | | 6-7 | |
| | 1001 | 4 | 4 | | | | | | | 8 | |
| 3 | 0000-0011 | 1-4 | 1 | 1 | | | | | | 3-6 | 13 |
| | 0100-0110 | 2-4 | 2 | 1 | | | | | | 5-7 | |
| | 0111-1000 | 3-4 | 3 | 2 | | | | | | 7-8 | |
| | 1001-1011 | 2-4 | 2 | 2 | | | | | | 6-8 | |
| | 1100 | 3 | 3 | 2 | | | | | | 8 | |
| 4 | 0000-0011 | 1-4 | 1 | 1 | 1 | | | | | 4-7 | 11 |
| | 0100-0110 | 2-4 | 2 | 1 | 1 | | | | | 6-8 | |
| | 0111 | 3-4 | 3 | 1 | 1 | | | | | 8 | |
| | 1000-1001 | 2-4 | 2 | 2 | 1 | | | | | 7-8 | |
| | 1010 | 3 | 2 | 2 | 2 | | | | | 8 | |
| 5 | 0000-0011 | 1-4 | 1 | 1 | 1 | 1 | | | | 5-8 | 6 |
| | 0100-0101 | 2-3 | 2 | 1 | 1 | 1 | | | | 7-8 | |
| 6 | 0000-0010 | 1-3 | 1 | 1 | 1 | 1 | 1 | | | 6-8 | 4 |
| | 0011 | 2 | 2 | 1 | 1 | 1 | 1 | | | 8 | |
| 7 | 0000-0001 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | | 7-8 | 2 |
| 8 | 0000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | 1 |

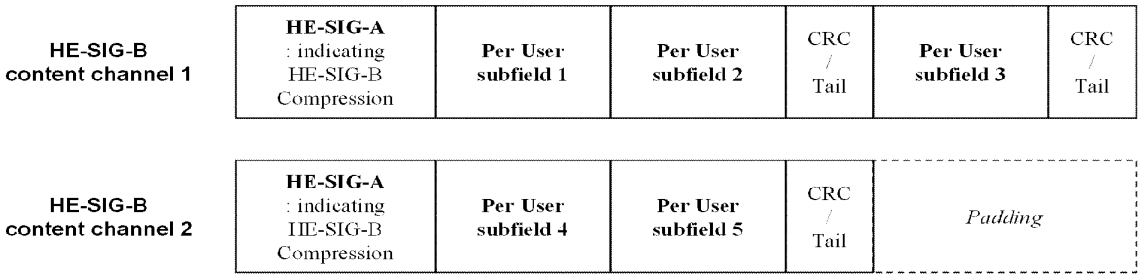
| dir. | RA (8bits) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | Entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DL / UL | 000 0 0000 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 0001 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 0010 | 26 | 26 | 26 | 26 | 26 | 52 | 26 | 26 | 26 | 1 |
| | 000 0 0011 | 26 | 26 | 26 | 26 | 26 | 52 | 52 | | | 1 |
| | 000 0 0100 | 26 | 26 | 52 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 0101 | 26 | 26 | 52 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 0110 | 26 | 26 | 52 | 26 | 52 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 0111 | 26 | 26 | 52 | 26 | 52 | 26 | 52 | | | 1 |
| | 000 0 1000 | 52 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 1001 | 52 | 26 | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 1010 | 52 | 26 | 26 | 26 | 26 | 52 | 26 | 26 | 26 | 1 |
| | 000 0 1011 | 52 | 26 | 26 | 26 | 26 | 52 | 52 | | | 1 |
| | 000 0 1100 | 52 | 52 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 1101 | 52 | 52 | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 1110 | 52 | 52 | 26 | 52 | 26 | 52 | 26 | 26 | 26 | 1 |
| | 000 0 1111 | 52 | 52 | 26 | 52 | 26 | 52 | 52 | | | 1 |
| | 000 1 0yyy | 52 | 52 | - | 106 | | | | | | 8 |
| | 000 1 1yyy | 106 | | - | 52 | 52 | | | | | 8 |
| | 00100 yyy | 26 | 26 | 26 | 26 | 106 | | | | | 8 |
| | 00101 yyy | 26 | 26 | 52 | 26 | 106 | | | | | 8 |
| | 00110 yyy | 52 | 26 | 26 | 106 | | | | | | 8 |
| | 00111 yyy | 52 | 52 | 26 | 106 | | | | | | 8 |
| | 01000 yyy | 106 | | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 8 |
| | 01001 yyy | 106 | | 26 | 26 | 26 | 26 | 52 | 26 | 26 | 8 |
| | 01010 yyy | 106 | | 26 | 26 | 52 | 26 | 26 | 26 | 26 | 8 |
| | 01011 yyy | 106 | | 26 | 26 | 52 | 52 | 52 | | | 8 |
| | 0110 zz zz | 106 | | - | 106 | | | | | | 16 |
| | 0111 0000 | 52 | 52 | - | 52 | 52 | | | | | 1 |
| | 0111 0001 | 242 Null | | | | | | | | | 1 |
| | 0111 0010 | 484 Null | | | | | | | | | 1 |
| | 0111 0011 | 996 Null | | | | | | | | | 1 |
| | 0111 01xx | Definition TBD | | | | | | | | | 4 |
| | 0111 1xxx | Definition TBD | | | | | | | | | 8 |
| | 10 yyy yyy | 106 | 26 | 106 | | | | | | | 64 |
| | 11 0 00yyy | 242 | | | | | | | | | 8 |
| | 11 0 01yyy | 484 | | | | | | | | | 8 |
| | 11 0 10yyy | 996 | | | | | | | | | 8 |
| | 11 0 11yyy | 2*996 | | | | | | | | | 8 |
| | 11 1 xxxxx | Definition TBD | | | | | | | | | 32 |

(c)

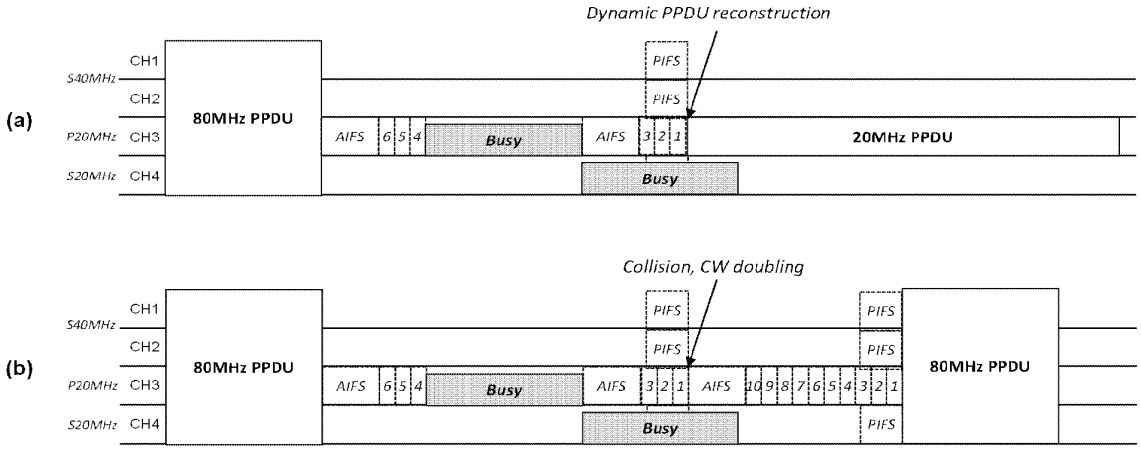
[도16]


(a)
SIG-B
Common
User-specific
Common bits + CRC +Tail
2 users + CRC + Tail
2 users + CRC + Tail
1 or 2 users + CRC + Tail
Padding
1 BCC Block
1 BCC Block
1 BCC Block
Last BCC Block
(b)
40 MHz
1 2
80 MHz
1 2 1 2
160 MHz
1 2 1 2 1 2 1 2

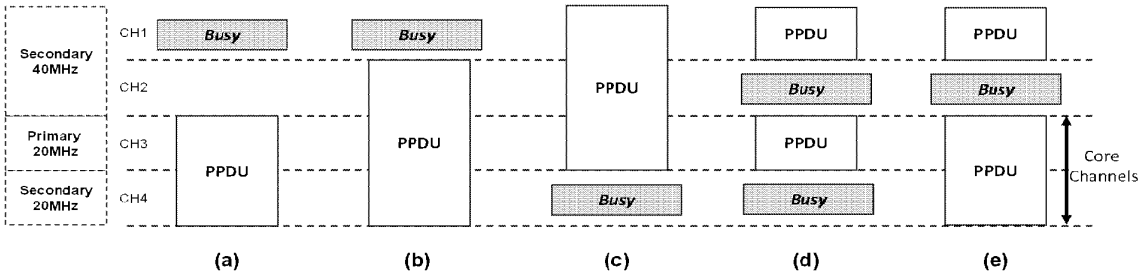
[도17]


HE-SIG-B content channel 1
HE-SIG-A : indicating HE-SIG-B Compression
Per User subfield 1
Per User subfield 2
CRC / Tail
Per User subfield 3
CRC / Tail
HE-SIG-B content channel 2
HE-SIG-A : indicating HE-SIG-B Compression
Per User subfield 4
Per User subfield 5
CRC / Tail
Padding

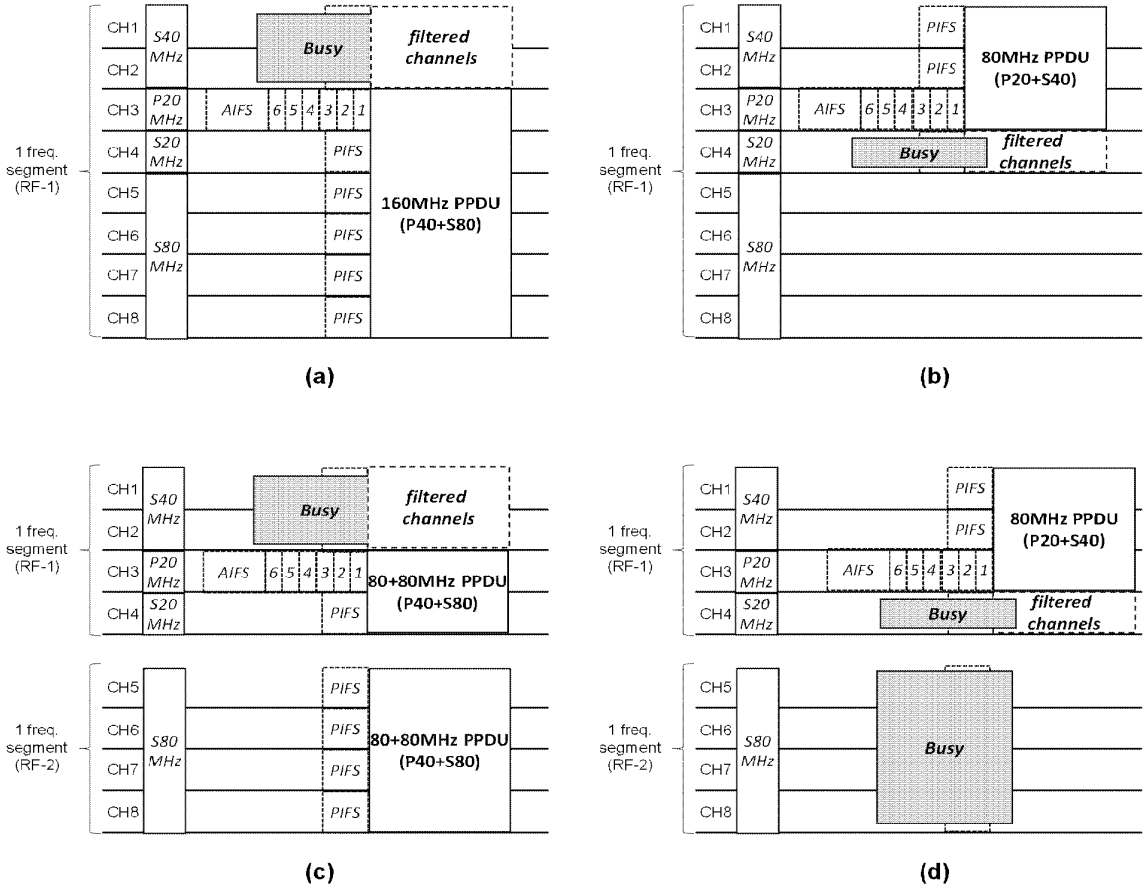
[도18]


(a)
Dynamic PPDU reconstruction
CH1
S40MHz
CH2
P20MHz
CH3
S20MHz
CH4
80MHz PPDU
PIFS
AIFS
Busy
20MHz PPDU
(b)
Collision, CW doubling
80MHz PPDU

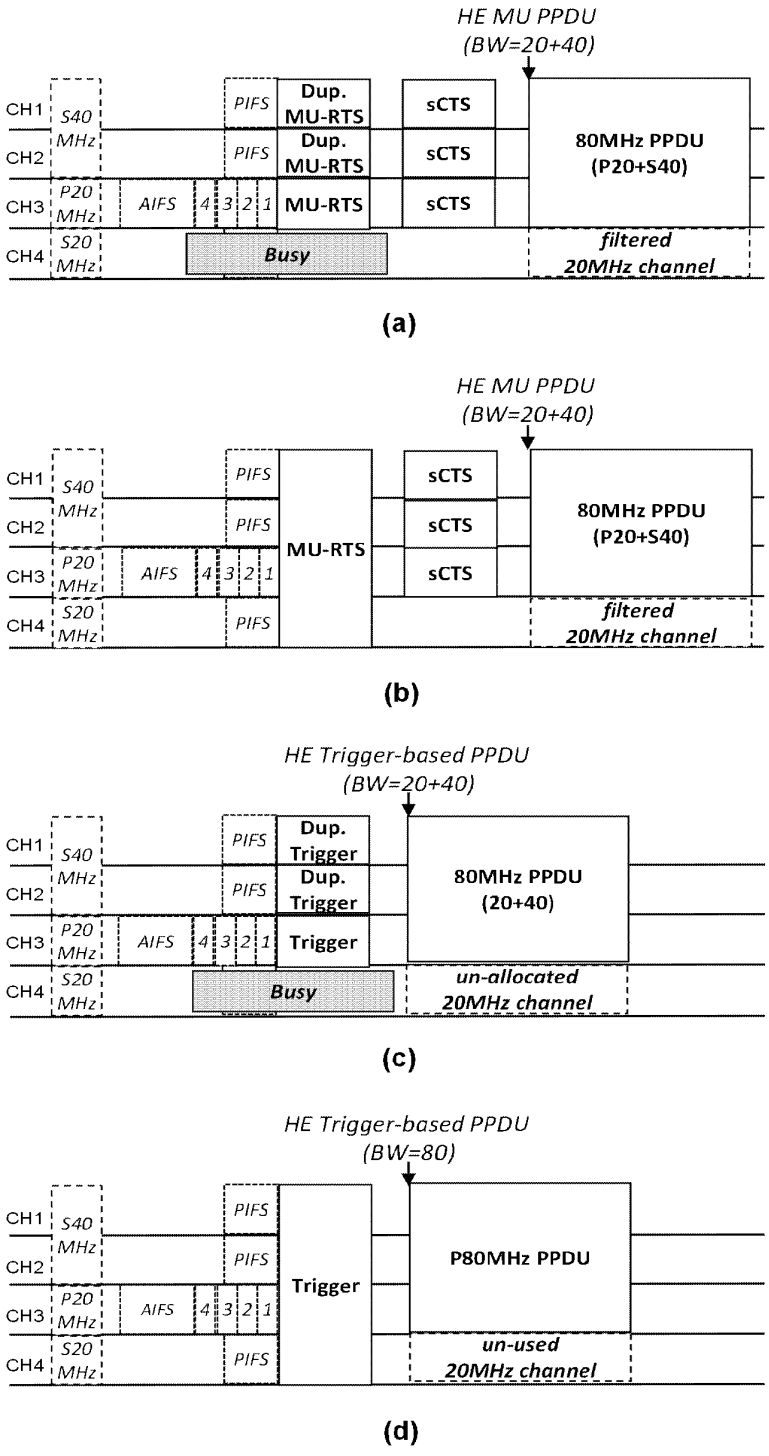
[도19]


Secondary 40MHz
Primary 20MHz
Secondary 20MHz
CH1
CH2
CH3
CH4
Busy
PPDU
Core Channels
(a)
(b)
(c)
(d)
(e)

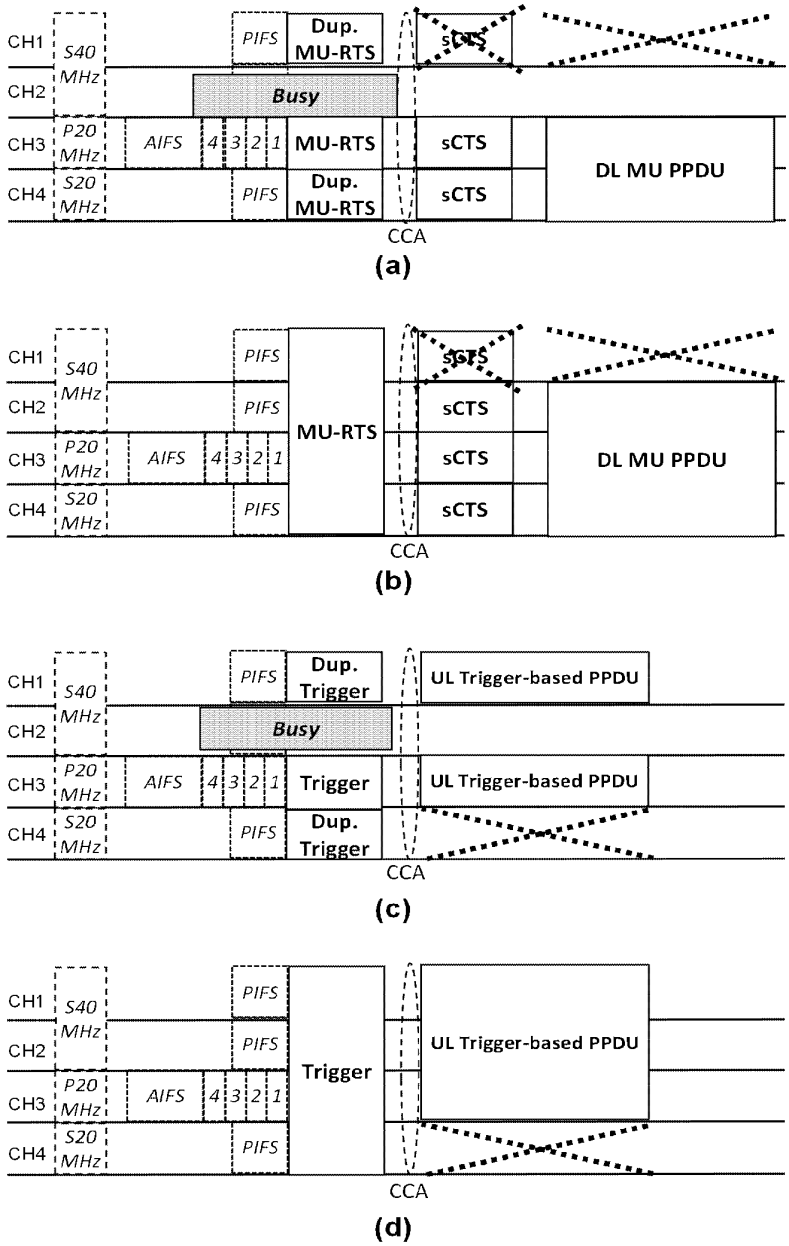
[도20]


1 freq. segment (RF-1)
1 freq. segment (RF-2)
CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH8
S40 MHz
P20 MHz
S20 MHz
S80 MHz
AIFS
6 5 4 3 2 1
PIFS
Busy
filtered channels
160MHz PPDU (P40+S80)
80MHz PPDU (P20+S40)
80+80MHz PPDU (P40+S80)
(a)
(b)
(c)
(d)

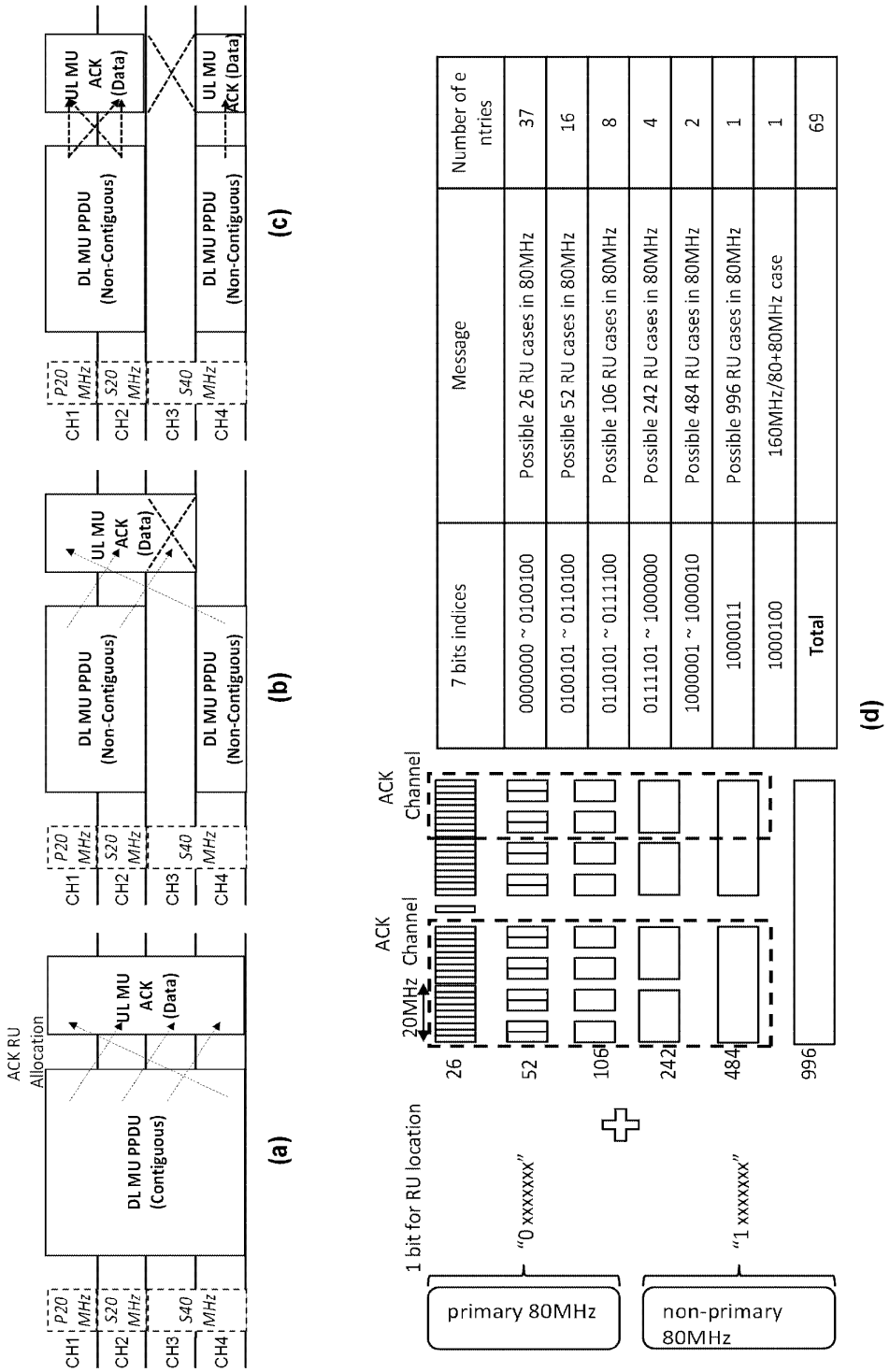
[도21]


HE MU PPDU
(BW=20+40)
CH1
S40 MHz
CH2
CH3
P20 MHz
CH4
S20 MHz
PIFS
Dup. MU-RTS
MU-RTS
AIFS
4
3
2
1
sCTS
80MHz PPDU
(P20+S40)
Busy
filtered 20MHz channel
(a)
HE MU PPDU
(BW=20+40)
MU-RTS
(b)
HE Trigger-based PPDU
(BW=20+40)
Dup. Trigger
Trigger
80MHz PPDU
(20+40)
un-allocated 20MHz channel
(c)
HE Trigger-based PPDU
(BW=80)
P80MHz PPDU
un-used 20MHz channel
(d)

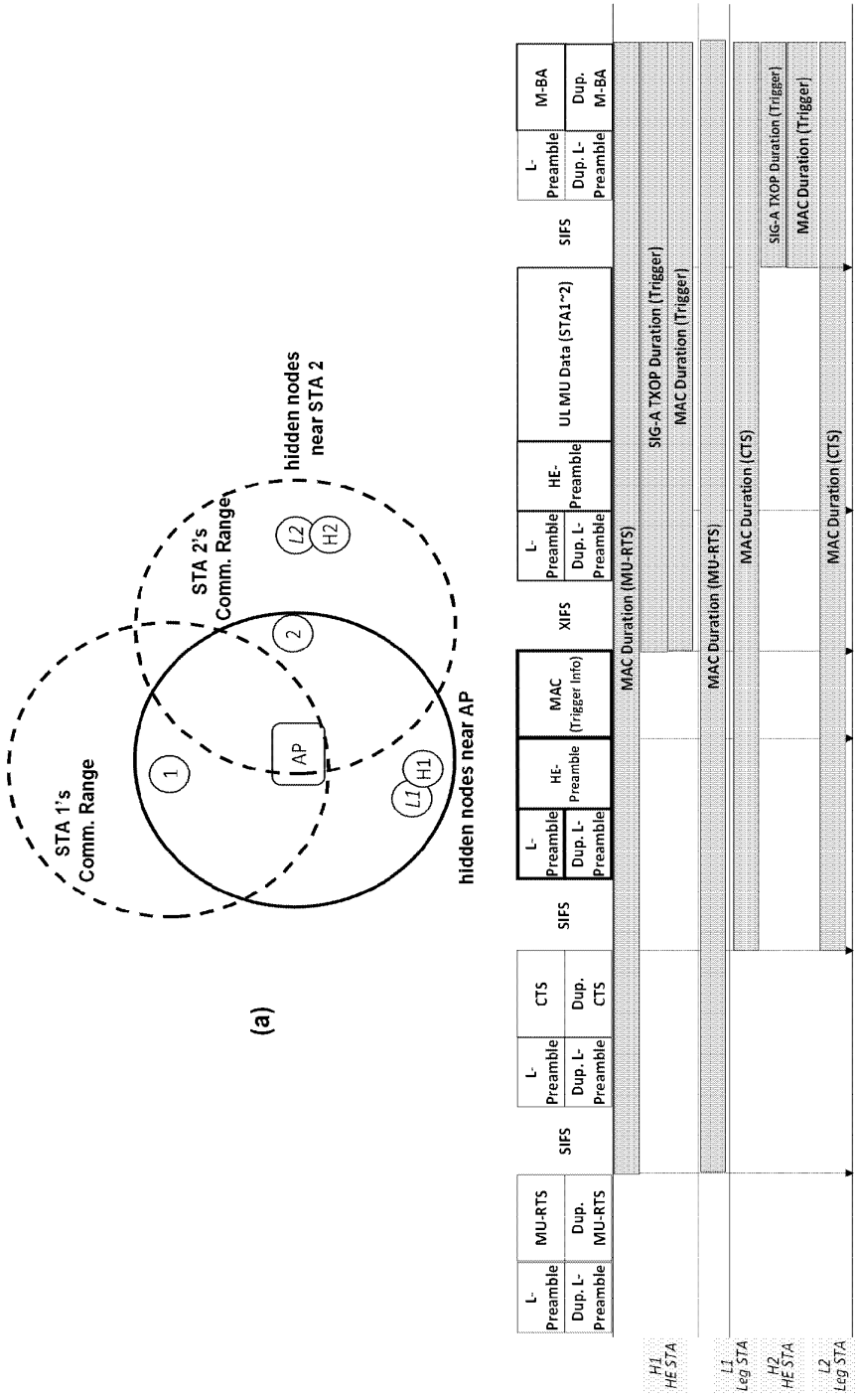
[도22]


CH1
S40 MHz
CH2
P20 MHz
CH3
S20 MHz
CH4
PIFS
Dup. MU-RTS
sCTS
Busy
AIFS
4 3 2 1
MU-RTS
DL MU PPDU
CCA
(a)
(b)
Dup. Trigger
UL Trigger-based PPDU
Trigger
(c)
(d)

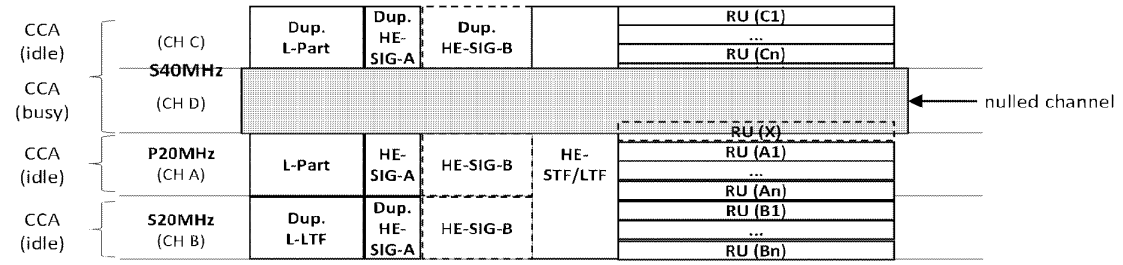
[도23]


(a)
(b)
(c)
(d)
ACK RU Allocation
UL MU ACK (Data)
DL MU PPDU (Contiguous)
DL MU PPDU (Non-Contiguous)
CH1 P20 MHz
CH2 S20 MHz
CH3 S40 MHz
CH4 MHz
ACK Channel
20MHz
1 bit for RU location
"0 xxxxxxx"
"1 xxxxxxx"
primary 80MHz
non-primary 80MHz
26
52
106
242
484
996
7 bits indices
Message
Number of entries
0000000 ~ 0100100
Possible 26 RU cases in 80MHz
37
0100101 ~ 0110100
Possible 52 RU cases in 80MHz
16
0110101 ~ 0111100
Possible 106 RU cases in 80MHz
8
0111101 ~ 1000000
Possible 242 RU cases in 80MHz
4
1000001 ~ 1000010
Possible 484 RU cases in 80MHz
2
1000011
Possible 996 RU cases in 80MHz
1
1000100
160MHz/80+80MHz case
1
Total
69

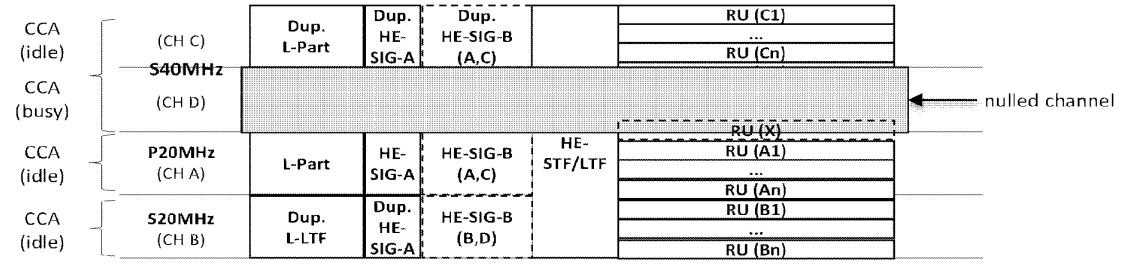
[도24]


STA 1's Comm. Range
STA 2's Comm. Range
hidden nodes near STA 2
AP
1
2
L1
H1
L2
H2
hidden nodes near AP
(a)
L-Preamble
Dup. L-Preamble
MU-RTS
Dup. MU-RTS
SIFS
CTS
Dup. CTS
HE-Preamble
MAC (Trigger Info)
XIFS
UL MU Data (STA1~2)
M-BA
Dup. M-BA
MAC Duration (MU-RTS)
SIG-A TXOP Duration (Trigger)
MAC Duration (Trigger)
MAC Duration (CTS)
H1 HE STA
L1 Leg STA
H2 HE STA
L2 Leg STA
(b)

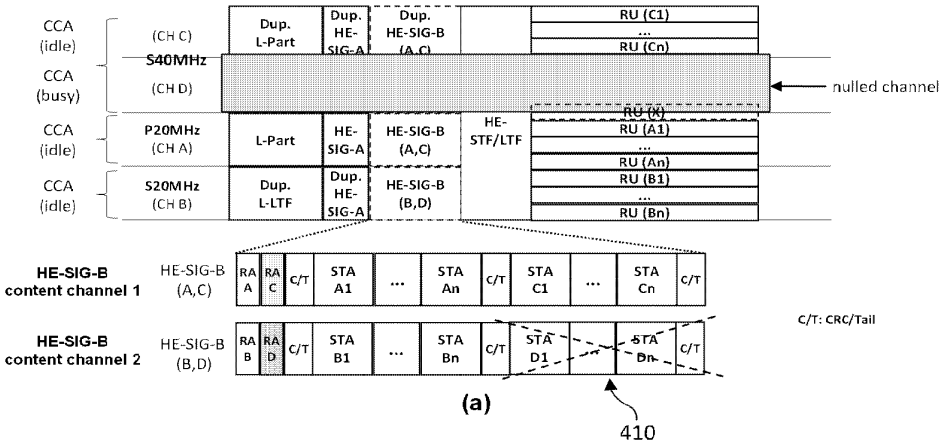
[도25]




[도26]




[도27]




| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| ... | | | | | ... | | | | | ... |
| 11000yyy | | | | | 242 | | | | | 8 |
| TBD | | | | | 242 Null | | | | | 1 |
| TBD | | | | | 484 Null | | | | | 1 |
| TBD | | | | | 996 Null | | | | | 1 |
| | | | | | ... | | | | | |

(b)

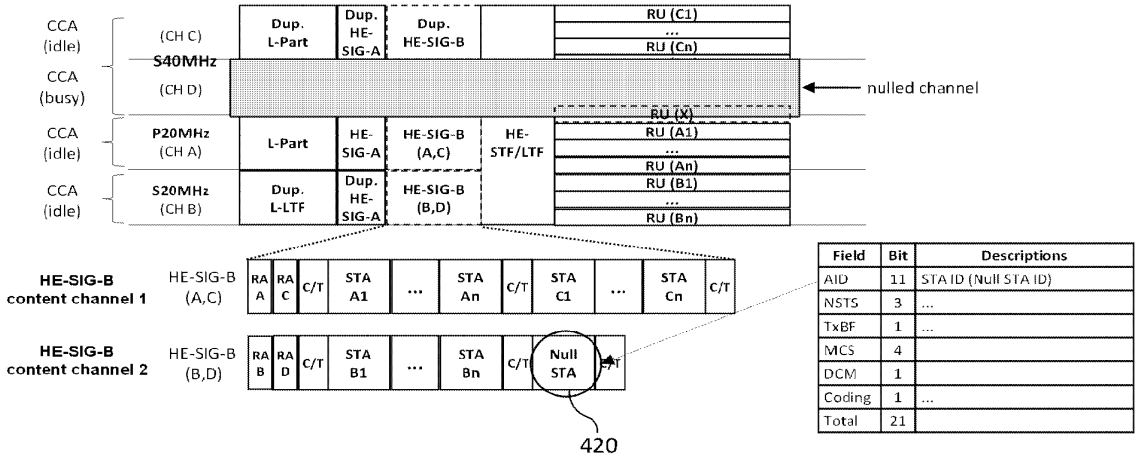
| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| ... | | | | | ... | | | | | ... |
| 11000yyy | | | | | 242 | | | | | 8 |
| TBD | | | | | 484 Null | | | | | 1 |
| TBD | | | | | 996 Null | | | | | 1 |
| | | | | | ... | | | | | |

(c)

| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| ... | | | | | ... | | | | | ... |
| 11000yyy | | | | | 242 | | | | | 8 |
| TBD | | | | | Null | | | | | 1 |
| | | | | | ... | | | | | |

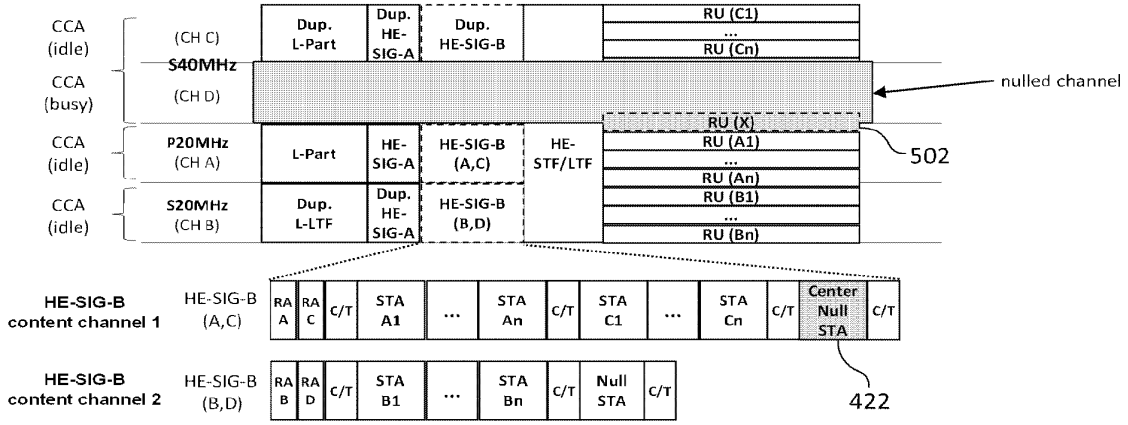
(d)

[도28]

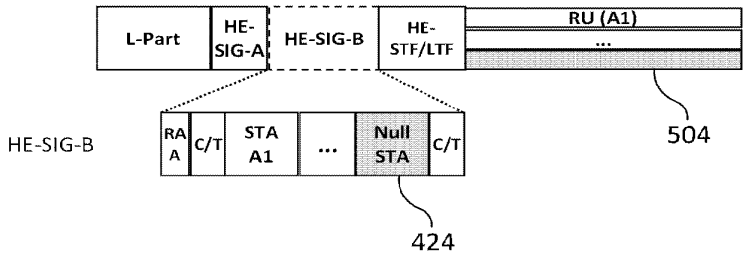



| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID (Null STA ID) |
| NSTS | 3 | ... |
| TxBF | 1 | ... |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | ... |
| Total | 21 | |

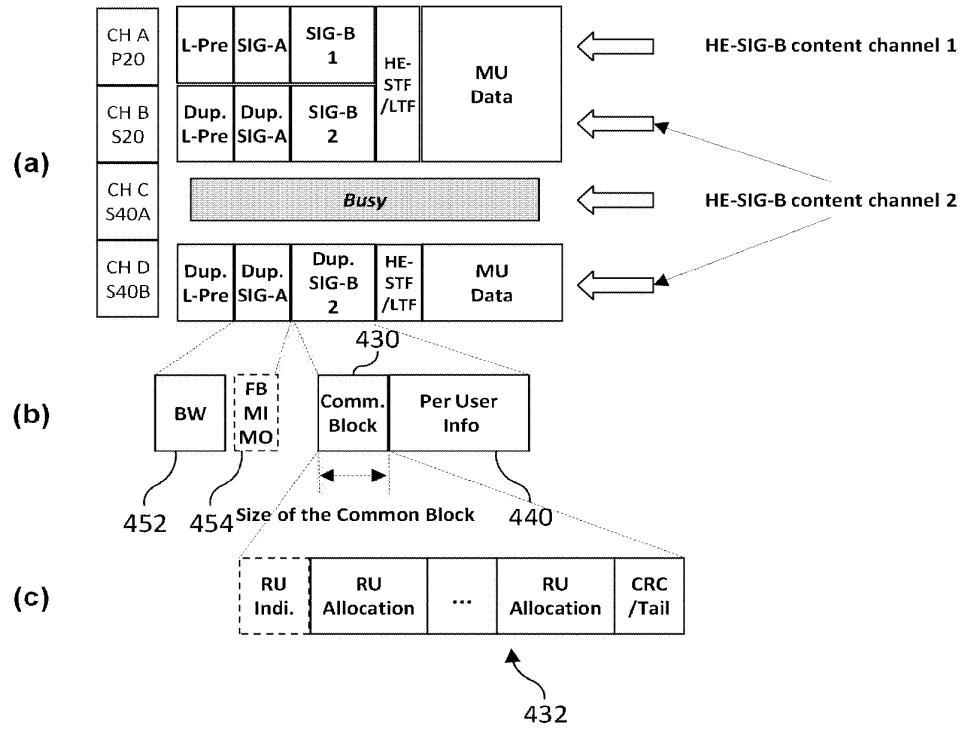
[도29]



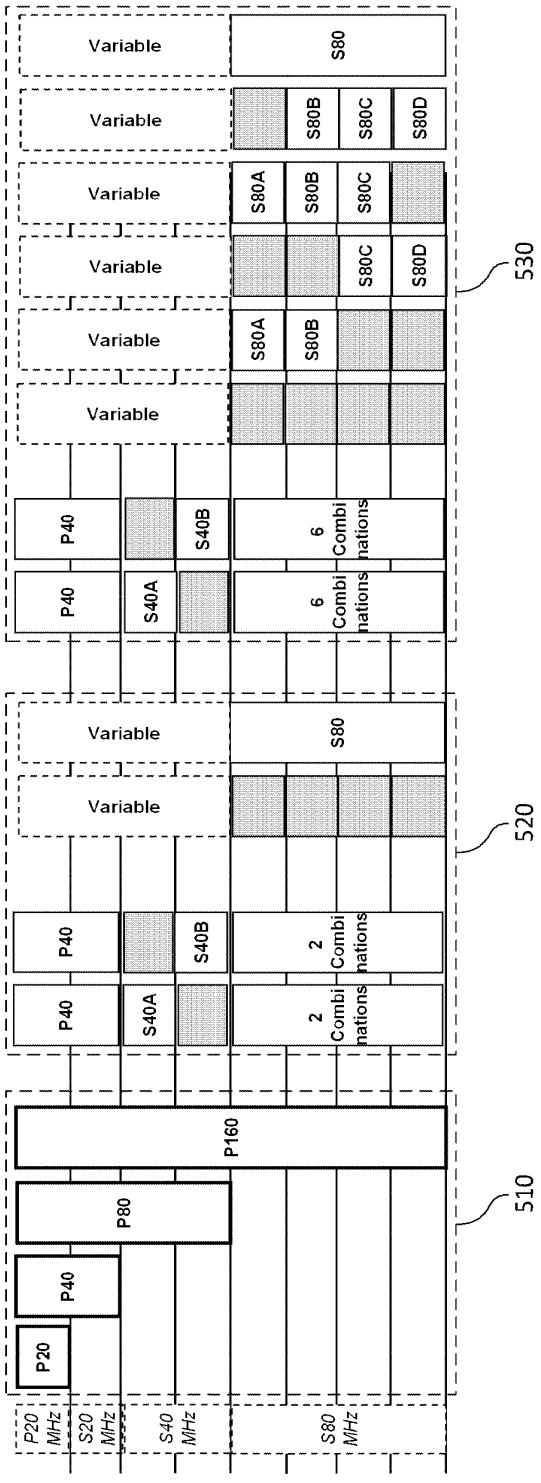

[도30]



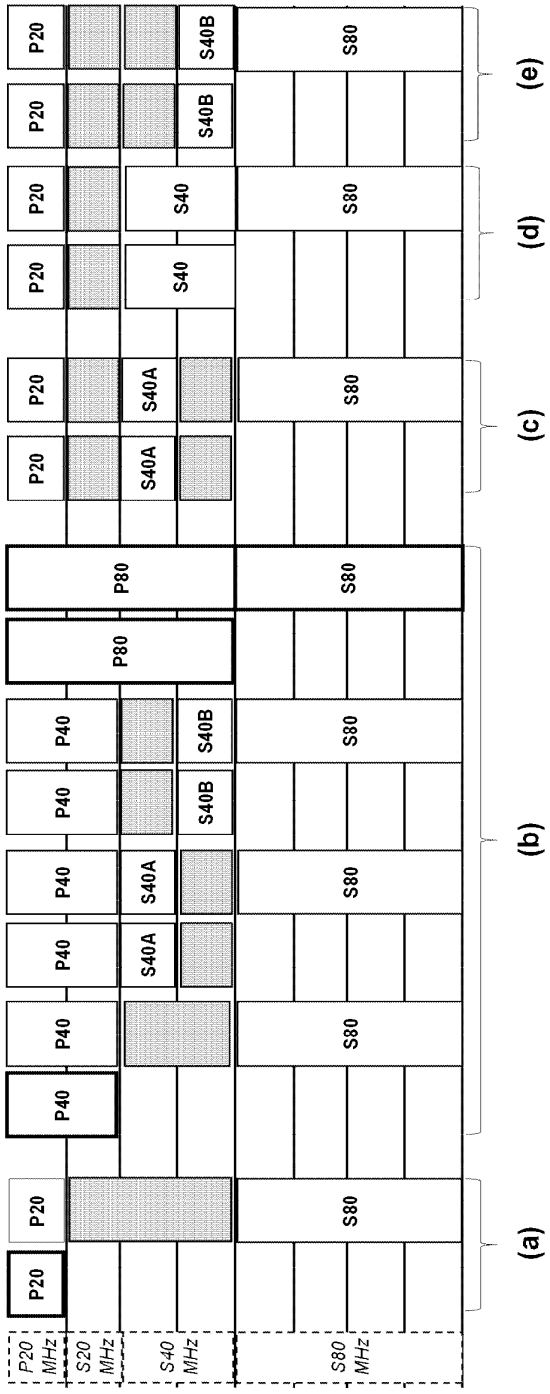
[도31]


(a)
CH A P20
CH B S20
CH C S40A
CH D S40B
L-Pre
SIG-A
SIG-B 1
Dup. L-Pre
Dup. SIG-A
SIG-B 2
HE-STF /LTF
MU Data
Busy
HE-SIG-B content channel 1
HE-SIG-B content channel 2
430
(b)
BW
FB MI MO
Comm. Block
Per User Info
452
454
Size of the Common Block
440
(c)
RU Indi.
RU Allocation
...
RU Allocation
CRC /Tail
432

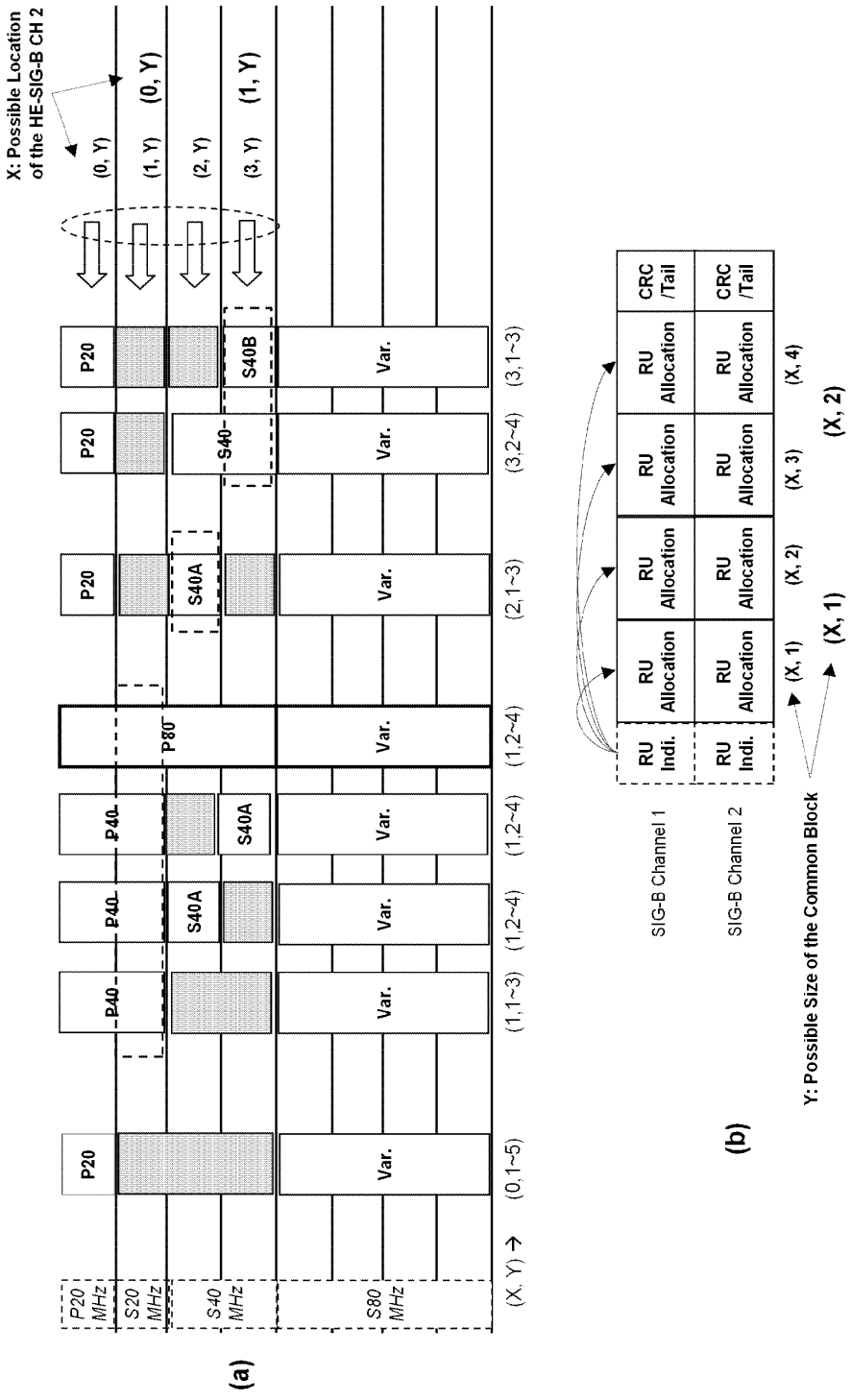
[도32]


Variable
S80
Variable
S80B
S80C
S80D
Variable
S80A
S80B
S80C
Variable
S80C
S80D
530
Variable
S80A
S80B
Variable
P40
S40B
6 Combinations
P40
S40A
6 Combinations
Variable
S80
Variable
520
P40
S40B
2 Combinations
P40
S40A
2 Combinations
P160
P80
510
P40
P20
P20 MHz
S20 MHz
S40 MHz
S80 MHz

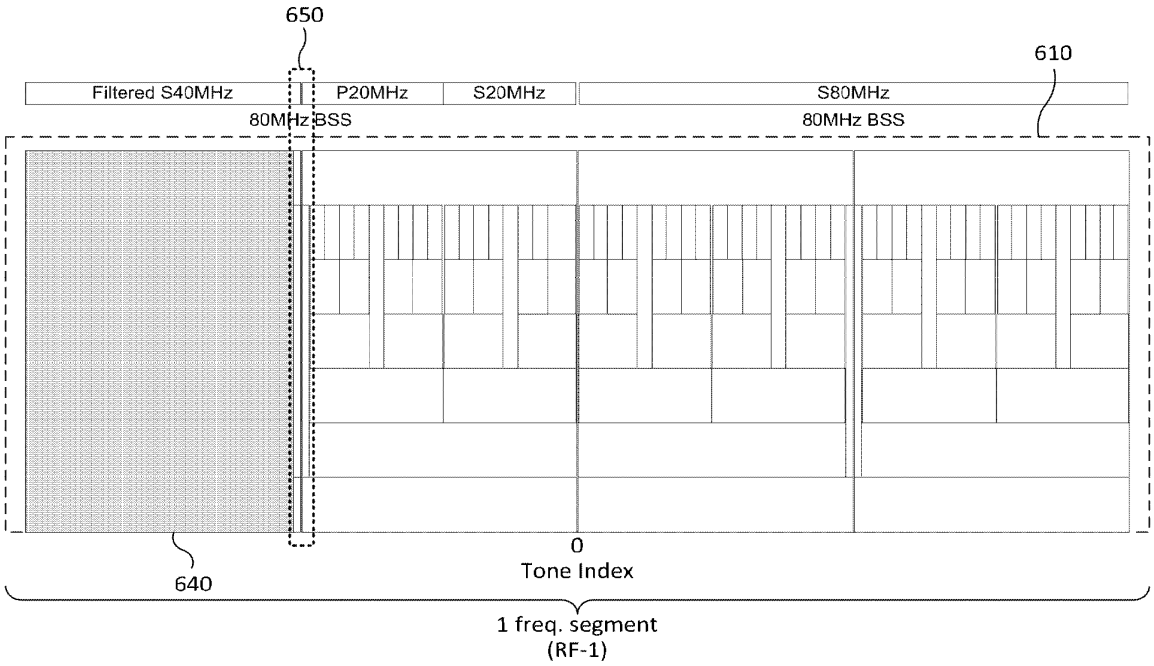
[도33]


P20
P20
P20
P20
P20
P20
P20
P20
P80
P80
P40
P40
P40
P40
P40
P40
S40B
S40B
S40
S40
S40A
S40A
S40B
S40B
S40A
S40A
S80
S80
S80
S80
S80
S80
S80
S80
(e)
(d)
(c)
(b)
(a)
P20 MHz
S20 MHz
S40 MHz
S80 MHz

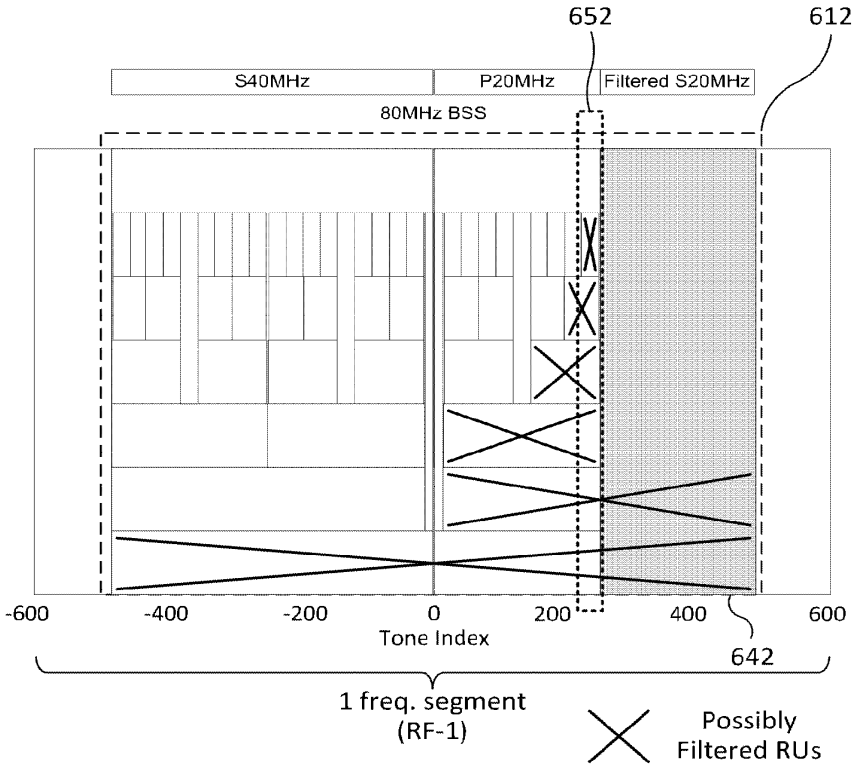
[도34]


X: Possible Location of the HE-SIG-B CH 2
(0, Y)
(1, Y)
(0, Y)
(2, Y)
(3, Y)
(1, Y)
P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
P80
S40A
S40
S40B
Var.
(X, Y) →
(0,1~5)
(1,1~3)
(1,2~4)
(2,1~3)
(3,2~4)
(3,1~3)
(a)
RU Indi.
RU Allocation
CRC /Tail
SIG-B Channel 1
SIG-B Channel 2
(X, 1)
(X, 2)
(X, 3)
(X, 4)
(b)
Y: Possible Size of the Common Block

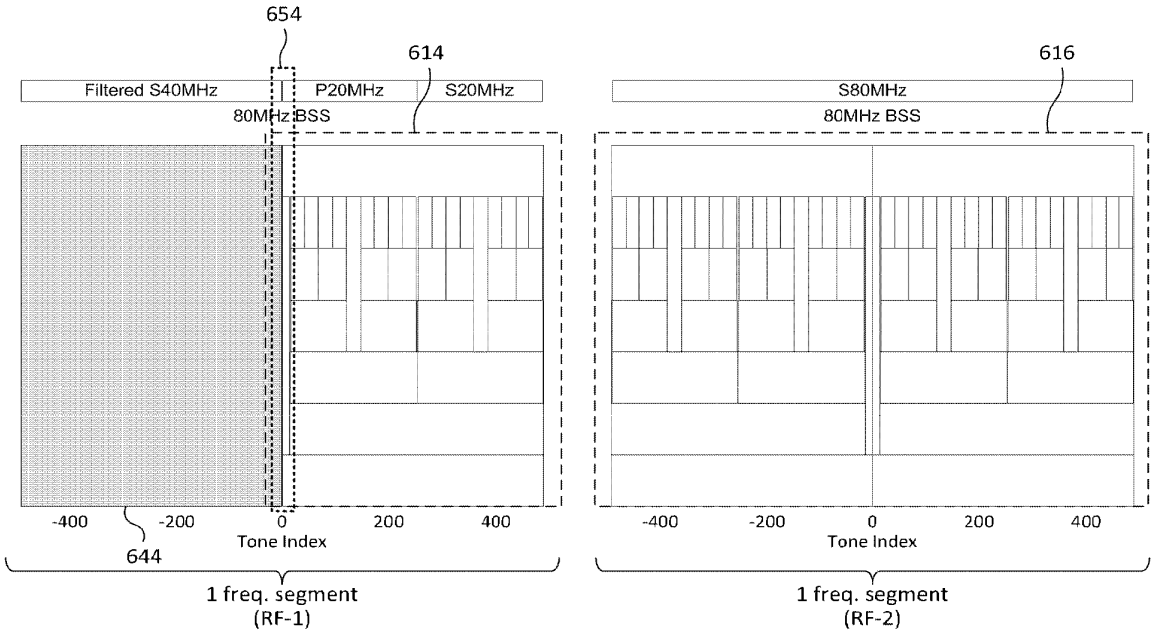
[도35]


650
610
Filtered S40MHz
P20MHz
S20MHz
S80MHz
80MHz BSS
80MHz BSS
640
0
Tone Index
1 freq. segment
(RF-1)

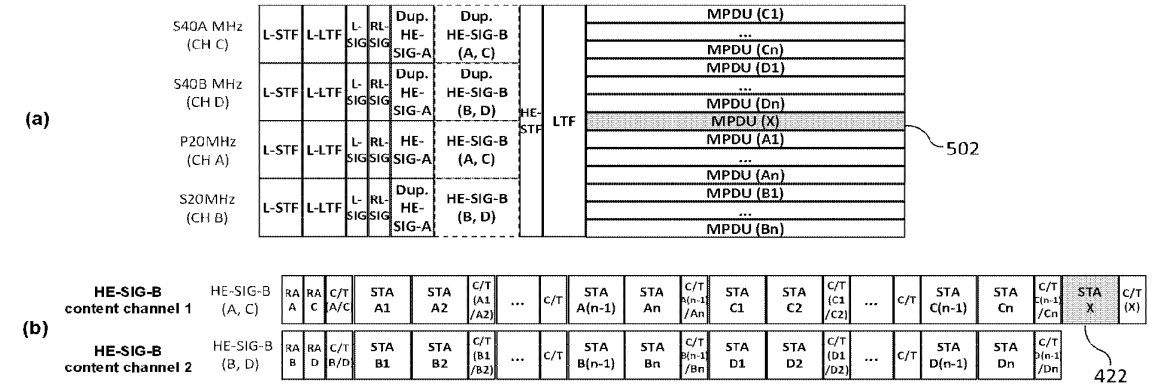
[도36]


652
612
S40MHz
P20MHz
Filtered S20MHz
80MHz BSS
-600
-400
-200
0
200
400
600
Tone Index
642
1 freq. segment
(RF-1)
Possibly
Filtered RUs

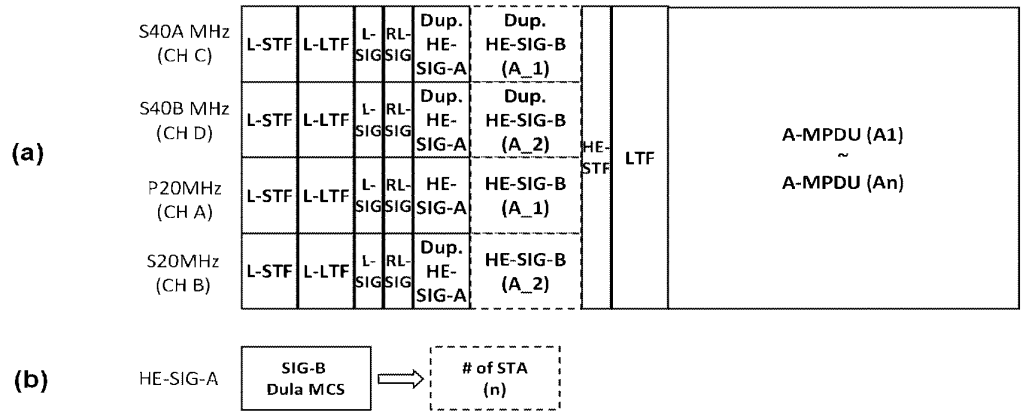
[도37]


654
614
616
Filtered S40MHz
P20MHz
S20MHz
S80MHz
80MHz BSS
80MHz BSS
-400
-200
0
200
400
Tone Index
644
1 freq. segment
(RF-1)
1 freq. segment
(RF-2)

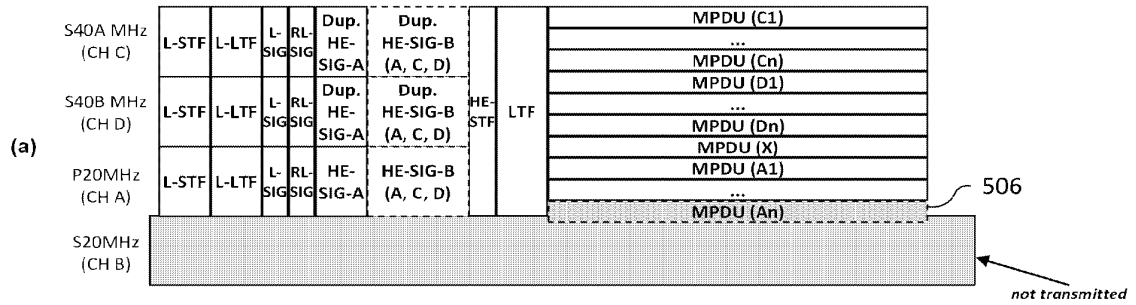
[도38]

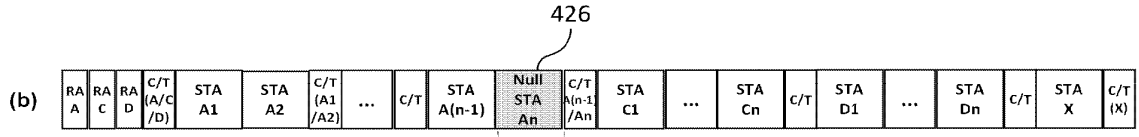

(a)
S40A MHz (CH C)
S40B MHz (CH D)
P20MHz (CH A)
S20MHz (CH B)
L-STF
L-LTF
L-SIG
RL-SIG
Dup. HE-SIG-A
HE-SIG-A
Dup. HE-SIG-B (A, C)
Dup. HE-SIG-B (B, D)
HE-SIG-B (A, C)
HE-SIG-B (B, D)
HE-STF
LTF
MPDU (C1)
MPDU (Cn)
MPDU (D1)
MPDU (Dn)
MPDU (X)
MPDU (A1)
MPDU (An)
MPDU (B1)
MPDU (Bn)
502
(b)
HE-SIG-B content channel 1
HE-SIG-B (A, C)
HE-SIG-B content channel 2
HE-SIG-B (B, D)
RA A
RA C
C/T A/C
STA A1
STA A2
C/T (A1 /A2)
C/T
STA A(n-1)
STA An
C/T A(n-1) /An
STA C1
STA C2
C/T (C1 /C2)
STA C(n-1)
STA Cn
C/T C(n-1) /Cn
STA X
C/T (X)
RA B
RA D
C/T B/D
STA B1
STA B2
C/T (B1 /B2)
STA B(n-1)
STA Bn
C/T B(n-1) /Bn
STA D1
STA D2
C/T (D1 /D2)
STA D(n-1)
STA Dn
C/T D(n-1) /Dn
422

[도39]



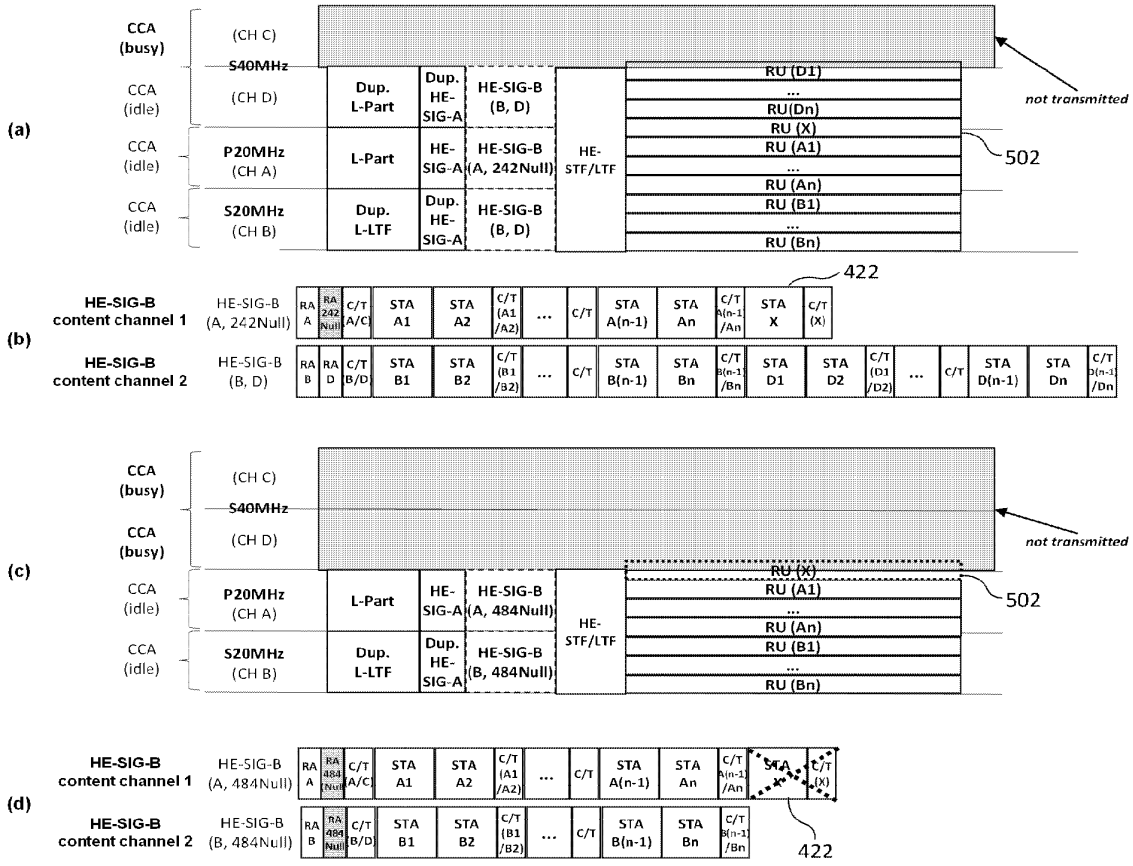

[도40]



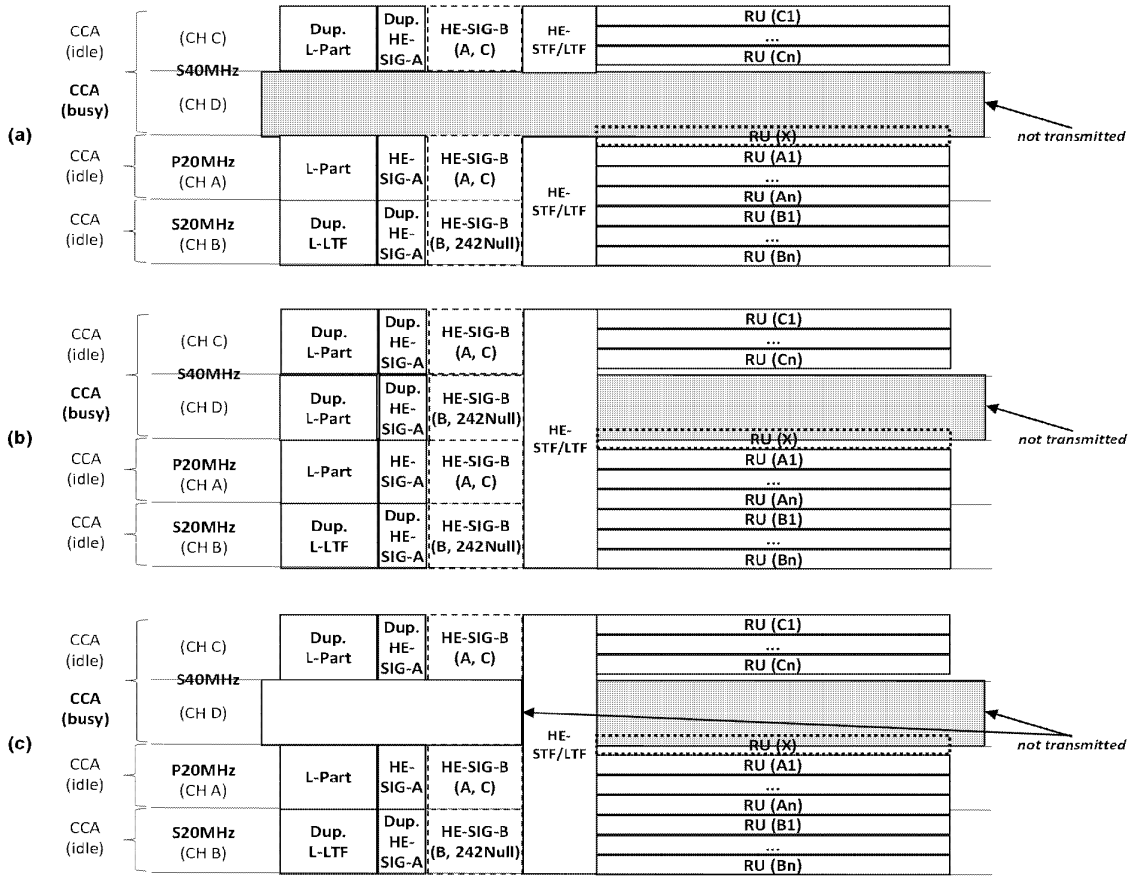




| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | Null STA ID |
| NSTS | 3 | ... |
| TxBF | 1 | ... |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | ... |
| Total | 21 | |

[도41]

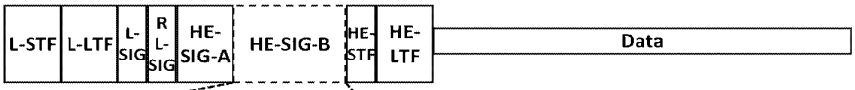

(a)
CCA (busy)
(CH C)
S40MHz
(CH D)
CCA (idle)
P20MHz (CH A)
CCA (idle)
S20MHz (CH B)
CCA (idle)
Dup. L-Part
Dup. HE-SIG-A
HE-SIG-B (B, D)
L-Part
HE-SIG-A
HE-SIG-B (A, 242Null)
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-B (B, D)
HE-STF/LTF
RU (D1)
...
RU(Dn)
RU (X)
RU (A1)
...
RU (An)
RU (B1)
...
RU (Bn)
not transmitted
502
422
(b)
HE-SIG-B content channel 1
HE-SIG-B (A, 242Null)
HE-SIG-B content channel 2
HE-SIG-B (B, D)
(c)
HE-SIG-B (A, 484Null)
HE-SIG-B (B, 484Null)
(d)
HE-SIG-B content channel 1
HE-SIG-B content channel 2

[도42]

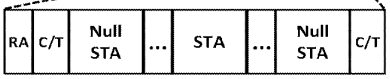

(a)
CCA (idle)
(CH C)
S40MHz
CCA (busy)
(CH D)
CCA (idle)
P20MHz (CH A)
CCA (idle)
S20MHz (CH B)
Dup. L-Part
L-Part
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-A
HE-SIG-B (A, C)
HE-SIG-B (B, 242Null)
HE-STF/LTF
RU (C1)
...
RU (Cn)
RU (X)
RU (A1)
RU (An)
RU (B1)
RU (Bn)
not transmitted
(b)
(c)

[도43]

(a)




(b)



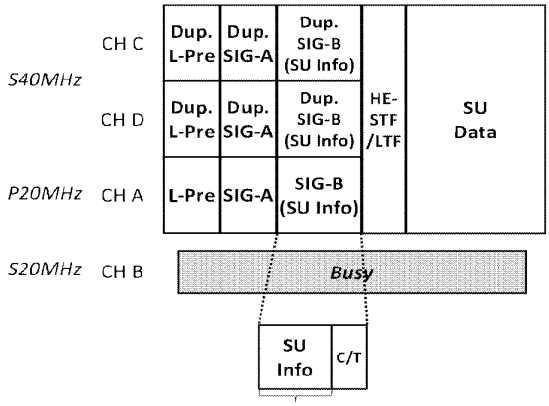

(c)

| direction | RA (8bits) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | Entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DL | others | X | X | X | X | X | X | X | X | X | X |
| UL | TBD | 26 | - | - | - | - | - | - | - | - | 1 |
| | TBD | - | 26 | - | - | - | - | - | - | - | 1 |
| | TBD | - | - | 26 | - | - | - | - | - | - | 1 |
| | TBD | - | - | - | 26 | - | - | - | - | - | 1 |
| | TBD | - | - | - | - | 26 | - | - | - | - | 1 |
| | TBD | - | - | - | - | - | 26 | - | - | - | 1 |
| | TBD | - | - | - | - | - | - | 26 | - | - | 1 |
| | TBD | - | - | - | - | - | - | - | 26 | - | 1 |
| | TBD | - | - | - | - | - | - | - | - | 26 | 1 |
| | TBD | 52 | | - | | - | - | | - | | 1 |
| | TBD | - | | 52 | | - | - | | - | | 1 |
| | TBD | - | | - | | - | 52 | | - | | 1 |
| | TBD | - | | - | | - | - | | 52 | | 1 |
| | TBD | 106 | | | | - | - | | | | 1 |
| | TBD | - | | | | - | 106 | | | | 1 |

(d)

| Field | Bit | Descriptions |
|---|---|---|
| | | |
| SIG-B Compression | 1 | **DL HE MU PPDU case**<br>- "0"refer RA field in SIG-B<br>**- "1" MU-MIMO user specific info**<br><br>**UL HE MU PPDU case**<br>- "0" refer RA field in SIG-B<br>**- "1" OFDMA user specific info** |
| | | |

[도44]



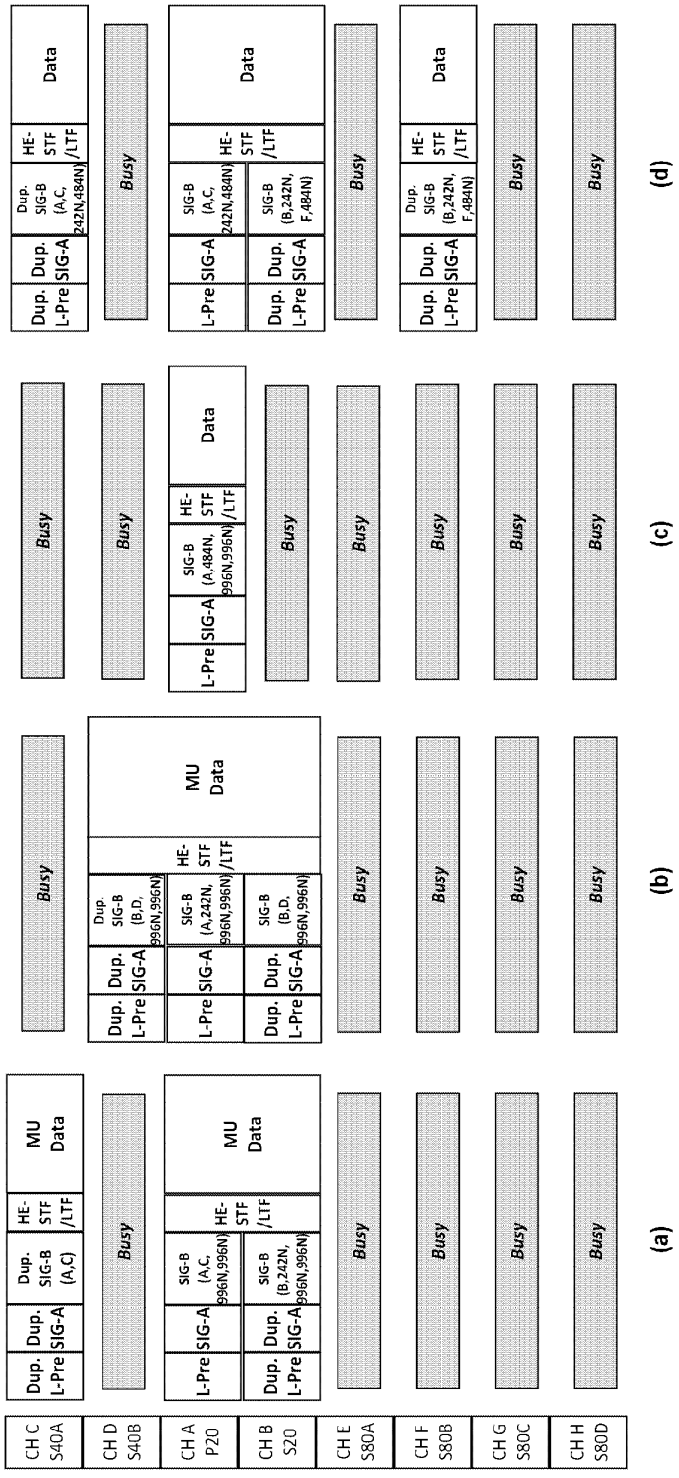




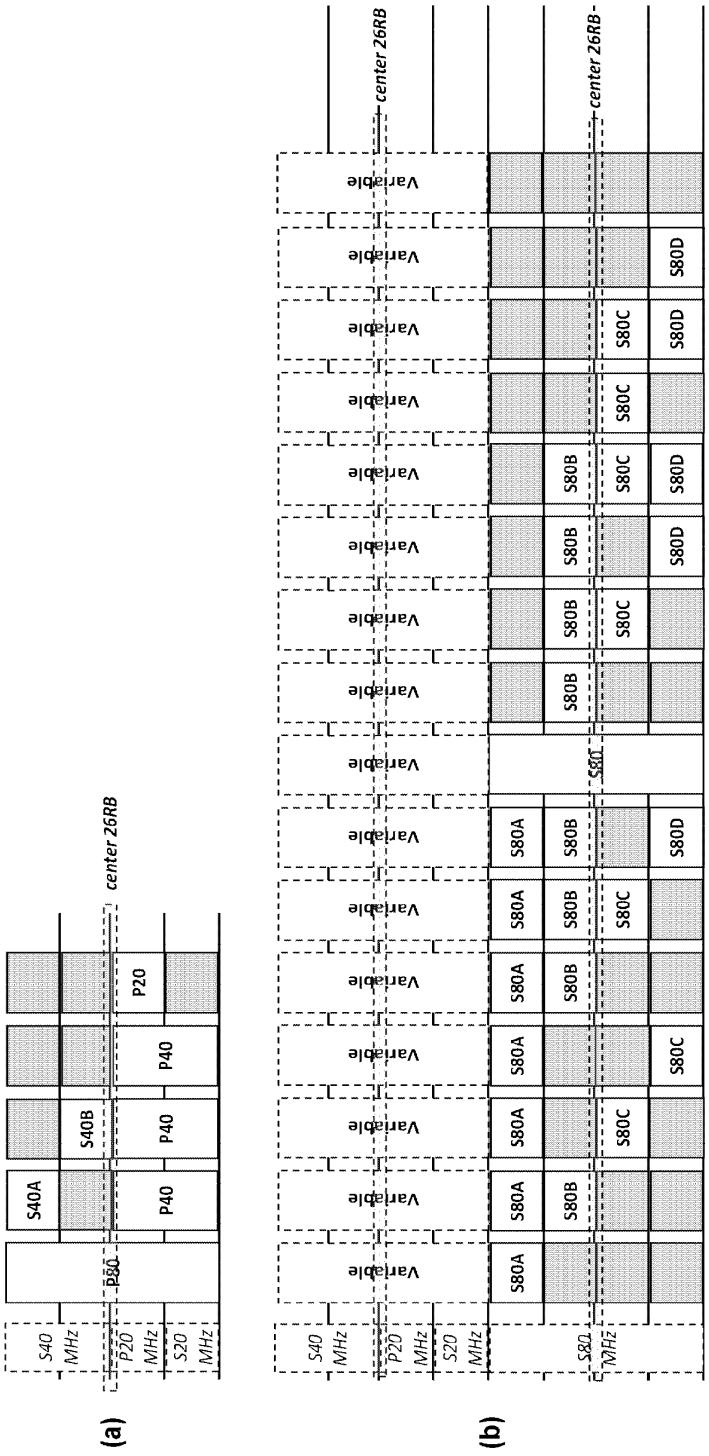
| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| NSTS | 3 | # of Spatial Streams |
| TxBF | 1 | TxBF on/off |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

user specific information

[도45]


CH C S40A
CH D S40B
CH A P20
CH B S20
CH E S80A
CH F S80B
CH G S80C
CH H S80D
Dup. L-Pre
Dup. SIG-A
Dup. SIG-B (A,C)
HE-STF /LTF
MU Data
Busy
SIG-A
SIG-B (A,C, 996N,996N)
SIG-B (B,242N, 996N,996N)
Dup. SIG-B (B,D, 996N,996N)
SIG-B (A,242N, 996N,996N)
SIG-B (B,D, 996N,996N)
L-Pre
SIG-B (A,484N, 996N,996N)
Data
Dup. SIG-B (A,C, 242N,484N)
SIG-B (B,242N, F,484N)
Dup. SIG-B (B,242N, F,484N)
(a)
(b)
(c)
(d)

[도46]


(a)
S40 MHz
P20 MHz
S20 MHz
center 26RB
S40A
S40B
P40
P40
P40
P20
P80
(b)
S40 MHz
P20 MHz
S20 MHz
S80 MHz
center 26RB
center 26RB
Variable
S80A
S80B
S80C
S80D
S80

Espacenet

# Bibliographic data: WO2015119374 (A1) — 2015-08-13

## METHOD AND DEVICE FOR TRANSMITTING FRAME IN WIRELESS LAN


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**Applicant(s):** LG ELECTRONICS INC [KR] ± (엘지전자 주식회사)



**Classification:** - international: ***H04B7/26; H04L27/26***
- cooperative: H04L5/0007; **H04W72/042**; **H04W72/0446**; **H04W74/0816**; H04L27/2602; H04W84/12

**Application number:** WO2014KR12437 20141217 Global Dossier

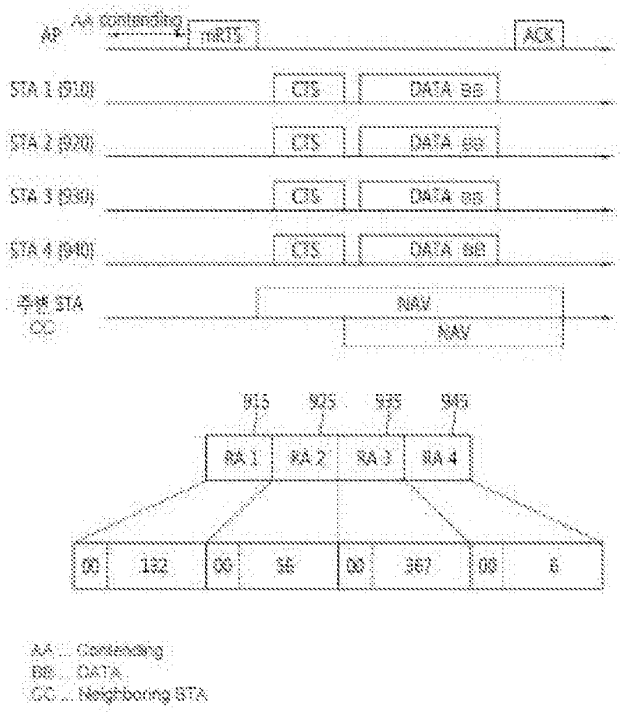
**Priority number(s):** US201461938101P 20140210 ; US201461938647P 20140211

**Also published as:** CN106105055 (A) CN106105055 (B) EP3107223 (A1) EP3107223 (A4) JP2017506460 (A) more



### Abstract of WO2015119374 (A1)

A method and a device for transmitting a frame in a wireless LAN are disclosed. A method for transmitting a data unit in a wireless LAN can comprise the steps of: transmitting, by an AP, an RTS frame for medium protection to a plurality of STAs through a plurality of channels; receiving, by the AP, a CTS frame in response to the RTS frame from each of the plurality of STAs through a first allocation channel, wherein the first allocation channel is at least one of the plurality of channels, which is determined on the basis of the RTS frame; and transmitting, by the AP, downlink data to each of the plurality of STAs through a second allocation channel on the basis of OFDMA in overlapped time resources, wherein the second allocation channel is at least one of the plurality of channels.




AA ... Contending
BB ... DATA
CC ... Neighboring STA

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## CLAIMS WO2015119374

1.

A method for transmitting a frame in a WLAN includes: transmitting, by an access point (AP), a request to send (RTS) frame for protecting a medium through a plurality of channels to a plurality of STAs; The AP receives a clear to send (CTS) frame in response to the RTS frame from each of the plurality of STAs through a first allocation channel, wherein the first allocation channel is determined based on the RTS frame. At least one channel of the plurality of channels; And transmitting downlink data to each of the plurality of STAs through the second allocation channel to each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resource, wherein the second allocation channel is at least one channel of the plurality of channels.

2.

The method of claim 1, wherein the RTS frame includes identification information indicating each of the plurality of STAs and bandwidth information for determining the first allocated channel.

3.

The method of claim 1, wherein the second allocation channel is determined based on channel allocation information included in a PPDU header of a downlink physical layer protocol data unit (PPDU) carrying the downlink data.

4.

The method of claim 1, wherein the bandwidth of each of the plurality of channels is 20 MHz, and the RTS frame is included in a duplicated format physical layer protocol data unit (PPDU) through the plurality of channels and transmitted. How to.

5.

The method of claim 1, wherein the bandwidth of each of the plurality of channels is 5 MHz, the number of the plurality of channels is four, and the RTS frame is non-duplicate format PPDU (non-duplicate) format through the plurality of channels. layer protocol data unit) and transmitted.

6.

An access point (AP) for transmitting a frame in a WLAN includes: a radio frequency (RF) unit configured to transmit or receive a radio signal; And a processor operatively connected to the RF unit, wherein the processor transmits a request to send (RTS) frame for protecting a medium to a plurality of STAs through a plurality of channels, and transmits the plurality of STAs.

Receiving a clear to send (CTS) frame in response to the RTS frame from each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resource; 2 is configured to transmit downlink data to each of the plurality of STAs through an allocation channel, wherein the first allocation channel is at least one channel among the plurality of channels determined based on the RTS frame, and the second allocation channel is An AP that is at least one channel of the plurality of channels.

7.

The AP of claim 6, wherein the RTS frame includes identification information indicating each of the plurality of STAs and bandwidth information for determining the first allocated channel.

8.

The AP of claim 6, wherein the second allocation channel is determined based on channel allocation information included in a PPDU header of a downlink physical layer protocol data unit (PPDU) that carries the downlink data.

9.

The method of claim 1, wherein the bandwidth of each of the plurality of channels is 20 MHz, and the RTS frame is included in a duplicated format physical layer protocol data unit (PPDU) through the plurality of channels and transmitted. AP made.

10.

The method of claim 6, wherein the bandwidth of each of the plurality of channels is 5 MHz, the number of the plurality of channels is four, and the RTS frame is non-duplicate format PPDU (non-duplicate) format through the plurality of channels. layer protocol data unit) and transmitted.

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# DESCRIPTION WO2015119374

Method and apparatus for transmitting frame in WLAN

The present invention relates to wireless communication, and more particularly, to a method and apparatus for transmitting a frame in a WLAN.

The channel bandwidth available in the existing WLAN system has been varied from 20MHz to 160MHz. Accordingly, determining an appropriate channel bandwidth for communication between the transmitting terminal and the receiving terminal has become an important factor in determining the Wi-Fi performance.

In order to determine an appropriate channel bandwidth for communication between a transmitting terminal and a receiving terminal, a dynamic channel bandwidth setting protocol based on a request to send (RTS) frame and a clear to send (CTS) frame has been developed from IEEE 802.11ac. Early RTS frames and CTS frames were designed to reduce hidden node problems and data frame collision overhead. The transmitting terminal transmits the RTS frame to the receiving terminal before transmitting the data frame. The destination terminal receiving the RTS frame responds to the transmitting terminal in the CTS frame. The third terminals receiving the RTS frame and the CTS control frame may delay the medium access for a predetermined time in order to protect data frames to be transmitted later.

In the dynamic channel bandwidth setting protocol supported from IEEE 802.11ac, a transmitting terminal transmits an RTS frame in a wide bandwidth exceeding a 20 MHz channel bandwidth, and a target terminal can respond to a CTS frame according to a channel bandwidth currently available to it. have. For example, if the transmitting terminal wants to use the 160MHz channel bandwidth, it transmits the RTS frame in 160MHz channel bandwidth. If the channel bandwidth currently available in the target terminal is 80MHz, the target terminal transmits the CTS frame in the 80MHz channel bandwidth. When a transmitting terminal transmitting an RTS frame receives a CTS frame with a channel bandwidth of 80 MHz, a data frame subsequently transmitted by the transmitting terminal to a target terminal should be less than or equal to an 80 MHz channel bandwidth.

An object of the present invention is to provide a method for transmitting a frame in a WLAN.

Still another object of the present invention is to provide an apparatus for performing a method of transmitting a frame in a WLAN.

In accordance with an aspect of the present invention, there is provided a method for transmitting a data unit in a WLAN according to an aspect of the present invention. Transmitting to a plurality of STAs, the AP receives a clear to send (CTS) frame in response to the RTS frame from each of the plurality of STAs through a first allocation channel, wherein the first allocation channel is And a second allocation channel to each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resource, wherein the AP and at least one channel of the plurality of channels determined based on the RTS frame are overlapped. And transmitting downlink data to each of the plurality of STAs, wherein the second allocation channel is at least one channel of the plurality of channels.

An access point (AP) for transmitting a frame in a WLAN according to another aspect of the present invention for achieving the

above object of the present invention is a radio frequency (RF) unit and a RF unit implemented to transmit or receive a radio signal. And a processor operatively connected to the processor, wherein the processor transmits a request to send (RTS) frame for protecting a medium to a plurality of STAs through a plurality of channels, and each of the plurality of STAs Receive a clear to send (CTS) frame in response to the RTS frame from the first allocation channel from the second, and the second allocation to each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resources The downlink data may be transmitted to each of the plurality of STAs through a channel, wherein the first allocation channel is determined based on the RTS frame. And at least one channel of the channel number, the second assignment channel may be at least one channel of the plurality of channels.

Communication efficiency may be increased by transmitting data to each of the plurality of STAs on the overlapped time resources.

1 is a conceptual diagram illustrating a structure of a wireless local area network (WLAN).

2 is a conceptual diagram illustrating a method of using an RTS frame and a CTS frame to solve a hidden node issue and an exposed node issue.

3 is a conceptual diagram illustrating CTS-to-Self Mechanism.

4 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

5 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

6 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

7 is a conceptual diagram illustrating an RTS frame according to an embodiment of the present invention.

8 is a conceptual diagram illustrating a sub RA field of an RTS frame according to an embodiment of the present invention.

9 is a conceptual diagram illustrating a format of an RTS frame according to an embodiment of the present invention.

10 is a conceptual diagram illustrating a format of an RTS frame according to an embodiment of the present invention.

11 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

12 illustrates a method for preventing interference between WLAN systems according to an embodiment of the present invention.

13 is a conceptual diagram illustrating a PPDU format for transmission of a frame according to an embodiment of the present invention.

14 is a block diagram illustrating a wireless device to which an embodiment of the present invention can be applied.

1 is a conceptual diagram illustrating a structure of a wireless local area network (WLAN).

1 shows the structure of the infrastructure basic service set (BSS) of the Institute of Electrical and Electronic Engineers (IEEE) 802.11.

Referring to the top of FIG. 1, the WLAN system may include one or more infrastructure BSSs 100 and 105 (hereinafter, BSS). The BSSs 100 and 105 are a set of APs and STAs such as an access point 125 and a STA1 (station 100-1) capable of successfully synchronizing and communicating with each other, and do not indicate a specific area. The BSS 105 may include one or more joinable STAs 105-1 and 105-2 to one AP 130.

The BSS may include at least one STA, APs 125 and 130 for providing a distribution service, and a distribution system (DS) 110 for connecting a plurality of APs.

The distributed system 110 may connect several BSSs 100 and 105 to implement an extended service set (ESS) 140 which is an extended service set. The ESS 140 may be used as a term indicating one network in which one or several APs 125 and 230 are connected through the distributed system 110. APs included in one ESS 140 may have the same service set identification (SSID).

The portal 120 may be a different network than the WLAN network (IEEE 802.11) (eg, 802. It can act as a bridge to connect with X).

In the BSS as shown in the upper part of FIG. 1, a network between the APs 125 and 130 and a network between the APs 125 and 130 and the STAs 100-1, 105-1, and 105-2 may be implemented. However, it may be possible to perform communication by setting up a network even between STAs without the APs 125 and 130. A network that performs communication by establishing a network even between STAs without APs 125 and 130 is defined as an ad-hoc network or an independent basic service set (BSS).

1 is a conceptual diagram illustrating an IBSS.

Referring to the bottom of FIG. 1, the IBSS is a BSS operating in an ad-hoc mode. Since IBSS does not contain an AP, there is no centralized management entity. That is, in the IBSS, the STAs 150-1, 150-2, 150-3, 155-4, and 155-5 are managed in a distributed manner. In the IBSS, all STAs 150-1, 150-2, 150-3, 155-4, and 155-5 may be mobile STAs, and access to a distributed system is not allowed, thus making a self-contained network. network).

A STA is any functional medium that includes medium access control (MAC) conforming to the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standard and a physical layer interface to a wireless medium. May be used to mean both an AP and a non-AP STA (Non-AP Station).

The STA may include a mobile terminal, a wireless device, a wireless transmit / receive unit (WTRU), a user equipment (UE), a mobile station (MS), a mobile subscriber unit ( It may also be called various names such as a mobile subscriber unit or simply a user.

2 is a conceptual diagram illustrating a method of using an RTS frame and a CTS frame to solve a hidden node issue and an exposed node issue.

Referring to FIG. 2, a short signal transmission frame such as a request to send (RTS) frame and a clear to send (CTS) frame to solve a hidden node issue and an exposed node issue ( short signaling frame) may be used. The neighboring STAs may know whether to transmit or receive data between the two STAs based on the RTS frame and the CTS frame.

2A illustrates a method of transmitting the RTS frame 203 and the CTS frame 205 to solve a hidden node issue.

It may be assumed that both STA A 200 and STA C 220 attempt to transmit a data frame to STA B 210. The STA A 200 may transmit the RTS frame 203 to the STA B 210 before transmitting the data frame, and the STA B 210 may transmit the CTS frame 205 to the STA A 200. STA C 220 may overhear the CTS frame 205 and may know transmission of the frame from STA A 200 to STA B 210 over the medium. The STA C 220 may set a network allocation vector (NAV) until the transmission of the data frame from the STA A 200 to the STA B 210 ends. By using this method, collision between frames due to hidden nodes can be prevented.

2B illustrates a method of transmitting the RTS frame 233 and the CTS frame 235 to solve the exposed node issue.

STA C 250 determines whether there is a collision when transmitting a frame to another STA D 260 based on the monitoring of the RTS frame 233 and the CTS frame 235 of STA A 230 and STA B 240. Can be.

STA B 240 may transmit an RTS frame 233 to STA A 230, and STA A 230 may transmit a CTS frame 235 to STA B 240. STA C 250 overhears only the RTS frame 233 transmitted by STA B 240 and fails to overhear the CTS frame 235 transmitted by STA A 230. Accordingly, STA C 250 may know that STA A 230 is outside the carrier sensing range of STA C 250. Accordingly, STA C 250 may transmit data to STA D 260.

The RTS frame format and the CTS frame format are disclosed in 8.3.1.2 RTS frame format and 8.3.1.3 CTS frame format of IEEE P802.11-REVmc ™ / D2.0, October 2013.

3 is a conceptual diagram illustrating CTS-to-Self Mechanism.

Referring to FIG. 3, a medium is sensed using an exchange method between an RTS frame and a CTS frame (FIG. 3A) and a medium is sensed using a CTS-to-Self frame (FIG. 3B). )).

The IEEE 802.11g standard defines the CTS-to-self protection mechanism. The CTS-to-self protection mechanism can be used in place of the medium sensing mechanism using the RTS frame and the CTS frame. Using the CTS-to-self protection mechanism can reduce the overhead of the medium compared to using a medium sensing mechanism that uses RTS / CTS frames.

Referring to FIG. 3A, a method of exchanging an RTS frame and a CTS frame before transmitting a data frame may be performed as follows.

In FIG. 3A, it is assumed that STA A 300 tries to send a data frame to STA B 305 or STA C 310.

1)

STA A 300 transmits an RTS frame 320.

2)

The RTS frame 320 is received by the STA B 305 and the STA C 310 that exist in a carrier sensing range.

3)

STA B 305 and STA C 310 transmit CTS frames 325 and 330.

4)

The transmitted CTS frames 325 and 330 are transmitted to the STA A 300, the STA B 305, the STA C 310, and the STA D 315.

In the case of the STA D 315, the RTS frame 320 transmitted by the STA A 300 was not received (ie, the STA D 315) outside the carrier sensing range of the STA A 300. Is a hidden node of STA A 300.

However, it can be seen that STA A 300 has occupied a medium for transmitting data by receiving the CTS frame 330 transmitted by STA C 310.

STA D may set the NAV and not access the medium.

5)

STA A 300 transmits a data frame to STA C 310.

Referring to FIG. 3B, the CTS-to-self frame-based media sensing method performed before the data frame is transmitted by the transmitter may be performed as follows.

In FIG. 3B, it is assumed that STA A 350 attempts to send a data frame to STA C 360.

1) The STA A 350 transmits the CTS-to-self frame 370 to the STA B 355 and the STA C 360 existing in the carrier sensing range.

2) Upon receiving the CTS-to-self frame 370, the STA B 355 and the STA C 360 delay the transmission of other data frames to receive the data frame transmitted from the STA A 350.

When using the above method, the STA D 365 existing outside the coverage area of the STA A 350 may not receive the CTS-to-self frame 370 from the STA A 350.

Accordingly, the STA D 365 may not know whether the data frame is transmitted by the STA A 350.

In this case, when the STA D 365 transmits the data frame to the STA A 350 or the STA C 360, a collision between the data frames may occur.

That is, the method using the CTS-to-self frame 370 cannot solve the hidden node problem. Therefore, the method using the CTS-to-self frame 370 is applied only when the transmission of data frames between the STAs can be sensed. Otherwise, the method can be performed using the RTS / CTS frame exchange method. You can sense it.

An AP operating in a WLAN system may transmit different data to each of a plurality of STAs through the same (or overlapped) time resource. If the transmission from the AP to the STA is called downlink transmission, the transmission of such an AP may be expressed in terms of DL MU transmission (or downlink multi-user transmission).

In the existing WLAN system, the AP may perform DL MU transmission based on MU multiple input multiple output (MUMI), and this transmission may be expressed by the term DL MU MIMO transmission. Unlike a conventional WLAN system, in an WLAN system according to an embodiment of the present invention, an operator may perform DL MU transmission based on

orthogonal frequency division multiplexing access (OFDMA), and such transmission is called DL MU OFDMA transmission. Can be expressed in terms. When DL MU OFDMA transmission is used, the AP may transmit a downlink frame to each of the plurality of STAs through each of a plurality of frequency resources (or subbands) on the overlapped time resources.

Each of the PPDUs, frames, and data transmitted through downlink transmission may be represented by the terms downlink PPDU, downlink frame, and downlink data. The PPDU may be a data unit including a PPDU header and a physical layer service data unit (PSDU) (or MAC protocol data unit (MPDU)). The PPDU header may include a PHY header and a PHY preamble, and the PSDU (or MPDU) may include or indicate a frame.

In contrast, transmission from the STA to the AP may be referred to as uplink transmission. The transmission of data to the AP by the plurality of STAs on the same (or overlapped) time resource may be expressed in terms of uplink multi-user transmission (or uplink multi-user transmission). Unlike the existing WLAN system, the UL MU transmission may be supported in the WLAN system according to an exemplary embodiment of the present invention. Each of the PPDUs, frames, and data transmitted through uplink transmission may be expressed in terms of uplink PPDU, uplink frame, and uplink data. Uplink transmission by each of the plurality of STAs may be performed based on different frequency resources (subbands) or different space time streams (or spatial streams).

When uplink transmission by each of the plurality of STAs is performed on different frequency resources (different subbands), different frequency resources may be allocated as uplink transmission resources for each of the plurality of STAs based on OFDMA. Each of the plurality of STAs may transmit an uplink frame to the AP through different frequency resources allocated on the overlapped time resources. The transmission method through these different frequency resources may be represented by the term UL MU OFDMA transmission method.

When uplink transmission by each of the plurality of STAs is performed on different space-time stream resources, different space-time streams (or spatial streams) may be allocated to each of the plurality of STAs. Each of the plurality of STAs may transmit an uplink frame to the AP through different space-time streams. The transmission method through these different spatial streams may be represented by the term UL MU MIMO transmission method.

In the next generation WLAN, a demand for high throughput and quality of experience (QoE) is increasing. When a new frame (or PPDU) format for a next generation WLAN system is introduced, a new system should be designed without performance impact on legacy STAs supporting only the existing WLAN system. In addition, the next generation WLAN system needs to be designed so that the performance is not affected by the presence of the legacy STA.

As described above, DL MU OFDMA transmission, UL MU MIMO transmission, and UL MU OFDMA transmission are not supported in the existing WLAN system. In a conventional WLAN system, a wide bandwidth (wider bandwidth) based on a multi-channel has been allocated for communication between one STA and one AP. The multi-channel can be a bandwidth in excess of 20 MHz, including a primary channel and a non primary channel (eg, a secondary channel).

In a conventional WLAN system, frequency resources are operated due to a primary channel rule. According to the primary channel rule, only when the non-primary channel (or the secondary channel) is idle, the STA may communicate through a multi-channel including a primary channel and a non-primary channel. Hereinafter, a method of an AP transmitting a plurality of downlink frames to each of a plurality of STAs based on DL MU OFDMA will be described.

4 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

In FIG. 4, the AP performs media protection based on the RTS frame 410 and the CTS frame 420, and the AP performs downlink data 415, 425, 435, 445 to each of the plurality of STAs through DL MU OFDMA transmission. It discloses a method of transmitting.

Referring to FIG. 4, the AP may transmit the RTS frame 410 through the multi channel based on the primary channel rule. Multi-channels may include primary channels and non-primary channels (or secondary channels).

For example, one 20 MHz channel band of four 20 MHz channel bands included in the 80 MHz channel band may be set as a primary channel for TXOP initial access. The AP may perform a back-off procedure for channel access for the established primary channel.

In more detail, the AP may perform TXOP initial access through a back-off procedure in the primary channel. The AP may check the channel state of the non-primary channel in a point coordination function (PCF) interframe space (PIFS) period before the back-off timer expires. In FIG. 4, the first channel may be a primary channel, a second channel, a third channel, and a fourth channel.

Hereinafter, the first channel used in the embodiment of the present invention may indicate a primary channel, a second channel, a third channel, and a fourth channel may indicate a non-primary channel (or secondary channel). In addition, in the present invention, for convenience of description, four channels (first channel to fourth channel) are assumed, but a medium protection method and downlink when performing OFDMA-based communication according to an embodiment of the present invention on a plurality of other channels. A link frame transmission method may be used, and such embodiments are also included in the scope of the present invention.

The AP may determine the channel states of the second, third and fourth channels during PIFS before TXOP to determine whether the second to fourth channels are idle or busy. . If the second channel, the third channel, and the fourth channel idle during PIFS, the AP may determine that the states of the second channel, the third channel, and the fourth channel are idle. In FIG. 4, for convenience of description, it is assumed that the second channel, the third channel, and the fourth channel are idle, but there may be a channel that is determined to be busy among the second, third, and fourth channels. The CTS frame 410 may not be transmitted through the channel determined to be busy.

The AP duplicates a PHY protocol data unit (PPDU) format (or duplicate frame) through a second channel, a third channel, and a fourth channel, which have determined that the channel and the channel state are idle. Format RTS PPDU (or RTS frame 410). The duplicate PPDU format may be a format including a duplicated field. In detail, when a duplicate PPDU format is used, a field that duplicates a field transmitted on a primary channel may be transmitted on a non-primary channel.

The RTS PPDU in the duplicate PPDU format may include an RTS PPDU transmitted on the first channel and a duplicated RTS PPDU transmitted on each of the second channel, the third channel, and the fourth channel. The duplicated RTS PPDU transmitted through the second channel, the third channel, and the fourth channel may be a duplicated PPDU transmitted through the RTS PPDU transmitted on the first channel. In frame units, the RTS frame transmitted on the first channel and the duplicated RTS frame transmitted on each of the second, third, and fourth channels may be represented by the RTS frame 410 of one duplicate frame format. It may be. That is, the RTS frame 410 of one duplicate frame format may include an RTS frame transmitted on the first channel and a duplicated RTS frame transmitted on the second channel, the third channel, and the fourth channel.

In FIG. 4, it is assumed that channel states of the second channel, the third channel, and the fourth channel are all idle. Accordingly, the AP may transmit an RTS PPDU (RTS frame 410) in a duplicate PPDU format (or duplicate frame format) through a first channel, a second channel, a third channel, and a fourth channel (eg, 80 MHz). ) Can be sent.

The RTS frame 410 transmitted by the AP may include identification information indicating a plurality of STAs to transmit the CTS frame 420. For example, the RA field of the RTS frame 410 may include identification information (eg, association identifier (AID)) for a plurality of STAs to transmit the CTS frame 420. In the case of FIG. 4, the RA field of the RTS frame 410 may include AID1 of STA1, AID2 of STA2, AID3 of STA3, and AID4 of STA4. The format (or structure) of the RTS frame 410 will be described later.

Each of the STAs 1, STA2, STA3, and STA4 that receives the RTS frame 410 may transmit the CTS frame 420 in response to the RTS frame 410. Each of STA 1, STA2, STA3, and STA4 includes a CTS frame 420 composed of fields including the same data, after receiving overlapping time resources (eg, after receiving the RTS frame 410 and short interframe space (SIFS)). Can be transmitted to the AP on the network. The CTS frame 420 may be transmitted to the AP through the first channel, the second channel, the third channel, and the fourth channel through the duplicated PPDU format similarly to the RTS frame 410.

In FIG. 4, it is assumed that the first channel, the second channel, the third channel, and the fourth channel are idle. If a specific channel (for example, a third channel) of the first channel, the second channel, the third channel, and the fourth channel is not idle, the STA1 does not transmit the CTS frame through the third channel. It may not. If neither STA1 to STA4 transmits the CTS frame through the third channel, the AP cannot receive the CTS frame through the third channel. In this case, the AP may not use the third channel when transmitting the downlink frame. That is, the AP may transmit the downlink frame through the first channel, the second channel, and the fourth channel except for the third channel.

In the following description, it is assumed that an AP receives a CTS frame 420 contained in a duplicate PPDU format through a first channel, a second channel, a third channel, and a fourth channel.

Based on the DL MU OFDMA transmission, the AP assigns each of a plurality of downlink data (or downlink frames, downlink PPDUs) 415, 425, 435, and 445 to a subband (or frequency resource) allocated to each of the plurality of STAs. Through each of the plurality of STAs may be transmitted. In another representation, the AP may transmit downlink data 415, 425, 435, 445 to each of the plurality of STAs through a PPDU format for DL MU OFDMA transmission.

For example, the AP may transmit a downlink data 1 415 to STA1 and a second channel allocated to STA2 through a first

channel (or subband 1) allocated to STA1 using a PPDU format for DL MU OFDMA. Downlink data 2 425 to STA2 via subband 2), downlink data 3 435 to STA3 through a third channel (or subband 3) allocated to STA3, and a fourth channel (or to STA4) assigned to STA4 Downlink data 4 445 may be transmitted to STA4 through subband 4). That is, the downlink data 1 415, the downlink data 2 425, the downlink data 3 435, and the downlink data 4 445 are each STA1, STA2, STA3, and STA4 by the AP on the overlapped time resource. May be sent to each.

In more detail, each of the plurality of STAs may obtain information on a channel (or subband) allocated to each of the plurality of STAs through a header of the downlink PPDU. The previous field of a specific field (eg, HE-SIG B) on the PPDU format for DL MU OFDMA may be transmitted in duplicated form in each of different transmission resources. In addition, on a PPDU format for DL MU OFDMA, a specific field (eg, HE-SIG B) is transmitted in encoded form on all transmission resources, and a field after the specific field (eg, HE-SIG B) is a PPDU. It may include individual information for each of a plurality of STAs receiving the. In this case, each of the plurality of STAs receives a downlink PPDU by monitoring a plurality of channels up to a specific field, and decodes data transmitted through a channel allocated to each of the plurality of STAs after the specific field, respectively, for each of the plurality of STAs. Downlink data may be received. The downlink PPDU format for DL MU OFDMA transmission by the AP will be described later.

Each of the plurality of STAs may transmit the ACK frame 430 to the AP through subbands (or frequency resources) allocated to each of the plurality of STAs based on UL MU OFDMA transmission. For example, STA1 transmits an ACK frame 1 that is a response to the downlink data 1 415 through a first channel, and STA2 transmits an ACK frame 2 that is a response to the downlink data 2 425 through a second channel. STA3 transmits an ACK frame 3 that is a response to the downlink data 3 435 through the third channel, and STA4 transmits an ACK frame 4 that is a response to the downlink data 4 445 through the fourth channel. Can be transmitted. That is, ACK frame 1, ACK frame 2, ACK frame 3 and ACK frame 4 may be transmitted to the AP by each of STA1 to STA4 on the overlapped time resources.

The neighbor STA may receive the RTS frame 410 and / or the CTS frame 420 and set a network allocation vector (NAV). In more detail, the neighbor STA may configure the NAV based on the duration field of the RTS frame 410 and / or the duration field of the CTS frame 420.

In the above case, it is assumed that each of the first channel, the second channel, the third channel, and the fourth channel is in a 20 MHz unit. Transmission of the DL MU OFDMA based downlink frame may be defined even in subband granularity (eg, 5 MHz) smaller than 20 MHz. In this case, each of the first channel, the second channel, the third channel, and the fourth channel may also be defined as a channel band (eg, 5 MHz) of less than 20 MHz. In this case, the RTS frame 410 and the CTS frame 420 may be transmitted based on the non duplicate PPDU format (or non duplicate frame format). The non duplicate PPDU format may be a format that does not include a duplicated field. That is, when a non-duplicate PPDU format is used, one field may be transmitted instead of a field duplicated on the PPDU through the entire channel band at a specific time.

For example, if each of the first channel, the second channel, the third channel, and the fourth channel is 5 MHz, the RTS frame 410 is included in the non-duplicate format PPDU for the NAV setting of the neighboring STAs, and thus is totally selected by the AP. It may be transmitted over a band (eg, 20 MHz). Similarly, the CTS frame 420 transmitted by each of the plurality of STAs may be included in the non-duplicate format PPDU and transmitted through the entire band (for example, 20 MHz).

Hereinafter, in the embodiment of the present invention, the bandwidth of each channel may be 20 MHz or more or less than 20 MHz.

5 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

In FIG. 5, the AP performs media protection based on the RTS frame 500 and the CTS frame 510, and transmits downlink data 515, 525, 535, and 545 to each of a plurality of STAs based on DL MU OFDMA transmission. While transmitting, downlink data 515, 525, and 535 are disclosed for the case where the bandwidths of channels allocated to each of the plurality of STAs for transmission of data are different from each other.

Referring to FIG. 5, as described above with reference to FIG. 4, the AP may transmit the RTS frame 500 to STA1, STA2, and STA3 through a first channel, a second channel, a third channel, and a fourth channel. The RTS PPDU delivered by the RTS frame 500 may be a duplicate format PPDU or a non duplicate format PPDU. For example, as described above, the RTS PPDU may be transmitted in a duplicated format PPDU or a non-duplicated format PPDU according to the size of the channel bandwidth of each of the first channel, the second channel, the third channel, and the fourth channel.

Each of the STA1, the STA2, and the STA3 may transmit the CTS frame 510 to the AP through the first channel, the second channel, the third channel, and the fourth channel in response to the RTS frame 500. Likewise, the CTS PPDU may be

transmitted in a duplicate format PPDU or a non duplicate format PPDU. The AP may receive the CTS frame 510 and transmit a downlink PPDU to each of STA 1, STA 2, and STA 3.

The AP is allocated to downlink data 1 515 through a first channel allocated to STA1 and to downlink data 2 525 and STA3 through a second channel assigned to STA2 using a PPDU format for DL MU OFDMA. The downlink data 3 535 may be transmitted through the third channel and the fourth channel. That is, the downlink data 1 515, the downlink data 2 525, and the downlink data 3 535 may be transmitted to the STA1 to the STA3 by the AP on the overlapped time resource. When the size of each subband is 20MHz, each of STA1 and STA2 receives downlink data 515 and 525 through a channel bandwidth of 20MHz, and STA3 receives downlink data 535 through a channel bandwidth of 40MHz. can do. When the size of each subband is 5MHz, each of STA1 and STA2 receives downlink data 515 and 525 through a channel bandwidth of 5MHz, and STA3 receives downlink data 535 through a channel bandwidth of 10MHz. can do.

The plurality of STAs may obtain information on channels allocated to each of the plurality of STAs based on the PPDU header of the downlink PPDU transmitted based on the PPDU format for the DL MU OFDMA. Each of the plurality of STAs may receive individual downlink data 515, 525, and 535 transmitted to each of the plurality of STAs through the assigned channel.

Each of the plurality of STAs may transmit the ACK frame 560 to the AP through a channel allocated to each of the plurality of STAs based on the UL MU OFDMA transmission. For example, STA1 transmits ACK frame 1, which is a response to downlink data 1 515, through a first channel, and STA2 transmits ACK frame 2, which is a response to downlink data 2 525, through subband 2. The STA3 may transmit an ACK frame 3 that is a response to the downlink data 3 535 through the third channel and the fourth channel. That is, the downlink data 1 515, the downlink data 2 525, and the downlink data 3 535 may be transmitted to the AP by each of STA1 to STA3 on the overlapped time resource. That is, ACK frame 1, ACK frame 2 and ACK frame 3 may be transmitted to the AP by each of the STA1 to STA3 on the overlapped time resources.

That is, the sizes of subbands allocated to each of the plurality of STAs may be different, and the AP may transmit a downlink frame to each of the plurality of STAs through subbands having different sizes.

6 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

In FIG. 6, the AP performs media protection based on the RTS frame 600 and the CTS frame 620, and transmits downlink data 615, 625, and 635 to each of the plurality of STAs through DL MU OFDMA transmission. In the case where interference occurs in a specific channel (or when a specific channel is busy), the communication is started.

Referring to FIG. 6, as described above with reference to FIG. 4, when the AP determines that there is interference in a specific channel (eg, the second channel) (or when a specific channel is sensed (or determined) as busy), The RTS frame 600 may not be transmitted through a specific channel.

When the AP senses that the second channel is busy, the AP may transmit the RTS frame 600 based on the duplicate PPDU format through the first channel, the third channel, and the fourth channel. The RA field of the RTS frame 600 may include identification information for each of a plurality of STAs (or a plurality of STA groups) to receive downlink data through the first channel, the third channel, and the fourth channel. In the case of FIG. 6, the RA field of the RTS frame 600 may include identification information about each of STA 1, STA2, and STA 3 or identification information about a group including STA 1, STA2, and STA 3.

Each of the plurality of STAs may transmit the CTS frame 620 in response to the RTS frame 600 through a channel that receives the RTS frame 600. For example, the STA1 may receive the RTS frame 600 through the first channel, the third channel, and the fourth channel. When the first channel, the third channel, and the fourth channel are idle, the STA1 may transmit the CTS frame 620 in response to the RTS frame 600 through the first channel, the third channel, and the fourth channel. Similarly, when the STA2 and the STA3 receive the RTS frame 600 through the first channel, the third channel, and the fourth channel, the STA2 and the STA3 determine whether the first channel, the third channel, and the fourth channel are idle to determine the RTS frame 600. In response to the CTS frame 620 may be transmitted. The CTS frame 620 may be in duplicate format.

Hereinafter, it is assumed that the AP receives the CTS frame 620 through the first channel, the third channel, and the fourth channel.

The AP may receive the CTS frame 620 from the plurality of STAs and transmit downlink data 615, 625, and 635 to each of the plurality of STAs through the channel that receives the CTS frame 620.

Specifically, the AP uses downlink data 1 615 through a first channel allocated to STA1 and a downlink data 2 625 and STA3

through a third channel assigned to STA2 using a PPDU format for DL MU OFDMA. Downlink data 3 635 may be transmitted through the allocated fourth channel. The AP may not use the second channel or transmit null data on the second channel.

According to another embodiment of the present invention, when the channel allocated to a plurality of STAs for transmission of a downlink frame is a continuous channel, the AP uses downlink data 625 and 635 using a PPDU format for DL MU OFDMA. Is transmitted to a plurality of STAs, and the AP transmits downlink data 615 to a specific STA using a PPDU format for a single STA when a channel allocated to a specific STA for discontinuing a downlink frame is a discontinuous channel. It may be. In the case of FIG. 6, the AP transmits downlink data 2 625 and downlink data 3 635 to STA2 and STA3 using the PPDU format for DL MU OFDMA on the third channel and the fourth channel. On the channel, downlink data 1 615 may be transmitted to STA1 using a PPDU format for a single STA.

Each of the plurality of STAs receiving the downlink data 615, 625, and 635 may transmit an ACK frame 660 for the downlink data 615, 625, and 635 to the AP based on the UL MU OFDMA.

4 to 6 assume that a CTS frame is transmitted based on a non-duplicate format or a duplicate format. However, the CTS frame may be transmitted by each of the plurality of STAs through a channel allocated to each of the plurality of STAs based on the RTS frame. For example, the RA field of the RTS frame may include a first channel for transmitting the CTS frame of STA1, a second channel for transmitting the CTS frame of STA2, a second channel for transmitting the CTS frame of STA3, and a third channel for transmitting the CTS frame of STA3. Channel, the channel for transmitting the CTS frame of the STA4 may be indicated as the fourth channel. In this case, the STA1 transmits the CTS frame through the first channel in response to the RTS frame, the STA2 transmits the CTS frame through the second channel in response to the RTS frame, and the STA3 transmits the CTS frame in response to the RTS frame. The CTS frame may be transmitted through three channels, and the STA4 may transmit the CTS frame through the first channel in response to the RTS frame.

7 is a conceptual diagram illustrating an RTS frame according to an embodiment of the present invention.

Referring to FIG. 7, the RTS frame includes a frame control field 700, a duration field 710, a receiver address (RA) field 720, a transmitter address (TA) field 730, and a frame check sequence (FCS) field ( 740.

The frame control field 700 may include information for indicating an RTS frame.

The duration field 710 may include duration information for transmission of a CTS frame, a downlink PPDU, and an ACK frame.

The RA field 720 receives identification information of each of a plurality of STAs or a group including a plurality of STAs to receive an RTS frame and respond through a CTS frame (or to receive downlink data transmitted based on a DL MU transmission). It may include identification information. In addition, the RA field 720 may further include information on a channel allocated for transmission of the CTS frame to each of the plurality of STAs. Each of a plurality of STAs that receive an RTS frame and respond to the CTS frame (or receive downlink data transmitted based on DL MU transmission) is represented by a term STA.

When the RA field 720 includes identification information and bandwidth information for four target STAs, the RA field 720 includes a sub RA field 1 750, a sub RA field 2 760, and a sub RA field 3 770. Sub-RA field 4 (780) may be included. Each sub-RA field 750, 760, 770, 780 may include identification information 769 of the target STA and information 763 about the channel bandwidth used to transmit the CTS frame to the target STA. The channel for transmission of the CTS frame of the target STA may be determined in consideration of the order of each sub-RA field 750, 760, 770, and 780 included in the RA field 720 and information on the channel bandwidth.

For example, sub RA field 1 750 includes STA1 identification information and information indicating a channel bandwidth of 20 MHz, and sub RA field 2 760 indicates STA2 identification information and information indicating a channel bandwidth of 20 MHz. The sub RA field 3 770 includes identification information of STA3 and information indicating a channel bandwidth of 20 MHz, and the sub RA field 4 780 indicates identification information of STA4 and a channel bandwidth of 20 MHz. It may include. In this case, STA1 may be sequentially allocated to the first channel, STA2 to the second channel, STA3 to the third channel, and STA4 to the fourth channel for transmission of the CTS frame.

As another example, the RA field may include four sub RA fields, three sub RA fields may include valid information, and one sub RA field may include null data. In detail, the sub RA field 1 750 includes STA1 identification information and information indicating a channel bandwidth of 20 MHz, and the sub RA field 2 760 includes identification information of STA2 and information indicating a channel bandwidth of 40 MHz. The sub-RA field 3 770 may include identification information of STA3 and information indicating a channel bandwidth of 20 MHz. Sub-RA field 4 780 may include null data (for example, a data sequence having a bit value of 0). In this case, STA1 may be sequentially allocated to the first channel, STA2 to the second

channel and the third channel, and STA3 to the fourth channel for transmission of the CTS frame.

When the STA decodes the RA field 720 by a method of decoding the legacy legacy RTS frame format after reception of the RTS frame, and the decoding fails, the STA may read the plurality of sub-RA fields 750, 760, according to an embodiment of the present invention. Decoding may be performed in consideration of the structure of the RA field 720 including 770 and 780.

The TA field 730 may include an address of an AP transmitting an RTS frame.

The FCS field 740 may include information for checking the validity of the frame.

8 is a conceptual diagram illustrating a sub RA field of an RTS frame according to an embodiment of the present invention.

In FIG. 8, when 12 bits are allocated to the sub RA field, the identification information and the bandwidth information of the target STA will be described in detail.

Referring to the upper part of FIG. 8, 2 bits may be allocated as the bandwidth information 800 and 10 bits may be allocated as the identification information 810 for the target STA. 2When the bandwidth information 800 of the bit is '00', 20 MHz, When the bandwidth information 800 of the 2 bits is '01', 40 MHz, When the bandwidth information 800 of the 2 bits is '10', 60 MHz, When the 2-bit bandwidth information 800 is '11', it may indicate 80 MHz. When 10 bits are allocated as the identification information 810 for the target STA, the 10 bits may indicate identification information (AID) of the target STA. 10The identification information 810 of the target STA of the bit may indicate one AID of 1 to 1023.

8, one bit may be allocated as the bandwidth information 820 and 11 bits may be allocated as the identification information 830 for the target STA. 1When the bandwidth information 820 of the bit is "0", 20MHz, and when the bandwidth information 820 of 1 bit is "1", it may indicate 40MHz. When 11 bits are allocated as the identification information 830 for the target STA, the 11 bits may indicate identification information (AID) of the target STA. 11The identification information 830 of the target STA of the bit may indicate one AID of 1 to 2007. 2008The AID corresponding to ~2047 may be stored without being used.

Referring to the bottom of FIG. 8, 12 bits may be allocated only by the identification information 840 for the target STA. 12The identification information 840 of the target STA of the bit may indicate one AID of 1 to 2007. 2008The AID corresponding to ~4095 may be stored without being used.

9 is a conceptual diagram illustrating a format of an RTS frame according to an embodiment of the present invention.

In FIG. 9, the RA field of the RTS frame includes four sub-RA fields, and each of the four sub-RA fields includes identification information and bandwidth information for each of the four target STAs.

Referring to FIG. 9, the RA field may include a sub RA field 1 915, a sub RA field 2 925, a sub RA field 3 935, and a sub RA field 4 945.

The sub RA field 1 915 may include identification information ('132') indicating the STA1 910 and bandwidth information ('00') for the STA1 910. The sub-RA field 2 925 may include identification information ('56') indicating the STA2 920 and bandwidth information ('00') for the STA2 920. The sub-RA field 3 935 may include identification information ('367') indicating the STA3 930 and bandwidth information ('00') for the STA3 930. The sub-RA field 4 945 may include identification information ('6') indicating the STA4 940 and bandwidth information ('00') for the STA4 940. As described above, the bandwidth information '00' may indicate a bandwidth of 20 MHz.

STA1 910 transmits a CTS frame through a first channel of 20 MHz, STA2 920 transmits a CTS frame through a second channel of 20 MHz, and STA3 930 sends a CTS frame through a third channel of 20 MHz The STA4 940 may transmit a CTS frame through a fourth channel of 20 MHz.

The AP may receive the CTS frame and transmit downlink data to the STA1 910, the STA2 920, the STA3 930, and the STA4 940 in response to the CTS frame.

Each of the STA1 910, the STA2 920, the STA3 930, and the STA4 940 may receive a downlink data frame and transmit an ACK frame in response to the downlink frame.

That is, in order to transmit a data unit in a WLAN, the AP transmits an RTS frame for protecting a medium to a plurality of STAs through a plurality of channels, and the AP responds to the RTS frame from each of the plurality of STAs through a first allocated channel. Can receive the CTS frame. The first allocation channel may be at least one channel of the plurality of channels determined based on the RTS frame. In addition, the AP may transmit downlink data to each of the plurality of STAs through the second allocation channel to each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resources. The second allocation channel may be at least one channel of the plurality of

channels through which the RTS frame is transmitted. The second allocation channel may be determined based on channel allocation information included in the PPDU header of the downlink PPDU carrying downlink data.

The bandwidth of each of the plurality of channels through which the RTS frame is transmitted is 20 MHz, and the RTS frame may be included in a duplicate format PPDU and transmitted through the plurality of channels. As another example, the bandwidth of each of the plurality of channels through which the RTS frame is transmitted is 5 MHz, the number of the plurality of channels is four, and the RTS frame may be included in the non-duplicate format PPDU through the plurality of channels and transmitted.

10 is a conceptual diagram illustrating a format of an RTS frame according to an embodiment of the present invention.

10 illustrates a case in which an AP transmits an RTS frame to three target STAs. The RA field of the RTS frame includes four sub-RA fields, each of the three sub-RA fields includes identification information and bandwidth information for each of the three target STAs, and the other sub-RA field. May include null data (eg, bit value 0).

Referring to FIG. 10, the sub RA field 1 1015 may include identifier information '132' indicating the STA1 1010 and bandwidth information '00' for the STA1 1010. The sub-RA field 2 1025 may include identifier information '56' indicating the STA2 1020 and bandwidth information '00' for the STA2 1020. The sub-RA field 3 1035 may include STA3. Identifier information '367' indicating 1030 and bandwidth information '01' for STA3 1030 may be included. As described above, the bandwidth information '00' may indicate a bandwidth of 20 MHz, and the bandwidth information '01' may indicate a bandwidth of 40 MHz. The sub RA field 4 1045 may include null data (eg, a bit sequence having a bit value of 0) as identification information for the target STA.

The STA1 1010 may be allocated a first channel based on the sub RA field 1 1015 and transmit a CTS frame on the first channel. The STA2 1020 may be allocated a second channel based on the sub RA field 2 1025 and transmit a CTS frame on the second channel. The STA3 1030 may be allocated a third channel and a fourth channel based on the sub RA field 3 1035 and transmit a CTS frame on the third channel and the fourth channel.

11 is a conceptual diagram illustrating a medium protection method when performing OFDMA-based communication in a WLAN according to an embodiment of the present invention.

11 illustrates a method in which an AP transmits each of a plurality of RTS frames through each of a plurality of channels.

Referring to FIG. 11, an AP may transmit each of a plurality of RTS frames 1110, 1120, 1130, and 1140 to each of a plurality of STAs through a plurality of channels. Each of the plurality of RTS frames 1110, 1120, 1130, and 1140 transmitted to each of the plurality of STAs through each of the plurality of channels may be different RTS frames. That is, data included in the RTS frame may be different.

For example, the AP transmits the RTS frame 1 1110 to STA1 through the first channel based on the DL MU OFDMA transmission, transmits the RTS frame 2 1120 to STA2 through the second channel, and transmits the third channel. The RTS frame 3 1130 may be transmitted to the STA 3 through the RTS frame 4, and the RTS frame 4 1140 may be transmitted to the STA 4 through the fourth channel. The RA field of the RTS frame 1 1110 may include identification information of the STA1 to receive the RTS frame 1 1110. The RA field of the RTS frame 2 1120 may include identification information of the STA2 to receive the RTS frame 2 1120. The RA field of the RTS frame 3 1130 may include identification information of the STA3 to receive the RTS frame 1 1130. The RA field of the RTS frame 4 1140 may include identification information of the STA4 to receive the RTS frame 4 1140.

Alternatively, as in the method of transmitting the RTS PPDU of the duplicate format PPDU, the AP may perform a back-off procedure for channel access for the configured first channel. In more detail, the AP may perform TXOP initial access through a back-off procedure in the first channel. The AP may check the channel state of the second channel to the fourth channel in a point coordination function (PIFS) interval before the back-off timer expires. That is, the AP is the channel of the second, third and fourth channels during PIFS before TXOP to determine whether the second, third and fourth channels are idle or busy. The state can be determined. If the second channel, the third channel, and the fourth channel are idle during the PIFS, the RTS frame1 1110 and the RTS frame through the first channel, the second channel, the third channel, and the fourth channel, respectively. 2 (1120), RTS frame 3 (1130) and RTS frame 4 (1140) may be transmitted respectively.

When the AP transmits RTS frames 1110, 1120, 1130, and 1140 based on DL MU OFDMA transmission, the AP transmits RTS frames 1110 and 1120 to each of a plurality of STAs through a downlink PPDU format for DL MU OFDMA transmission. , 1130 and 1140 may be transmitted. Each of the plurality of STAs may obtain information about a channel allocated to each of the plurality of STAs by decoding the PPDU header. Each of the plurality of STAs may receive the RTS frames 1110, 1120, 1130, and 1140 through channels allocated to each of the plurality of STAs.

Each of the plurality of STAs that have received each of the plurality of RTS frames 1110, 1120, 1130, and 1140 may transmit CTS frames 1113, 1123, 1133, and 1143 to the AP. Each of the plurality of STAs may transmit the CTS frames 1113, 1123, 1133, and 1143 to the AP through a channel that receives the RTS frames 1110, 1120, 1130, and 1140.

The AP that receives the CTS frames 1113, 1123, 1133, and 1143 from the plurality of STAs may transmit downlink data 1116, 1126, 1136, and 1146 to each of the plurality of STAs.

12 illustrates a method for preventing interference between WLAN systems according to an embodiment of the present invention.

12 illustrates a WLAN system supporting DL MU OFDMA transmission and UL MU OFDMA transmission according to an embodiment of the present invention, and a legacy WLAN system not supporting DL MU OFDMA transmission and UL MU OFDMA transmission according to an embodiment of the present invention. A method for preventing interference between the liver is disclosed.

Hereinafter, the AP and the STA indicate the AP and the STA operating in the WLAN system supporting the DL MU OFDMA transmission and the UL MU OFDMA transmission, and the legacy AP and the legacy STA do not support the DL MU OFDMA transmission and the UL MU OFDMA transmission. An AP and an STA operating in a legacy WLAN system may be indicated.

Referring to FIG. 12, the AP may perform a back-off procedure for channel access on the configured first channel (primary channel) 1210. In more detail, the AP may perform TXOP initial access through a back-off procedure on the first channel 1210. The AP performs a second channel 1220, a third channel 1230, and a fourth channel (secondary channel) 1240 in a point coordination function (PIFS) interval before the back-off timer expires. You can check the channel status.

The secondary channels (second channel 1220, third channel 1230, and fourth channel 1240) of the AP may overlap with the secondary channels 1230 and 1240 of the legacy AP or the legacy STA. In this case, the AP may check the channel state up to the primary channel 1250 of the legacy AP or the legacy STA, and when the channel state is idle, may transmit an RTS frame through the primary channel 1250 of the legacy AP or the legacy STA. .

In more detail, the AP may know information about the primary channel 1250 and the secondary channels 1230 and 1240 of the legacy AP or the legacy STA included in the BSS having the possibility of interference. The AP may determine whether the secondary channels 1220, 1230, and 1240 to be used for the transmission of the RTS frame overlap with the secondary channels 1230 and 1240 of the legacy AP or the legacy STA. If the secondary channels 1220, 1230, and 1240 to be used for the transmission of the RTS frame overlap with the secondary channels 1230 and 1240 of the legacy AP or the legacy STA, the AP is the primary channel 1250 of the legacy AP or the legacy STA. ) May determine whether the children are idle and transmit the RTS frame.

The AP may also transmit the downlink frame based on the DL MU OFDMA transmission by using the primary channel 1250 of the legacy AP or the legacy STA as an additional channel. Hereinafter, an embodiment of the present invention will be described on the assumption that the AP does not use the legacy channel or the primary channel 1250 of the legacy STA as an additional channel for transmission of a DL MU OFDMA based downlink frame. Hereinafter, the primary channel 1250 of the legacy AP or the legacy STA, through which the RTS frame is transmitted by the AP, may be referred to as an additional secondary channel.

The AP performs RTS through a first channel 1210 that is a primary channel and a second channel 1220 that is a secondary channel, a third channel 1230 and a fourth channel 1240, and a fifth channel 1250 that is an additional secondary channel. You can send a frame.

The AP may allocate only the first channel 1210, the second channel 1220, the third channel 1230, and the fourth channel 1240 as a channel for transmitting the CTS frame, and the AP may assign the first channel 1210. ), The CTS frame may be received from each of the plurality of STAs through the second channel 1220, the third channel 1230, and the fourth channel 1240. That is, the CTS frame may not be transmitted through the fifth channel 1250.

The AP may transmit downlink data to each of the plurality of STAs through the first channel 1210, the second channel 1220, the third channel 1230, and the fourth channel 1240.

The AP may transmit null data through the fifth channel 1250, and the legacy STA or the legacy AP may set the NAV based on the header of the PPDU transmitting the null data. By using this method, interference by the legacy STA or the legacy AP operating on the legacy WLAN system may be prevented.

13 is a conceptual diagram illustrating a PPDU format for transmission of a frame according to an embodiment of the present invention.

13 illustrates a PPDU format according to an embodiment of the present invention. 13 may be used for transmission of an ACK frame transmitted based on the UL MU OFDMA transmission disclosed in FIG. 13 and downlink data transmitted based on the DL MU OFDMA transmission.

For example, the PPDU format disclosed in the top and middle of FIG. 13 is used to carry an ACK frame transmitted based on UL MU OFDMA transmission, and the PPDU format disclosed in the bottom of FIG. 13 is transmitted based on DL MU OFDMA transmission. It may be used to deliver downlink data for each of the plurality of STAs.

The PPDU format disclosed in FIG. 13 may be used when the RTS frame and the CTS frame are transmitted based on DL MU OFDMA or UL MU OFDMA. For example, when the RTS frame is transmitted by the AP based on DL MU OFDMA, the PPDU format disclosed at the bottom of FIG. 13 may carry the RTS frame. For another example, when a CTS frame is transmitted based on UL MU OFDMA by a plurality of STAs, the PPDU format disclosed at the top or the middle of FIG. 13 may carry the CTS frame.

Referring to the top of FIG. 13, the PHY header of the downlink PPDU may include a legacy short training field (L-STF), a legacy long training field (L-LTF), a legacy-signal (L-SIG), and an HE-SIG A. (high efficiency-signal A), high efficiency-short training field (HE-STF), high efficiency-long training field (HE-LTF), and high efficiency-signal-B (HE-SIG B). From the PHY header to the L-SIG may be divided into a legacy part and a high efficiency (HE) part after the L-SIG.

The L-STF 1300 may include a short training orthogonal frequency division multiplexing symbol. The L-STF 1300 may be used for frame detection, automatic gain control (AGC), diversity detection, and coarse frequency / time synchronization.

The L-LTF 1310 may include a long training orthogonal frequency division multiplexing symbol. The L-LTF 1310 may be used for fine frequency / time synchronization and channel prediction.

L-SIG 1320 may be used to transmit control information. The L-SIG 1320 may include information about a data rate and a data length. As described above, the legacy STA may configure the NAV based on information included in the L-SIG.

The HE-SIG A 1330 may include information for indicating an STA to receive the PPDU. For example, the HE-SIG A 1330 may include an identifier of a specific STA (or AP) to receive a PPDU, and information for indicating a group of the specific STA. In addition, the HE-SIG A 1430 may also include resource allocation information for the STA when the PPDU is transmitted based on OFDMA or MIMO.

In addition, the HE-SIG A 1330 may include color bit information, bandwidth information, tail bits, CRC bits, and MCS for the HE-SIG B 1360 for BSS identification information. It may include modulation and coding scheme information, symbol number information for the HE-SIG B 1460, and cyclic prefix (CP) (or guard interval (GI)) length information.

The HE-STF 1340 may be used to improve automatic gain control estimation in a multiple input multiple output (MIMO) environment or an OFDMA environment.

The HE-LTF 1350 may be used to estimate a channel in a MIMO environment or an OFDMA environment.

The HE-SIG B 1360 may include information on a length MCS of a physical layer service data unit (PSDU) for each STA, tail bits, and the like. In addition, the HE-SIG B 1360 may include information on an STA to receive the PPDU, OFDMA-based resource allocation information (or MU-MIMO information). When the HE-SIG B 1360 includes OFDMA-based resource allocation information (or MU-MIMO related information), the HE-SIG A 1330 may not include resource allocation information.

The size of the IFFT applied to the fields after the HE-STF 1340 and the HE-STF 1340 and the size of the IFFT applied to the field before the HE-STF 1340 may be different. For example, the size of the IFFT applied to the field after the HE-STF 1340 and the HE-STF 1340 may be four times larger than the size of the IFFT applied to the field before the HE-STF 1340. The STA may receive the HE-SIG A 1330 and may be instructed to receive a downlink PPDU based on the HE-SIG A 1330. In this case, the STA may perform decoding based on the FFT size changed from the field after the HE-STF 1340 and the HE-STF 1340. On the contrary, when the STA is not instructed to receive the downlink PPDU based on the HE-SIG A 1330, the STA may stop decoding and configure a network allocation vector (NAV). The cyclic prefix (CP) of the HE-STF 1340 may have a larger size than the CP of another field, and during this CP period, the STA may perform decoding on the downlink PPDU by changing the FFT size.

The order of fields constituting the format of the PPDU disclosed at the top of FIG. 13 may vary. For example, the HE-SIG B 1315 of the HE portion may be located immediately after the HE-SIG A 1305, as disclosed in the interruption of FIG. 13. The STA may decode up to the HE-SIG A 1305 and the HE-SIG B 1315, receive necessary control information, and make NAV settings. Similarly, the size of the IFFT applied to the fields after the HE-STF 1325 and the HE-STF 1325 may be different from

the size of the IFFT applied to the fields before the HE-STF 1325.

The STA may receive the HE-SIG A 1305 and the HE-SIG B 1315. When the reception of the PPDU is indicated based on the HE-SIG A 1305, the STA may perform decoding on the PPDU by changing the FFT size from the HE-STF 1325. Conversely, when the STA receives the HE-SIG A 1305 and is not instructed to receive the downlink PPDU based on the HE-SIG A 1305, the STA may configure a network allocation vector (NAV).

Referring to the bottom of FIG. 13, a PPDU format for DL MU OFDMA transmission is disclosed. According to an embodiment of the present invention, the AP may transmit a downlink frame or a downlink PPDU to a plurality of STAs using a PPDU format for DL MU OFDMA transmission. Each of the plurality of downlink PPDUs may be transmitted to each of the plurality of STAs through different transmission resources (frequency resources or spatial streams). The previous field of the HE-SIG B 1345 on the PPDU may be transmitted in duplicated form in each of different transmission resources. The HE-SIG B 1345 may be transmitted in an encoded form on all transmission resources. The field after the HE-SIG B 1345 may include individual information for each of the plurality of STAs that receive the PPDU.

For example, the HE-SIG A 1335 may include identification information on a plurality of STAs to receive downlink data and information on a channel on which downlink data of the plurality of STAs are transmitted. For another example, the HE-SIG A 1335 may include identification information on a plurality of STAs to receive the RTS frame and information on a channel on which the RTS frames of the plurality of STAs are transmitted.

When the fields included in the PPDU are transmitted through each of the transmission resources, the CRC for each of the fields may be included in the PPDU. On the contrary, when a specific field included in the PPDU is encoded and transmitted on all transmission resources, the CRC for each field may not be included in the PPDU. Thus, overhead for CRC can be reduced.

The PPDU format for DL MU transmission may likewise be encoded based on an IFFT size different from that of the HE-STF 1355 and the fields after the HE-STF 1355. Therefore, when the STA receives the HE-SIG A 1335 and the HE-SIG B 1345 and is instructed to receive the PPDU based on the HE-SIG A 1335, the STA-FFT size from the HE-STF 1355. Can be changed to perform decoding on the PPDU.

14 is a block diagram illustrating a wireless device to which an embodiment of the present invention can be applied.

Referring to FIG. 14, the wireless device 1400 may be an STA that may implement the above-described embodiment, and may be an AP 1400 or a non-AP station (or STA) 1450.

The AP 1400 includes a processor 1410, a memory 1420, and an RF unit 1430.

The RF unit 1430 may be connected to the processor 1410 to transmit / receive a radio signal.

The processor 1410 may implement the functions, processes, and / or methods proposed in the present invention. For example, the processor 1410 may be implemented to perform the operation of the AP according to the above-described embodiment of the present invention. The processor may perform the operation of the AP disclosed in the embodiment of FIGS. 1 to 13.

For example, the processor 1410 transmits an RTS frame for protecting a medium to a plurality of STAs through a plurality of channels, and clears CTSs in response to the RTS frame through a first allocated channel from each of the plurality of STAs. send) frame, and transmit downlink data to each of the plurality of STAs through the second allocation channel to each of the plurality of STAs based on orthogonal frequency division multiple access (OFDMA) on the overlapped time resources. The first allocation channel may be at least one channel among a plurality of channels determined based on the RTS frame, and the second allocation channel may be at least one channel among the pluralily of channels. The RTS frame may include identification information indicating each of the plurality of STAs and bandwidth information for determining the first allocation channel.

The STA 1450 includes a processor 1460, a memory 1470, and a radio frequency unit 1480.

The RF unit 1480 may be connected to the processor 1460 to transmit / receive a radio signal.

The processor 1460 may implement the functions, processes, and / or methods proposed in the present invention. For example, the processor 1460 may be implemented to perform the operation of the STA according to the above-described embodiment of the present invention. The processor may perform an operation of the STA in the embodiment of FIGS. 1 to 13.

For example, the processor 1460 may be implemented to receive an RTS frame for medium protection and to transmit a CTS frame in response to the RTS frame on the first allocation channel. The first allocation channel may be at least one channel of the plurality of channels determined based on the RTS frame. In addition, the processor 1460 may be implemented to receive

downlink data transmitted through a second allocation channel based on OFDMA on the overlapped time resource. The second allocation channel may be at least one channel of the plurality of channels. The RTS frame may include identification information indicating each of the plurality of STAs and bandwidth information for determining the first allocation channel.

Processors 1410 and 1460 may include application-specific integrated circuits (ASICs), other chipsets, logic circuits, data processing devices, and / or converters for interconverting baseband signals and wireless signals. The memories 1420 and 1470 may include read-only memory (ROM), random access memory (RAM), flash memory, memory cards, storage media, and / or other storage devices. The RF unit 1430 and 1480 may include one or more antennas for transmitting and / or receiving a radio signal.

When the embodiment is implemented in software, the above-described technique may be implemented as a module (process, function, etc.) for performing the above-described function. The module may be stored in the memories 1420 and 1470 and executed by the processors 1410 and 1460. The memories 1420 and 1470 may be inside or outside the processors 1410 and 1460, and may be connected to the processors 1410 and 1460 by various well-known means.

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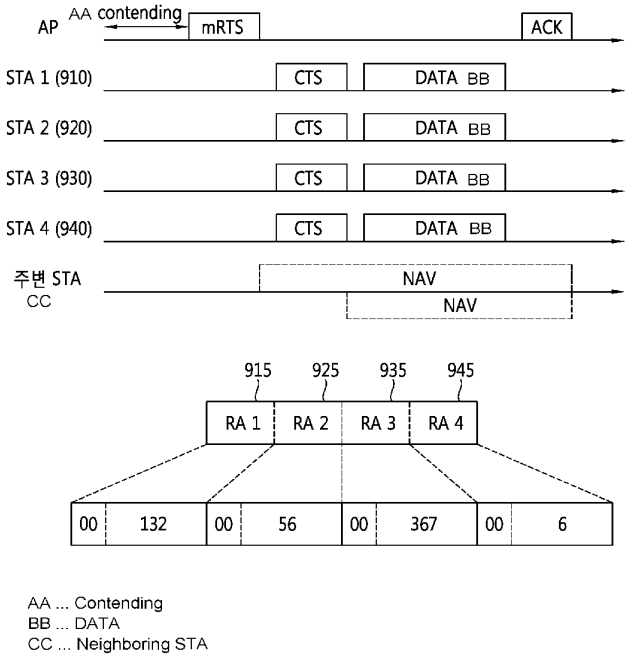
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[다음 쪽 계속]

(54) **Title**: METHOD AND DEVICE FOR TRANSMITTING FRAME IN WIRELESS LAN

(54) **발명의 명칭** : 무선랜에서 프레임을 전송하는 방법 및 장치




(57) **Abstract**: A method and a device for transmitting a frame in a wireless LAN are disclosed. A method for transmitting a data unit in a wireless LAN can comprise the steps of: transmitting, by an AP, an RTS frame for medium protection to a plurality of STAs through a plurality of channels; receiving, by the AP, a CTS frame in response to the RTS frame from each of the plurality of STAs through a first allocation channel, wherein the first allocation channel is at least one of the plurality of channels, which is determined on the basis of the RTS frame; and transmitting, by the AP, downlink data to each of the plurality of STAs through a second allocation channel on the basis of OFDMA in overlapped time resources, wherein the second allocation channel is at least one of the plurality of channels.

(57) **요약서**: 무선랜에서 프레임을 전송하는 방법 및 장치가 개시되어 있다. 무선랜에서 데이터 단위를 전송하는 방법은 AP 가 복수의 채널을 통해 매체 보호를 위한 RTS 프레임을 복수의 STA 으로 전송하는 단계, AP 가 상기 복수의 STA 각각으로부터 제 1 할당 채널을 통해 RTS 프레임에 대한 응답으로 CTS 프레임을 수신하되, 제 1 할당 채널은 RTS 프레임을 기반으로 결정된 복수의 채널 중 적어도 하나의 채널인, 단계와 AP 가 중첩된 시간 자원 상에서 OFDMA 를 기반으로 복수의 STA 각각으로 제 2 할당 채널을 통해 복수의 STA 각각으로 하향링크 데이터를 전송하되, 제 2 할당 채널은 복수의 채널 중 적어도 하나의 채널인, 단계를 포함할 수 있다.

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# 명세서

## 발명의 명칭: 무선랜에서 프레임을 전송하는 방법 및 장치

### 기술분야

[0001] 본 발명은 무선 통신에 관한 것으로 보다 상세하게는 무선랜에서 프레임을 전송하는 방법 및 장치에 관한 것이다.

### 배경기술

[0002] 기존의 무선랜 시스템에서 사용 가능한 채널 대역폭이 20MHz에서 160MHz까지 다양해졌다. 이에 따라, 송신 단말 및 수신 단말 간에 통신을 위한 적절한 채널 대역폭을 결정하는 것이 와이파이 성능을 결정하는데 중요한 요인이 되었다.

[0003] 송신 단말 및 수신 단말 간에 통신을 위한 적절한 채널 대역폭을 결정하기 위해 IEEE 802.11ac부터는 RTS(request to send) 프레임 및 CTS(clear to send) 프레임을 기반으로 한 동적 채널 대역폭 설정 프로토콜이 개발되었다. 초기 RTS 프레임 및 CTS 프레임은 히든 노드(hidden node) 문제, 데이터 프레임 충돌 오버 헤드를 줄이기 위해 고안되었다. 송신 단말이 데이터 프레임을 전송하기 전에 수신 단말로 RTS 프레임을 전송한다. RTS 프레임을 수신한 목적 단말은 CTS 프레임으로 송신 단말에 응답한다. RTS 프레임 및 CTS 컨트롤프레임을 수신한 제3의 단말들은 이후에 전송될 데이터 프레임의 보호를 위해 매체 접속을 일정 시간 지연할 수 있다.

[0004] IEEE 802.11ac에서부터 지원되는 동적 채널 대역폭 설정 프로토콜을 보면, 송신 단말이 RTS 프레임을 20MHz 채널 대역폭을 초과하는 광 대역으로 전송하고, 목적 단말은 현재 자신이 사용 가능한 채널 대역폭에 맞춰 CTS 프레임을 응답할 수 있다. 예를 들어 송신 단말이 160MHz 채널 대역폭을 사용하길 원하는 경우, RTS 프레임을 160MHz 채널 대역폭으로 전송하게 된다. 목적 단말에서 현재 사용 가능한 채널 대역폭이 80MHz인 경우, 목적 단말은 80MHz 채널 대역폭으로 CTS 프레임을 전송하게 된다. RTS 프레임을 전송한 송신 단말이 80MHz의 채널 대역폭으로 CTS 프레임을 수신받는 경우, 송신 단말에 의해 이후에 타겟 단말로 전송되는 데이터 프레임은 80MHz 채널 대역폭보다 작거나 같아야 한다.

### 발명의 요약

### 기술적 과제

[0005] 본 발명의 목적은 무선랜에서 프레임을 전송하는 방법을 제공하는 것이다.

[0006] 본 발명의 또 다른 목적은 무선랜에서 프레임을 전송하는 방법을 수행하는 장치를 제공하는 것이다.

### 과제 해결 수단

[0007] 상술한 본 발명의 목적을 달성하기 위한 본 발명의 일 측면에 따른 무선랜에서

데이터 단위를 전송하는 방법은 AP(access point)가 복수의 채널을 통해 매체 보호를 위한 RTS(request to send) 프레임을 복수의 STA으로 전송하는 단계, 상기 AP가 상기 복수의 STA(station) 각각으로부터 제1 할당 채널을 통해 상기 RTS 프레임에 대한 응답으로 CTS(clear to send) 프레임을 수신하되, 상기 제1 할당 채널은 상기 RTS 프레임을 기반으로 결정된 상기 복수의 채널 중 적어도 하나의 채널인, 단계와 상기 AP가 중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 상기 복수의 STA 각각으로 제2 할당 채널을 통해 상기 복수의 STA 각각으로 하향링크 데이터를 전송하되, 상기 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널인, 단계를 포함할 수 있다.

[0008] 상술한 본 발명의 목적을 달성하기 위한 본 발명의 다른 측면에 따른 무선랜에서 프레임을 전송하는 AP(access point)는 무선 신호를 송신 또는 수신하기 위해 구현되는 RF(radio frequency) 부와 상기 RF부와 동작 가능하게(operatively) 연결된 프로세서를 포함할 수 있되, 상기 프로세서는 복수의 채널을 통해 매체 보호를 위한 RTS(request to send) 프레임을 복수의 STA으로 전송하고, 상기 복수의 STA(station) 각각으로부터 제1 할당 채널을 통해 상기 RTS 프레임에 대한 응답으로 CTS(clear to send) 프레임을 수신하고, 중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 상기 복수의 STA 각각으로 제2 할당 채널을 통해 상기 복수의 STA 각각으로 하향링크 데이터를 전송하도록 구현될 수 있되, 상기 제1 할당 채널은 상기 RTS 프레임을 기반으로 결정된 상기 복수의 채널 중 적어도 하나의 채널이고, 상기 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널일 수 있다.

## 발명의 효과

[0009] 중첩된 시간 자원 상에서 복수의 STA 각각으로 데이터를 전송함으로써 통신 효율이 증가될 수 있다.

## 도면의 간단한 설명

[0010] 도 1은 무선랜(wireless local area network, WLAN)의 구조를 나타낸 개념도이다.

[0011] 도 2는 숨겨진 노드 문제(hidden node issue) 및 노출된 노드 문제(exposed node issue)를 해결하기 위해 RTS 프레임 및 CTS 프레임을 사용하는 방법을 나타낸 개념도이다.

[0012] 도 3은 CTS-to-Self Mechanism을 나타낸 개념도이다.

[0013] 도 4는 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0014] 도 5는 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0015] 도 6은 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시

매체 보호 방법을 나타낸 개념도이다.

[0016] 도 7은 본 발명의 실시예에 따른 RTS 프레임을 나타낸 개념도이다.

[0017] 도 8은 본 발명의 실시예에 따른 RTS 프레임의 서브 RA 필드를 나타낸 개념도이다.

[0018] 도 9는 본 발명의 실시예에 따른 RTS 프레임의 포맷을 나타낸 개념도이다.

[0019] 도 10은 본 발명의 실시예에 따른 RTS 프레임의 포맷을 나타낸 개념도이다.

[0020] 도 11은 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0021] 도 12는 본 발명의 실시예에 따른 무선랜 시스템 간 간섭을 방지하기 위한 방법에 대해 개시한다.

[0022] 도 13은 본 발명의 실시예에 따른 프레임의 전송을 위한 PPDU 포맷을 나타낸 개념도이다.

[0023] 도 14는 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다.

## 발명의 실시를 위한 형태

[0024] 도 1은 무선랜(wireless local area network, WLAN)의 구조를 나타낸 개념도이다.

[0025] 도 1의 상단은 IEEE(institute of electrical and electronic engineers) 802.11의 인프라스트럭처 BSS(basic service set)의 구조를 나타낸다.

[0026] 도 1의 상단을 참조하면, 무선랜 시스템은 하나 또는 그 이상의 인프라스트럭처 BSS(100, 105)(이하, BSS)를 포함할 수 있다. BSS(100, 105)는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 AP(access point, 125) 및 STA1(Station, 100-1)과 같은 AP와 STA의 집합으로서, 특정 영역을 가리키는 개념은 아니다. BSS(105)는 하나의 AP(130)에 하나 이상의 결합 가능한 STA(105-1, 105-2)을 포함할 수도 있다.

[0027] BSS는 적어도 하나의 STA, 분산 서비스(distribution Service)를 제공하는 AP(125, 130) 및 다수의 AP를 연결시키는 분산 시스템(distribution System, DS, 110)을 포함할 수 있다.

[0028] 분산 시스템(110)는 여러 BSS(100, 105)를 연결하여 확장된 서비스 셋인 ESS(extended service set, 140)를 구현할 수 있다. ESS(140)는 하나 또는 여러 개의 AP(125, 230)가 분산 시스템(110)을 통해 연결되어 이루어진 하나의 네트워크를 지시하는 용어로 사용될 수 있다. 하나의 ESS(140)에 포함되는 AP는 동일한 SSID(service set identification)를 가질 수 있다.

[0029] 포털(portal, 120)은 무선랜 네트워크(IEEE 802.11)와 다른 네트워크(예를 들어, 802.X)와의 연결을 수행하는 브리지 역할을 수행할 수 있다.

[0030] 도 1의 상단과 같은 BSS에서는 AP(125, 130) 사이의 네트워크 및 AP(125, 130)와 STA(100-1, 105-1, 105-2) 사이의 네트워크가 구현될 수 있다. 하지만, AP(125, 130)가 없이 STA 사이에서도 네트워크를 설정하여 통신을 수행하는 것도 가능할 수 있다. AP(125, 130)가 없이 STA 사이에서도 네트워크를 설정하여

통신을 수행하는 네트워크를 애드-혹 네트워크(Ad-Hoc network) 또는 독립 BSS(independent basic service set, IBSS)라고 정의한다.

[0031] 도 1의 하단은 IBSS를 나타낸 개념도이다.

[0032] 도 1의 하단을 참조하면, IBSS는 애드-혹 모드로 동작하는 BSS이다. IBSS는 AP를 포함하지 않기 때문에 중앙에서 관리 기능을 수행하는 개체(centralized management entity)가 없다. 즉, IBSS에서 STA(150-1, 150-2, 150-3, 155-4, 155-5)들은 분산된 방식(distributed manner)으로 관리된다. IBSS에서는 모든 STA(150-1, 150-2, 150-3, 155-4, 155-5)이 이동 STA으로 이루어질 수 있으며, 분산 시스템으로의 접속이 허용되지 않아서 자기 완비적 네트워크(self-contained network)를 이룬다.

[0033] STA은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준의 규정을 따르는 매체 접속 제어(medium access control, MAC)와 무선 매체에 대한 물리 계층(Physical Layer) 인터페이스를 포함하는 임의의 기능 매체로서, 광의로는 AP와 비-AP STA(Non-AP Station)을 모두 포함하는 의미로 사용될 수 있다.

[0034] STA은 이동 단말(mobile terminal), 무선 기기(wireless device), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장비(User Equipment; UE), 이동국(Mobile Station; MS), 이동 가입자 유닛(Mobile Subscriber Unit) 또는 단순히 유저(user) 등의 다양한 명칭으로도 불릴 수 있다.

[0035] 도 2는 숨겨진 노드 문제(hidden node issue) 및 노출된 노드 문제(exposed node issue)를 해결하기 위해 RTS 프레임 및 CTS 프레임을 사용하는 방법을 나타낸 개념도이다.

[0036] 도 2를 참조하면, 숨겨진 노드 문제(hidden node issue) 및 노출된 노드 문제(exposed node issue)를 해결하기 위해 RTS(request to send) 프레임과 CTS(clear to send) 프레임 등의 짧은 신호 전송 프레임(short signaling frame)이 사용될 수 있다. 주위의 STA들은 RTS 프레임 및 CTS 프레임을 기반으로 두 STA 간의 데이터 송신 또는 수신 여부에 대해 알 수 있다.

[0037] 도 2의 (A)는 숨겨진 노드 문제(hidden node issue)를 해결하기 위해 RTS 프레임(203) 및 CTS 프레임(205)을 전송하는 방법을 나타낸 것이다.

[0038] STA A(200)와 STA C(220)가 모두 STA B(210)에 데이터 프레임을 전송하려고 하는 경우를 가정할 수 있다. STA A(200)는 데이터 프레임의 전송 전 RTS 프레임(203)을 STA B(210)로 전송하고 STA B(210)는 CTS 프레임(205)을 STA A(200)로 전송을 할 수 있다. STA C(220)는 CTS 프레임(205)을 오버히어하고 매체를 통한 STA A(200)로부터 STA B(210)로의 프레임의 전송을 알 수 있다. STA C(220)는 STA A(200)로부터 STA B(210)으로의 데이터 프레임의 전송이 끝날 때까지 NAV(network allocation vector)를 설정할 수 있다. 이러한 방법을 사용함으로써 숨겨진 노드로 인한 프레임 간의 충돌(collision)이 방지될 수 있다.

[0039] 도 2의 (B)는 노출된 노드 문제(exposed node issue)를 해결하기 위해 RTS

프레임(233) 및 CTS 프레임(235)을 전송하는 방법을 나타낸 것이다.

[0040] STA C(250)는 STA A(230)와 STA B(240)의 RTS 프레임(233) 및 CTS 프레임(235)의 모니터링을 기반으로 다른 STA D(260)로 프레임을 전송시 충돌 여부에 대해 결정할 수 있다.

[0041] STA B(240)는 STA A(230)로 RTS 프레임(233)를 전송하고 STA A(230)는 CTS 프레임(235)을 STA B(240)으로 전송할 수 있다. STA C(250)는 STA B(240)에 의해 전송된 RTS 프레임(233)만을 오버히어하고 STA A(230)에 의해 전송된 CTS 프레임(235)을 오버히어하지 못했다. 따라서, STA C(250)는 STA A(230)가 STA C(250)의 캐리어 센싱 범위(carrier sensing range) 밖에 있다는 것을 알 수 있다. 따라서, STA C(250)는 STA D(260)로 데이터를 전송할 수 있다.

[0042] RTS frame format과 CTS frame format에 대해서는 IEEE P802.11-REVmcTM/D2.0, October 2013의 8.3.1.2 RTS frame format 및 8.3.1.3 CTS frame format에 개시되어 있다.

[0043] 도 3은 CTS-to-Self Mechanism을 나타낸 개념도이다.

[0044] 도 3을 참조하면, RTS 프레임 및 CTS 프레임 간의 교환 방법을 사용하여 매체를 센싱하는 경우(도 3의 (A))와 CTS-to-Self 프레임을 이용한 매체를 센싱하는 경우(도 3의 (B))를 비교하여 나타낸 것이다.

[0045] IEEE 802.11g 표준에서는 CTS-to-self 보호 메커니즘(protection mechanism)을 정의하였다. CTS-to-self 보호 메커니즘은 RTS 프레임 및 CTS 프레임을 사용하는 매체 센싱(medium sensing) 매커니즘을 대신하여 사용할 수 있다. CTS-to-self 보호 메커니즘을 사용할 경우 RTS/CTS 프레임을 사용하는 매체 센싱 매커니즘을 사용할 때보다 매체의 오버헤드를 줄일 수 있다.

[0046] 도 3의 (A)를 참조하면, 전송단에서 데이터 프레임을 전송하기 전에 RTS 프레임과 CTS 프레임을 교환하는 방법은 아래와 같이 수행될 수 있다.

[0047] 도 3의 (A)에서는 STA A(300)가 STA B(305) 또는 STA C(310)로 데이터 프레임을 보내려고 하는 경우를 가정한다.

[0048] 1) STA A(300)가 RTS 프레임(320)을 전송한다.

[0049] 2) RTS 프레임(320)은 캐리어 센싱 범위(carrier sensing range)에 존재하는 STA B(305)와 STA C(310)에 의해 수신된다.

[0050] 3) STA B(305)와 STA C(310)는 CTS 프레임(325, 330)을 전송한다.

[0051] 4) 전송된 CTS 프레임(325, 330)이 STA A(300), STA B(305), STA C(310), STA D(315)로 전송된다.

[0052] STA D(315)의 경우 STA A(300)의 캐리어 센싱 범위(carrier sensing range) 밖에 있어서 STA A(300)에 의해 전송된 RTS 프레임(320)을 수신하지 못하였다(즉, STA D(315)는 STA A(300)의 히든 노드). 하지만, STA C(310)에 의해 전송된 CTS 프레임(330)을 수신함으로써 STA A(300)가 데이터를 전송하기 위해 매체를 점유하였음을 알 수 있다. STA D는 NAV를 설정하고 매체에 액세스하지 않을 수 있다.

[0053] 5) STA A(300)는 STA C(310)로 데이터 프레임을 전송한다.

[0054] 도 3의 (B)를 참조하면, 전송단에서 데이터 프레임을 전송하기 전에 수행되는 CTS-to-self 프레임 기반의 매체 센싱 방법은 아래와 같이 수행될 수 있다. 도 3의 (B)에서는 STA A(350)가 STA C(360)로 데이터 프레임을 보내려고 하는 경우를 가정한다.

[0055] 1) STA A(350)는 CTS-to-self 프레임(370)을 캐리어 센싱 범위(carrier sensing range)에 존재하는 STA B(355)와 STA C(360)에 전송한다.

[0056] 2) CTS-to-self 프레임(370)을 수신한 STA B(355)와 STA C(360)는 STA A(350)로부터 전송되는 데이터 프레임을 수신하기 위해 다른 데이터 프레임의 전송을 연기한다.

[0057] 위와 같은 방법을 사용할 경우, STA A(350)의 커버리지 영역 밖에 존재하는 STA D(365)는 STA A(350)로부터 CTS-to-self 프레임(370)을 수신하지 못한다. 따라서 STA D(365)는 STA A(350)에 의한 데이터 프레임의 전송 여부에 대해 알지 못할 수 있다.

[0058] 이러한 경우, STA D(365)가 데이터 프레임을 STA A(350) 또는 STA C(360)로 전송할 때 데이터 프레임 사이의 충돌이 발생할 수 있다. 즉, CTS-to-self 프레임(370)을 이용한 방법은 숨겨진 노드 문제를 해결할 수 없다. 따라서, CTS-to-self 프레임(370)을 이용한 방법은 STA들 사이에서 서로의 데이터 프레임의 전송을 센싱할 수 있을 경우에만 적용되고, 그 외의 경우에는 RTS/CTS 프레임 교환 방법을 사용하여 매체를 센싱할 수 있다.

[0059] 무선랜 시스템에서 동작하는 AP는 복수의 STA(station) 각각으로 동일한(또는 중첩된) 시간 자원을 통해 서로 다른 데이터를 전송할 수 있다. AP에서 STA으로의 전송을 하향링크 전송이라고 한다면, 이러한 AP의 전송은 DL MU 전송(downlink multi-user transmission)(또는 하향링크 다중 사용자 전송)이라는 용어로 표현할 수 있다.

[0060] 기존의 무선랜 시스템에서 AP는 MU MIMO(multiple input multiple output)를 기반으로 DL MU 전송을 수행할 수 있었고, 이러한 전송은 DL MU MIMO 전송이라는 용어로 표현될 수 있다. 기존의 무선랜 시스템과 달리 본 발명의 실시예에 따른 무선랜 시스템에서 동작사는 AP는 OFDMA(orthogonal frequency division multiplexing access)를 기반으로 DL MU 전송을 수행할 수도 있고, 이러한 전송은 DL MU OFDMA 전송이라는 용어로 표현될 수 있다. DL MU OFDMA 전송이 사용되는 경우, AP는 중첩된 시간 자원 상에서 복수의 주파수 자원(또는 서브밴드) 각각을 통해 복수의 STA 각각으로 하향링크 프레임을 전송할 수 있다.

[0061] 하향링크 전송을 통해 전송되는 PPDU, 프레임 및 데이터 각각은 하향링크 PPDU, 하향링크 프레임 및 하향링크 데이터라는 용어로 표현될 수 있다. PPDU는 PPDU 헤더와 PSDU(physical layer service data unit)(또는 MPDU(MAC protocol data unit))를 포함하는 데이터 단위일 수 있다. PPDU 헤더는 PHY 헤더와

PHY 프리앰블을 포함할 수 있고, PSDU(또는 MPDU)는 프레임을 포함하거나 프레임을 지시할 수 있다.

[0062] 반대로, STA에서 AP로의 전송은 상향링크 전송이라고 할 수 있다. 복수의 STA이 동일한(또는 중첩된) 시간 자원 상에서 AP로 데이터를 전송하는 것은 UL MU 전송(uplink multi-user transmission)(또는 상향링크 다중 사용자 전송)이라는 용어로 표현될 수 있다. 기존의 무선랜 시스템과 달리 본 발명의 실시예에 따른 무선랜 시스템에서는 UL MU 전송이 지원될 수 있다. 상향링크 전송을 통해 전송되는 PPDU, 프레임 및 데이터 각각은 상향링크 PPDU, 상향링크 프레임 및 상향링크 데이터라는 용어로 표현될 수 있다. 복수의 STA 각각에 의한 상향링크 전송은 서로 다른 주파수 자원(서브밴드) 또는 서로 다른 시공간 스트림(space time stream)(또는 공간적 스트림(spatial stream))을 기반으로 수행될 수 있다.

[0063] 복수의 STA 각각에 의한 상향링크 전송이 서로 다른 주파수 자원(서로 다른 서브밴드) 상에서 수행되는 경우, OFDMA를 기반으로 복수의 STA 각각에 대해 서로 다른 주파수 자원이 상향링크 전송 자원으로서 할당될 수 있다. 복수의 STA 각각은 중첩된 시간 자원 상에서 할당된 서로 다른 주파수 자원을 통해 AP로 상향링크 프레임을 전송할 수 있다. 이러한 서로 다른 주파수 자원을 통한 전송 방법은 UL MU OFDMA 전송 방법이라는 용어로 표현될 수도 있다.

[0064] 복수의 STA 각각에 의한 상향링크 전송이 서로 다른 시공간 스트림 자원 상에서 수행되는 경우, 복수의 STA 각각에 대해 서로 다른 시공간 스트림(또는 공간적 스트림)이 할당될 수 있다. 복수의 STA 각각이 서로 다른 시공간 스트림을 통해 상향링크 프레임을 AP로 전송할 수 있다. 이러한 서로 다른 공간적 스트림을 통한 전송 방법은 UL MU MIMO 전송 방법이라는 용어로 표현될 수도 있다.

[0065] 차세대 무선랜에서는 높은 처리량(high throughput) 및 QoE(quality of experience) 향상에 대한 요구가 높아지고 있다. 차세대 무선랜 시스템을 위한 새로운 프레임(또는 PPDU) 포맷이 도입되는 경우, 기존의 무선랜 시스템만을 지원하는 레가시 STA들에 대한 성능 영향(performance impact)이 없이 새로운 시스템의 설계가 이뤄져야 한다. 또한, 차세대 무선랜 시스템은 레가시 STA의 존재로 인해 성능에 영향을 받지 않도록 설계될 필요가 있다.

[0066] 전술한 바와 같이 기존의 무선랜 시스템에서 DL MU OFDMA 전송, UL MU MIMO 전송 및 UL MU OFDMA 전송이 지원되지 않았다. 기존의 무선랜 시스템에서 하나의 STA과 하나의 AP의 통신을 위해 멀티 채널 기반의 넓은 대역폭(wider bandwidth)이 할당되었다. 멀티 채널은 프라이머리 채널과 논 프라이머리 채널(예를 들어, 세컨더리 채널(secondary channel))을 포함하는 20MHz를 초과하는 대역폭일 수 있다.

[0067] 기존의 무선랜 시스템에서는 프라이머리 채널 규칙(primary channel rule)으로 인해 주파수 자원이 운용되었다. 프라이머리 채널 규칙에 따르면, 논 프라이머리 채널(또는 세컨더리 채널)이 아이들(idle)한 경우에만 STA은 프라이머리 채널과

논 프라이머리 채널을 포함한 멀티 채널을 통해 통신할 수 있다. 이하, AP가 DL MU OFDMA를 기반으로 복수의 STA 각각으로 복수의 하향링크 프레임 각각을 전송하는 방법에 대해 개시한다.

[0068] 도 4는 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0069] 도 4에서는 AP가 RTS 프레임(410) 및 CTS 프레임(420)을 기반으로 매체 보호를 수행하고, AP가 DL MU OFDMA 전송을 통해 복수의 STA 각각으로 하향링크 데이터(415, 425, 435, 445)을 전송하는 방법을 개시한다.

[0070] 도 4를 참조하면, AP는 프라이머리 채널 규칙에 기반하여 멀티 채널을 통해 RTS 프레임(410)을 전송할 수 있다. 멀티 채널은 프라이머리 채널 및 논 프라이머리 채널(또는 세컨더리 채널)을 포함할 수 있다.

[0071] 예를 들어, 80MHz 채널 대역에 포함된 4개의 20MHz 채널 대역 중 하나의 20MHz 채널 대역이 TXOP 초기 액세스(TXOP initial access)를 위한 프라이머리 채널로 설정할 수 있다. AP는 설정된 프라이머리 채널에 대하여 채널 액세스를 위한 백-오프(back-off) 절차를 수행할 수 있다.

[0072] 구체적으로 AP는 프라이머리 채널에서 백-오프 절차를 통해 TXOP 초기 액세스를 수행할 수 있다. AP는 백-오프 타이머가 만료(expire)되기 이전 PIFS(PCF(point coordination function) interframe space) 구간에서 논 프라이머리 채널의 채널 상태를 확인할 수 있다. 도 4에서 제1 채널은 프라이머리 채널, 제2 채널, 제3 채널 및 제4 채널은 논 프라이머리 채널일 수 있다.

[0073] 이하, 본 발명의 실시예에서 사용되는 제1 채널은 프라이머리 채널, 제2 채널, 제3 채널, 제4 채널은 논 프라이머리 채널(또는 세컨더리 채널)을 지시할 수 있다. 또한, 이하, 본 발명에서는 설명의 편의상 4개의 채널(제1 채널 내지 제4 채널)을 가정하나, 다른 복수개의 채널 상에서도 본 발명의 실시예에 따른 OFDMA 기반의 통신을 수행시 매체 보호 방법 및 하향링크 프레임 전송 방법이 사용될 수 있고, 이러한 실시예 또한 본 발명의 권리 범위에 포함된다.

[0074] AP는 제2 채널 내지 제4 채널이 아이들(idle)한지 비지(busy)한지 여부에 대한 결정하기 위해 TXOP 이전의 PIFS 동안 제2 채널, 제3 채널 및 제4 채널의 채널 상태를 판단할 수 있다. 만약, 제2 채널, 제3 채널 및 제4 채널이 PIFS 동안 아이들(idle)한 경우, AP는 제2 채널, 제3 채널 및 제4 채널의 상태를 아이들한 것으로 판단할 수 있다. 도 4에서는 설명의 편의상 제2 채널, 제3 채널 및 제4 채널이 아이들한 것으로 가정하여 설명하나, 제2 채널, 제3 채널 및 제4 채널 중 비지 상태로 판단되는 채널이 존재할 수도 있다. 비지 상태로 판단되는 채널을 통해 CTS 프레임(410)이 전송되지 않을 수 있다.

[0075] AP는 채널 액세스를 수행한 제1 채널 및 채널 상태가 아이들 상태로 판단된 제2 채널, 제3 채널 및 제4 채널을 통해 듀플리케이트(duplicate) PPDU(PHY protocol data unit) 포맷(또는 듀플리케이트 프레임 포맷)의 RTS PPDU(또는 RTS 프레임(410))을 전송할 수 있다. 듀플리케이트 PPDU 포맷은 복제된 필드를

포함하는 포맷일 수 있다. 구체적으로 듀플리케이트 PPDU 포맷이 사용되는 경우, 프라이머리 채널 상에서 전송되는 필드를 복제한 필드가 논 프라이머리 채널 상에서 전송될 수 있다.

[0076] 듀플리케이트 PPDU 포맷의 RTS PPDU는 제1 채널 상에서 전송되는 RTS PPDU과 제2 채널, 제3 채널 및 제4 채널 각각을 통해 전송되는 복제된(duplicated) RTS PPDU를 포함할 수 있다. 제2 채널, 제3 채널 및 제4 채널 각각을 통해 전송되는 복제된 RTS PPDU는 제1 채널 상에서 전송되는 RTS PPDU를 복제한 PPDU일 수 있다. 프레임 단위로 보면, 제1 채널 상에서 전송되는 RTS 프레임과 제2 채널, 제3 채널 및 제4 채널 각각을 통해 전송되는 복제된 RTS 프레임은 하나의 듀플리케이트 프레임 포맷의 RTS 프레임(410)으로 표현될 수도 있다. 즉, 하나의 듀플리케이트 프레임 포맷의 RTS 프레임(410)은 제1 채널 상에서 전송되는 RTS 프레임과 제2 채널, 제3 채널 및 제4 채널 상에서 전송되는 복제된 RTS 프레임을 포함할 수 있다.

[0077] 도 4에서는 제2 채널, 제3 채널 및 제4 채널의 채널 상태가 모두 아이들인 경우를 가정한다. 따라서, AP는 제1 채널, 제2 채널, 제3 채널 및 제 4채널을 통해(예를 들어, 80MHz)을 통하여 듀플리케이트 PPDU 포맷(또는 듀플리케이트 프레임 포맷)의 RTS PPDU(RTS 프레임(410))을 전송할 수 있다.

[0078] AP에 의해 전송되는 RTS 프레임(410)은 CTS 프레임(420)을 전송할 복수의 STA을 지시하는 식별 정보를 포함할 수 있다. 예를 들어, RTS 프레임(410)의 RA 필드는 CTS 프레임(420)을 전송할 복수의 STA에 대한 식별 정보(예를 들어, AID(association identifier)) 포함할 수 있다. 도 4와 같은 경우, RTS 프레임(410)의 RA 필드는 STA1의 AID1, STA2의 AID2, STA3의 AID3, STA4의 AID4를 포함할 수 있다. RTS 프레임(410)의 포맷(또는 구조)에 대해서는 후술한다.

[0079] RTS 프레임(410)을 수신한 STA 1, STA2, STA3 및 STA4 각각은 RTS 프레임(410)에 대한 응답으로 CTS 프레임(420)을 전송할 수 있다. STA 1, STA2, STA3 및 STA4 각각은 동일한 데이터를 포함하는 필드로 구성되는 CTS 프레임(420)을 중첩된 시간 자원(예를 들어, RTS 프레임(410)의 수신하고 SIFS(short interframe space) 후) 상에서 AP로 전송할 수 있다. CTS 프레임(420)은 RTS 프레임(410)과 유사하게 듀플리케이티드 PPDU 포맷을 통해 제1 채널, 제2 채널, 제3 채널 및 제4 채널을 통해 AP로 전송될 수 있다.

[0080] 도 4에서는 제1 채널, 제2 채널, 제3 채널 및 제4 채널이 아이들한 경우를 가정한다. 만약, STA1에게 제1 채널, 제2 채널, 제3 채널 및 내지 제4 채널 중 특정 채널(예를 들어, 제3 채널)이 아이들하지 못한 경우, STA1은 제3 채널을 통해서 CTS 프레임을 전송하지 않을 수도 있다. 만약, STA1 내지 STA4 모두가 제3 채널을 통해서 CTS 프레임을 전송하지 않는 경우, AP는 제3 채널을 통해 CTS 프레임을 수신할 수 없다. 이러한 경우, AP는 하향링크 프레임을 전송시 제3 채널을 사용하지 않을 수 있다. 즉, AP는 제3 채널을 제외한 제1 채널, 제2 채널 및 제4 채널을 통해 하향링크 프레임을 전송할 수 있다.

[0081] 이하에서는 AP가 제1 채널, 제2 채널, 제3 채널 및 제4 채널을 통해 듀플리케이트 PPDU 포맷에 포함되는(containing) CTS 프레임(420)을 수신한 경우를 가정하여 설명한다.

[0082] AP는 DL MU OFDMA 전송을 기반으로 복수의 하향링크 데이터(또는 하향링크 프레임, 하향링크 PPDU)(415, 425, 435, 445) 각각을 복수의 STA 각각에 할당된 서브밴드(또는 주파수 자원)을 통해 복수의 STA 각각으로 전송할 수 있다. 또 다른 표현으로 AP는 DL MU OFDMA 전송을 위한 PPDU 포맷을 통해 복수의 STA 각각으로 하향링크 데이터(415, 425, 435, 445)를 전송할 수 있다.

[0083] 예를 들어, AP는 DL MU OFDMA를 위한 PPDU 포맷을 사용하여 STA1으로 할당된 제1 채널(또는 서브밴드1)을 통해 STA1으로 하향링크 데이터1(415), STA2로 할당된 제2 채널(또는 서브밴드2)을 통해 STA2로 하향링크 데이터2(425), STA3으로 할당된 제3 채널(또는 서브밴드3)을 통해 STA3으로 하향링크 데이터3(435), STA4로 할당된 제4 채널(또는 서브밴드4)을 통해 STA4로 하향링크 데이터4(445)를 전송할 수 있다. 즉, 하향링크 데이터1(415), 하향링크 데이터2(425), 하향링크 데이터3(435), 하향링크 데이터4(445) 각각은 중첩된 시간 자원 상에서 AP에 의해 STA1, STA2, STA3 및 STA4 각각으로 전송될 수 있다.

[0084] 구체적으로, 복수의 STA 각각은 복수의 STA 각각으로 할당된 채널(또는 서브밴드)에 대한 정보를 하향링크 PPDU의 헤더를 통해 획득할 수 있다. DL MU OFDMA를 위한 PPDU 포맷 상에서 특정 필드(예를 들어, HE-SIG B)의 이전 필드는 서로 다른 전송 자원 각각에서 듀플리케이트된 형태로 전송될 수 있다. 또한, DL MU OFDMA를 위한 PPDU 포맷 상에서 특정 필드(예를 들어, HE-SIG B)는 전체 전송 자원 상에서 인코딩된 형태로 전송되고 특정 필드(예를 들어, HE-SIG B) 이후의 필드는 PPDU를 수신하는 복수의 STA 각각을 위한 개별 정보를 포함할 수 있다. 이러한 경우, 복수의 STA 각각은 특정 필드까지는 복수의 채널을 모니터링하여 하향링크 PPDU를 수신하고, 특정 필드 이후는 복수의 STA 각각으로 할당된 채널을 통해 전송되는 데이터를 디코딩하여 복수의 STA 각각을 위한 하향링크 데이터를 수신할 수 있다. AP에 의해 DL MU OFDMA 전송을 위한 하향링크 PPDU 포맷에 대해서는 후술한다.

[0085] 복수의 STA 각각은 ACK 프레임(430)을 UL MU OFDMA 전송을 기반으로 복수의 STA 각각에 할당된 서브밴드(또는 주파수 자원)을 통해 AP로 전송할 수 있다. 예를 들어, STA1은 제1 채널을 통해 하향링크 데이터1(415)에 대한 응답인 ACK 프레임1을 전송하고, STA2는 제2 채널을 통해 하향링크 데이터2(425)에 대한 응답인 ACK 프레임2를 전송하고, STA3은 제3 채널을 통해 하향링크 데이터3(435)에 대한 응답인 ACK 프레임3을 전송하고, STA4는 제4 채널을 통해 하향링크 데이터4(445)에 대한 응답인 ACK 프레임4를 전송할 수 있다. 즉, ACK 프레임1, ACK 프레임2, ACK 프레임3 및 ACK 프레임4는 중첩된 시간 자원 상에서 STA1 내지 STA4 각각에 의해 AP로 전송될 수 있다.

[0086] 주변 STA은 RTS 프레임(410) 및/또는 CTS 프레임(420)을 수신하고, NAV(network allocation vector)를 설정할 수 있다. 구체적으로 주변 STA은 RTS 프레임(410)의 듀레이션 필드 및/또는 CTS 프레임(420)의 듀레이션 필드를 기반으로 NAV를 설정할 수 있다.

[0087] 전술한 경우는 제1 채널, 제2 채널 및 제3 채널 및 제4 채널 각각이 20MHz 단위인 경우를 가정하였다. DL MU OFDMA 기반의 하향링크 프레임의 전송은 20MHz 보다 작은 서브밴드 입도(granularity)(예를 들어, 5MHz)에서도 정의될 수 있다. 이러한 경우, 각각의 제1 채널, 제2 채널, 제3 채널 및 제4 채널도 20MHz 미만의 채널 대역(예를 들어, 5MHz)으로 정의될 수 있다. 이러한 경우, RTS 프레임(410) 및 CTS 프레임(420)은 논 듀플리케이트 PPDU 포맷(또는 논 듀플리케이트 프레임 포맷)을 기반으로 전송될 수 있다. 논 듀플리케이트 PPDU 포맷은 복제된 필드를 포함하지 않는 포맷일 수 있다. 즉, 논 듀플리케이트 PPDU 포맷이 사용되는 경우, 특정 시간에 전체 채널 대역을 통해 PPDU 상에서 복제된 필드가 아닌 하나의 필드가 전송될 수 있다.

[0088] 예를 들어, 제1 채널, 제2 채널, 제3 채널 및 제4 채널 각각이 5MHz인 경우, 주변 STA의 NAV 설정을 위해 RTS 프레임(410)은 논 듀플리케이트 포맷 PPDU에 포함되어 AP에 의해 전체 대역(예를 들어, 20MHz)를 통해 전송될 수 있다. 마찬가지로 복수의 STA 각각에 의해 전송되는 CTS 프레임(420)도 논 듀플리케이트 포맷 PPDU에 포함되어 전체 대역(예를 들어, 20MHz)을 통해 전송될 수도 있다.

[0089] 이하, 본 발명의 실시예에서 각 채널의 대역폭은 20MHz 이상 또는 20MHz 미만일 수 있다.

[0090] 도 5는 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0091] 도 5에서는 AP가 RTS 프레임(500) 및 CTS 프레임(510)을 기반으로 매체 보호를 수행하고, DL MU OFDMA 전송을 기반으로 복수의 STA 각각으로 하향링크 데이터(515, 525, 535, 545)를 전송하되, 하향링크 데이터(515, 525, 535)의 전송을 위해 복수의 STA 각각으로 할당된 채널의 대역폭의 크기가 서로 다른 경우에 대해 개시한다.

[0092] 도 5를 참조하면, 도 4에서 전술한 바와 같이 AP는 제1 채널, 제2 채널, 제3 채널 및 제4 채널을 통해 RTS 프레임(500)을 STA1, STA2 및 STA3으로 전송할 수 있다. RTS 프레임(500)은 전달하는 RTS PPDU는 듀플리케이트 포맷 PPDU이거나 논 듀플리케이트 포맷 PPDU일 수 있다. 예를 들어, 전술한 바와 같이 제1 채널, 제2 채널, 제3 채널 및 제4 채널 각각의 채널 대역폭의 크기에 따라 RTS PPDU는 듀플리케이트 포맷 PPDU 또는 논 듀플리케이트 포맷 PPDU으로 전송될 수 있다.

[0093] STA1, STA2 및 STA3 각각은 RTS 프레임(500)에 대한 응답으로 CTS 프레임(510)을 제1 채널, 제2 채널, 제3 채널 및 제4 채널을 통해 AP로 전송할 수

있다. 마찬가지로 CTS PPDU는 듀플리케이트 포맷 PPDU 또는 논 듀플리케이트 포맷 PPDU으로 전송될 수 있다. AP는 CTS 프레임(510)을 수신하고, STA 1, STA2 및 STA3 각각으로 하향링크 PPDU를 전송할 수 있다.

[0094] AP는 DL MU OFDMA를 위한 PPDU 포맷을 사용하여 STA1으로 할당된 제1 채널을 통해 하향링크 데이터1(515), STA2로 할당된 제2 채널을 통해 하향링크 데이터2(525), STA3으로 할당된 제3 채널 및 제4 채널을 통해 하향링크 데이터3(535)을 전송할 수 있다. 즉, 하향링크 데이터1(515), 하향링크 데이터2(525) 및 하향링크 데이터3(535)은 중첩된 시간 자원 상에서 AP에 의해 STA1 내지 STA3 각각으로 전송될 수 있다. 각각의 서브밴드의 크기가 20MHz인 경우, STA1, STA2 각각은 20MHz의 채널 대역폭을 통해 하향링크 데이터(515, 525)를 수신하고, STA3는 40MHz의 채널 대역폭을 통해 하향링크 데이터(535)를 수신할 수 있다. 각각의 서브밴드의 크기가 5MHz인 경우, STA1, STA2 각각은 5MHz의 채널 대역폭을 통해 하향링크 데이터(515, 525)를 수신하고, STA3는 10MHz의 채널 대역폭을 통해 하향링크 데이터(535)를 수신할 수 있다.

[0095] 복수의 STA은 DL MU OFDMA를 위한 PPDU 포맷을 기반으로 전송되는 하향링크 PPDU의 PPDU 헤더를 기반으로 복수의 STA 각각으로 할당된 채널에 대한 정보를 획득할 수 있다. 복수의 STA 각각은 할당된 채널을 통해 복수의 STA 각각으로 전송되는 개별적인 하향링크 데이터(515, 525, 535)를 수신할 수 있다.

[0096] 복수의 STA 각각은 ACK 프레임(560)을 UL MU OFDMA 전송을 기반으로 복수의 STA 각각에 할당된 채널을 통해 AP로 전송할 수 있다. 예를 들어, STA1은 제1 채널을 통해 하향링크 데이터1(515)에 대한 응답인 ACK 프레임1을 전송하고, STA2는 서브밴드2를 통해 하향링크 데이터2(525)에 대한 응답인 ACK 프레임2를 전송하고, STA3은 제3 채널 및 제4 채널을 통해 하향링크 데이터3(535)에 대한 응답인 ACK 프레임3을 전송할 수 있다. 즉, 하향링크 데이터1(515), 하향링크 데이터2(525) 및 하향링크 데이터3(535)은 중첩된 시간 자원 상에서 STA1 내지 STA3 각각에 의해 AP로 전송될 수 있다. 즉, ACK 프레임1, ACK 프레임2 및 ACK 프레임3은 중첩된 시간 자원 상에서 STA1 내지 STA3 각각에 의해 AP로 전송될 수 있다.

[0097] 즉, 복수의 STA 각각으로 할당된 서브밴드의 크기는 서로 다를 수 있고, AP는 서로 다른 크기의 서브밴드를 통해 하향링크 프레임을 복수의 STA 각각으로 전송할 수 있다.

[0098] 도 6은 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0099] 도 6에서는 AP가 RTS 프레임(600) 및 CTS 프레임(620)을 기반으로 매체 보호를 수행하고, DL MU OFDMA 전송을 통해 복수의 STA 각각으로 하향링크 데이터(615, 625, 635)를 전송하되, 특정 채널에 간섭이 발생한 경우(또는 특정 채널이 비지한 경우)에 대해 개시한다.

[0100] 도 6을 참조하면, 도 4에서 전술한 바와 같이 AP는 특정 채널(예를 들어, 제2 채널)에 간섭이 있다고 판단되는 경우(또는 특정 채널이 비지한 것으로 센싱(또는 결정)되는 경우), 특정 채널을 통해 RTS 프레임(600)을 전송하지 않을 수 있다.

[0101] AP가 제2 채널을 비지한 것으로 센싱한 경우, AP는 제1 채널, 제3 채널 및 제4 채널을 통해 듀플리케이트 PPDU 포맷을 기반으로 RTS 프레임(600)을 전송할 수 있다. RTS 프레임(600)의 RA 필드는 제1 채널, 제3 채널 및 제4 채널을 통해 하향링크 데이터를 수신할 복수의 STA 각각(또는 복수의 STA 그룹)에 대한 식별 정보가 포함될 수 있다. 도 6의 경우, RTS 프레임(600)의 RA 필드는 STA 1, STA2 및 STA 3 각각에 대한 식별 정보 또는 STA 1, STA2 및 STA 3을 포함하는 그룹에 대한 식별 정보를 포함할 수 있다.

[0102] 복수의 STA 각각은 RTS 프레임(600)을 수신한 채널을 통해 RTS 프레임(600)에 대한 응답으로 CTS 프레임(620)을 전송할 수 있다. 예를 들어, STA1은 제1 채널, 제3 채널 및 제4 채널을 통해 RTS 프레임(600)을 수신할 수 있다. STA1은 제1 채널, 제3 채널 및 제4 채널이 아이들한 경우, 제1 채널, 제3 채널 및 제4 채널을 통해 RTS 프레임(600)에 대한 응답으로 CTS 프레임(620)을 전송할 수 있다. STA2 및 STA3도 마찬가지로 제1 채널, 제3 채널 및 제4 채널을 통해 RTS 프레임(600)을 수신한 경우, 제1 채널, 제3 채널 및 제4 채널이 아이들한지 여부를 판단하여 RTS 프레임(600)에 대한 응답으로 CTS 프레임(620)을 전송할 수 있다. CTS 프레임(620)은 듀플리케이트 포맷일 수 있다.

[0103] 이하, AP가 제1 채널, 제3 채널 및 제4 채널을 통해 CTS 프레임(620)을 수신한 경우를 가정한다.

[0104] AP는 복수의 STA으로부터 CTS 프레임(620)을 수신하고, CTS 프레임(620)을 수신한 채널을 통해 복수의 STA 각각으로 하향링크 데이터(615, 625, 635)를 전송할 수 있다.

[0105] 구체적으로 AP는 DL MU OFDMA를 위한 PPDU 포맷을 사용하여 STA1으로 할당된 제1 채널을 통해 하향링크 데이터1(615), STA2로 할당된 제3 채널을 통해 하향링크 데이터2(625), STA3으로 할당된 제4 채널을 통해 하향링크 데이터3(635)을 전송할 수 있다. AP는 제2 채널을 사용하지 않거나 제2 채널을 통해 널 데이터를 전송할 수도 있다.

[0106] 본 발명의 다른 실시예에 따르면, AP는 하향링크 프레임의 전송을 위해 복수의 STA으로 할당되는 채널이 연속되는 채널인 경우, DL MU OFDMA를 위한 PPDU 포맷을 사용하여 하향링크 데이터(625, 635)를 복수의 STA으로 전송하고, AP는 하향링크 프레임의 전송을 위해 특정 STA으로 할당되는 채널이 불연속되는 채널인 경우, 단일 STA을 위한 PPDU 포맷을 사용하여 하향링크 데이터(615)를 특정 STA으로 전송할 수도 있다. 도 6의 경우, AP는 제3 채널 및 제4 채널 상에서는 DL MU OFDMA를 위한 PPDU 포맷을 사용하여 하향링크 데이터2(625) 및 하향링크 데이터 3(635)을 STA2 및 STA3으로 전송하고, 제1

채널 상에서는 단일 STA을 위한 PPDU 포맷을 사용하여 하향링크 데이터1(615)을 STA1으로 전송할 수 있다.

[0107] 하향링크 데이터(615, 625, 635)를 수신한 복수의 STA 각각은 하향링크 데이터(615, 625, 635)에 대한 ACK 프레임(660)을 UL MU OFDMA를 기반으로 AP로 전송할 수 있다.

[0108] 도 4 내지 도 6에서는 CTS 프레임이 논 듀플리케이티 포맷 또는 듀플리케이트 포맷을 기반으로 전송되는 경우를 가정하였다. 하지만, CTS 프레임은 RTS 프레임을 기반으로 복수의 STA 각각으로 할당된 채널을 통해 복수의 STA 각각에 의해 전송될 수 있다. 예를 들어, RTS 프레임의 RA 필드는 STA1의 CTS 프레임의 전송을 위한 채널을 제1 채널, STA2의 CTS 프레임의 전송을 위한 채널을 제2 채널, STA3의 CTS 프레임의 전송을 위한 채널을 제3 채널, STA4의 CTS 프레임의 전송을 위한 채널을 제4 채널로 지시할 수 있다. 이러한 경우, STA1은 RTS 프레임에 대한 응답으로 제1 채널을 통해 CTS 프레임을 전송하고, STA2는 RTS 프레임에 대한 응답으로 제2 채널을 통해 CTS 프레임을 전송하고, STA3은 RTS 프레임에 대한 응답으로 제3 채널을 통해 CTS 프레임을 전송하고, STA4느 RTS 프레임에 대한 응답으로 제1 채널을 통해 CTS 프레임을 전송할 수 있다.

[0109] 도 7은 본 발명의 실시예에 따른 RTS 프레임을 나타낸 개념도이다.

[0110] 도 7을 참조하면, RTS 프레임은 프레임 제어 필드(700), 듀레이션 필드(710), RA(receiver address) 필드(720), TA(transmitter address) 필드(730) 및 FCS(frame check sequence) 필드(740)를 포함할 수 있다.

[0111] 프레임 제어 필드(700)는 RTS 프레임을 지시하기 위한 정보를 포함할 수 있다.

[0112] 듀레이션 필드(710)는 CTS 프레임, 하향링크 PPDU, ACK 프레임의 전송을 위한 듀레이션 정보를 포함할 수 있다.

[0113] RA 필드(720)는 RTS 프레임을 수신하고 CTS 프레임을 통해 응답할(또는 DL MU 전송을 기반으로 전송되는 하향링크 데이터를 수신할) 복수의 STA 각각의 식별 정보 또는 복수의 STA을 포함하는 그룹의 식별 정보를 포함할 수 있다. 또한, RA 필드(720)는 복수의 STA 각각으로 CTS 프레임의 전송을 위해 할당된 채널에 대한 정보를 더 포함할 수도 있다. RTS 프레임을 수신하고 CTS 프레임을 통해 응답할(또는 DL MU 전송을 기반으로 전송되는 하향링크 데이터를 수신할) 복수의 STA 각각을 타겟 STA이라는 용어로 표현한다.

[0114] RA 필드(720)에 4개의 타겟 STA에 대한 식별 정보 및 대역폭 정보가 포함되는 경우, RA 필드(720)는 서브 RA 필드1(750), 서브 RA 필드2(760), 서브 RA 필드3(770) 서브 RA 필드4(780)를 포함할 수 있다. 각 서브 RA 필드(750, 760, 770, 780)는 타겟 STA의 식별 정보(769) 및 타겟 STA으로 CTS 프레임을 전송하기 위해 사용되는 채널 대역폭에 대한 정보(763)를 포함할 수 있다. RA 필드(720)에 포함되는 각 서브 RA 필드(750, 760, 770, 780)의 순서 및 채널 대역폭에 대한 정보를 고려하여 타겟 STA의 CTS 프레임의 전송을 위한 채널이 결정될 수 있다.

[0115] 예를 들어, 서브 RA 필드1(750)가 STA1의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함하고, 서브 RA 필드2(760)가 STA2의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함하고, 서브 RA 필드3(770)이 STA3의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함하고, 서브 RA 필드4(780)가 STA4의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함할 수 있다. 이러한 경우, CTS 프레임의 전송을 위해 순차적으로 STA1은 제1 채널, STA2는 제2 채널, STA3은 제3 채널, STA4는 제4 채널을 할당받을 수 있다.

[0116] 다른 예로, RA 필드가 4개의 서브 RA 필드를 포함하되, 3개의 서브 RA 필드는 유효한 정보를 포함하고, 1개의 서브 RA 필드는 널 데이터를 포함할 수도 있다. 구체적으로 서브 RA 필드1(750)가 STA1의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함하고, 서브 RA 필드2(760)가 STA2의 식별 정보 및 40MHz의 채널 대역폭을 지시하는 정보를 포함하고, 서브 RA 필드3(770)이 STA3의 식별 정보 및 20MHz의 채널 대역폭을 지시하는 정보를 포함할 수 있다. 서브 RA 필드4(780)는 널 데이터(null data)(예를 들어, 비트값이 0인 데이터 시퀀스)를 포함할 수 있다. 이러한 경우, CTS 프레임의 전송을 위해 순차적으로 STA1은 제1 채널, STA2는 제2 채널 및 제3 채널, STA3은 제4 채널을 할당받을 수 있다.

[0117] STA은 RTS 프레임의 수신 후 기존의 레가시 RTS 프레임 포맷을 디코딩하는 방법으로 RA 필드(720)를 디코딩하고, 디코딩에 실패하는 경우, 본 발명의 실시예에 따른 복수의 서브 RA 필드(750, 760, 770, 780)를 포함하는 RA 필드(720)의 구조를 고려하여 디코딩을 수행할 수 있다.

[0118] TA 필드(730)는 RTS 프레임을 전송하는 AP의 주소를 포함할 수 있다.

[0119] FCS 필드(740)는 프레임의 유효성의 확인을 위한 정보를 포함할 수 있다.

[0120] 도 8은 본 발명의 실시예에 따른 RTS 프레임의 서브 RA 필드를 나타낸 개념도이다.

[0121] 도 8에서는 서브 RA 필드로 12비트가 할당되는 경우, 타겟 STA에 대한 식별 정보 및 대역폭 정보에 대해 구체적으로 개시한다.

[0122] 도 8의 상단을 참조하면, 대역폭 정보(800)로 2비트가 할당되고, 타겟 STA에 대한 식별 정보(810)로 10비트가 할당될 수 있다. 2비트의 대역폭 정보(800)가 '00'인 경우, 20MHz, 2비트의 대역폭 정보(800)가 '01'인 경우, 40MHz, 2비트의 대역폭 정보(800)가 '10'인 경우, 60MHz, 2비트의 대역폭 정보(800)가 '11'인 경우, 80MHz를 지시할 수 있다. 타겟 STA에 대한 식별 정보(810)로서 10비트가 할당된 경우, 10비트는 타겟 STA의 식별 정보(AID)를 지시할 수 있다. 10비트의 타겟 STA의 식별 정보(810)는 1~1023 중 하나의 AID를 지시할 수 있다.

[0123] 도 8의 중단을 참조하면, 대역폭 정보(820)로 1비트가 할당되고, 타겟 STA에 대한 식별 정보(830)로 11비트가 할당될 수 있다. 1비트의 대역폭 정보(820)가 '0'인 경우, 20MHz, 1비트의 대역폭 정보(820)가 '1'인 경우, 40MHz를 지시할 수

있다. 타겟 STA에 대한 식별 정보(830)로서 11비트가 할당된 경우, 11비트는 타겟 STA의 식별 정보(AID)를 지시할 수 있다. 11비트의 타겟 STA의 식별 정보(830)는 1~2007 중 하나의 AID를 지시할 수 있다. 2008~2047에 대응되는 AID는 사용되지 않고 보존될 수 있다.

[0124] 도 8의 하단을 참조하면, 타겟 STA에 대한 식별 정보(840)만으로 12비트가 할당될 수 있다. 12비트의 타겟 STA에 대한 식별 정보(840)는 1~2007 중 하나의 AID를 지시할 수 있다. 2008~4095에 대응되는 AID는 사용되지 않고 보존될 수 있다.

[0125] 도 9는 본 발명의 실시예에 따른 RTS 프레임의 포맷을 나타낸 개념도이다.

[0126] 도 9에서는 RTS 프레임의 RA 필드가 4개의 서브 RA 필드를 포함하고, 4개의 서브 RA 필드 각각은 4개의 타겟 STA 각각에 대한 식별 정보 및 대역폭 정보를 포함하는 경우에 대해 개시한다.

[0127] 도 9를 참조하면, RA 필드는 서브 RA 필드1(915), 서브 RA 필드2(925), 서브 RA 필드3(935), 서브 RA 필드4(945)를 순차적으로 포함할 수 있다.

[0128] 서브 RA 필드1(915)은 STA1(910)을 지시하는 식별 정보('132')와 STA1(910)을 위한 대역폭 정보('00')를 포함할 수 있다. 서브 RA 필드2(925)는 STA2(920)를 지시하는 식별 정보('56')와 STA2(920)를 위한 대역폭 정보('00')를 포함할 수 있다. 서브 RA 필드3(935)은 STA3(930)을 지시하는 식별 정보('367')와 STA3(930)을 위한 대역폭 정보('00')를 포함할 수 있다. 서브 RA 필드4(945)는 STA4(940)를 지시하는 식별 정보('6')와 STA4(940)를 위한 대역폭 정보('00')를 포함할 수 있다. 전술한 바와 같이 대역폭 정보 '00'은 20MHz의 대역폭을 지시할 수 있다.

[0129] STA1(910)은 20MHz의 제1 채널을 통해 CTS 프레임을 전송하고, STA2(920)는 20MHz의 제2 채널을 통해 CTS 프레임을 전송하고, STA3(930)은 20MHz의 제3 채널을 통해 CTS 프레임을 전송하고, STA4(940)는 20MHz의 제4 채널을 통해 CTS 프레임을 전송할 수 있다.

[0130] AP는 CTS 프레임을 수신하고, CTS 프레임에 대한 응답으로 하향링크 데이터를 STA1(910), STA2(920), STA3(930) 및 STA4(940) 각각으로 전송할 수 있다.

[0131] STA1(910), STA2(920), STA3(930) 및 STA4(940) 각각은 하향링크 데이터 프레임을 수신하고, 하향링크 프레임에 대한 응답으로 ACK 프레임을 전송할 수 있다.

[0132] 즉, 무선랜에서 데이터 단위를 전송하기 위해 AP는 복수의 채널을 통해 매체 보호를 위한 RTS 프레임을 복수의 STA으로 전송하고, AP가 복수의 STA 각각으로부터 제1 할당 채널을 통해 RTS 프레임에 대한 응답으로 CTS 프레임을 수신할 수 있다. 제1 할당 채널은 RTS 프레임을 기반으로 결정된 복수의 채널 중 적어도 하나의 채널일 수 있다. 또한, AP는 중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 상기 복수의

STA 각각으로 제2 할당 채널을 통해 복수의 STA 각각으로 하향링크 데이터를 전송할 수 있다. 제2 할당 채널은 RTS 프레임이 전송된 복수의 채널 중 적어도 하나의 채널일 수 있다. 제2 할당 채널은 하향링크 데이터를 전달하는 하향링크 PPDU의 PPDU 헤더에 포함된 채널 할당 정보를 기반으로 결정될 수 있다.

[0133] RTS 프레임이 전송되는 복수의 채널 각각의 대역폭의 크기는 20MHz이고, RTS 프레임은 복수의 채널을 통해 듀플리케이트 포맷 PPDU에 포함되어 전송될 수 있다. 또 다른 예로 RTS 프레임이 전송되는 복수의 채널 각각의 대역폭의 크기는 5MHz이고, 복수의 채널의 개수는 4개이고, RTS 프레임은 복수의 채널을 통해 논 듀플리케이트 포맷 PPDU에 포함되어 전송될 수도 있다.

[0134] 도 10은 본 발명의 실시예에 따른 RTS 프레임의 포맷을 나타낸 개념도이다.

[0135] 도 10에서는 AP가 3개의 타겟 STA으로 RTS 프레임을 전송하는 경우에 대해 개시한다. RTS 프레임의 RA 필드가 4개의 서브 RA 필드를 포함하고, 4개의 서브 RA 필드 중 3개의 서브 RA 필드 각각은 3개의 타겟 STA 각각에 대한 식별 정보 및 대역폭 정보를 포함하고, 나머지 하나의 서브 RA 필드는 널 데이터(예를 들어, 비트값 0)을 포함할 수 있다.

[0136] 도 10을 참조하면, 서브 RA 필드1(1015)은 STA1(1010)을 지시하는 식별자 정보('132')와 STA1(1010)을 위한 대역폭 정보('00')를 포함할 수 있다. 서브 RA 필드2(1025)는 STA2(1020)를 지시하는 식별자 정보('56')와 STA2(1020)를 위한 대역폭 정보('00')를 포함할 수 있다 서브 RA 필드3(1035)은 STA3(1030)을 지시하는 식별자 정보('367')와 STA3(1030)을 위한 대역폭 정보('01')를 포함할 수 있다. 전술한 바와 같이 대역폭 정보 '00'은 20MHz의 대역폭을 지시하고, 대역폭 정보 '01'은 40MHz의 대역폭을 지시할 수 있다. 서브 RA 필드4(1045)는 타겟 STA에 대한 식별 정보로 널 데이터(예를 들어, 비트값 0인 비트시퀀스)를 포함할 수 있다.

[0137] STA1(1010)은 서브 RA 필드1(1015)을 기반으로 제1 채널을 할당받고 제1 채널 상에서 CTS 프레임을 전송할 수 있다. STA2(1020)는 서브 RA 필드2(1025)를 기반으로 제2 채널을 할당받고 제2 채널 상에서 CTS 프레임을 전송할 수 있다. STA3(1030)은 서브 RA 필드3(1035)을 기반으로 제3 채널 및 제4 채널을 할당받고 제3 채널 및 제4 채널 상에서 CTS 프레임을 전송할 수 있다.

[0138] 도 11은 본 발명의 실시예에 따른 무선랜에서 OFDMA 기반의 통신을 수행시 매체 보호 방법을 나타낸 개념도이다.

[0139] 도 11에서는 AP가 복수의 RTS 프레임 각각을 복수의 채널 각각을 통해 전송하는 방법을 개시한다.

[0140] 도 11을 참조하면, AP는 복수의 채널 각각을 통해 복수의 STA 각각으로 복수의 RTS 프레임(1110, 1120, 1130, 1140) 각각을 전송할 수 있다. 복수의 채널 각각을 통해 복수의 STA 각각으로 전송되는 복수의 RTS 프레임(1110, 1120, 1130, 1140) 각각은 서로 다른 RTS 프레임일 수 있다. 즉, RTS 프레임에 포함된 데이터는 서로 다를 수 있다.

[0141] 예를 들어, AP는 DL MU OFDMA 전송을 기반으로 제1 채널을 통해 RTS 프레임1(1110)을 STA1으로 전송하고, 제2 채널을 통해 RTS 프레임2(1120)를 STA2로 전송하고, 제3 채널을 통해 RTS 프레임3(1130)을 STA3으로 전송하고, 제4 채널을 통해 RTS 프레임4(1140)를 STA4로 전송할 수 있다. RTS 프레임1(1110)의 RA 필드는 RTS 프레임1(1110)을 수신할 STA1의 식별 정보를 포함할 수 있다. RTS 프레임2(1120)의 RA 필드는 RTS 프레임2(1120)을 수신할 STA2의 식별 정보를 포함할 수 있다. RTS 프레임3(1130)의 RA 필드는 RTS 프레임1(1130)을 수신할 STA3의 식별 정보를 포함할 수 있다. RTS 프레임4(1140)의 RA 필드는 RTS 프레임4(1140)을 수신할 STA4의 식별 정보를 포함할 수 있다.

[0142] 또는 듀플리케이트 포맷 PPDU의 RTS PPDU를 전송하는 방법과 마찬가지로 AP는 설정된 제1 채널에 대하여 채널 액세스를 위한 백-오프(back-off) 절차를 수행할 수 있다. 구체적으로 AP는 제1 채널에서 백-오프 절차를 통해 TXOP 초기 액세스를 수행할 수 있다. AP는 백-오프 타이머가 만료(expire)되기 이전 PIFS(PCF(point coordination function) interframe space) 구간에서 제2 채널 내지 제4 채널의 채널 상태를 확인할 수 있다. 즉, AP는 제2 채널, 제3 채널 및 제4 채널이 아이들(idle)한지 비지(busy)한지 여부에 대한 결정하기 위해 TXOP 이전의 PIFS 동안 제2 채널, 제3 채널 및 제4 채널의 채널 상태를 판단할 수 있다. 만약, 제2 채널, 제3 채널 및 제4 채널이 PIFS 동안 아이들(idle)한 경우, 제1 채널, 제2 채널, 제3 채널 및 제4 채널 각각을 통해 RTS 프레임1(1110), RTS 프레임2(1120), RTS 프레임3(1130) 및 RTS 프레임4(1140) 각각을 전송할 수 있다.

[0143] AP가 DL MU OFDMA 전송을 기반으로 RTS 프레임(1110, 1120, 1130, 1140)을 전송하는 경우, AP는 DL MU OFDMA 전송을 위한 하향링크 PPDU 포맷을 통해 복수의 STA 각각으로 RTS 프레임(1110, 1120, 1130, 1140)을 전송할 수 있다. 복수의 STA 각각은 PPDU 헤더를 디코딩하여 복수의 STA 각각으로 할당된 채널에 대한 정보를 획득할 수 있다. 복수의 STA 각각은 복수의 STA 각각으로 할당된 채널을 통해 RTS 프레임(1110, 1120, 1130, 1140)을 수신할 수 있다.

[0144] 복수의 RTS 프레임(1110, 1120, 1130, 1140) 각각을 수신한 복수의 STA 각각은 AP로 CTS 프레임(1113, 1123, 1133, 1143)을 전송할 수 있다. 복수의 STA 각각은 RTS 프레임(1110, 1120, 1130, 1140)을 수신한 채널을 통해 CTS 프레임(1113, 1123, 1133, 1143)을 AP로 전송할 수 있다.

[0145] 복수의 STA으로부터 CTS 프레임(1113, 1123, 1133, 1143)을 수신한 AP는 복수의 STA 각각으로 하향링크 데이터(1116, 1126, 1136, 1146)를 전송할 수 잇다.

[0146] 도 12는 본 발명의 실시예에 따른 무선랜 시스템 간 간섭을 방지하기 위한 방법에 대해 개시한다.

[0147] 도 12에서는 본 발명의 실시예에 따른 DL MU OFDMA 전송 및 UL MU OFDMA 전송을 지원하는 무선랜 시스템과 본 발명의 실시예에 따른 DL MU

OFDMA 전송 및 UL MU OFDMA 전송을 지원하지 않는 레가시 무선랜 시스템 간의 간섭을 방지하기 위한 방법이 개시된다.

[0148] 이하, AP, STA은 DL MU OFDMA 전송 및 UL MU OFDMA 전송을 지원하는 무선랜 시스템에서 동작하는 AP, STA을 지시하고, 레가시 AP, 레가시 STA은 DL MU OFDMA 전송 및 UL MU OFDMA 전송을 지원하지 않는 레가시 무선랜 시스템에서 동작하는 AP, STA을 지시할 수 있다.

[0149] 도 12를 참조하면, AP는 설정된 제1 채널(프라이머리 채널)(1210)에 대하여 채널 액세스를 위한 백-오프(back-off) 절차를 수행할 수 있다. 구체적으로 AP는 제1 채널(1210)에서 백-오프 절차를 통해 TXOP 초기 액세스를 수행할 수 있다. AP는 백-오프 타이머가 만료(expire)되기 이전 PIFS(PCF(point coordination function) interframe space) 구간에서 제2 채널(1220), 제3 채널(1230) 및 제4 채널(세컨더리 채널)(1240)의 채널 상태를 확인할 수 있다.

[0150] AP의 세컨더리 채널(제2 채널(1220), 제3 채널(1230) 및 제4 채널(1240))과 레가시 AP 또는 레가시 STA의 세컨더리 채널(1230, 1240)이 겹칠 수 있다. 이러한 경우, AP는 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)까지 채널 상태를 확인하여 채널 상태가 아이들한 경우, 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)을 통해 RTS 프레임을 전송할 수 있다.

[0151] 구체적으로 AP는 간섭 가능성을 가진 BSS에 포함되는 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250) 및 세컨더리 채널(1230, 1240)에 대한 정보를 알고 있을 수 있다. AP는 RTS 프레임의 전송을 위해 사용할 세컨더리 채널(1220, 1230, 1240)이 레가시 AP 또는 레가시 STA의 세컨더리 채널(1230, 1240)과 중첩되는지 여부에 대해 판단할 수 있다. 만약, RTS 프레임의 전송을 위해 사용할 세컨더리 채널(1220, 1230, 1240)이 레가시 AP 또는 레가시 STA의 세컨더리 채널(1230, 1240)과 중첩되는 경우, AP는 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)의 아이들 여부를 판단하여 RTS 프레임을 전송할 수 있다.

[0152] AP는 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)도 추가적인 채널로 사용하여 DL MU OFDMA 전송을 기반으로 하향링크 프레임을 전송할 수도 있다. 이하, 본 발명의 실시예에서는 AP가 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)을 DL MU OFDMA 기반의 하향링크 프레임의 전송을 위한 추가적인 채널로 사용하지 않는 경우를 가정하여 설명한다. 이하, AP에 의해 RTS 프레임이 전송되는 레가시 AP 또는 레가시 STA의 프라이머리 채널(1250)은 추가 세컨더리 채널이라는 용어로 표현할 수 있다.

[0153] AP는 프라이머리 채널인 제1 채널(1210) 및 세컨더리 채널인 제2 채널(1220), 제3 채널(1230) 및 제4 채널(1240) 및 추가 세컨더리 채널인 제 5채널(1250)을 통해 RTS 프레임을 전송할 수 있다.

[0154] AP는 제1 채널(1210), 제2 채널(1220), 제3 채널(1230) 및 제4 채널(1240)만을 CTS 프레임의 전송을 위한 채널로 할당할 수 있고, AP는 제1 채널(1210), 제2 채널(1220), 제3 채널(1230 및 제4 채널(1240)을 통해 CTS 프레임을 복수의 STA

각각으로부터 수신할 수 있다. 즉, 제5 채널(1250)을 통해 CTS 프레임이 전송되지 않을 수 있다.

[0155] AP는 제1 채널(1210), 제2 채널(1220), 제3 채널(1230) 및 제4 채널(1240)을 통해 복수의 STA 각각으로 하향링크 데이터를 전송할 수 있다.

[0156] AP는 제5 채널(1250)을 통해서도 널 데이터를 전송할 수 있고, 레가시 STA 또는 레가시 AP는 널 데이터를 전송하는 PPDU의 헤더를 기반으로 NAV를 설정할 수 있다. 이러한 방법을 사용함으로써 레가시 무선랜 시스템 상에서 동작하는 레가시 STA 또는 레가시 AP에 의한 간섭이 방지될 수 있다.

[0157] 도 13은 본 발명의 실시예에 따른 프레임의 전송을 위한 PPDU 포맷을 나타낸 개념도이다.

[0158] 도 13에서는 본 발명의 실시예에 따른 PPDU 포맷에 대해 개시한다. 도 13에서 개시되는 UL MU OFDMA 전송을 기반으로 전송되는 ACK 프레임, DL MU OFDMA 전송을 기반으로 전송되는 하향링크 데이터의 전송을 위해 사용될 수 있다.

[0159] 예를 도 13의 상단 및 중단에 개시된 PPDU 포맷은 UL MU OFDMA 전송을 기반으로 전송되는 ACK 프레임을 전달(carrying)하기 위해 사용되고, 도 13의 하단에 개시된 PPDU 포맷은 DL MU OFDMA 전송을 기반으로 전송되는 복수의 STA 각각을 위한 하향링크 데이터를 전달하기 위해 사용될 수 있다.

[0160] 도 13에 개시된 PPDU 포맷은 RTS 프레임 및 CTS 프레임이 DL MU OFDMA 또는 UL MU OFDMA를 기반으로 전송되는 경우 사용될 수도 있다. 예를 들어, RTS 프레임이 AP에 의해 DL MU OFDMA를 기반으로 전송되는 경우, 도 13의 하단에 개시된 PPDU 포맷이 RTS 프레임을 전달할 수 있다. 또 다른 예를 들어, CTS 프레임이 복수의 STA에 의해 UL MU OFDMA를 기반으로 전송되는 경우, 도 13의 상단 또는 중단에 개시된 PPDU 포맷이 CTS 프레임을 전달할 수 있다.

[0161] 도 13의 상단을 참조하면, 하향링크 PPDU의 PHY 헤더는 L-STF(legacy-short training field), L-LTF(legacy-long training field), L-SIG(legacy-signal), HE-SIG A(high efficiency-signal A), HE-STF(high efficiency-short training field), HE-LTF(high efficiency-long training field), HE-SIG B(high efficiency-signal-B)를 포함할 수 있다. PHY 헤더에서 L-SIG까지는 레가시 부분(legacy part), L-SIG 이후의 HE(high efficiency) 부분(HE part)으로 구분될 수 있다.

[0162] L-STF(1300)는 짧은 트레이닝 OFDM 심볼(short training orthogonal frequency division multiplexing symbol)을 포함할 수 있다. L-STF(1300)는 프레임 탐지(frame detection), AGC(automatic gain control), 다이버시티 탐지(diversity detection), 대략적인 주파수/시간 동기화(coarse frequency/time synchronization)을 위해 사용될 수 있다.

[0163] L-LTF(1310)는 긴 트레이닝 OFDM 심볼(long training orthogonal frequency division multiplexing symbol)을 포함할 수 있다. L-LTF(1310)는 정밀한 주파수/시간 동기화(fine frequency/time synchronization) 및 채널 예측을 위해

사용될 수 있다.

[0164] L-SIG(1320)는 제어 정보를 전송하기 위해 사용될 수 있다. L-SIG(1320)는 데이터 전송률(rate), 데이터 길이(length)에 대한 정보를 포함할 수 있다. 전술한 바와 같이 레가시 STA은 L-SIG에 포함되는 정보를 기반으로 NAV를 설정할 수도 있다.

[0165] HE-SIG A(1330)는 PPDU를 수신할 STA을 지시하기 위한 정보를 포함할 수도 있다. 예를 들어, HE-SIG A(1330)는 PPDU를 수신할 특정 STA(또는 AP)의 식별자, 특정 STA의 그룹을 지시하기 위한 정보를 포함할 수 있다. 또한, HE-SIG A(1430)는 PPDU가 OFDMA 또는 MIMO를 기반으로 전송되는 경우, STA에 대한 자원 할당 정보도 포함될 수 있다.

[0166] 또한, HE-SIG A(1330)는 BSS 식별 정보를 위한 칼라 비트(color bits) 정보, 대역폭(bandwidth) 정보, 테일 비트(tail bit), CRC 비트, HE-SIG B(1360)에 대한 MCS(modulation and coding scheme) 정보, HE-SIG B(1460)를 위한 심볼 개수 정보, CP(cyclic prefix)(또는 GI(guard interval)) 길이 정보를 포함할 수도 있다.

[0167] HE-STF(1340)는 MIMO(multilple input multiple output) 환경 또는 OFDMA 환경에서 자동 이득 제어 추정(automatic gain control estimation)을 향상시키기 위하여 사용될 수 있다.

[0168] HE-LTF(1350)는 MIMO 환경 또는 OFDMA 환경에서 채널을 추정하기 위하여 사용될 수 있다.

[0169] HE-SIG B(1360)는 각 STA에 대한 PSDU(Physical layer service data unit)의 길이 MCS에 대한 정보 및 테일 비트 등을 포함할 수 있다. 또한 HE-SIG B(1360)는 PPDU를 수신할 STA에 대한 정보, OFDMA 기반의 자원 할당(resource allocation) 정보(또는 MU-MIMO 정보)를 포함할 수도 있다. HE-SIG B(1360)에 OFDMA 기반의 자원 할당 정보(또는 MU-MIMO 관련 정보)가 포함되는 경우, HE-SIG A(1330)에는 자원 할당 정보가 포함되지 않을 수도 있다.

[0170] HE-STF(1340) 및 HE-STF(1340) 이후의 필드에 적용되는 IFFT의 크기와 HE-STF(1340) 이전의 필드에 적용되는 IFFT의 크기는 서로 다를 수 있다. 예를 들어, HE-STF(1340) 및 HE-STF(1340) 이후의 필드에 적용되는 IFFT의 크기는 HE-STF(1340) 이전의 필드에 적용되는 IFFT의 크기보다 4배 클 수 있다. STA은 HE-SIG A(1330)를 수신하고, HE-SIG A(1330)를 기반으로 하향링크 PPDU의 수신을 지시받을 수 있다. 이러한 경우, STA은 HE-STF(1340) 및 HE-STF(1340) 이후 필드부터 변경된 FFT 사이즈를 기반으로 디코딩을 수행할 수 있다. 반대로 STA이 HE-SIG A(1330)를 기반으로 하향링크 PPDU의 수신을 지시받지 못한 경우, STA은 디코딩을 중단하고 NAV(network allocation vector) 설정을 할 수 있다. HE-STF(1340)의 CP(cyclic prefix)는 다른 필드의 CP보다 큰 크기를 가질 수 있고, 이러한 CP 구간 동안 STA은 FFT 사이즈를 변화시켜 하향링크 PPDU에 대한 디코딩을 수행할 수 있다.

[0171] 도 13의 상단에서 개시된 PPDU의 포맷을 구성하는 필드의 순서는 변할 수도

있다. 예를 들어, 도 13의 중단에서 개시된 바와 같이 HE 부분의 HE-SIG B(1315)가 HE-SIG A(1305)의 바로 이후에 위치할 수도 있다. STA은 HE-SIG A(1305) 및 HE-SIG B(1315)까지 디코딩하고 필요한 제어 정보를 수신하고 NAV 설정을 할 수 있다. 마찬가지로 HE-STF(1325) 및 HE-STF(1325) 이후의 필드에 적용되는 IFFT의 크기는 HE-STF(1325) 이전의 필드에 적용되는 IFFT의 크기와 다를 수 있다.

[0172] STA은 HE-SIG A(1305) 및 HE-SIG B(1315)를 수신할 수 있다. HE-SIG A(1305)를 기반으로 PPDU의 수신이 지시되는 경우, STA은 HE-STF(1325)부터는 FFT 사이즈를 변화시켜 PPDU에 대한 디코딩을 수행할 수 있다. 반대로 STA은 HE-SIG A(1305)를 수신하고, HE-SIG A(1305)를 기반으로 하향링크 PPDU의 수신이 지시되지 않는 경우, NAV(network allocation vector) 설정을 할 수 있다.

[0173] 도 13의 하단을 참조하면, DL MU OFDMA 전송을 위한 PPDU 포맷이 개시된다. 본 발명의 실시예에 따르면, AP는 DL MU OFDMA 전송을 위한 PPDU 포맷을 사용하여 하향링크 프레임 또는 하향링크 PPDU를 복수의 STA으로 전송할 수 있다. 복수의 하향링크 PPDU 각각은 서로 다른 전송 자원(주파수 자원 또는 공간적 스트림)을 통해 복수의 STA 각각으로 전송될 수 있다. PPDU 상에서 HE-SIG B(1345)의 이전 필드는 서로 다른 전송 자원 각각에서 듀플리케이트된 형태로 전송될 수 있다. HE-SIG B(1345)는 전체 전송 자원 상에서 인코딩된 형태로 전송될 수 있다. HE-SIG B(1345) 이후의 필드는 PPDU를 수신하는 복수의 STA 각각을 위한 개별 정보를 포함할 수 있다.

[0174] 예를 들어, HE-SIG A(1335)는 하향링크 데이터를 수신할 복수의 STA에 대한 식별 정보 및 복수의 STA의 하향링크 데이터가 전송되는 채널에 대한 정보를 포함할 수 있다. 또 다른 예를 들어, HE-SIG A(1335)는 RTS 프레임을 수신할 복수의 STA에 대한 식별 정보 및 복수의 STA의 RTS 프레임이 전송되는 채널에 대한 정보를 포함할 수 있다.

[0175] PPDU에 포함되는 필드가 전송 자원 각각을 통해 각각 전송되는 경우, 필드 각각에 대한 CRC가 PPDU에 포함될 수 있다. 반대로, PPDU에 포함되는 특정 필드가 전체 전송 자원 상에서 인코딩되어 전송되는 경우, 필드 각각에 대한 CRC가 PPDU에 포함되지 않을 수 있다. 따라서, CRC에 대한 오버 헤드가 감소될 수 있다.

[0176] DL MU 전송을 위한 PPDU 포맷도 마찬가지로 HE-STF(1355) 및 HE-STF(1355) 이후의 필드는 HE-STF(1355) 이전의 필드와 다른 IFFT 사이즈를 기반으로 인코딩될 수 있다. 따라서, STA은 HE-SIG A(1335) 및 HE-SIG B(1345)를 수신하고, HE-SIG A(1335)를 기반으로 PPDU의 수신을 지시받은 경우, HE-STF(1355)부터는 FFT 사이즈를 변화시켜 PPDU에 대한 디코딩을 수행할 수 있다.

[0177] 도 14는 본 발명의 실시예가 적용될 수 있는 무선 장치를 나타내는 블록도이다.

[0178] 도 14를 참조하면, 무선 장치(1400)는 상술한 실시예를 구현할 수 있는

STA로서, AP(1400) 또는 비AP STA(non-AP station)(또는 STA)(1450)일 수 있다.

[0179] AP(1400)는 프로세서(1410), 메모리(1420) 및 RF부(radio frequency unit, 1430)를 포함한다.

[0180] RF부(1430)는 프로세서(1410)와 연결하여 무선신호를 송신/수신할 수 있다.

[0181] 프로세서(1410)는 본 발명에서 제안된 기능, 과정 및/또는 방법을 구현할 수 있다. 예를 들어, 프로세서(1410)는 전술한 본 발명의 실시예에 따른 AP의 동작을 수행하도록 구현될 수 있다. 프로세서는 도 1 내지 13의 실시예에서 개시한 AP의 동작을 수행할 수 있다.

[0182] 예를 들어, 프로세서(1410)는 복수의 채널을 통해 매체 보호를 위한 RTS 프레임을 복수의 STA으로 전송하고, 복수의 STA 각각으로부터 제1 할당 채널을 통해 상기 RTS 프레임에 대한 응답으로 CTS(clear to send) 프레임을 수신하고, 중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 복수의 STA 각각으로 제2 할당 채널을 통해 복수의 STA 각각으로 하향링크 데이터를 전송하도록 구현될 수 있다. 제1 할당 채널은 RTS 프레임을 기반으로 결정된 복수의 채널 중 적어도 하나의 채널이고, 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널일 수 있다. RTS 프레임은 복수의 STA 각각을 지시하는 식별 정보 및 제1 할당 채널을 결정하기 위한 대역폭 정보를 포함할 수 있다.

[0183] STA(1450)는 프로세서(1460), 메모리(1470) 및 RF부(radio frequency unit, 1480)를 포함한다.

[0184] RF부(1480)는 프로세서(1460)와 연결하여 무선신호를 송신/수신할 수 있다.

[0185] 프로세서(1460)는 본 발명에서 제안된 기능, 과정 및/또는 방법을 구현할 수 있다. 예를 들어, 프로세서(1460)는 전술한 본 발명의 실시예에 따른 STA의 동작을 수행하도록 구현될 수 있다. 프로세서는 도 1 내지 13의 실시예에서 STA의 동작을 수행할 수 있다.

[0186] 예를 들어, 프로세서(1460)는 통해 매체 보호를 위한 RTS 프레임을 수신하고, 제1 할당 채널을 통해 RTS 프레임에 대한 응답으로 CTS 프레임을 전송하도록 구현될 수 있다. 제1 할당 채널은 RTS 프레임을 기반으로 결정된 복수의 채널 중 적어도 하나의 채널일 수 있다. 또한, 프로세서(1460)은 중첩된 시간 자원 상에서 OFDMA를 기반으로 제2 할당 채널을 통해 전송되는 하향링크 데이터를 수신하도록 구현될 수 있다. 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널일 수 있다. RTS 프레임은 복수의 STA 각각을 지시하는 식별 정보 및 제1 할당 채널을 결정하기 위한 대역폭 정보를 포함할 수 있다.

[0187] 프로세서(1410, 1460)는 ASIC(application-specific integrated circuit), 다른 칩셋, 논리 회로, 데이터 처리 장치 및/또는 베이스밴드 신호 및 무선 신호를 상호 변환하는 변환기를 포함할 수 있다. 메모리(1420, 1470)는 ROM(read-only memory), RAM(random access memory), 플래쉬 메모리, 메모리 카드, 저장 매체 및/또는 다른 저장 장치를 포함할 수 있다. RF부(1430, 1480)는 무선 신호를 전송

및/또는 수신하는 하나 이상의 안테나를 포함할 수 있다.

[0188] 실시예가 소프트웨어로 구현될 때, 상술한 기법은 상술한 기능을 수행하는 모듈(과정, 기능 등)로 구현될 수 있다. 모듈은 메모리(1420, 1470)에 저장되고, 프로세서(1410, 1460)에 의해 실행될 수 있다. 메모리(1420, 1470)는 프로세서(1410, 1460) 내부 또는 외부에 있을 수 있고, 잘 알려진 다양한 수단으로 프로세서(1410, 1460)와 연결될 수 있다.

[0189]

# 청구범위

[청구항 1] 무선랜에서 프레임을 전송하는 방법은,
AP(access point)가 복수의 채널을 통해 매체 보호를 위한 RTS(request to send) 프레임을 복수의 STA으로 전송하는 단계;
상기 AP가 상기 복수의 STA(station) 각각으로부터 제1 할당 채널을 통해 상기 RTS 프레임에 대한 응답으로 CTS(clear to send) 프레임을 수신하되, 상기 제1 할당 채널은 상기 RTS 프레임을 기반으로 결정된 상기 복수의 채널 중 적어도 하나의 채널인, 단계; 및
상기 AP가 중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 상기 복수의 STA 각각으로 제2 할당 채널을 통해 상기 복수의 STA 각각으로 하향링크 데이터를 전송하되, 상기 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널인, 단계를 포함하는 방법.

[청구항 2] 제1항에 있어서,
상기 RTS 프레임은 상기 복수의 STA 각각을 지시하는 식별 정보 및 상기 제1 할당 채널을 결정하기 위한 대역폭 정보를 포함하는 것을 특징으로 하는 방법.

[청구항 3] 제1항에 있어서,
상기 제2 할당 채널은 상기 하향링크 데이터를 전달하는 하향링크 PPDU(physical layer protocol data unit)의 PPDU 헤더에 포함된 채널 할당 정보를 기반으로 결정되는 것을 특징으로 하는 방법.

[청구항 4] 제1항에 있어서,
상기 복수의 채널 각각의 대역폭의 크기는 20MHz이고,
상기 RTS 프레임은 상기 복수의 채널을 통해 듀플리케이트(duplicate) 포맷 PPDU(physical layer protocol data unit)에 포함되어 전송되는 것을 특징으로 하는 방법.

[청구항 5] 제1항에 있어서,
상기 복수의 채널 각각의 대역폭의 크기는 5MHz이고,
상기 복수의 채널의 개수는 4개이고,
상기 RTS 프레임은 상기 복수의 채널을 통해 논 듀플리케이트(non duplicate) 포맷 PPDU(physical layer protocol data unit)에 포함되어 전송되는 것을 특징으로 하는 방법.

[청구항 6] 무선랜에서 프레임을 전송하는 AP(access point)는,
무선 신호를 송신 또는 수신하기 위해 구현되는 RF(radio frequency) 부; 및
상기 RF부와 동작 가능하게(operatively) 연결된 프로세서를

포함하되,
상기 프로세서는 복수의 채널을 통해 매체 보호를 위한 RTS(request to send) 프레임을 복수의 STA으로 전송하고,
상기 복수의 STA(station) 각각으로부터 제1 할당 채널을 통해 상기 RTS 프레임에 대한 응답으로 CTS(clear to send) 프레임을 수신하고,
중첩된 시간 자원 상에서 OFDMA(orthogonal frequency division multiple access)를 기반으로 상기 복수의 STA 각각으로 제2 할당 채널을 통해 상기 복수의 STA 각각으로 하향링크 데이터를 전송하도록 구현되되,
상기 제1 할당 채널은 상기 RTS 프레임을 기반으로 결정된 상기 복수의 채널 중 적어도 하나의 채널이고,
상기 제2 할당 채널은 상기 복수의 채널 중 적어도 하나의 채널인 AP.

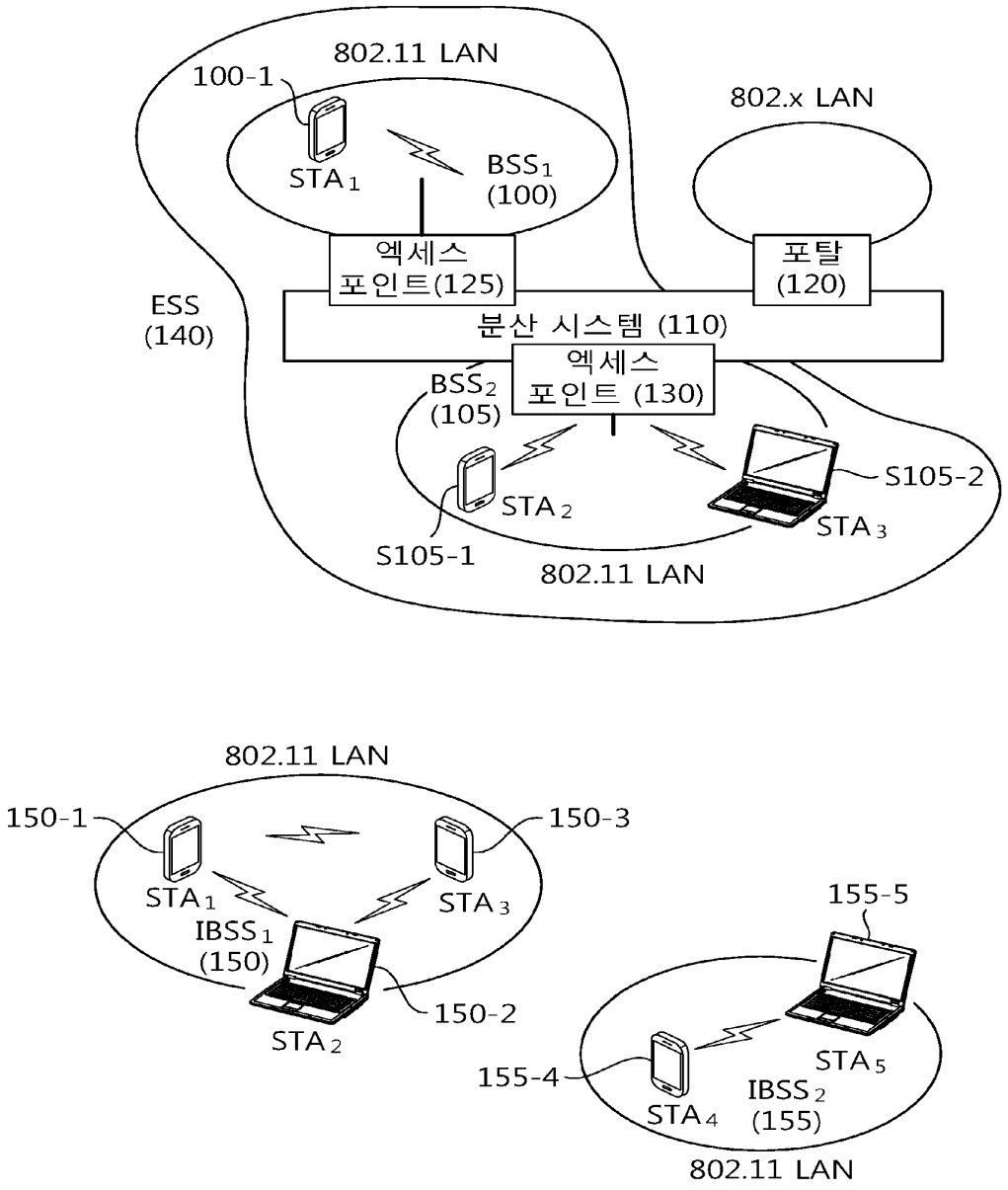
[청구항 7] 제6항에 있어서,
상기 RTS 프레임은 상기 복수의 STA 각각을 지시하는 식별 정보 및 상기 제1 할당 채널을 결정하기 위한 대역폭 정보를 포함하는 것을 특징으로 하는 AP.

[청구항 8] 제6항에 있어서,
상기 제2 할당 채널은 상기 하향링크 데이터를 전달하는 하향링크 PPDU(physical layer protocol data unit)의 PPDU 헤더에 포함된 채널 할당 정보를 기반으로 결정되는 것을 특징으로 하는 AP.

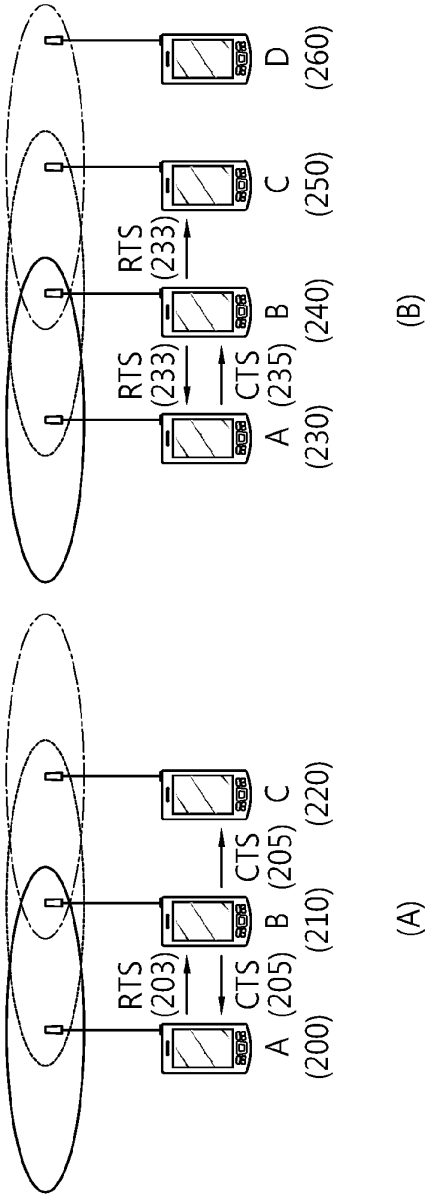
[청구항 9] 제1항에 있어서,
상기 복수의 채널 각각의 대역폭의 크기는 20MHz이고,
상기 RTS 프레임은 상기 복수의 채널을 통해 듀플리케이트(duplicate) 포맷 PPDU(physical layer protocol data unit)에 포함되어 전송되는 것을 특징으로 하는 AP.

[청구항 10] 제6항에 있어서,
상기 복수의 채널 각각의 대역폭의 크기는 5MHz이고,
상기 복수의 채널의 개수는 4개이고,
상기 RTS 프레임은 상기 복수의 채널을 통해 논 듀플리케이트(non duplicate) 포맷 PPDU(physical layer protocol data unit)에 포함되어 전송되는 것을 특징으로 하는 AP.

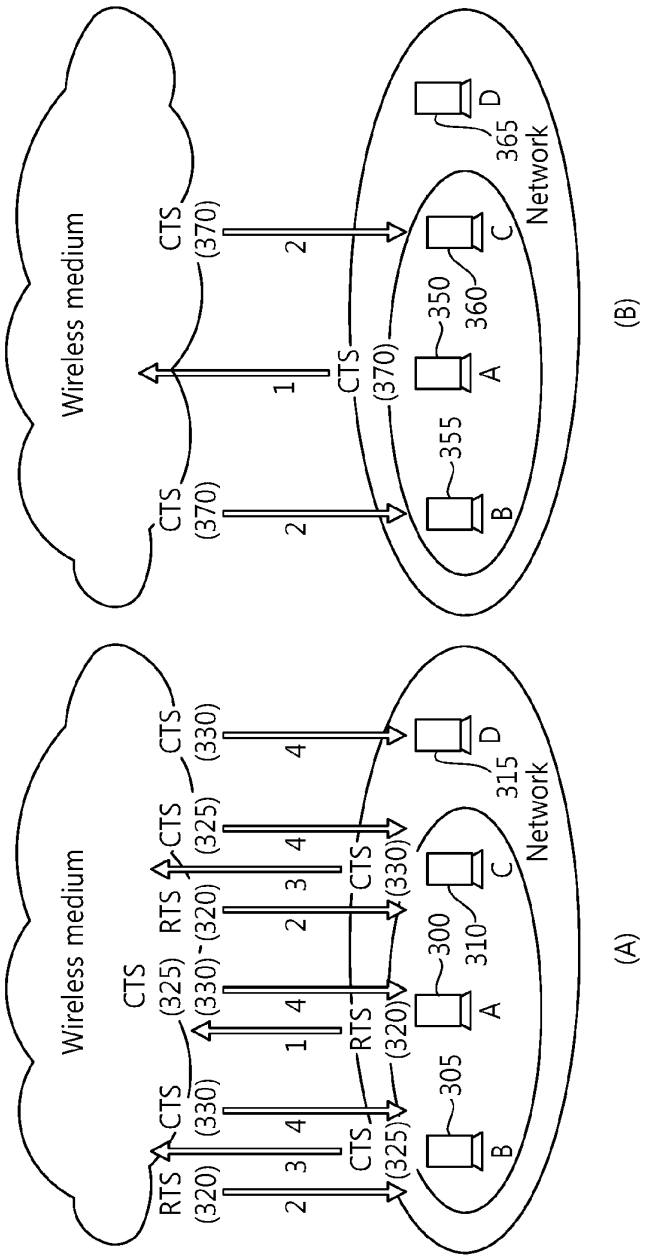
[Fig. 1]


802.11 LAN
100-1
802.x LAN
STA1
BSS1
(100)
엑세스
포인트(125)
포탈
(120)
ESS
(140)
분산 시스템 (110)
엑세스
포인트 (130)
BSS2
(105)
S105-2
STA2
STA3
S105-1
802.11 LAN
802.11 LAN
150-1
150-3
STA1
STA3
IBSS1
(150)
150-2
STA2
155-5
STA5
155-4
IBSS2
(155)
STA4
802.11 LAN

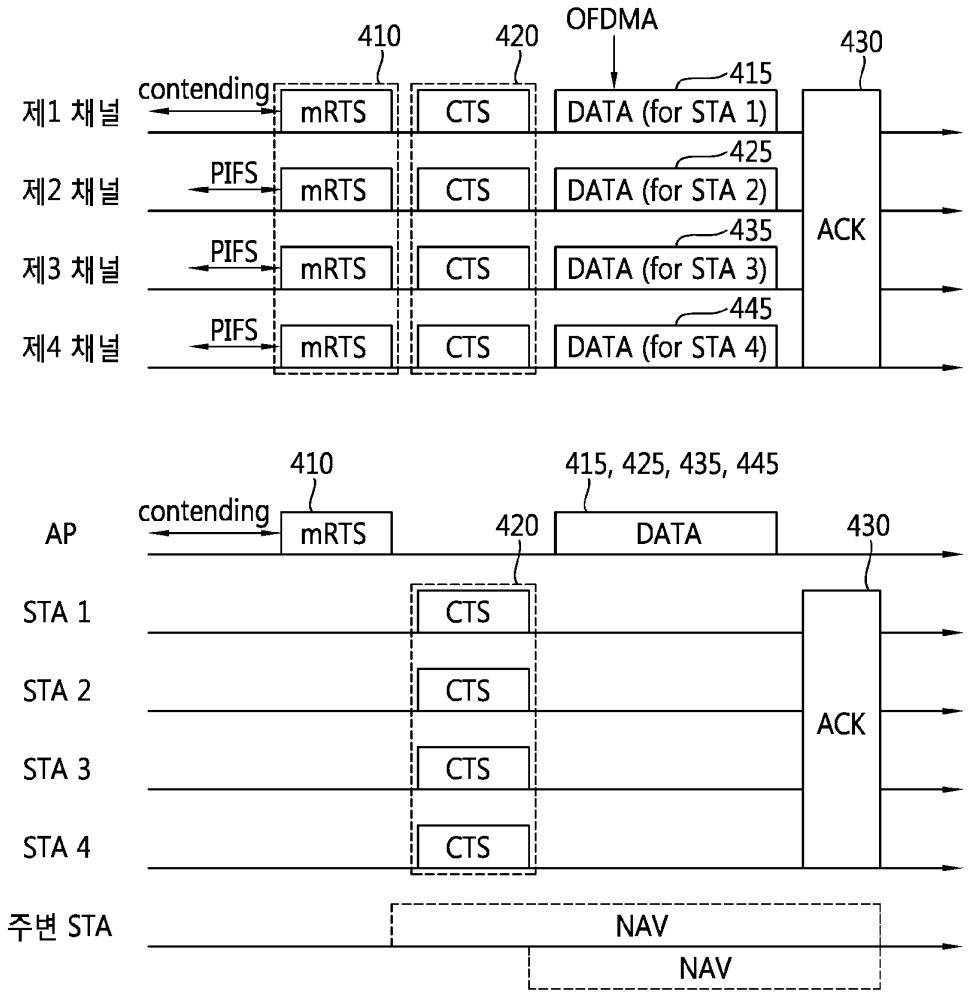
[Fig. 2]


A (200)
RTS (203)
CTS (205)
B (210)
C (220)
(A)
A (230)
RTS (233)
CTS (235)
B (240)
RTS (233)
C (250)
D (260)
(B)

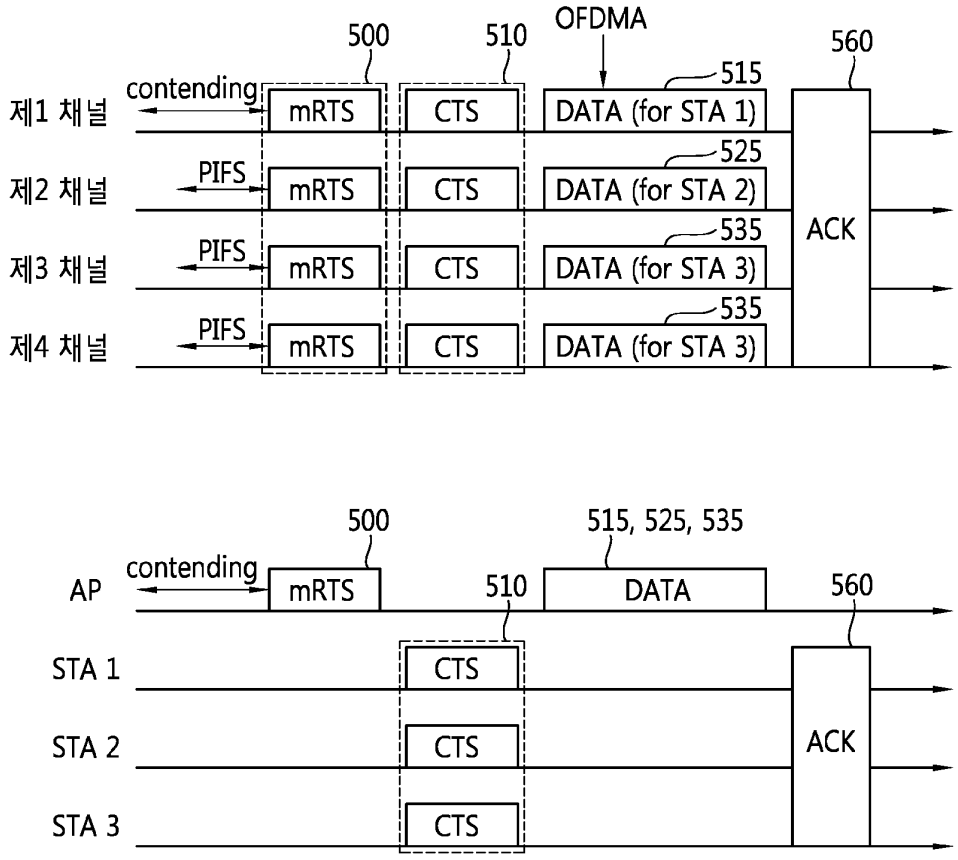
[Fig. 3]


Wireless medium
CTS (370)
2
1
CTS (370)
2
CTS (370)
2
Network
A
B
C
D
350
360
355
365
(B)
Wireless medium
RTS (320)
CTS (325)
CTS (330)
2
3
4
1
4
2
3
4
CTS (330)
RTS (320)
CTS (325)
CTS (330)
Network
A
B
C
D
300
310
305
315
(A)

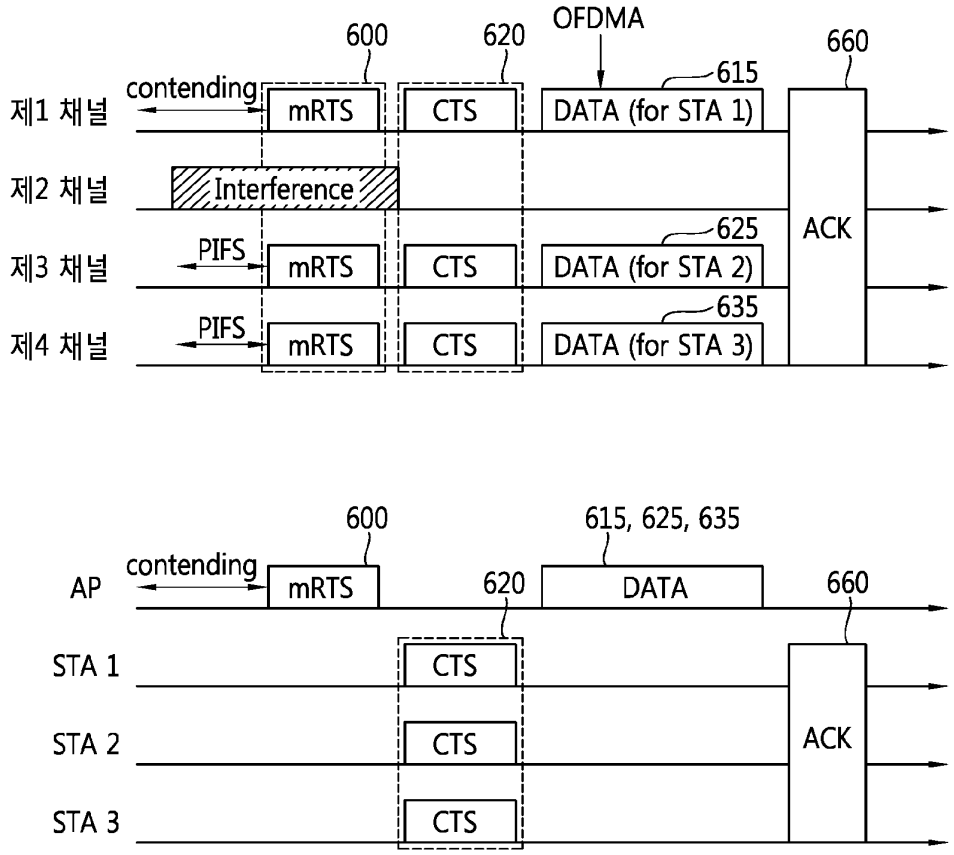
[Fig. 4]


410
420
OFDMA
430
415
contending
제1 채널
mRTS
CTS
DATA (for STA 1)
425
PIFS
제2 채널
mRTS
CTS
DATA (for STA 2)
435
ACK
PIFS
제3 채널
mRTS
CTS
DATA (for STA 3)
445
PIFS
제4 채널
mRTS
CTS
DATA (for STA 4)
410
415, 425, 435, 445
contending
AP
mRTS
420
DATA
430
STA 1
CTS
STA 2
CTS
ACK
STA 3
CTS
STA 4
CTS
주변 STA
NAV
NAV

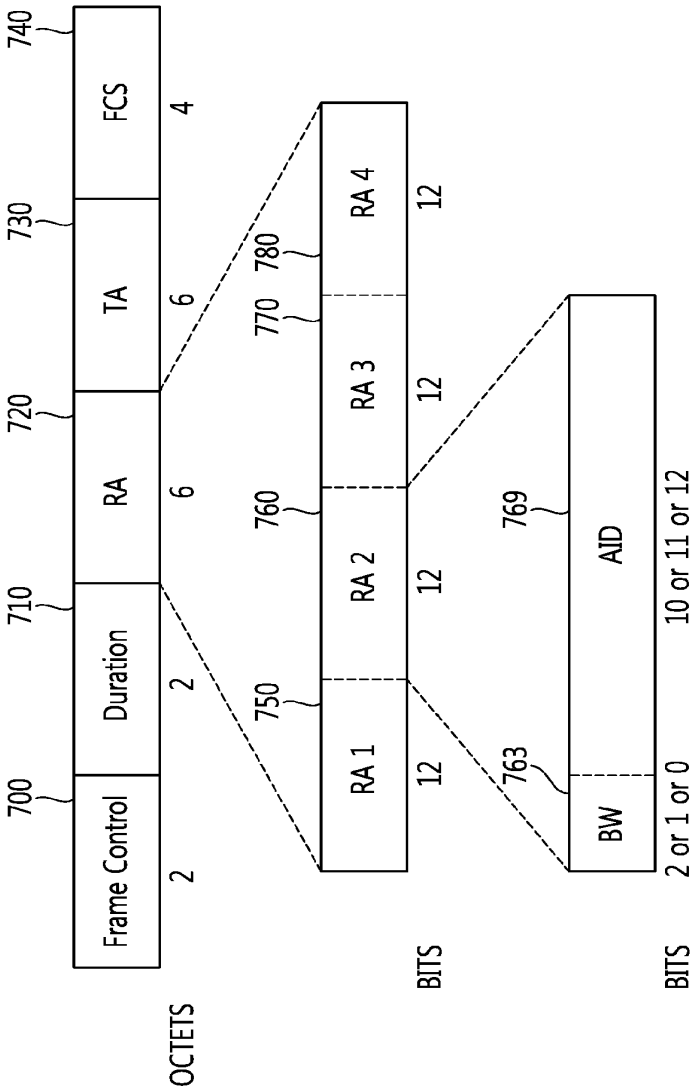
[Fig. 5]


500
510
OFDMA
560
515
contending
제1 채널
mRTS
CTS
DATA (for STA 1)
525
PIFS
제2 채널
mRTS
CTS
DATA (for STA 2)
ACK
535
PIFS
제3 채널
mRTS
CTS
DATA (for STA 3)
535
PIFS
제4 채널
mRTS
CTS
DATA (for STA 3)
500
515, 525, 535
contending
AP
mRTS
510
DATA
560
STA 1
CTS
STA 2
CTS
ACK
STA 3
CTS

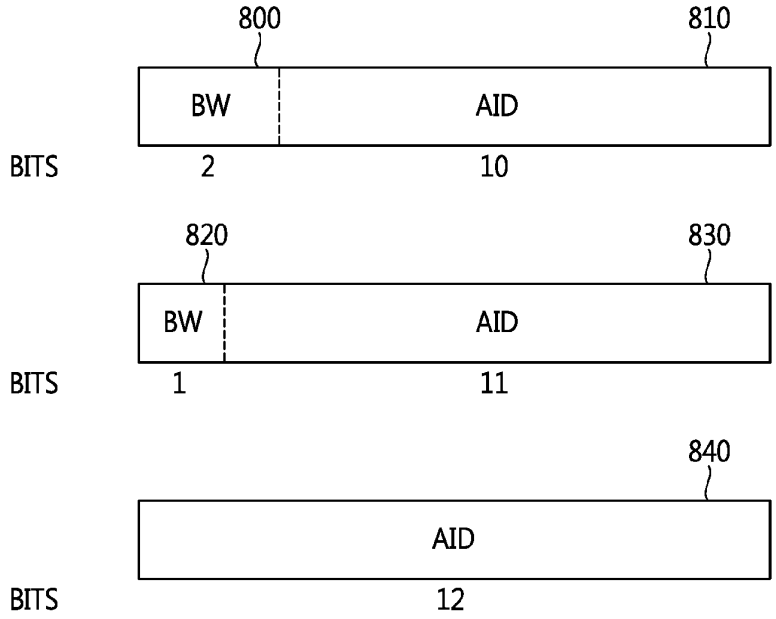
[Fig. 6]


600
620
OFDMA
660
615
contending
mRTS
CTS
DATA (for STA 1)
제1 채널
제2 채널
Interference
제3 채널
PIFS
625
DATA (for STA 2)
ACK
제4 채널
PIFS
635
DATA (for STA 3)
600
615, 625, 635
AP
contending
mRTS
620
DATA
660
STA 1
CTS
STA 2
CTS
ACK
STA 3
CTS

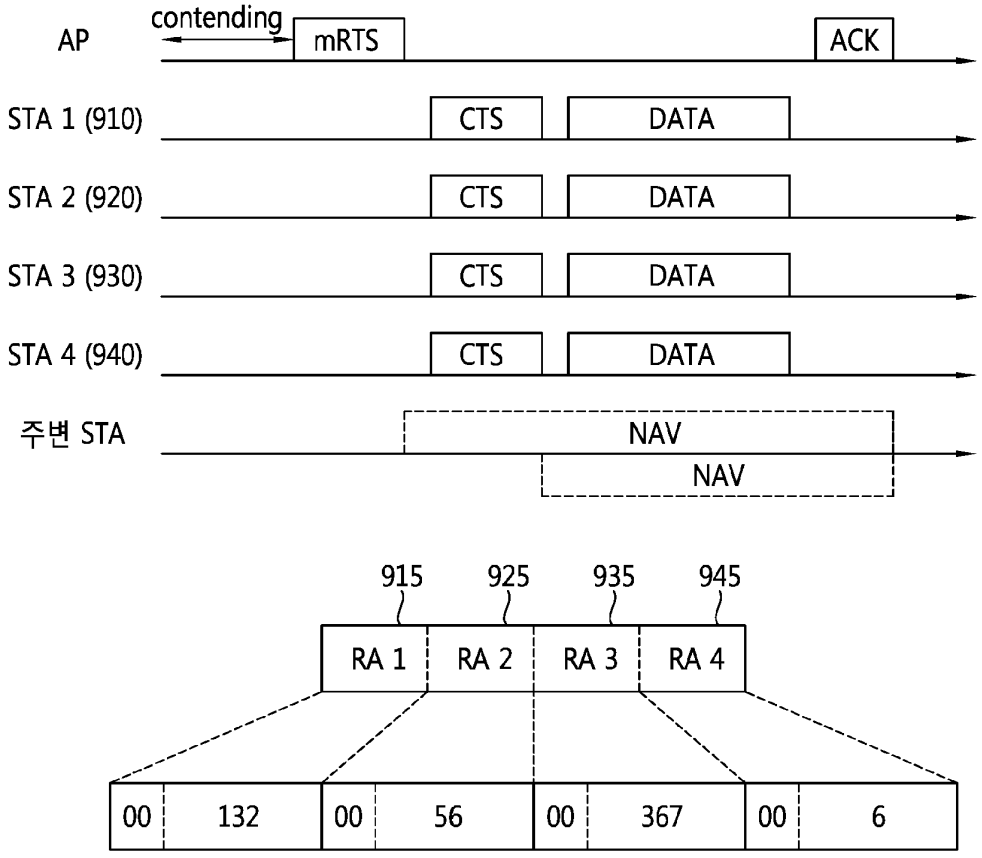
[Fig. 7]


700
Frame Control
2
710
Duration
2
720
RA
6
730
TA
6
740
FCS
4
OCTETS
750
RA 1
12
760
RA 2
12
770
RA 3
12
780
RA 4
12
BITS
763
BW
2 or 1 or 0
769
AID
10 or 11 or 12
BITS

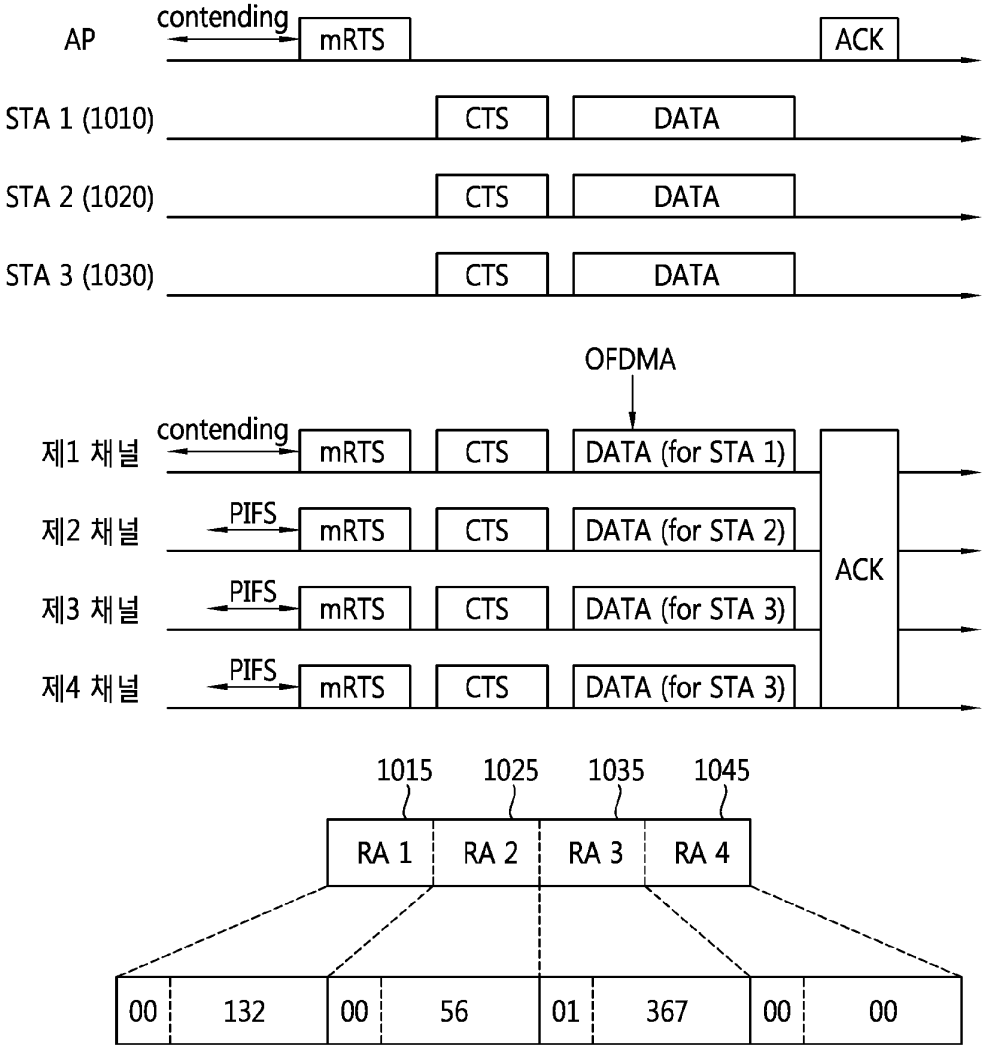
[Fig. 8]


800
810
BW
AID
BITS
2
10
820
830
BW
AID
BITS
1
11
840
AID
BITS
12

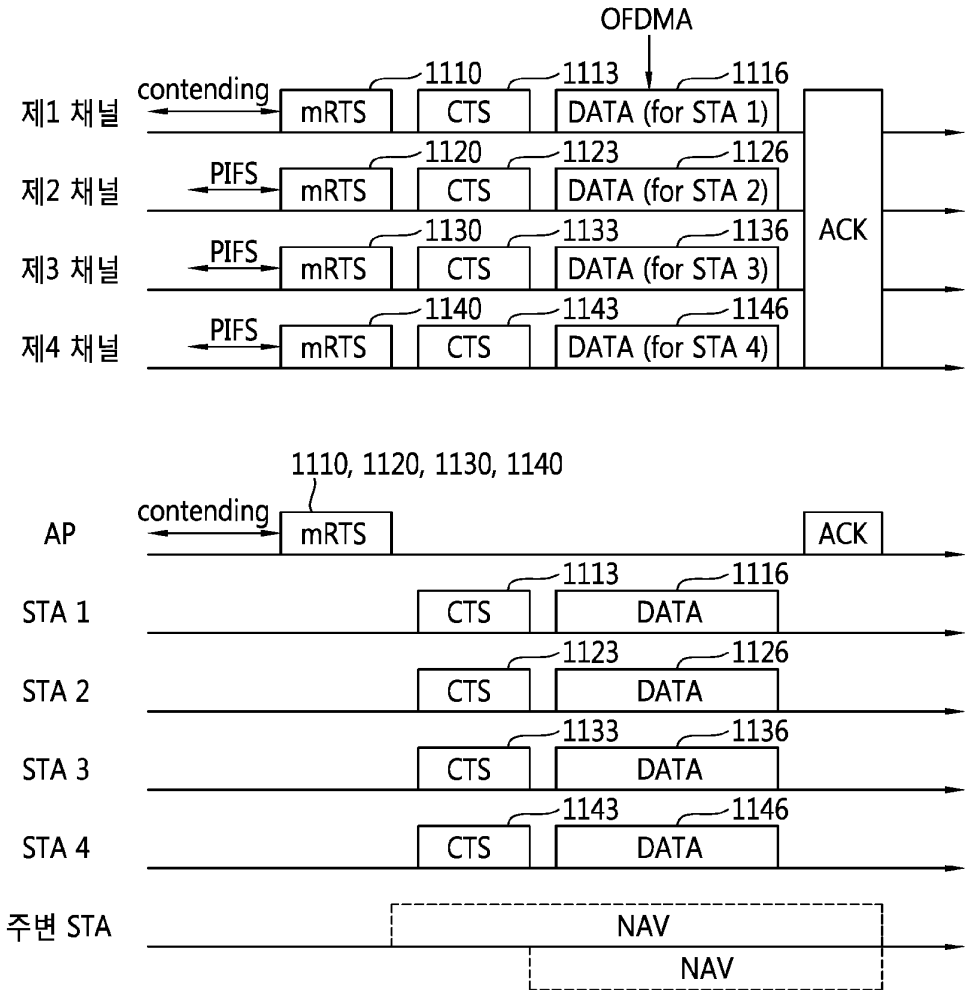
[Fig. 9]


AP
contending
mRTS
ACK
STA 1 (910)
CTS
DATA
STA 2 (920)
CTS
DATA
STA 3 (930)
CTS
DATA
STA 4 (940)
CTS
DATA
주변 STA
NAV
NAV
915
925
935
945
RA 1
RA 2
RA 3
RA 4
00
132
00
56
00
367
00
6

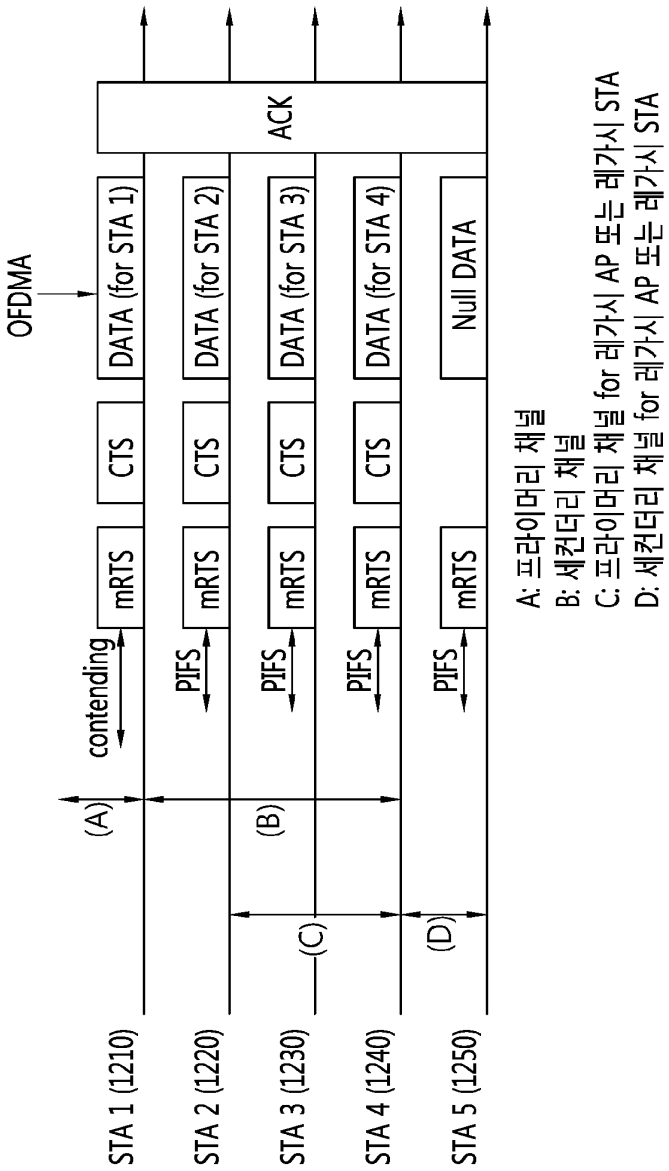
[Fig. 10]


AP
contending
mRTS
ACK
STA 1 (1010)
CTS
DATA
STA 2 (1020)
CTS
DATA
STA 3 (1030)
CTS
DATA
OFDMA
제1 채널
contending
mRTS
CTS
DATA (for STA 1)
제2 채널
PIFS
mRTS
CTS
DATA (for STA 2)
제3 채널
PIFS
mRTS
CTS
DATA (for STA 3)
제4 채널
PIFS
mRTS
CTS
DATA (for STA 3)
ACK
1015
1025
1035
1045
RA 1
RA 2
RA 3
RA 4
00
132
00
56
01
367
00
00

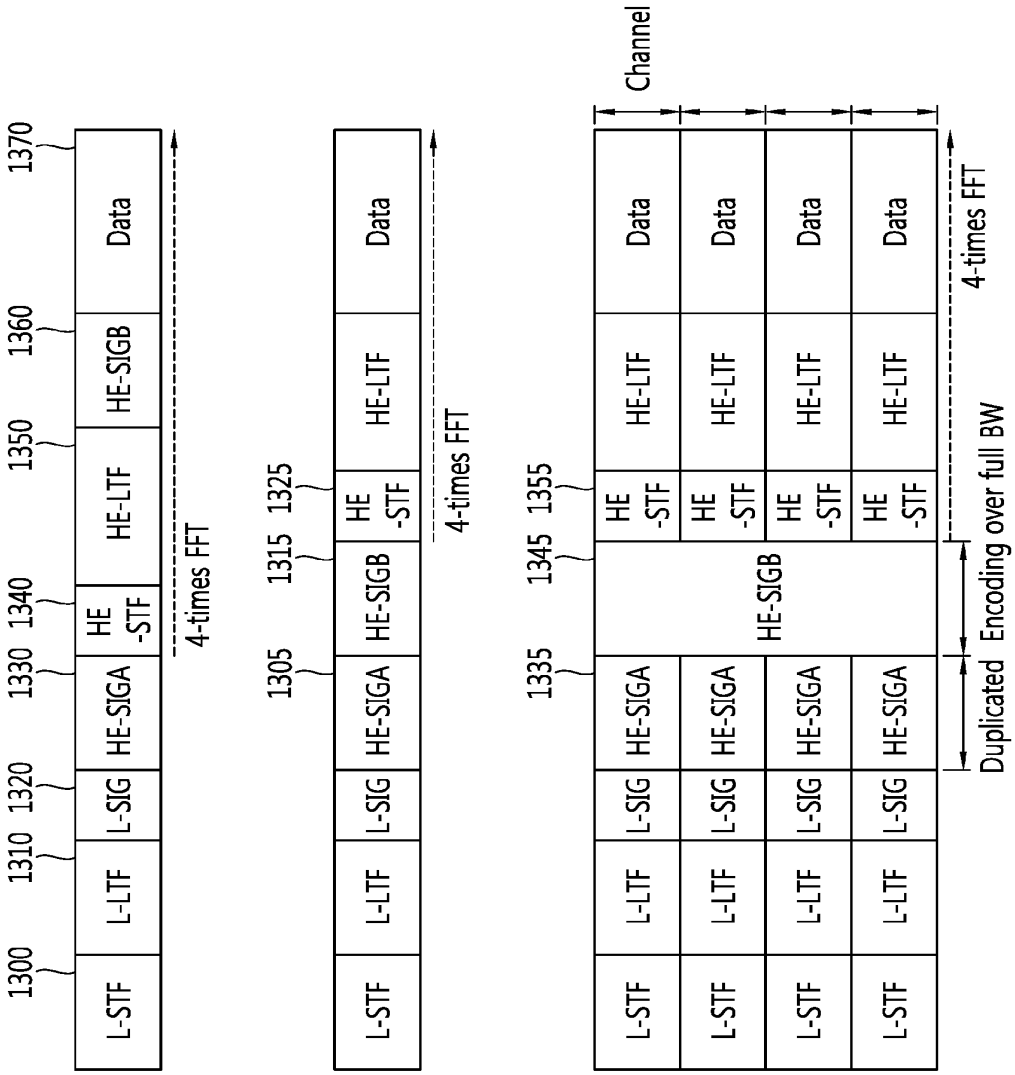
[Fig. 11]


OFDMA
제1 채널
contending
1110
1113
1116
mRTS
CTS
DATA (for STA 1)
제2 채널
PIFS
1120
1123
1126
mRTS
CTS
DATA (for STA 2)
제3 채널
PIFS
1130
1133
1136
mRTS
CTS
DATA (for STA 3)
제4 채널
PIFS
1140
1143
1146
mRTS
CTS
DATA (for STA 4)
ACK
1110, 1120, 1130, 1140
AP
contending
mRTS
ACK
STA 1
1113
1116
CTS
DATA
STA 2
1123
1126
CTS
DATA
STA 3
1133
1136
CTS
DATA
STA 4
1143
1146
CTS
DATA
주변 STA
NAV
NAV

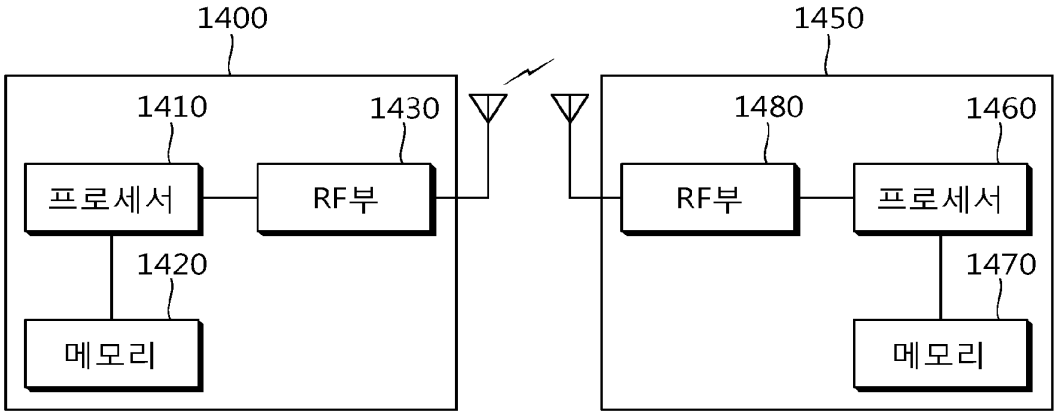
[Fig. 12]


OFDMA
ACK
DATA (for STA 1)
DATA (for STA 2)
DATA (for STA 3)
DATA (for STA 4)
Null DATA
CTS
mRTS
contending
PIFS
(A)
(B)
(C)
(D)
STA 1 (1210)
STA 2 (1220)
STA 3 (1230)
STA 4 (1240)
STA 5 (1250)
A: 프라이머리 채널
B: 세컨더리 채널
C: 프라이머리 채널 for 레가시 AP 또는 레가시 STA
D: 세컨더리 채널 for 레가시 AP 또는 레가시 STA

[Fig. 13]


1370
Data
1360
HE-SIGB
1350
HE-LTF
1340
HE -STF
1330
HE-SIGA
1320
L-SIG
1310
L-LTF
1300
L-STF
4-times FFT
1325
1315
1305
Channel
1355
1345
1335
Duplicated
Encoding over full BW

[Fig. 14]


1400
1410
1430
프로세서
RF부
1420
메모리
1450
1480
1460
RF부
프로세서
1470
메모리

# INTERNATIONAL SEARCH REPORT

International application No.
**PCT/KR2014/012437**

A. CLASSIFICATION OF SUBJECT MATTER

***H04B 7/26(2006.01)i, H04L 27/26(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04B 7/26; H04H 20/71; H04K 1/10; H04W 4/00; H04W 72/04; H04W 24/08; H04L 27/26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: RTS, CTS, MU-MIMO, OFDMA, first assignment channel, wireless local area network (WLAN)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 2010-0316150 A1 (AMINI, Pelman et al.) 16 December 2010<br>See paragraphs [0125]-[0145], [0169]-[0185]; and figures 13, 19, 29, 30. | 1,2,6,7 |
| A | | 3-5,8-10 |
| Y | US 2012-0082040 A1 (GONG, Michelle et al.) 05 April 2012<br>See paragraphs [0032]-[0052]; and figures 3-8. | 1,2,6,7 |
| A | US 2012-0082147 A1 (LIU, Yong et al.) 05 April 2012<br>See paragraphs [0058]-[0111]; and figures 6-10. | 1-10 |
| A | US 2013-0188571 A1 (CHEONG, Min-Ho et al.) 25 July 2013<br>See paragraphs [0046]-[0048], [0057]-[0066]; and figures 4, 5, 10, 11. | 1-10 |
| A | US 2012-0147804 A1 (HEDAYAT, Ahmadreza et al.) 14 June 2012<br>See paragraphs [0021]-[0059]; and figures 3-13. | 1-10 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 19 MARCH 2015 (19.03.2015) | **20 MARCH 2015 (20.03.2015)** |
| Name and mailing address of the ISA/**KR**<br>Korean Intellectual Property Office<br>Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea<br>Facsimile No. 82-42-472-7140 | Authorized officer<br><br>Telephone No. |

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
**PCT/KR2014/012437**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
**PCT/KR2014/012437**

| Patent document cited in search report | Publication date | Patent family member | Publication date |
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Form PCT/ISA/210 (patent family annex) (July 2009)

# 국 제 조 사 보 고 서

국제출원번호
**PCT/KR2014/012437**

**A. 발명이 속하는 기술분류(국제특허분류(IPC))**

**H04B 7/26(2006.01)i, H04L 27/26(2006.01)i**

**B. 조사된 분야**

조사된 최소문헌(국제특허분류를 기재)
H04B 7/26; H04H 20/71; H04K 1/10; H04W 4/00; H04W 72/04; H04W 24/08; H04L 27/26

조사된 기술분야에 속하는 최소문헌 이외의 문헌
한국등록실용신안공보 및 한국공개실용신안공보: 조사된 최소문헌란에 기재된 IPC
일본등록실용신안공보 및 일본공개실용신안공보: 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))
eKOMPASS(특허청 내부 검색시스템) & 키워드: RTS, CTS, MU-MIMO, OFDMA, 제 1 할당 채널, 무선랜

**C. 관련 문헌**

| 카테고리* | 인용문헌명 및 관련 구절(해당하는 경우)의 기재 | 관련 청구항 |
|---|---|---|
| Y | US 2010-0316150 A1 (PEIMAN AMINI 외 4명) 2010.12.16<br>단락 [0125]-[0145], [0169]-[0185]; 및 도면 13, 19, 29, 30 참조. | 1,2,6,7 |
| A | | 3-5,8-10 |
| Y | US 2012-0082040 A1 (MICHELLE GONG 외 2명) 2012.04.05<br>단락 [0032]-[0052]; 및 도면 3-8 참조. | 1,2,6,7 |
| A | US 2012-0082147 A1 (YONG LIU 외 2명) 2012.04.05<br>단락 [0058]-[0111]; 및 도면 6-10 참조. | 1-10 |
| A | US 2013-0188571 A1 (MIN-HO CHEONG 외 1명) 2013.07.25<br>단락 [0046]-[0048], [0057]-[0066]; 및 도면 4, 5, 10, 11 참조. | 1-10 |
| A | US 2012-0147804 A1 (AHMADREZA HEDAYAT 외 1명) 2012.06.14<br>단락 [0021]-[0059]; 및 도면 3-13 참조. | 1-10 |

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

☒ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허 문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허문헌에 속하는 문헌

| 국제조사의 실제 완료일 | 국제조사보고서 발송일 |
|---|---|
| 2015년 03월 19일 (19.03.2015) | 2015년 03월 20일 (20.03.2015) |


ISA/KR의 명칭 및 우편주소
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심사관
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서식 PCT/ISA/210 (두 번째 용지) (2015년 1월)

**국 제 조 사 보 고 서**
대응특허에 관한 정보

국제출원번호
**PCT/KR2014/012437**

| 국제조사보고서에서 인용된 특허문헌 | 공개일 | 대응특허문헌 | 공개일 |
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**국 제 조 사 보 고 서**
대응특허에 관한 정보

국제출원번호
**PCT/KR2014/012437**

| 국제조사보고서에서 인용된 특허문헌 | 공개일 | 대응특허문헌 | 공개일 |
|---|---|---|---|
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Espacenet

# Bibliographic data: JP2015527780 (A) — 2015-09-17

## METHOD AND APPARATUS FOR TRANSMITTING/RECEIVING OPERATING CHANNEL INFORMATION IN WIRELESS COMMUNICATION SYSTEM

**Inventor(s):**

**Applicant(s):**

**Classification:** **- international:** ***H04W16/16; H04W28/06; H04W48/10; H04W72/04; H04W84/12***
**- cooperative:** **H04W16/14**; **H04W28/20**; **H04W48/08**; **H04W72/0453**; H04W74/002

**Application number:** JP20150518311 20121016 Global Dossier

**Priority number(s):** US201261669656P 20120709 ; WO2012KR08433 20121016

**Also published as:** CA2877484 (A1) CA2877484 (C) CN104471873 (A) CN104471873 (B) EP2871785 (A1) more

**Abstract not available for JP2015527780 (A)**
**Abstract of corresponding document: EP2871785 (A1)**

The present invention relates to a wireless communication system, and more specifically, disclosed are a method and an apparatus for transreceiving operating channel information. A method for providing an operating parameter of a station, which operates in a whitespace band, according to the present invention, comprises the steps of: transmitting a frame comprising an operation information field including a channel width subfield; and transmitting a signal (SIG) field of a physical layer convergence procedure (PLCP) protocol data unit (PPDU) preamble, wherein the SIG field comprises a bandwidth (BW) field, and wherein the type of the PPDU can be determined on the basis of the channel width subfield and the BW field.

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## Notice

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## CLAIMS JP2015527780

1.

A method for providing an operation parameter to a station (STA) operating in a white space band, the step of transmitting a frame including an operation information field including a channel width subfield, and PPDU (Physical layer convergence procedure (PLCP)) Protocol Data Unit)) transmitting a preamble SIG (Signal) field, and the SIG field includes a BW (BandWidth) field, and the type of the PPDU includes the channel width lower field and the BW field. An operation parameter providing method determined based on the method.

2.

The channel width includes one or more W channels, and the value of the channel width subfield includes a first type channel width for one W channel, a second type channel width for two consecutive W channels, and two 3rd type channel width for discontinuous W channels, 4th type channel width for 4 consecutive W channels, or 2 discontinuous frequency segments where each frequency segment includes 2 consecutive W channels The operation parameter providing method according to claim 1, wherein one of the fifth type channel widths is indicated.

3.

The method of claim 2, wherein the PPDU type corresponds to one W channel when the channel width subfield indicates the first type channel width and the BW field indicates a first value. .

4.

When the channel width subfield indicates the second type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield indicates the second type channel width. The method of claim 3, wherein the PPDU type corresponds to two consecutive W channels when the type channel width is indicated and the BW field indicates a second value.

5.

When the channel width subfield indicates the third type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield indicates the third type channel width. The method of claim 4, wherein the PPDU type corresponds to two discontinuous W channels when the type channel width is indicated and the BW field indicates the second value.

6.

When the channel width subfield indicates the fourth type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield is the fourth type channel width. If the BW field indicates the second value, the PPDU type corresponds to two consecutive W channels, and the channel width subfield indicates the fourth type channel width, The method of claim 5, wherein the PPDU type corresponds to four consecutive W channels when the BW field indicates the third value.

7.

When the channel width subfield indicates the fifth type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield indicates the fifth type. If the BW field indicates the second value, the PPDU type corresponds to two consecutive W channels, the channel width subfield indicates the fifth type channel width, and the BW field indicates the second value. The operating parameter according to claim 6, wherein when the BW field indicates a third value, the PPDU type corresponds to two non-contiguous frequency segments, each frequency segment including two consecutive W channels. How to provide.

8.

If the BW field has a first value and the channel width subfield indicates a first, second, third, fourth or fifth type channel width, the PPDU type corresponds to one W channel. The operation parameter providing method according to claim 2.

9.

The PPDU type corresponds to two consecutive W channels when the BW field has a second value and the channel width subfield indicates a second, fourth or fifth type channel width. Item 3. The operation parameter providing method according to item 2.

10.

The PPDU type corresponds to two discontinuous W channels when the BW field has a second value and the channel width subfield indicates a third type channel width. How to provide operating parameters.

11.

The operation of claim 2, wherein the PPDU type corresponds to four consecutive W channels when the BW field has a third value and the channel width subfield indicates a fourth type channel width. How to provide parameters.

12.

When the BW field has a third value and the channel width subfield indicates a fifth type channel width, the PPDU type is defined as two non-consecutive channels each containing two consecutive W channels. The operating parameter providing method according to claim 2, corresponding to continuous frequency segments.

13.

A method for receiving operation parameters for a station (STA) operating in a white space band, comprising: receiving a frame including an operation information field including a channel width subfield; and PPDU (Physical layer convergence procedure (PLCP) Protocol Data. Unit)) receiving a preamble SIG (Signal) field, the SIG field including a BW (BandWidth) field, and the type of the PPDU is based on the channel width lower field and the BW field. The operating parameter receiving method to be determined.

14.

An apparatus for providing operation parameters to a station (STA) operating in a white space band, wherein the transceiver

includes a transceiver configured to transmit / receive to / from another device, and controls the apparatus including the transceiver A processor configured to transmit a frame including an operation information field including a channel width subfield via the transceiver, and to provide a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit. )) Further configured to transmit an SIG (Signal) field of a preamble, the SIG field includes a BW (BandWidth) field, and the type of the PPDU includes the channel width lower field and It is determined based on the BW field operating parameters providing apparatus.

**15.**

An apparatus for receiving operating parameters for a station (STA) operating in a white space band, wherein the transceiver includes a transceiver configured to transmit / receive to / from another device, and controls the apparatus including the transceiver A processor configured to receive, via the transceiver, a frame including an operation information field including a channel width subfield, and a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit) It is further configured to receive an SIG (Signal) field of a preamble, the SIG field includes a BW (BandWidth) field, and the type of the PPDU includes the channel width lower field and It is determined based on the BW field operation parameter receiving device.

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## DESCRIPTION JP2015527780

The present invention relates to a wireless communication system, and in particular, provides a method and apparatus for transmitting / receiving operating channel information. According to an embodiment of the present invention, a method for providing an operation parameter to a station operating in a white space band (STA) includes transmitting a frame including an operation information field including a channel width subfield, and a PPDU (Physical). transmitting a SIG (Signal) field of a preamble, and the SIG field includes a BW (BandWidth) field, and the type of the PPDU includes the channel width lower order. Determined based on the field and the BW field. [Selection] Figure 7

Method and apparatus for transmitting / receiving operating channel information in a wireless communication system

**[0001]**

The following description relates to a wireless communication system, and more particularly to a method and apparatus for transmitting / receiving operating channel information in a wireless LAN system.

**[0002]**

The standard of wireless local area network (WLAN) technology has been developed as an IEEE (Institut of Electrical and Electronics Engineers) 802.11 standard.

IEEE 802.11a and b use an unlicensed band at 2.4 GHz or 5 GHz, IEEE 802.11b provides a transmission rate of 11 Mbps, and IEEE 802.11a provides a transmission rate of 54 Mbps. IEEE 802.11g applies Orthogonal Frequency Division Multiplexing (OFDM) at 2.4 GHz and provides a transmission rate of 54 Mbps. IEEE 802.11n applies Multiple Input Multiple Output-OFDM (MIMO-OFDM) and provides a transmission rate of 300 Mbps for four spatial streams. IEEE 802.11n supports a channel bandwidth up to 40 MHz, and in this case provides a transmission rate of 600 Mbps.

**[0003]**

Currently, an IEEE 802.11af standard has been developed to define the operation of unlicensed devices in the TV white space (TV whitespace) band.

**[0004]**

TVWS includes VHF (Very High Frequency) bands (54-60, 76-88, 174-216 MHz) and UHF (Ultra High Frequency) bands (470-698 MHz) allocated for TV broadcasting. It means a frequency band that is permitted to be used for non-licensed devices under the condition that it does not hinder communication of licensed devices (licensed devices; TV broadcasts, wireless microphones, etc.).

**[0005]**

in 512 to 608 MHz and 614 to 698 MHz, all non-licensed devices are allowed to operate except for some special cases, but the 54 to 60 MHz, 76 to 88 MHz, 174 to 216 MHz, and 470 to 512 MHz bands are it is allowed only for communication between fixed devices.

A fixed device refers to a device that transmits only at a predetermined position.

In the following description, the white space band includes the above-described TVWS, but is not limited thereto.

**[0006]**

Non-licensed devices that intend to use the white space band must provide protection for licensed devices. Therefore, before starting transmission in the white space band, it is necessary to check whether the licensed device occupies the band. That is, use of a non-licensed device can be permitted only when the licensed device is not in use in the white space band.

**[0007]**

For this purpose, an unlicensed device connects to a geo-location data base (GDB) through the Internet or a dedicated line, and obtains information on a channel list (that is, a set of usable channels) that can be used in the corresponding region. Must get. GDB is a database that stores and manages licensed device information registered in itself and channel usage information that dynamically changes according to the geographical location and usage time of these licensed devices. In addition, in order to solve the coexistence problem between non-licensed devices using white space, a signaling protocol such as a common beacon frame and a spectrum sensing mechanism are used. be able to.

**[0008]**

In the IEEE 802.11 system, a TVWS terminal may refer to an unlicensed device that operates using an IEEE 802.11 MAC (Medium Access Control) layer and a PHY (Physical) layer in the TVWS spectrum. Unless otherwise stated in this document, a station (STA) refers to a TVWS terminal operating in the TVWS spectrum.

**[0009]**

The STA provides a function for protecting a priority user including a licensed user (such as a TV user and a wireless microphone) or a primary user who is an authorized user of a priority connection. Must. That is, if the preferential user is using TVWS, the STA must stop using the channel. Therefore, the STA must find an available channel that can be used by an unlicensed device (that is, a channel that is not used by the licensed device), and must operate on the available channel.

**[0010]**

As a method for the STA to find an available channel, there are a method of performing a spectrum sensing mechanism and a method of confirming a TV channel schedule by connecting to the GDB. As a spectrum sensing mechanism, an energy detection method (a method in which a preferential user determines that a received signal is in use if the intensity of a received signal is equal to or greater than a certain value), a feature detection method (a feature detection method) (digital When a TV preamble (Preamble) is detected, a method in which a preferential user determines that it is in use can be used. Next, the STA must connect to the GDB, acquire GDB information based on its own location information, and check whether the licensed device is using the channel at that location. Also, connection to GDB and information acquisition must be performed with sufficient frequency to protect the licensed device.

**[0011]**

When it is determined from the spectrum sensing method or GDB that the preferential user is in use in a channel adjacent to the channel currently in use, the terminal (or STA) and the base station (or AP (Access Point)) ) Can protect preferential users by reducing the transmission power.

**[0012]**

Available channels in the white space band may not be continuous in frequency.

Therefore, the existing wireless LAN channel structure cannot be applied as it is as the white space band channel structure. In order for the STA to operate correctly in the white space band, it is necessary to know the channel structure supported by the basic service set (BSS) configured by the AP and the allowed data unit types.

[0013]

In the present invention, it is a technical problem to provide a method for accurately and efficiently informing STAs about information regarding operating channels.

[0014]

The technical problem to be achieved by the present invention is not limited to the technical problem mentioned above, and other technical problems that are not mentioned are described below. It will be clear to those who have knowledge.

[0015]

In order to solve the above technical problem, according to an embodiment of the present invention, a method for providing operation parameters for a station (STA) operating in a white space band includes an operation information field including a channel width subfield. And a step of transmitting a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit) preamble SIG, and the SIG field includes a BW (BandWidth) field. And the PPDU type is determined based on the channel width lower field and the BW field.

[0016]

In order to solve the above technical problem, according to another embodiment of the present invention, a method for receiving operation parameters for a station (STA) operating in a white space band includes an operation information field including a channel width subfield. Receiving a frame including a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit), and receiving a SIG (Signal) field of a preamble, and the SIG field includes a BW (BandWidth) field. The type of the PPDU is determined based on the channel width lower field and the BW field.

[0017]

In order to solve the above technical problem, an apparatus for providing operation parameters to a station (STA) operating in a white space band according to still another embodiment of the present invention transmits and receives with other devices. A transceiver configured to perform and a processor configured to control the device including the transceiver, the processor via the transceiver operating information including a channel width subfield. A frame including a field, and further configured to transmit a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit) preamble, the SIG field including a BW (BandWidth) field; Type serial PPDU is characterized in that it is determined based on the channel width lower field and the BW field.

[0018]

In order to solve the above technical problem, an apparatus for receiving operation parameters for a station (STA) operating in a white space band according to still another embodiment of the present invention performs transmission and reception with other devices. And a processor configured to control the device including the transceiver, the processor having an operation information field including a channel width subfield via the transceiver. Receiving a frame including, and further configured to receive an SIG (Signal) field of a PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit) preamble, and the SIG field includes a BW (BandWidth) field; Type serial PPDU is characterized in that it is determined based on the channel width lower field and the BW field.

[0019]

The following matters can be commonly applied to the above-described embodiments of the present invention.

[0020]

The channel width includes one or more W channels, and the value of the channel width subfield includes a first type channel width for one W channel, a second type channel width for two consecutive W channels, and two For a third type channel width for discontinuous W channels, a fourth type channel width for four consecutive W channels, or for two discontinuous frequency segments where each frequency segment includes two consecutive W channels One of the fifth type channel widths may be indicated.

[0021]

When the channel width subfield indicates the first type channel width and the BW field indicates a first value, the PPDU type can correspond to one W channel.

[0022]

When the channel width subfield indicates the second type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield is the second type channel width. When indicating the type channel width and the BW field indicates a second value, the PPDU type may correspond to two consecutive W channels.

[0023]

When the channel width subfield indicates the third type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield is the third type channel width. If the type channel width is indicated and the BW field indicates the second value, the PPDU type may correspond to two discontinuous W channels.

[0024]

When the channel width subfield indicates the fourth type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield indicates the fourth type channel width. If the BW field indicates the second value, the PPDU type corresponds to two consecutive W channels, and the channel width subfield indicates the fourth type channel width. When the BW field indicates the third value, the PPDU type may correspond to four consecutive W channels.

[0025]

When the channel width subfield indicates the fifth type channel width and the BW field indicates the first value, the PPDU type corresponds to one W channel, and the channel width subfield indicates the fifth type. If the BW field indicates the second value, the PPDU type corresponds to two consecutive W channels, the channel width subfield indicates the fifth type channel width, and the BW field indicates the second value. When the BW field indicates a third value, the PPDU type may correspond to two discontinuous frequency segments, each frequency segment including two consecutive W channels.

[0026]

If the BW field has a first value and the channel width subfield indicates a first, second, third, fourth or fifth type channel width, the PPDU type corresponds to one W channel. May be.

[0027]

If the BW field has a second value and the channel width subfield indicates a second, fourth, or fifth type channel width, the PPDU type may correspond to two consecutive W channels. Good.

[0028]

When the BW field has a second value and the channel width subfield indicates a third type channel width, the PPDU type may

correspond to two discontinuous W channels.

[0029]

When the BW field has a third value and the channel width subfield indicates a fourth type channel width, the PPDU type may correspond to four consecutive W channels.

[0030]

When the BW field has a third value and the channel width subfield indicates a fifth type channel width, the PPDU type is defined as two non-consecutive channels each containing two consecutive W channels. It may correspond to consecutive frequency segments.

[0031]

The foregoing general description and the following detailed description of the invention are exemplary and are for the purpose of further description of the claimed invention.

[0032]

According to the present invention, it is possible to provide a method and apparatus for accurately and efficiently informing a STA of information regarding an operation channel.

[0033]

The effects obtained from the present invention are not limited to the effects mentioned above, and other effects not mentioned are clearly understood from those described below by those having ordinary knowledge in the technical field to which the present invention belongs. Will be done.

[0034]

The drawings attached hereto are provided to provide an understanding of the invention, illustrate various embodiments of the invention, and together with the description serve to explain the principles of the invention.

FIG. 1 is a diagram illustrating an exemplary structure of an IEEE 802.11 system to which the present invention can be applied.

FIG. 2 is a diagram illustrating another exemplary structure of an IEEE 802.11 system to which the present invention can be applied.

FIG. 3 is a diagram illustrating still another exemplary structure of an IEEE 802.11 system to which the present invention can be applied.

FIG. 4 is a diagram illustrating an exemplary structure of a WLAN system.

FIG. 5 is a flowchart illustrating an exemplary link setup process according to an example of the present invention.

FIG. 6A shows an example of WSM.

FIG. 6B is a diagram illustrating an exemplary format of the device ID.

FIG. 6C is a diagram illustrating an exemplary format of the channel availability request frame.

FIG. 6D is a diagram illustrating an exemplary format of a channel availability response frame.

FIG. 7 is a diagram showing a format of the operation information element.

FIG. 8 is a diagram illustrating an exemplary form of a WLAN operation channel in TVWS.

FIG. 9 is a block diagram illustrating a configuration of a wireless device according to an embodiment of the present invention.

[0035]

DESCRIPTION OF EXEMPLARY EMBODIMENTS Hereinafter, preferred embodiments of the invention will be described in detail with reference to the accompanying drawings.

The detailed description disclosed below in connection with the appended drawings is intended as a description of exemplary embodiments of the invention and is not intended to represent the only embodiments in which the invention may be practiced.

The following detailed description includes specific details in order to provide a thorough understanding of the present invention.

However, it will be understood by those skilled in the art that the present invention may be practiced without such specific details.

**[0036]**

In the following embodiments, constituent elements and features of the present invention are combined in a predetermined form.

Each component or feature may be considered optional unless specifically stated otherwise.

Each component or feature may be implemented in a form that is not combined with other components or features, or some components and / or features may be combined to form an embodiment of the present invention.

The order of operations described in the embodiments of the present invention may be changed.

Some configurations or features of one embodiment may be included in other embodiments, or may be replaced with corresponding configurations or features of other embodiments.

**[0037]**

The specific terms used in the following description are provided to help the understanding of the present invention, and the use of such specific terms can be changed to other forms without departing from the technical idea of the present invention. May be.

**[0038]**

In order to avoid obscuring the concepts of the present invention in some cases, well-known structures and devices are omitted or shown in block diagram form centered on the core functions of each structure and device.

Further, the same constituent elements will be described using the same reference numerals throughout the present specification.

**[0039]**

Embodiments of the present invention can be supported by standard documents disclosed in at least one of IEEE 802 system, 3GPP system, 3GPP LTE, LTE-A (LTE-Advanced) system and 3GPP2 system which are wireless connection systems.

That is, in the embodiments of the present invention, the steps or portions that are not described in order to clarify the technical idea of the present invention can be supported by the above document.

In addition, all terms disclosed in this document can be explained by the above standard documents.

**[0040]**

The following technology, CDMA (Code Division Multiple Access), FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access), OFDMA (Orthogonal Frequency Division Multiple Access), SC-FDMA (Single Carrier Frequency Division Multiple Access), etc. it can be used for various wireless connection systems. CDMA can be realized by a radio technology such as UTRA (Universal Terrestrial Radio Access) or CDMA2000. TDMA can be achieved by GSM (Global System for Mobile communications) / GPRS (General Packet Radio Service) / EDGE (Enhanced Data Rates for GSM (registered trademark) Evolution) technology. OFDMA can be realized by a radio technology such as IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802-20, E-UTRA (Evolved UTRA), and the like. For the sake of clarity, the following description will focus on the IEEE 802.11 system, but the technical idea of the present invention is not limited thereto.

[0041]

FIG. 1 is a diagram illustrating an exemplary structure of an IEEE 802.11 system to which the present invention can be applied.

[0042]

The IEEE 802.11 structure can be composed of a plurality of components, and these interactions can provide a WLAN that supports STA mobility that is transparent to higher layers.

A basic service set (BSS) may correspond to a basic configuration block in an IEEE 802.11 LAN. In FIG. 1, there are two BSSs (BSS1 and BSS2), and two STAs are included as members of each BSS (STA1 and STA2 are included in BSS1, and STA3 and STA4 are included in BSS2). An example is shown. In FIG. 1, an ellipse representing a BSS may be understood to represent a coverage area where STAs included in the BSS maintain communication. This area can be called a BSA (Basic Service Area). When the STA moves out of the BSA, it cannot communicate directly with other STAs in the BSA.

[0043]

The most basic type of BSS in an IEEE 802.11 LAN is an independent BSS (Independent BSS; IBSS). For example, the IBSS may have a minimum configuration composed of only two STAs. Moreover, it can be said that BSS (BSS1 or BSS2) of FIG. 1 which is the simplest form and other components are omitted corresponds to a representative example of IBSS. Such a configuration is possible when the STA can communicate directly. In addition, such a form of LAN is not planned and configured in advance, but can be configured when necessary, and can also be referred to as an ad-hoc network.

[0044]

STA membership in the BSS may change dynamically as STAs are turned on and off, and STAs enter and leave the BSS region. To become a member of the BSS, the STA only needs to join the BSS using the synchronization process. In order to access all the services of the BSS base structure, the STA must be associated with the BSS. Such association may be set dynamically and may include the use of a distribution system service (DSS).

[0045]

FIG. 2 is a diagram illustrating another exemplary structure of an IEEE 802.11 system to which the present invention can be applied. FIG. 2 is a form in which components such as a distribution system (DS), a distribution system medium (DSM), an access point (AP), and the like are added to the structure of FIG.

[0046]

The direct station-to-station distance in a LAN may be limited by PHY performance. Such distance limitations may be sufficient, but communication between stations at greater distances may be required. A distribution system (DS) can be configured to support extended coverage.

[0047]

DS means a structure in which BSSs are interconnected. Specifically, the BSS may exist as a component of an expanded form of a network composed of a plurality of BSSs, instead of the BSS independently as shown in FIG.

[0048]

DS is a logical concept and can be specified by the characteristics of a distribution system medium (DSM). In this regard, the IEEE 802.11 standard makes a logical distinction between wireless medium (WM) and distribution system medium (DSM). Each logical medium is used for a different purpose and is used by different components. The definition of the IEEE 802.11 standard does not restrict these media to be the same or different. In this way, the flexibility of the IEEE 802.11 LAN structure (DS structure or other network structure) can be explained in that the plurality of media are logically different. That is, the IEEE 802.11 LAN structure can be implemented in various ways, and the LAN structure may be specified independently according to

the physical characteristics of each implementation.

[0049]

DS can support mobile devices by providing seamless integration of multiple BSSs and providing the logical services necessary to handle addresses to destinations.

[0050]

AP refers to an individual that enables access to a DS through a WM for a linked STA and has STA functionality.

Data movement between the BSS and the DS can be performed via the AP. For example, the STA2 and the STA3 illustrated in FIG. 2 have a function of enabling the linked STAs (STA1 and STA4) to access the DS while having the STA functionality. Since all APs basically correspond to STAs, all APs are addressable individuals. The address used by the AP for communication on the WM and the address used by the AP for communication on the DSM are not necessarily the same.

[0051]

Data transmitted from one of the STAs associated with the AP to the STA address of the AP can always be received by an uncontrolled port and processed by an IEEE 802.1X port access individual. When the control port is authenticated, the transmission data (or frame) can be transmitted to the DS.

[0052]

FIG. 3 is a diagram illustrating still another exemplary structure of an IEEE 802.11 system to which the present invention can be applied. FIG. 3 conceptually illustrates an extended service set (ESS) for providing wider coverage to the structure of FIG.

[0053]

A wireless network having arbitrary size and complexity can be composed of DS and BSS. In the IEEE 802.11 system, such a network is called an ESS network. It can be said that the ESS corresponds to a set of BSSs connected to one DS. However, ESS does not include DS. The ESS network is characterized in that it appears as an IBSS network in an LLC (Logical Link Control) layer. STAs included in an ESS can communicate with each other, and mobile STAs can move from one BSS to another (within the same ESS) transparently to the LLC.

[0054]

IEEE 802.11 makes no assumptions about the relative physical positions of the BSSs in FIG. 3, and all of the following forms are possible. The BSSs may partially overlap, which is a form commonly used to provide continuous coverage. Further, the BSSs do not have to be physically connected to each other, and there is no limitation on the distance between the BSSs. Also, the BSSs may be physically located at the same position, which can be used to provide redundancy. Further, one (or one or more) IBSS or ESS network may physically exist in the same space as one (or one or more) ESS networks. This is because when an ad hoc network operates in a location where an ESS network exists, when an IEEE 802.11 network physically overlapped by different organizations is configured, or when two or more different accesses are made at the same location. It can be said that this corresponds to the ESS network form when security policy is necessary.

[0055]

FIG. 4 is a diagram illustrating an exemplary structure of a WLAN system. FIG. 4 shows an example of a base structure BSS including DS.

[0056]

In the illustration of FIG. 4, BSS1 and BSS2 constitute an ESS. In a WLAN system, an STA is a device that operates in accordance with IEEE 802.11 MAC / PHY specifications. STAs include AP STAs and non-AP (non-AP) STAs. Non-AP STA

generally corresponds to a device directly handled by a user such as a laptop computer or a mobile phone. In the example of FIG. 4, STA1, STA3, and STA4 correspond to non-AP STA, and STA2 and STA5 correspond to AP STA.

[0057]

In the following description, a non-AP STA includes a terminal, a wireless transmission / reception unit (Wireless Transmit / Receive Unit; WTRU), a user equipment (User Equipment; UE), a mobile station (Mobile Station; MS), and a mobile terminal. (Mobile Terminal), Mobile Subscriber Station (MSS), and the like. In addition, an AP is a base station (BS), a node-B (Node-B), an evolved Node-B (evolved Node-B; eNB), a base transceiver system (Base Transceiver System) in other radio communication fields. BTS), femto base station (Femto BS), and the like.

[0058]

(Available Channels in White Space) In order for STAs to operate in white space, protection techniques for licensed devices (or priority users) must be preferentially provided. Therefore, the STA must find an available channel that is not used by a licensed device and can be used by a non-licensed device and must operate on the available channel.

[0059]

In order for the STA to grasp the channel (for example, TV channel) availability in the white space (for example, TVWS), it is only necessary to perform spectrum sensing or connect to the GDB to check the TV channel schedule. The GDB information can include information such as a use schedule (that is, channel use time) of a specific channel of the licensed device at a specific position. A STA trying to grasp the availability of a TV channel must connect to the GDB via the Internet and acquire GDB information based on its own location information, which is sufficient to protect the licensed device. Must be done in hours.

[0060]

In this document, for convenience of explanation, information on available channels and frequencies received from the GDB may be referred to as a white space map (WSM). WSM is based on the channel and frequency information acquired by STA from GDB, and creates information about channels that can be used by unlicensed devices in the TVWS band in the form of a map. The WSM may include information about available channel lists or frequencies that can be used by unlicensed devices. The channels included in the available channel list are channels that are not used by legally protected signals (or users) and can be used by unlicensed devices when the unlicensed devices connect to GDB. is a channel. Alternatively, when a request is made for a usable channel from a specific time after the unlicensed device is connected to the GDB, information on a channel and a frequency that can be used from that point can be included. As another example, when a non-licensed device makes a request for an available channel to the GDB, information on the usable channel and frequency may be transmitted by signaling a channel that the unlicensed device cannot use.

[0061]

Currently, the regulation for TVWS of FCC (Federal Communications Commission) largely defines two types of devices. That is, a personal / portable device that can be carried by a small-output individual (Personal / Portable Device) and a fixed device that operates at a fixed position and has a high output (Fixed Device) are defined. Fixed devices can be called fixed STAs, and personal / portable devices can also be called P / P STAs. Both fixed STAs and P / P STAs are common STAs in WLAN systems (ie, the term STA includes APs and non-APs). When these two types of devices each operate on TVWS, different operation rules can be applied to each. The fixed device transmits / receives a signal at a specific position where the position does not change. Of course, in order for a fixed device to transmit a signal at a corresponding position, it must be connected to the GDB to acquire usable channel information. The fixed device may be equipped with a device such as a GPS that can confirm the position, or the position information may be transmitted to the GDB by a person directly inputting the position by an installer. . Of course, when a person directly inputs a position, it is assumed that the position will not change after the position has been input, and if the position is changed, the position will be changed accordingly. / Must register. A fixed device can service other fixed devices of the same type, and can also service P / P devices. When a fixed device acquires available channel information from the GDB, it must always transmit its own device type and receive its own available channel information that can be directly used by itself. At the same time, in order to provide a service for the P / P device, the available channel information that can be used by the P / P device must be further received from the GDB or a proxy server connected to the GDB. This is because the channel

sections in which the fixed device and the P / P device can be used are different, and the maximum allowable transmission power and the requirements for the adjacent channel are different during each operation, so that the available channel list is different for each device type.

For example, the fixed device is allowed to transmit signals in the frequency sections of the 512 to 608 MHz and 614 to 698 MHz bands in addition to the frequency sections of the 54 to 60 MHz, 76 to 88 MHz, 174 to 216 MHz, and 470 to 512 MHz bands. On the other hand, the P / P device does not allow signal transmission in the TVWS band of a frequency band other than the frequency sections of the 512-608 MHz and 614-698 MHz bands. The fixed device can transmit a signal with higher power than the P / P device, and a transmission power of up to 4 Watts is allowed as an effective isotropic radiated power (EIRP).

**[0062]**

The P / P device is a device that can send / receive a signal at an unspecified position, and is characterized in that its position is variable. In most cases, it is equipment that can be carried by humans, and its mobility cannot be predicted. The usable frequency band is a frequency section of 512 to 608 MHz and 614 to 698 MHz, and the maximum transmission power is 100 mW (EIRP). Depending on whether the P / P device has an identification capability for its own location, that is, a geo-location capability and a connection capability to GDB using Internet access. The mode II device can be classified into two types: Mode II device and Mode I device. That is, a Mode II device has geographical-positioning capability and internet access capability, and can connect to GDB to obtain information about available channels at its location and then operate on TVWS at that location. it can. A mode II device can also start a network by transmitting a signal (eg, an enable signal) that can instruct the mode I device to begin communication after obtaining available channel information from the GDB. . On the other hand, mode I devices are not required to have geo-location determination capability or GDB access capability and operate under control by mode II devices or fixed devices that access GDB and have valid available channel information. Is required. The P / P device corresponding to the mode II device can serve other P / P devices, or can provide services to fixed devices. In this case, the mode IIP / P device may acquire the available channel information for the fixed device from the GDB and transmit it to the fixed device.

**[0063]**

On the other hand, the GDB calculates the available channel information at the location requested by the unlicensed device and transmits it to the unlicensed device in consideration of the channel usage schedule and protection range of priority users such as DTVs and microphones. do it. Parameters to be considered when calculating available channel information in GDB include device type, position to operate, transmission power, spectrum mask, and the like. In the FCC rules, whether or not an adjacent channel can be used is determined depending on the device type. For example, when DTV is in use on channel 30, even if channels 29 and 31 are free, fixed devices cannot use channels 29 and 31, but P / P devices use both channels. can do. This is because, in the case of a fixed device, the transmission power is high, so that there is a high possibility of inducing interference with adjacent channels.

**[0064]**

In the following, for convenience of explanation, TVWS is taken as an example of a white space to explain the present invention, but the scope of the present invention is not limited thereto. That is, the scope of the present invention includes illustrations of the present invention applied to operation in all white spaces controlled by a DB that provides information about channels available at a specific location. For example, it is expected that the operation of non-licensed equipment controlled by GDB is allowed in other frequency bands that are not currently considered white space but are expected to fall under white space in the future. Examples in accordance with the principles of the invention described herein are also within the scope of the invention. Further, in the present invention, the principle of the present invention will be described based on the FCC rules regarding the TVWS for which the final rule has been announced for convenience of explanation. However, the scope of the present invention is the operation on the white space band based on the FCC rules. But also includes illustrations according to the principles of the present invention over a white space band according to other rules.

**[0065]**

(Link Setup in White Space) This embodiment relates to a link setup process in TVWS. In particular, a specific example for link setup between a mode I device and a mode II device (or a fixed device) will be described. Link setup proceeds in the process of network discovery, authentication, and association. In particular, in the case of a mode I device operating in the white space

band, an acquisition process of available channel information is required at the time of link setup.

[0066]

FIG. 5 is a flowchart illustrating an exemplary link setup process according to an example of the present invention.

[0067]

In step S510, a mode II device or a fixed device (hereinafter referred to as mode II device / fixed device).

) Can access the GDB through the Internet or the like, and obtain a channel list (for example, WSM) that is currently available at its own location. Mode II devices / fixed devices can select specific channels from the available channel list.

[0068]

In step S520, the mode II device / fixed device can transmit a beacon to configure the BSS. The beacon frame can include the device type of the transmitting side (eg, Mode II device / fixed device), etc., thereby notifying the receiving side (eg, Mode I device) that link setup is possible. it can. Further, the beacon frame may include information on the available channel list. The beacon frame can be transmitted periodically.

[0069]

In step S530, the mode I device attempting to participate in the BSS can perform a scanning process for the TVWS. If the mode I device knows the channel list that is currently available at its own location, it may perform passive or active scanning only for channels on the available channel list. it can.

[0070]

Passive scanning refers to the process in which a mode I device listens for beacon transmissions from a mode II device / fixed device on the scanning channel. Active scanning means that a mode I device transmits a probe request frame on a scanning channel, and receives a probe response frame from a mode II device / fixed device.

[0071]

Mode II devices / fixed devices can include a list of available channels in beacon frames, probe response frames, etc. to reduce the scanning burden on Mode I devices. In the present invention, the available channel list acquired from the GDB by the mode II device / fixed device can be called WSM.

[0072]

FIG. 6A shows an example of WSM.

[0073]

In the example of FIG. 6A, the device type field indicates whether the terminal transmitting the WSM is a mode II device or a fixed device.

The map ID (Map ID) field indicates the ID of the available channel list. A channel number field indicates a channel number that can be used by a mode II device / fixed device in TVWS. The channel number is expressed by a TV channel number, a spectrum range, etc., and means information that can identify an available channel in the frequency domain. The maximum power level field indicates the maximum transmission power of the mode II device / fixed device in the available channel. The Valid Time field indicates a period during which an available channel can be used continuously. The valid time field is not essential and may be optionally included. Such WSM can be transmitted through beacon frames, probe response frames, or other forms of frames. In addition, the format of the WSM in FIG. 6A is merely an example, and other forms of WSM including information on available channels may be applied in the example of the present invention.

[0074]

Here, in order for the mode I device to participate in the BSS, it must operate under the control of the mode II device / fixed device. Therefore, mode I equipment must perform link setup with mode II equipment / fixed equipment.

[0075]

in step S540, the mode I device may perform an association process to participate in the BSS after the scanning process is completed. Therefore, the mode I device can transmit the cooperation request frame to the mode II device / fixed device. Table 1 below shows an exemplary format of the cooperation request frame.

[0076]

[0077]

Table 1 above illustrates some examples of information that can be included in the cooperation request frame, and may include additional information.

[0078]

in an example of the present invention, the mode I device may further include device ID information in the cooperation request frame so that the mode II device / fixed device can confirm the device type of the mode I device.

As a result, the mode II device / fixed device confirms the device ID (for example, FCC ID, serial number, etc.) of the mode I device that requested the cooperation, and the mode I device is required for the TVWS operation. It can be determined whether or not

After confirming the device ID, the mode II device / fixed device can transmit a cooperation response frame to the mode I device.

[0079]

According to such an example of the present invention, after the cooperation process is completed, the operation after the cooperation process is simplified and the operation is simplified as compared with the method in which the mode I device provides the device ID to the mode II device / fixed device after the cooperation process is completed. Since the device that transmitted the cooperation request during the process can be identified, the efficiency, quickness, and accuracy of link setup can be improved.

[0080]

FIG. 6B is a diagram illustrating an exemplary format of the device ID.

[0081]

The device type field indicates whether the device that transmits the cooperation request is a mode I device, a mode II device, or a fixed device.

The FCC ID corresponds to a device ID value assigned by a regulatory administrator to which a device that transmits a cooperation request belongs.

The FCC ID field is a value corresponding to a device ID assigned by a US regulatory administrator, and may be replaced with a field including appropriate device identification information in another regulatory domain. The device serial number field may include information on a serial number of a device that transmits the cooperation request (for example, an identification number assigned by a manufacturer).

[0082]

If the device that transmits the cooperation request frame is a mode II device / fixed device, the link setup process may be completed only by the cooperation request / response process. This is because the Mode II device / fixed device already has an available channel list (eg, WSM) accessing the GDB and does not need to be controlled by other Mode II devices / fixed devices. . That is, if the mode II device performs link setup, the link setup process may be completed in step S540.

**[0083]**

On the other hand, if the device that transmits the cooperation request frame is a mode I device, a security setup process is performed in step S550 after the cooperation request / response process is successfully completed. The security setup may include, for example, a process of performing a private key setup by 4-way handshaking through an EAPOL (Extensible Authentication Protocol over LAN) frame.

**[0084]**

There must be a security setup between the Mode II device / fixed device and the Mode I device. This is because when the mode II device / fixed device transmits the WSM to the mode I device, integrity check or the like is required.

**[0085]**

In step S560, the mode I device transmits a channel availability request frame (or a channel availability query (CAQ) request frame) to the mode II device / fixed device after the security setup is completed. A list of available channels (eg, WSM) can then be requested. A mode II device / fixed device can provide an available channel list (eg, WSM) by sending a channel availability response frame (or CAQ response frame) to the mode I device.

**[0086]**

FIG. 6C shows an exemplary format of the channel availability request frame, and FIG. 6D shows an exemplary format of the channel availability response frame.

**[0087]**

The category field indicates the classification to which the frame belongs.

In this example, the category field can be set to a value indicating an action frame to which a channel availability request / response belongs. The action field indicates what operation the frame is related to. In this example, the action field can be set to a specific value for a channel availability request / response. The dialog token field functions to match an action response with an action request, and can be used when a plurality of action requests exist at the same time. The dialog token field may include a value set by a requesting STA (eg, a mode I device).

**[0088]**

Through the channel availability response frame, the mode I device can complete the link setup process with the mode II device / fixed device by receiving an available channel list (eg, WSM). When the link setup is completed, the mode I device can start mutual transmission / reception of data, control, management frames, etc. with the mode II device / fixed device.

**[0089]**

After the link setup, as shown in step S570, the mode I device can periodically receive a CVS (Contact Verification Signal) from the mode II device / fixed device. The CVS can have a function of effectively maintaining the link setup state.

**[0090]**

Further, as in the exemplary format of the CVS frame shown in FIG. 6E, the CVS transmitted from the mode II device / fixed device includes the WSM map ID of the mode II device / fixed device. Can do. As a result, the mode I device can periodically

check the currently valid channel, and can determine that the WSM not indicated by the map ID of the CVS is not valid. In other words, when the mode I device receives the CVS frame, the channel availability request frame is transmitted to the mode II device / fixed device by comparing with the WSM map ID that the mode I device has, and a new available channel is transmitted. A list (eg, WSM) can be requested.

[0091]

In the above-described embodiment of the present invention, the method for executing / supporting efficient and quick link setup by the type of equipment operating in the white space has been described. By performing such a link setup, the mode I device can participate in the BSS under the control of the mode II device / fixed device. Hereinafter, an example of the present invention relating to a method in which a mode II device / fixed device configuring a BSS provides information necessary for operation in the BSS will be described.

[0092]

(BSS Operation Information) The operation of a STA (or mode I device) in a certain BSS is controlled by information (for example, an operation information element) necessary for the operation in the BSS. This operation information element can specify an operation parameter to be applied depending on the device type. This operational information can be transmitted through the beacon frame, probe response frame or other form of frame by the AP (or mode II device / fixed device) that configured the BSS.

[0093]

FIG. 7 is a diagram showing a format of the operation information element. The operation information element in FIG. 7 can also be referred to as a TVWS operation information element in the sense that it includes parameters related to the operation in TVWS. In addition, it can also be referred to as a TVHT operation information element in the sense that it includes parameters related to operation in a high yield (HT) BSS in TVWS. Hereinafter, for convenience, it will be referred to as an operation information element or an operation element.

[0094]

In FIG. 7, an element ID field may have a predetermined value that is predetermined for the motion information element. The length field may have a value corresponding to the length of the subsequent field. The operation information (Operation information) field includes information such as a bandwidth and a center frequency regarding the operation channel, and see Table 2 for specific contents regarding the subfield (subfield) of the operation information field. Will be described later. The basic MCS set field may have a value corresponding to a modulation and coding scheme (MCS) supported by all STAs in the BSS.

[0095]

With reference to Table 2 below, the format of the operation information field in FIG. 7 and the contents of the subfields will be described. The operation information field in FIG. 7 can also be referred to as a TVWS operation information field or a TVHT operation information field.

[0096]

[0097]

[0098]

Prior to describing the specific contents of the operation information field shown in Table 2 above, terms for expressing the structure of the WLAN channel described in the present invention will be described.

[0099]

First, the operation channel of the BSS can be expressed as a WLAN channel, and a basic unit channel constituting the WLAN channel is defined as a bandwidth of W MHz size.

in the following description, a basic unit channel is referred to as a "W channel".

The WLAN channel can be composed of one W channel or a plurality of W channels.

A plurality of W channels may be positioned continuously on the frequency axis, or may be positioned non-continuously. A segment is composed of one W channel or a plurality of continuous W channels.

**[0100]**

A primary channel is a channel that is basically used for transmission of a data unit (for example, PPDU (Physical Layer Convergence Procedure (PLCP) Protocol Data Unit)), and is a basic channel such as a beacon. Can be used for signal transmission. The primary channel may correspond to one W channel or may correspond to two consecutive W channels (that is, 2W channels). On the other hand, the secondary channel means a channel other than the primary channel.

**[0101]**

in Table 2 above, the Primary Channel Width subfield indicates the bandwidth of the primary channel. Since the bandwidth of the TV channel varies from country to country, the width of the primary channel among the WLAN operation channels defined by TVWS can be defined to differ from country to country. Therefore, in order for the STA to operate correctly in the BSS, it is necessary to inform the width of the primary channel. Table 2 above illustrates that the primary channel has a width of W MHz and the value of W is any one of 6, 7 or 8 MHz.

**[0102]**

The channel width subfield of Table 2 indicates the channel bandwidth of the operation channel supported by the BSS. In the case of TVWS, the available channels do not necessarily exist continuously on the frequency axis. Therefore, the WLAN operation channel in TVWS must support both continuous and discontinuous structures.

**[0103]**

FIG. 8 is a diagram illustrating an exemplary form of a WLAN operation channel in TVWS.

**[0104]**

As exemplarily shown in FIG. 8 and Table 2 above, the operation channel supported by the BSS can have the following five forms of structure.

The first example is a case where the operation channel is composed of one W channel, which can be expressed as "W operation channel width" (FIG. 8A). The second example is a case where the operation channel is composed of two continuous W channels, which can be expressed as "2W operation channel width" (FIG. 8B). The third example is a case where the operation channel is composed of two discontinuous W channels, which can be expressed as "W + W operation channel width" (FIG. 8C). The fourth example is a case where the operation channel is composed of four consecutive W channels, which can be expressed as "4 W operation channel width" (FIG. 8D). The fifth example is a case where the operating channel is composed of two discontinuous frequency units (that is, segments) and each frequency unit is composed of two consecutive W channels. It can be expressed as "2W + 2W operation channel width" (FIG. 8E).

**[0105]**

Based on the above channel width subfield, the following PPDU transmission rule can be applied.

**[0106]**

The first example of the PPDU transmission rule can be defined as shown in Table 3 below.

[0107]

[0108]

A second example of the PPDU transmission rule can be defined as shown in Table 4 below.

[0109]

[0110]

In the above first and second PPDU transmission rules, 2 W MHz PPDU transmission or W + W MHz PPDU transmission is permitted in BSS supporting 4 W operation channel width and BSS supporting 2 W + 2 W operation channel width. It is different in that.

It is preferable to select the first PPDU transmission rule (that is, the rule of Table 3 above) when there are many continuous channels in the available channels, and the second PPDU transmission rule when there are many discontinuous channels. It is preferable to select (that is, the rules in Table 4 above).

[0111]

As described above, there are multiple allowed PPDU transmissions for 2W, W + W, 4W, 2W + 2W operating channel widths.

It is required to clearly determine which type of PPDU is used.

The present invention proposes a method for determining the PPDU type (ie, the allowable PPDU transmission type) based on the operation channel width and PPDU bandwidth supported by the BSS.

[0112]

First, the PPDU may include a PLCP preamble field, a PLCP header field, and a data field.

The PLCP preamble field includes a training field and the like.

The PLCP header field includes a SIG (Signal) field and the like. The data field includes PSDU and the like. Here, the SIG field included in the PLCP header field includes a BW (Bandwidth) field. The BW field is defined as a 2-bit size, and basically has a function indicating a PPDU bandwidth of X, 2X, 4X, or 8X / 4X + 4X (for example, X = 20 MHz).

[0113]

In addition, as described above, in TVWS, the BSS operation channel width is set in the form of W, 2W, W + W, 4W, or 2W + 2W based on the primary channel of W (= 6, 7 or 8 MHz), and each operation channel is set. The PPDU transmission allowed for the width can be set as shown in Table 3 or Table 4 above.

[0114]

In short, the PPDU bandwidth defined by the BW field in the SIG field of the PLCP header is defined as X, 2X, 4X, or 8X / 4X + 4X, but the operation channel can be supported by the BSS operating in TVWS. The bandwidth of PPDU transmission by width has the form of W, 2W, W + W, 4W or 2W + 2W.

That is, when the PPDU bandwidth defined by the BW field in the SIG field of the PLCP header is used as it is, the PPDU transmission bandwidth allowed by the BSS operation channel width in TVWS cannot be correctly indicated. For example, depending on the BW field in the SIG field of the PLCP header, a PPDU type such as X + X or 2X + 2X cannot be set.

[0115]

Therefore, in the present invention, based on the operation channel width supported by the BSS (ie, the value of the Channel

Width subfield of Table 2 above) and the PPDU bandwidth (ie, the value of the BW field in the SIG field of the PLCP header). A new method for determining the PPDU type is proposed.

[0116]

As a specific example, when the BW field of the SIG field is the first value (or 00), it can be defined that the PPDU type of the W MHz bandwidth is set.

In addition, when the BW field of the SIG field is the second value (or 01), it can be defined that the PPDU type of 2W or W + W MHz is set. In addition, when the BW field of the SIG field is the third value (or 10), it can be defined that the PPDU type of 4W or 2W + 2W MHz is set. This is summarized in Table 5 below.

[0117]

[0118]

As shown in Table 5 above, when the PPDU type according to the BW value of the SIG field is defined, the specific PPDU type (that is, the allowable PPDU transmission type) is clearly defined in consideration of the operation channel width supported by the BSS. Can be determined.

[0119]

For example, it is assumed that the PPDU transmission type allowed by the operation channel width as shown in Table 3 above and the PPDU type by the BW field as shown in Table 5 above are considered simultaneously.

In this case, when the operating channel width is W, only W MHz PPDU transmission is allowed, so BW is only relevant for the first value.

When the operating channel width is 2 W, W MHz or 2 W MHz PPDU transmission is allowed. If BW is the first value, it indicates W MHz PPDU transmission. If BW is the second value, 2 W MHz PPDU transmission ( Because W + W MHz PPDU transmission is not allowed with 2W operating channel width). When the operating channel width is W + W, W MHz or W + W MHz PPDU transmission is allowed. If BW is the first value, it indicates W MHz PPDU transmission, and if BW is the second value, W + W MHz PPDU transmission ( Because 2 W MHz PPDU transmission is not allowed with W + W operating channel width). When the operating channel width is 4 W, P MHz transmission of W MHz, 2 W MHz or 4 W MHz is allowed. If BW is the first value, it indicates W MHz PPDU transmission, and if BW is the second value, 2 W MHz Indicates PPDU transmission (because W + W MHz PPDU transmission is not allowed with 4W operating channel width) and if BW is the third value, 4W MHz PPDU transmission (because 2W + 2W MHz PPDU transmission is not allowed with 4W operating channel width) Indicates. When the operating channel width is 2W + 2W, P MHz transmission of W MHz, 2W MHz or 2W + 2W MHz is allowed, and if BW is the first value, it indicates W MHz PPDU transmission, and if BW is the second value, 2W MHz Indicates PPDU transmission (because W + W MHz PPDU transmission is not allowed with 2W + 2W operating channel width) and if BW is the third value, 2W + 2W MHz PPDU transmission (because 4W MHz PPDU transmission is not allowed with 2W + 2W operating channel width) Indicates. This is summarized in Table 6 below.

[0120]

[0121]

The present invention also includes a method for determining the PPDU type by the combination of Table 3 and Table 4 above.

This is summarized as shown in Table 7, and a detailed description thereof is omitted.

[0122]

[0123]

As shown in the examples of Table 6 and Table 7 above, the operating channel width supported by the BSS (ie, the value of the Channel Width subfield of Table 2 above) and the PPDU bandwidth (ie, in the SIG field of the PLCP header) The specific PPDU type allowed by the BSS supported operation channel width can be clearly indicated based on the value of the BW field), and the PPDU type in a form not shown in the existing BW field (eg, W + W or 2W + 2W) It can be clearly shown.

**[0124]**

On the other hand, unlike the example of Table 5 above, when all four states of the BW field in the SIG field of the PLCP header are used, a scheme indicating the PPDU type allowed by the operating channel width is It can be defined differently from the above example.

For example, when the BW field is the first value (or 00), it can be defined that the PPDU type of the W MHz bandwidth is set.

In addition, when the BW field is the second value (or 01), it can be defined that a 2 W MHz PPDU type is set. In addition, when the BW field of the SIG field is the third value (or 10), it can be defined that the PPDU type of 4W or 2W + 2W MHz is set. Further, when the BW field is the fourth value (or 11), it can be defined that a PPDU type of W + W MHz is set. This is summarized in Table 8 below.

**[0125]**

**[0126]**

In this case, unlike the examples in Table 3 and Table 4 above, the PPDU transmission allowed by the operating channel width can be defined as shown in Table 9 below.

**[0127]**

**[0128]**

In this case, based on the operating channel width supported by the BSS (ie, the value of the Channel Width subfield of Table 2 above) and the PPDU bandwidth (ie, the value of the BW field in the SIG field of the PLCP header), the BSS The specific PPDU types allowed by the supported operating channel width can be clearly indicated as in Table 10 below.

**[0129]**

**[0130]**

Referring back to Table 2 above, the Primary Channel Offset subfield indicates the position of the primary channel when the frequency segment bandwidth is 2 W MHz or 4 W MHz.

**[0131]**

For example, as illustrated in FIG. 8E, one frequency segment is defined as 2 W bandwidth, two frequency segments (frequency segments 0 and 1) are defined, and the primary channel is located in frequency segment 0. I can assume the case.

In this case, if the primary channel offset has a value of 0, the primary channel is located in the first W channel of frequency segment 0, and if the primary channel offset has a value of 1, the primary channel is the second W of frequency segment 0. It can be shown that it is located in a channel.

**[0132]**

As another example, as shown in FIG. 8D, when the primary channel exists in a frequency segment of 4 MHz bandwidth and the primary channel offset has a zero value, the primary channel is first in frequency segment 0. If the primary channel offset has a value of 1, the primary channel is located in the second W channel of frequency segment 0, and if the primary channel offset has a binary value, the primary channel is of frequency segment 0 If it is located in the third W channel and the primary

channel offset has a ternary value, it can indicate that the primary channel is located in the fourth W channel of frequency segment 0.

[0133]

The Secondary Channel Offset subfield of Table 2 indicates the relative position of the secondary channel with respect to the position of the primary channel.

When the secondary channel offset has a value of 1, the secondary channel is located at a higher frequency than the primary channel, and when the secondary channel offset has a value of 3, the secondary channel is located at a lower frequency than the primary channel. If the channel offset has a value of 0, it can indicate that there is no secondary channel.

[0134]

The channel center frequency segment 0 (Channel Center Frequency Segment 0) subfield of Table 2 indicates a channel center frequency value of the frequency segment 0.

Frequency segment 0 means a segment including a primary channel.

For example, when the operating channel width is W, 2W, or 4W MHz, since there is one frequency segment, the channel center frequency segment 0 subfield can indicate the center frequency of the frequency segment.

On the other hand, when the operation channel width is W + W or 2W + 2W MHz, since there are two frequency segments (frequency segments 0 and 1), the channel center frequency segment 0 subfield indicates the center frequency of frequency segment 0. be able to.

[0135]

The channel center frequency segment 1 (Channel Center Frequency Segment 1) subfield of Table 2 indicates a channel center frequency value of the frequency segment 1.

Since there is only one frequency segment (ie, frequency segment 0) in a continuous channel, the channel center frequency segment 1 subfield is defined only for discontinuous channels.

For example, since there are two frequency segments (frequency segments 0 and 1) when the operation channel width is W + W or 2W + 2W MHz, the channel center frequency segment 1 subfield may indicate the center frequency of the frequency segment 1 among them. it can.

[0136]

In Table 2 above, the Allowed Device Type subfield indicates whether each frequency segment is allowed to be used for each device type. Specifically, for each frequency segment, an allowed device type subfield may indicate whether a fixed device is allowed to be used or a P / P device is allowed to be used. For example, for an available channel adjacent to the TV channel, the use of a fixed device (for example, a device with high transmission power) is not permitted, but the use of a P / P device may be permitted. If the frequency segment 1 is adjacent to the TV channel, the use of a fixed device is not permitted, but the use of a P / P device may be permitted. Thus, the APs that make up the BSS can inform what type of equipment is allowed for each frequency segment.

[0137]

As described above, the bandwidth of the channel on which the BSS operates, the position on the frequency axis, whether or not each device can be used, depending on the subfields of the motion information field of Table 2 included in the motion information element of FIG. is defined. In addition, the PPDU types allowed in the operation channel can be clearly determined by the examples described in Tables 3 to 10 above.

[0138]

The matters described in the various embodiments of the present invention may be applied independently, or may be

implemented so that two or more embodiments are applied simultaneously.

[0139]

FIG. 9 is a block diagram illustrating a configuration of a wireless device according to an embodiment of the present invention.

[0140]

The AP 10 can include a processor 11, a memory 12, and a transceiver 13.

The STA 20 may include a processor 21, a memory 22, and a transceiver 23.

The transceivers 13 and 23 can transmit / receive wireless signals, and can implement a physical layer based on, for example, the IEEE 802 system. The processors 11 and 21 may be connected to the transceivers 13 and 21 to implement a physical layer and / or a MAC layer based on the IEEE 802 system. The processors 11 and 21 can be configured to perform the operations according to the above-described embodiments of the present invention. In addition, modules that implement the operations of the AP and the STA according to the embodiments of the present invention described above may be stored in the memories 12 and 22 and executed by the processors 11 and 21. The memories 12 and 22 may be included in the processors 11 and 21, or may be provided outside the processors 11 and 21 and connected to the processors 11 and 21 by known means.

[0141]

The specific configuration of such an apparatus may be implemented so that the matters described in the above-described embodiments of the present invention can be applied independently, or two or more can be applied simultaneously. Are omitted for clarity.

[0142]

The embodiments of the present invention described above can be implemented using various means.

For example, the embodiments of the present invention may be implemented by hardware, firmware, software, or a combination thereof.

[0143]

In the case of implementation by hardware, a method according to an embodiment of the present invention includes one or more ASICs (Application Specific Integrated Circuits), DSPs (Digital Signal Processing), DSPSs (Digital Signal Processing). Devices, FPGAs (Field Programmable Gate Arrays), processors, controllers, microcontrollers, microprocessors, and the like.

[0144]

In the case of implementation by firmware or software, the method according to the embodiment of the present invention may be implemented in the form of a module, procedure, function, or the like that performs the function or operation described above.

The software code may be stored in a memory unit and driven by a processor. The memory unit is provided inside or outside the processor, and can exchange data with the processor by various known means.

[0145]

The detailed description of the preferred embodiments of the present invention as described above is provided to enable those skilled in the art to implement and practice the present invention. Although the foregoing has been described with reference to preferred embodiments of the present invention, those skilled in the art will not depart from the spirit and scope of the invention as set forth in the appended claims. It will be understood that various modifications and variations of the present invention are possible within the scope. Accordingly, the present invention is not intended to be limited to the embodiments disclosed herein, but is intended to provide the widest scope consistent with the principles and novel features disclosed herein.

[0146]

The various embodiments of the present invention described above have been described centering on the IEEE 802.11 system, but can be similarly applied to various mobile communication systems.

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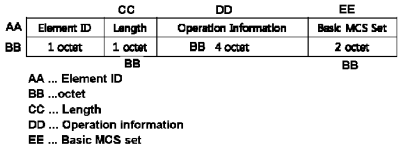
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(54)【発明の名称】無線通信システムにおいて動作チャネル情報を送受信する方法及び装置

(57)【要約】
本発明は、無線通信システムに関し、特に、動作チャネル情報を送受信する方法及び装置を提供する。本発明の一実施例に係るホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する方法は、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信するステップと、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ）　Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するステップと、を含み、前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される　。
【選択図】図７



【特許請求の範囲】
【請求項１】
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する方法であって、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信するステップと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するステップと、
を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ提供方法。
【請求項２】
前記チャネル幅は一つ以上のＷチャネルを含み、
前記チャネル幅サブフィールドの値は、
一つのＷチャネルに対する第１タイプチャネル幅、
２個の連続したＷチャネルに対する第２タイプチャネル幅、
２個の不連続したＷチャネルに対する第３タイプチャネル幅、
４個の連続したＷチャネルに対する第４タイプチャネル幅、又は
それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対する第５タイプチャネル幅
のうち一つを示す、請求項１に記載の動作パラメータ提供方法。
【請求項３】
前記チャネル幅サブフィールドが前記第１タイプチャネル幅を示し、前記ＢＷフィールドが第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項４】
前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応する、請求項３に記載の動作パラメータ提供方法。
【請求項５】
前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応する、請求項４に記載の動作パラメータ提供方法。
【請求項６】
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第３値を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応する、請求項５に記載の動作パラメータ提供方法。
【請求項７】
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィール

ドが前記第１値を示す場合に、前記ＰＰＤＵタイプは一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが第３値を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応する、請求項６に記載の動作パラメータ提供方法。
【請求項８】
前記ＢＷフィールドが第１値を有し、前記チャネル幅サブフィールドが第１、第２、第３、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項９】
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第２、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項１０】
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第３タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項１１】
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第４タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項１２】
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応する、請求項２に記載の動作パラメータ提供方法。
【請求項１３】
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する方法であって、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信するステップと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するステップと、
を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ受信方法。
【請求項１４】
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する装置であって、
他の機器との送受信を行うように構成された送受信器と、
前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕ

ｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ提供装置。
【請求項１５】
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する装置であって、
他の機器との送受信を行うように構成された送受信器と、
前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ受信装置。
【発明の詳細な説明】
【技術分野】
【０００１】
以下の説明は、無線通信システムに関し、特に、無線ＬＡＮシステムにおいて動作チャネル情報を送受信する方法及び装置に関する。
【背景技術】
【０００２】
無線ＬＡＮ（ｗｉｒｅｌｅｓｓ ｌｏｃａｌ ａｒｅａ ｎｅｔｗｏｒｋ；ＷＬＡＮ）技術の標準は、ＩＥＥＥ（Ｉｎｓｔｉｔｕｔｅ ｏｆ Ｅｌｅｃｔｒｉｃａｌ ａｎｄ Ｅｌｅｃｔｒｏｎｉｃｓ Ｅｎｇｉｎｅｅｒｓ）８０２．１１標準として開発されている。ＩＥＥＥ ８０２．１１ａ及びｂは、２．４ＧＨｚ又は５ＧＨｚで非免許帯域（ｕｎｌｉｃｅｎｓｅｄ ｂａｎｄ）を用い、ＩＥＥＥ ８０２．１１ｂは１１Ｍｂｐｓの伝送速度を提供し、ＩＥＥＥ ８０２．１１ａは５４Ｍｂｐｓの伝送速度を提供する。ＩＥＥＥ ８０２．１１ｇは、２．４ＧＨｚで直交周波数分割多重化（Ｏｒｔｈｏｇｏｎａｌ Ｆｒｅｑｕｅｎｃｙ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅｘｉｎｇ；ＯＦＤＭ）を適用し、５４Ｍｂｐｓの伝送速度を提供する。ＩＥＥＥ ８０２．１１ｎは、多重入出力ＯＦＤＭ（Ｍｕｌｔｉｐｌｅ Ｉｎｐｕｔ Ｍｕｌｔｉｐｌｅ Ｏｕｔｐｕｔ－ＯＦＤＭ；ＭＩＭＯ－ＯＦＤＭ）を適用し、４個の空間的なストリーム（ｓｐａｔｉａｌ ｓｔｒｅａｍ）に対して３００Ｍｂｐｓの伝送速度を提供する。ＩＥＥＥ ８０２．１１ｎではチャネル帯域幅（ｃｈａｎｎｅｌ ｂａｎｄｗｉｄｔｈ）を４０ＭＨｚまでサポートし、この場合には６００Ｍｂｐｓの伝送速度を提供する。
【０００３】
現在、ＴＶホワイトスペース（ＴＶ ｗｈｉｔｅｓｐａｃｅ、ＴＶＷＳ）帯域において非免許機器（ｕｎｌｉｃｅｎｓｅｄ ｄｅｖｉｃｅ）の動作を規定するためのＩＥＥＥ ８０２．１１ａｆ標準が開発されている。
【０００４】
ＴＶＷＳは、ＴＶ放送のために割り当てられたＶＨＦ（Ｖｅｒｙ Ｈｉｇｈ Ｆｒｅｑｕｅｎｃｙ）帯域（５４～６０、７６～８８、１７４～２１６ＭＨｚ）及びＵＨＦ（Ｕｌｔｒａ Ｈｉｇｈ Ｆｒｅｑｕｅｎｃｙ）帯域（４７０～６９８ＭＨｚ）を含み、この周波数帯域で動作する免許機器（ｌｉｃｅｎｓｅｄ ｄｅｖｉｃｅ；ＴＶ放送及び無線マイクなど）の通信を阻害しないという条件下で非免許機器に対して使用の許可された周波数

帯域を意味する。

【０００５】

５１２～６０８ＭＨｚ、６１４～６９８ＭＨｚでは、いくつかの特殊な場合を除いて全ての非免許機器に動作が許容されているが、５４～６０ＭＨｚ、７６～８８ＭＨｚ、１７４～２１６ＭＨｚ、４７０～５１２ＭＨｚ帯域は、固定型機器（ｆｉｘｅｄ　ｄｅｖｉｃｅ）間の通信にのみ許容されている。固定型機器とは、定められた位置でのみ送信を行う機器のことをいう。以下の説明においてホワイトスペース帯域は、上述のＴＶＷＳを含むが、これに限定されるものではない。

【０００６】

ホワイトスペース帯域を使用しようとする非免許機器は、免許機器に対する保護機能を提供しなければならない。そのため、ホワイトスペース帯域で送信を始める前には、免許機器が当該帯域を占有しているか否かを確認する必要がある。すなわち、ホワイトスペース帯域で免許機器が使用中でない場合に限って非免許機器の使用を許容することができる。

【０００７】

そのために、非免許機器はインターネット或いは専用回線を通じて地理的－位置データベース（Ｇｅｏ－ｌｏｃａｔｉｏｎ　ＤａｔａＢａｓｅ；ＧＤＢ）に接続し、該当の地域で使用可能なチャネルリスト（すなわち、使用可能なチャネルのセット）情報を取得しなければならない。ＧＤＢは、自身に登録された免許機器の情報と、これら免許機器の地理的位置及び使用時間に従って動的に変化するチャネル使用情報を保存して管理するデータベースである。また、ホワイトスペースを使用する非免許機器間の共存（ｃｏｅｘｉｓｔｅｎｃｅ）問題を解決するために、共通ビーコンフレーム（ｃｏｍｍｏｎ　ｂｅａｃｏｎ　ｆｒａｍｅ）などのようなシグナリングプロトコル及びスペクトルセンシングメカニズム（ｓｐｅｃｔｒｕｍ　ｓｅｎｓｉｎｇ　ｍｅｃｈａｎｉｓｍ）などを利用することができる。

【０００８】

ＩＥＥＥ　８０２．１１システムにおいて、ＴＶＷＳ端末とは、ＴＶＷＳスペクトルでＩＥＥＥ　８０２．１１ＭＡＣ（Ｍｅｄｉｕｍ　Ａｃｃｅｓｓ　Ｃｏｎｔｒｏｌ）層及びＰＨＹ（Ｐｈｙｓｉｃａｌ）層を用いて動作する非免許機器のことを指すことができる。本文書で、特に説明がない限り、ステーション（ＳＴＡ）は、ＴＶＷＳスペクトルで動作するＴＶＷＳ端末のことを指す。

【０００９】

ＳＴＡは、免許使用者（ＴＶ使用者及び無線マイクなど）を含めて優先接続の許容される使用者である優先的使用者（ｉｎｃｕｍｂｅｎｔ　ｕｓｅｒ）又はプライマリ使用者（ｐｒｉｍａｒｙ　ｕｓｅｒ）を保護する機能を提供しなければならない。すなわち、優先的使用者がＴＶＷＳを使用中であれば、ＳＴＡは、当該チャネルの使用を中断しなければならない。したがって、ＳＴＡは、非免許機器が使用できる可用チャネル（すなわち、免許機器が使用しないチャネル）を見つけ、可用チャネル（ａｖａｉｌａｂｌｅ　ｃｈａｎｎｅｌ）で動作しなければならない。

【００１０】

ＳＴＡが可用チャネルを見つけるための方法には、スペクトルセンシングメカニズムを行う方式、及びＧＤＢに接続してＴＶチャネルスケジュールを確認する方式などがある。スペクトルセンシングメカニズムとして、エネルギー検出（ｅｎｅｒｇｙ　ｄｅｔｅｃｔｉｏｎ）方式（受信信号の強度が一定値以上であれば、優先的使用者が使用中であると判断する方式）、特徴部検出（ｆｅａｔｕｒｅ　ｄｅｔｅｃｔｉｏｎ）方式（デジタルＴＶプリアンブル（Ｐｒｅａｍｂｌｅ）が検出されると、優先的使用者が使用中であると判断する方式）などを活用することができる。次に、ＳＴＡは、ＧＤＢに接続し、自身の位置情報に基づくＧＤＢ情報を取得し、当該位置で免許機器がチャネルを使用しているか否かを確認しなければならない。また、ＧＤＢへの接続及び情報取得は、免許機器を保護するのに充分な頻度で行わなければならない。

【００１１】
スペクトルセンシング方式又はＧＤＢから、現在使用中のチャネルに隣接しているチャネルで優先的使用者が使用中であることが判断されたとき、端末（又はＳＴＡ）と基地局（又はＡＰ（Ａｃｃｅｓｓ　Ｐｏｉｎｔ））は送信電力を下げる方式で優先的使用者を保護することができる。
【発明の概要】
【発明が解決しようとする課題】
【００１２】
ホワイトスペース帯域における可用チャネルは、周波数上で連続していないことがある。そのため、ホワイトスペース帯域チャネル構造として、既存の無線ＬＡＮチャネル構造をそのまま適用することはできない。ホワイトスペース帯域でＳＴＡが正しく動作するためには、ＡＰが構成する基本サービスセット（Ｂａｓｉｃ　Ｓｅｒｖｉｃｅ　Ｓｅｔ；ＢＳＳ）で支援するチャネル構造及び許容されるデータユニットタイプを知らなければならない。
【００１３】
本発明では、ＳＴＡに動作チャネルに関する情報を正確に且つ効率的に知らせる方案を提供することを技術的課題とする。
【００１４】
本発明で達成しようとする技術的課題は、以上に言及した技術的課題に制限されず、言及していない他の技術的課題は、下の記載から、本発明の属する技術の分野における通常の知識を有する者には明らかになるであろう。
【課題を解決するための手段】
【００１５】
上記の技術的課題を解決するために、本発明の一実施例に係る、ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する方法は、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信するステップと、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ）　Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するステップと、を含み、前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定されることを特徴とする。
【００１６】
上記の技術的課題を解決するために、本発明の他の実施例に係る、ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する方法は、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信するステップと、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ）　Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するステップと、を含み、前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定されることを特徴とする。
【００１７】
上記の技術的課題を解決するために、本発明の更に他の実施例に係る、ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する装置は、他の機器との送受信を行うように構成された送受信器と、前記送受信器を含む前記装置を制御するように構成されたプロセッサと、を備え、前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ）　Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するようにさらに構成され、前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、前記ＰＰＤＵのタイプは、前記チャネル幅下位フ

ィールド及び前記ＢＷフィールドに基づいて決定されることを特徴とする。

【００１８】

上記の技術的課題を解決するために、本発明の更に他の実施例に係る、ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する装置は、他の機器との送受信を行うように構成された送受信器と、前記送受信器を含む前記装置を制御するように構成されたプロセッサと、を備え、前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するようにさらに構成され、前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定されることを特徴とする。

【００１９】

上述の本発明の実施例において以下の事項を共通に適用することができる。

【００２０】

前記チャネル幅は一つ以上のＷチャネルを含み、前記チャネル幅サブフィールドの値は、一つのＷチャネルに対する第１タイプチャネル幅、２個の連続したＷチャネルに対する第２タイプチャネル幅、２個の不連続したＷチャネルに対する第３タイプチャネル幅、４個の連続したＷチャネルに対する第４タイプチャネル幅、又はそれぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対する第５タイプチャネル幅のうち一つを示すことができる。

【００２１】

前記チャネル幅サブフィールドが前記第１タイプチャネル幅を示し、前記ＢＷフィールドが第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応できる。

【００２２】

前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応してもよい。

【００２３】

前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応してもよい。

【００２４】

前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第３値を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応してもよい。

【００２５】

前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは一つのＷチャネルに対応し、前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが第

３値を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応してもよい。

【００２６】

前記ＢＷフィールドが第１値を有し、前記チャネル幅サブフィールドが第１、第２、第３、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応してもよい。

【００２７】

前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第２、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応してもよい。

【００２８】

前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第３タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応してもよい。

【００２９】

前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第４タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応してもよい。

【００３０】

前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応してもよい。

【００３１】

本発明について前述した一般的な説明と後述する詳細な説明は、例示的なもので、請求項に記載の発明に関するさらなる説明のためのものである。

【発明の効果】

【００３２】

本発明によれば、ＳＴＡに動作チャネルに関する情報を正確に且つ効率的に知らせる方法及び装置を提供することができる。

【００３３】

本発明から得られる効果は、以上に言及した効果に制限されず、言及していない他の効果は、下の記載から、本発明の属する技術の分野における通常の知識を有する者にとって明確に理解されるであろう。

【図面の簡単な説明】

【００３４】

本明細書に添付する図面は、本発明に関する理解を提供するためのもので、本発明の様々な実施の形態を示し、明細書の記載と共に本発明の原理を説明するためのものである。

【図１】図１は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの例示的な構造を示す図である。

【図２】図２は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの他の例示的な構造を示す図である。

【図３】図３は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの更に他の例示的な構造を示す図である。

【図４】図４は、ＷＬＡＮシステムの例示的な構造を示す図である。

【図５】図５は、本発明の一例に係る例示的なリンクセットアップ過程を説明するためのフローチャートである。

【図６】図６（ａ）は、ＷＳＭの一例を示す図である。図６（ｂ）は、機器ＩＤの例示的なフォーマットを示す図である。図６（ｃ）は、チャネル可用性要請フレームの例示的なフォーマットを示す図である。図６（ｄ）は、チャネル可用性応答フレームの例示的なフォーマットを示す図である。

【図７】図７は、動作情報要素のフォーマットを示す図である。
【図８】図８は、ＴＶＷＳにおいてＷＬＡＮ動作チャネルの例示的な形態を示す図である。
【図９】図９は、本発明の一実施例に係る無線装置の構成を示すブロック図である。
【発明を実施するための形態】
【００３５】
以下、本発明の好適な実施の形態を添付の図面を参照しつつ詳細に説明する。添付の図面と共に以下に開示される詳細な説明は、本発明の例示的な実施の形態を説明するためのもので、本発明を実施できる唯一の実施の形態を示すためのものではない。以下の詳細な説明は、本発明の完全な理解を提供するために具体的な細部事項を含む。しかし、このような具体的な細部事項なしにも本発明を実施できるということが当業者には理解される。
【００３６】
以下の諸実施例は、本発明の構成要素及び特徴を所定の形態で結合したものである。各構成要素又は特徴は、別の明示的な言及がない限り、選択的なものとして考慮すればいい。各構成要素又は特徴は、他の構成要素や特徴と結合しない形態で実施することもでき、一部の構成要素及び／又は特徴を結合して本発明の実施例を構成することもできる。本発明の実施例で説明する動作の順序は変更してもよい。ある実施例の一部構成や特徴は、他の実施例に含まれてもよく、又は他の実施例の対応する構成又は特徴に置き換えられてもよい。
【００３７】
以下の説明で使われる特定用語は、本発明の理解を助けるために提供されたものであり、このような特定用語の使用は、本発明の技術的思想から逸脱しない範囲で他の形態に変更してもよい。
【００３８】
場合によって、本発明の概念が曖昧になることを避けるために、公知の構造及び装置を省略したり、各構造及び装置の核心機能を中心にしたブロック図の形式で示す。また、本明細書全体を通じて同一の構成要素については同一の図面符号を使用して説明する。
【００３９】
本発明の実施例は、無線接続システムであるＩＥＥＥ　８０２システム、３ＧＰＰシステム、３ＧＰＰ　ＬＴＥ、ＬＴＥ－Ａ（ＬＴＥ－Ａｄｖａｎｃｅｄ）システム及び３ＧＰＰ２システムの少なくとも一つに開示された標準文書によってサポートできる。すなわち、本発明の実施例のうち、本発明の技術的思想を明確にするために説明を省いた段階又は部分は、上記文書によってサポートできる。また、本文書で開示している全ての用語は、上記の標準文書によって説明することができる。
【００４０】
以下の技術は、ＣＤＭＡ（Ｃｏｄｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）、ＦＤＭＡ（Ｆｒｅｑｕｅｎｃｙ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）、ＴＤＭＡ（Ｔｉｍｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）、ＯＦＤＭＡ（Ｏｒｔｈｏｇｏｎａｌ　Ｆｒｅｑｕｅｎｃｙ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）、ＳＣ－ＦＤＭＡ（Ｓｉｎｇｌｅ　Ｃａｒｒｉｅｒ　Ｆｒｅｑｕｅｎｃｙ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）などのような種々の無線接続システムに用いることができる。ＣＤＭＡは、ＵＴＲＡ（Ｕｎｉｖｅｒｓａｌ　Ｔｅｒｒｅｓｔｒｉａｌ　Ｒａｄｉｏ　Ａｃｃｅｓｓ）やＣＤＭＡ２０００のような無線技術（ｒａｄｉｏ　ｔｅｃｈｎｏｌｏｇｙ）によって実現することができる。ＴＤＭＡは、ＧＳＭ（登録商標）（Ｇｌｏｂａｌ　Ｓｙｓｔｅｍ　ｆｏｒ　Ｍｏｂｉｌｅ　ｃｏｍｍｕｎｉｃａｔｉｏｎｓ）／ＧＰＲＳ（Ｇｅｎｅｒａｌ　Ｐａｃｋｅｔ　Ｒａｄｉｏ　Ｓｅｒｖｉｃｅ）／ＥＤＧＥ（Ｅｎｈａｎｃｅｄ　Ｄａｔａ　Ｒａｔｅｓ　ｆｏｒ　ＧＳＭ（登録商標）　Ｅｖｏｌｕｔｉｏｎ）のような無線技術によって実現することができる。ＯＦＤＭＡは、ＩＥＥＥ　８０２．１１（Ｗｉ－Ｆｉ）、ＩＥＥＥ　８０２．１６（ＷｉＭＡＸ）、ＩＥＥＥ　８０２－２０、Ｅ－ＵＴＲＡ（Ｅｖｏｌｖｅｄ　ＵＴＲＡ）などの

ような無線技術によって実現することができる。明確性のため、以下ではＩＥＥＥ　８０２．１１システムを中心にして説明するが、本発明の技術的思想がこれに制限されるものではない。

【００４１】

図１は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの例示的な構造を示す図である。

【００４２】

ＩＥＥＥ　８０２．１１構造は、複数個の構成要素で構成することができ、これらの相互作用によって上位層に対してトランスペアレントなＳＴＡ移動性をサポートするＷＬＡＮを提供することができる。基本サービスセット（Ｂａｓｉｃ　Ｓｅｒｖｉｃｅ　Ｓｅｔ；ＢＳＳ）は、ＩＥＥＥ　８０２．１１　ＬＡＮにおける基本的な構成ブロックに該当してもよい。図１では、２個のＢＳＳ（ＢＳＳ１及びＢＳＳ２）が存在し、それぞれのＢＳＳのメンバーとして２個のＳＴＡが含まれる（ＳＴＡ１及びＳＴＡ２はＢＳＳ１に含まれて、ＳＴＡ３及びＳＴＡ４はＢＳＳ２に含まれる）例を示す。図１で、ＢＳＳを表す楕円は、当該ＢＳＳに含まれたＳＴＡが通信を維持するカバレッジ領域を表すものと理解してもよい。この領域をＢＳＡ（Ｂａｓｉｃ　Ｓｅｒｖｉｃｅ　Ａｒｅａ）と呼ぶことができる。ＳＴＡがＢＳＡ外に移動すると、当該ＢＳＡ内の他のＳＴＡとは直接通信できなくなる。

【００４３】

ＩＥＥＥ　８０２．１１　ＬＡＮにおいて最も基本的なタイプのＢＳＳは、独立したＢＳＳ（Ｉｎｄｅｐｅｎｄｅｎｔ　ＢＳＳ；ＩＢＳＳ）である。例えば、ＩＢＳＳは、２個のＳＴＡのみで構成された最小の形態を有することができる。また、最も単純な形態であるとともに、他の構成要素が省かれている図１のＢＳＳ（ＢＳＳ１又はＢＳＳ２）が、ＩＢＳＳの代表的な例示に該当するといえる。このような構成はＳＴＡが直接通信できる場合に可能である。また、このような形態のＬＡＮは、あらかじめ計画して構成するものではなく、必要な場合に構成できるものであって、これをアドホック（ａｄ－ｈｏｃ）ネットワークと呼ぶこともできる。

【００４４】

ＳＴＡがついたり切れたりすること、ＳＴＡがＢＳＳ領域に入ったりＢＳＳ領域から出たりすることによって、ＢＳＳでのＳＴＡのメンバーシップが動的に変更することがある。ＢＳＳのメンバーになるには、ＳＴＡは同期化過程を用いてＢＳＳにジョインすればよい。ＢＳＳベース構造の全てのサービスにアクセスするために、ＳＴＡはＢＳＳに連携されなければならない。このような連携（ａｓｓｏｃｉａｔｉｏｎ）は、動的に設定されてよく、分配システムサービス（Ｄｉｓｔｒｉｂｕｔｉｏｎ　Ｓｙｓｔｅｍ　Ｓｅｒｖｉｃｅ；ＤＳＳ）の利用を含むことができる。

【００４５】

図２は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの他の例示的な構造を示す図である。図２は、図１の構造において、分配システム（Ｄｉｓｔｒｉｂｕｔｉｏｎ　Ｓｙｓｔｅｍ；ＤＳ）、分配システム媒体（Ｄｉｓｔｒｉｂｕｔｉｏｎ　Ｓｙｓｔｅｍ　Ｍｅｄｉｕｍ；ＤＳＭ）、アクセスポイント（Ａｃｃｅｓｓ　Ｐｏｉｎｔ；ＡＰ）などの構成要素が追加された形態である。

【００４６】

ＬＡＮにおいて直接的なステーション－対－ステーションの距離はＰＨＹ性能によって制限されることがある。このような距離の限界で充分である場合もあるが、より遠い距離のステーション間の通信を必要とする場合もある。拡張されたカバレッジをサポートするために分配システム（ＤＳ）を構成することができる。

【００４７】

ＤＳは、ＢＳＳが相互連結される構造を意味する。具体的に、図１のようにＢＳＳが独立して存在する代わり、複数個のＢＳＳで構成されたネットワークの拡張された形態の構成要素としてＢＳＳが存在してもよい。

【００４８】
ＤＳは、論理的な概念であり、分配システム媒体（ＤＳＭ）の特性によって特定することができる。これに関し、ＩＥＥＥ　８０２．１１標準では無線媒体（Ｗｉｒｅｌｅｓｓ　Ｍｅｄｉｕｍ；ＷＭ）と分配システム媒体（ＤＳＭ）を論理的に区別している。それぞれの論理的媒体は、異なった目的のために用いられ、異なった構成要素によって用いられる。ＩＥＥＥ　８０２．１１標準の定義では、これらの媒体を同一のものと制限することもなければ、異なるものと制限することもない。このように複数個の媒体が論理的に異なるという点で、ＩＥＥＥ　８０２．１１　ＬＡＮ構造（ＤＳ構造又は他のネットワーク構造）の柔軟性を説明することができる。すなわち、ＩＥＥＥ　８０２．１１　ＬＡＮ構造は様々に具現することができ、それぞれの具現例の物理的な特性に応じて独立して当該ＬＡＮ構造を特定すればよい。

【００４９】
ＤＳは、複数個のＢＳＳのシームレス（ｓｅａｍｌｅｓｓ）統合を提供し、目的地へのアドレスを扱うのに必要な論理的サービスを提供することによって移動機器をサポートすることができる。

【００５０】
ＡＰは、連携されたＳＴＡに対してＷＭを通じてＤＳへのアクセスを可能にし、且つＳＴＡ機能性を有する個体を意味する。ＡＰを介してＢＳＳ及びＤＳ間のデータ移動を行うことができる。例えば、図２に示すＳＴＡ２及びＳＴＡ３は、ＳＴＡの機能性を有しながら、連携されたＳＴＡ（ＳＴＡ１及びＳＴＡ４）がＤＳへアクセスできるようにする機能を担う。また、全てのＡＰは基本的にＳＴＡに該当するため、全てのＡＰはアドレス可能な個体である。ＷＭ上での通信のためにＡＰによって用いられるアドレスとＤＳＭ上での通信のためにＡＰによって用いられるアドレスとが必ずしも同一である必要はない。

【００５１】
ＡＰに連携されたＳＴＡのうちの一つから該ＡＰのＳＴＡアドレスに送信されるデータは、常に非制御ポート（ｕｎｃｏｎｔｒｏｌｌｅｄ　ｐｏｒｔ）で受信し、ＩＥＥＥ　８０２．１Ｘポートアクセス個体によって処理することができる。また、制御ポート（ｃｏｎｔｒｏｌｌｅｄ　ｐｏｒｔ）が認証されると、送信データ（又はフレーム）をＤＳに伝達することができる。

【００５２】
図３は、本発明を適用することができるＩＥＥＥ　８０２．１１システムの更に他の例示的な構造を示す図である。図３では、図２の構造に更に広いカバレッジを提供するための拡張されたサービスセット（Ｅｘｔｅｎｄｅｄ　Ｓｅｒｖｉｃｅ　Ｓｅｔ；ＥＳＳ）を概念的に示している。

【００５３】
任意の（ａｒｂｉｔｒａｒｙ）大きさ及び複雑度を有する無線ネットワークをＤＳ及びＢＳＳで構成することができる。ＩＥＥＥ　８０２．１１システムでは、このような方式のネットワークをＥＳＳネットワークと呼ぶ。ＥＳＳは、一つのＤＳに接続されたＢＳＳの集合に該当するといえる。しかし、ＥＳＳはＤＳを含まない。ＥＳＳネットワークは、ＬＬＣ（Ｌｏｇｉｃａｌ　Ｌｉｎｋ　Ｃｏｎｔｒｏｌ）層でＩＢＳＳネットワークとして見える点に特徴がある。ＥＳＳに含まれるＳＴＡは互いに通信することができ、移動ＳＴＡは、ＬＬＣにトランスペアレントに、あるＢＳＳから他のＢＳＳへ（同じＥＳＳ内で）移動することができる。

【００５４】
ＩＥＥＥ　８０２．１１では、図３におけるＢＳＳ同士の相対的な物理的位置について何ら仮定しておらず、次のような形態が全て可能である。ＢＳＳ同士は部分的に重なってもよく、これは、連続したカバレッジを提供するために一般的に用いられる形態である。また、ＢＳＳ同士は物理的に接続していなくてもよく、論理的にはＢＳＳ間の距離に制限はない。また、ＢＳＳ同士は物理的に同一位置に置かれてもよく、これは、リダンダンシを提供するために用いることができる。また、一つ（又は一つ以上の）ＩＢＳＳ又はＥＳ

ＳネットワークがＳＳＳネットワークとして同一の空間に物理的に存在してもよい。これは、ＥＳＳネットワークが存在する位置にアドホックネットワークが動作する場合、異なった機関（ｏｒｇａｎｉｚａｔｉｏｎｓ）によって物理的に重なるＩＥＥＥ　８０２．１１ネットワークが構成される場合、又は同一位置で２つ以上の異なったアクセス及び保安政策が必要な場合などにおいてのＥＳＳネットワーク形態に該当するといえる。

【００５５】

図４は、ＷＬＡＮシステムの例示的な構造を示す図である。図４では、ＤＳを含む基盤構造ＢＳＳの一例が示されている。

【００５６】

図４の例示で、ＢＳＳ１及びＢＳＳ２がＥＳＳを構成している。ＷＬＡＮシステムにおいてＳＴＡはＩＥＥＥ　８０２．１１のＭＡＣ／ＰＨＹ規定に従って動作する機器である。ＳＴＡは、ＡＰ　ＳＴＡ及び非－ＡＰ（ｎｏｎ－ＡＰ）　ＳＴＡを含む。Ｎｏｎ－ＡＰ　ＳＴＡは、ラップトップコンピュータ、移動電話機のように一般的に使用者が直接扱う機器に該当する。図４の例示で、ＳＴＡ１、ＳＴＡ３、ＳＴＡ４はｎｏｎ－ＡＰ　ＳＴＡに該当し、ＳＴＡ２及びＳＴＡ５はＡＰ　ＳＴＡに該当する。

【００５７】

以下の説明で、ｎｏｎ－ＡＰ　ＳＴＡは、端末（ｔｅｒｍｉｎａｌ）、無線送受信ユニット（Ｗｉｒｅｌｅｓｓ　Ｔｒａｎｓｍｉｔ／Ｒｅｃｅｉｖｅ　Ｕｎｉｔ；ＷＴＲＵ）、使用者装置（Ｕｓｅｒ　Ｅｑｕｉｐｍｅｎｔ；ＵＥ）、移動局（Ｍｏｂｉｌｅ　Ｓｔａｔｉｏｎ；ＭＳ）、移動端末（Ｍｏｂｉｌｅ　Ｔｅｒｍｉｎａｌ）、移動加入者局（Ｍｏｂｉｌｅ　Ｓｕｂｓｃｒｉｂｅｒ　Ｓｔａｔｉｏｎ；ＭＳＳ）などと呼ぶこともできる。また、ＡＰは、他の無線通信分野における基地局（Ｂａｓｅ　Ｓｔａｔｉｏｎ；ＢＳ）、ノード－Ｂ（Ｎｏｄｅ－Ｂ）、発展したノード－Ｂ（ｅｖｏｌｖｅｄ　Ｎｏｄｅ－Ｂ；ｅＮＢ）、基底送受信システム（Ｂａｓｅ　Ｔｒａｎｓｃｅｉｖｅｒ　Ｓｙｓｔｅｍ；ＢＴＳ）、フェムト基地局（Ｆｅｍｔｏ　ＢＳ）などに対応する概念である。

【００５８】

（ホワイトスペースでの可用チャネル）

ホワイトスペースでＳＴＡが動作するためには、免許機器（又は、優先的使用者）に対する保護技法を優先的に提供しなければならない。そのため、ＳＴＡは、免許機器によって使用されておらず、非免許機器が使用できる可用チャネルを見つけ、該可用チャネル上で動作しなければならない。

【００５９】

ＳＴＡがホワイトスペース（例えば、ＴＶＷＳ）でのチャネル（例えば、ＴＶチャネル）可用性（ａｖａｉｌａｂｉｌｉｔｙ）を把握するには、スペクトルセンシングを行ったり、ＧＤＢに接続してＴＶチャネルスケジュールを確認したりすればよい。ＧＤＢ情報は、特定位置で免許機器の特定チャネルの使用スケジュール（すなわち、チャネル使用時間）などの情報を含むことができる。ＴＶチャネルの可用性を把握しようとするＳＴＡは、インターネットなどを介してＧＤＢに接続し、自身の位置情報に基づくＧＤＢ情報を取得しなければならないが、これは、免許機器を保護するのに充分の時間単位で行わなければならない。

【００６０】

本文書では、説明の便宜上、ＧＤＢから受信する可用チャネル及び周波数に関する情報をホワイトスペースマップ（Ｗｈｉｔｅ　Ｓｐａｃｅ　Ｍａｐ；ＷＳＭ）と呼ぶことができる。ＷＳＭは、ＳＴＡがＧＤＢから取得したチャネル及び周波数情報に基づき、ＴＶＷＳ帯域で非免許機器が使用できるチャネルに関する情報をマップの形態で作ったものである。ＷＳＭは、非免許機器が使用できる可用チャネルリスト又は周波数（ａｖａｉｌａｂｌｅ　ｃｈａｎｎｅｌ　ｌｉｓｔ　ｏｒ　ｆｒｅｑｕｅｎｃｉｅｓ）に関する情報を含むことができる。可用チャネルリストに含まれたチャネルは、法的に保護されるべき信号（又は、使用者）が使用していないチャネルであり、非免許機器がＧＤＢに接続した時点で

非免許機器が使用可能なチャネルである。又は、非免許機器がＧＤＢに接続した時点から特定時間以降からの使用可能チャネルに対する要請をした場合、当該時点から使用可能なチャネル及び周波数に関する情報を含むこともできる。他の実施例として、非免許機器がＧＤＢに可用チャネルに対する要請をした場合、非免許機器が使用できないチャネルをシグナリングすることによって、使用可能チャネル及び周波数に関する情報を伝達することもできる。

【００６１】

現在ＦＣＣ（Ｆｅｄｅｒａｌ Ｃｏｍｍｕｎｉｃａｔｉｏｎｓ Ｃｏｍｍｉｓｓｉｏｎ）のＴＶＷＳに対する規定（ｒｅｇｕｌａｔｉｏｎ）では、大きく、２種類の機器タイプを定義する。すなわち、小出力の個人が携帯できる個人用／携帯用機器（Ｐｅｒｓｏｎａｌ／Ｐｏｒｔａｂｌｅ Ｄｅｖｉｃｅ）、及び固定した位置で動作する大出力の固定した機器（Ｆｉｘｅｄ Ｄｅｖｉｃｅ）が定義される。固定した機器（Ｆｉｘｅｄ Ｄｅｖｉｃｅ）は固定したＳＴＡと呼ぶこともでき、個人用／携帯用（Ｐｅｒｓｏｎａｌ／Ｐｏｒｔａｂｌｅ）機器はＰ／Ｐ ＳＴＡと呼ぶこともできる。固定したＳＴＡ及びＰ／Ｐ ＳＴＡは両方ともＷＬＡＮシステムにおいて一般的なＳＴＡ（すなわち、ＳＴＡという用語は、ＡＰ及びｎｏｎ－ＡＰを含む）に該当する。これら２種類の機器がそれぞれＴＶＷＳで動作する時、それぞれには異なった動作規則（ｏｐｅｒａｔｉｏｎ ｒｕｌｅ）を適用することができる。固定した機器は、その位置が変わらない特定位置で信号を送／受信する。勿論、固定した機器も該当の位置で信号を伝送するためには、ＧＤＢに接続して可用チャネル情報を取得しなければならない。固定した機器は、ＧＰＳのような位置を確認できる装備が内蔵されていてもよく、又は設置者（ｉｎｓｔａｌｌｅｒ）によってその位置を人間が直接入力することによってその位置情報をＧＤＢに伝達してもよい。もちろん、位置を人間が直接入力する場合には、一度設置され、位置が入力されてからはその位置が変わらないということを前提とし、位置が変更される場合には、それに応じて位置も変更／登録しなければならない。固定した機器は、同種の他の固定した機器をサービスすることもでき、Ｐ／Ｐ機器をサービスすることもできる。固定した機器が可用チャネル情報をＧＤＢから取得する際には、必ず自身の機器タイプを伝達し、自身が直接使用できる自身の可用チャネル情報を受け取らなければならない。同時に、Ｐ／Ｐ機器のためのサービスをするためには、Ｐ／Ｐ機器が使用できる可用チャネル情報をＧＤＢから又はＧＤＢに接続されているプロキシ（ｐｒｏｘｙ）サーバーから更に受け取らなければならない。固定した機器とＰ／Ｐ機器が使用できるチャネル区間が異なり、それぞれの動作時に、最大許容送信電力と隣接チャネルに対する要求条件が異なるため、各機器タイプ別に可用チャネルリストが異なってくるからである。例えば、固定した機器は、５４～６０ＭＨｚ、７６～８８ＭＨｚ、１７４～２１６ＭＨｚ、４７０～５１２ＭＨｚ帯域の周波数区間に加え、５１２～６０８ＭＨｚ、６１４～６９８ＭＨｚ帯域の周波数区間でも信号伝送が許容される。一方、Ｐ／Ｐ機器は５１２～６０８ＭＨｚ、６１４～６９８ＭＨｚ帯域の周波数区間以外の周波数帯域のＴＶＷＳ帯域では信号伝送が許容されない。固定した機器はＰ／Ｐ機器よりも高い電力で信号を伝送でき、実効等方放射電力（Ｅｆｆｅｃｔｉｖｅ Ｉｓｏｔｒｏｐｉｃ Ｒａｄｉａｔｅｄ Ｐｏｗｅｒ；ＥＩＲＰ）として最大４Ｗａｔｔの送信電力が許容される。

【００６２】

Ｐ／Ｐ機器は、特定されていない位置で信号を送／受信できる装備であり、その位置が可変するという点に特徴がある。大部分の場合、人間が携帯できる装備であって、その移動性が予測できない。可用周波数帯域は５１２～６０８ＭＨｚ、６１４～６９８ＭＨｚの周波数区間であり、最大送信電力は１００ｍＷ（ＥＩＲＰ）である。Ｐ／Ｐ機器は、自身の位置に対する識別能力（ｉｄｅｎｔｉｆｉｃａｔｉｏｎ ｃａｐａｂｉｌｉｔｙ）、すなわち、地理的－位置決定能力（ｇｅｏ－ｌｏｃａｔｉｏｎ ｃａｐａｂｉｌｉｔｙ）及びインターネットアクセスを用いたＧＤＢへの接続能力を有しているか否かによって、モードＩＩ機器（Ｍｏｄｅ ＩＩ ｄｅｖｉｃｅ）とモードＩ機器（Ｍｏｄｅ Ｉ ｄｅｖｉｃｅ）の２種類に分類することができる。すなわち、モードＩＩ機器は、地理的－位置

決定能力及びインターネットアクセス能力を有し、ＧＤＢに接続して自身の位置での可用チャネルに関する情報を取得した後、当該位置でＴＶＷＳ上で動作することができる。また、モードＩＩ機器は、可用チャネル情報をＧＤＢから取得した後、モードＩ機器に通信を始めるように命令できる信号（例えば、イネーブル（ｅｎａｂｌｅ）信号）を伝送することによって、ネットワークを始めることができる。一方、モードＩ機器には地理的－位置決定能力やＧＤＢアクセス能力が要求されず、ＧＤＢにアクセスして有効な可用チャネル情報を有しているモードＩＩ機器又は固定した機器による制御によって動作することが要求される。モードＩＩ機器に該当するＰ／Ｐ機器は、他のＰ／Ｐ機器をサービスすることもでき、又は、固定した機器にサービスを提供することもできる。この場合、モードＩＩＰ／Ｐ機器は、固定した機器のための可用チャネル情報をＧＤＢから取得し、固定した機器に伝達すればよい。

【００６３】

一方、ＧＤＢは、ＤＴＶやマイクロホンなどの優先的使用者のチャネル使用スケジュール及び保護範囲（ｐｒｏｔｅｃｔｉｏｎ　ｃｏｎｔｏｕｒ）を考慮し、非免許機器が要請する位置での可用チャネル情報を計算して非免許機器に伝達すればよい。ＧＤＢで可用チャネル情報を計算する時に考慮するパラメータには、機器タイプ、動作しようとする位置、送信電力、及びスペクトルマスク（ｓｐｅｃｔｒｕｍ　ｍａｓｋ）などがある。ＦＣＣ規定では機器タイプによって、隣接チャネルを使用できるか否かが決定される。例えば、ＤＴＶが３０番チャネルで使用中の時、２９番及び３１番チャネルが空いていても、固定した機器は２９番及び３１番チャネルを使用できない反面、Ｐ／Ｐ機器はこれら両チャネルを使用することができる。これは、固定した機器の場合、送信電力が高いため、隣接チャネルへの干渉を誘発する可能性が高いからである。

【００６４】

以下では、説明の便宜上、ホワイトスペースの一例としてＴＶＷＳを挙げて本発明の例示について説明するが、本発明の範囲がこれに制限されるものではない。すなわち、本発明の範囲は、特定位置で使用可能なチャネルに関する情報を提供するＤＢによって制御される全てのホワイトスペースでの動作に適用される本発明の例示を含む。例えば、現時点ではホワイトスペースに該当しないが、将来、ホワイトスペースに該当すると期待される他の周波数帯域でも、ＧＤＢによって制御される非免許装備の動作が許容されると期待されており、これに適用される本発明の原理による例示も本発明の範囲に含まれるだろう。また、本発明では、説明の便宜上、現在最終規則が発表されたＴＶＷＳに関するＦＣＣ規則に基づいて本発明の原理について説明するが、本発明の範囲は、ＦＣＣ規則に基づくホワイトスペース帯域上での動作に制限されるものではなく、他の規則に従うホワイトスペース帯域上での本発明の原理による例示をも含む。

【００６５】

（ホワイトスペースにおけるリンクセットアップ）

この実施の形態は、ＴＶＷＳにおけるリンクセットアップ過程に関する。特に、モードＩ機器とモードＩＩ機器（又は、固定した機器）間のリンクセットアップのための具体的な例示について説明する。リンクセットアップは、ネットワーク発見（ｎｅｔｗｏｒｋ　ｄｉｓｃｏｖｅｒｙ）、認証（Ａｕｔｈｅｎｔｉｃａｔｉｏｎ）、連携（ａｓｓｏｃｉａｔｉｏｎ）などの過程で進行される。特に、ホワイトスペース帯域で動作するモードＩ機器の場合は、リンクセットアップ時に可用チャネル情報の取得過程が要求される。

【００６６】

図５は、本発明の一例に係る例示的なリンクセットアップ過程を説明するためのフローチャートである。

【００６７】

段階Ｓ５１０で、モードＩＩ機器又は固定した機器（以下では、モードＩＩ機器／固定した機器と表現する。）は、インターネットなどを通してＧＤＢにアクセスし、現在自身の位置で使用可能なチャネルリスト（例えば、ＷＳＭ）を取得することができる。モードＩＩ機器／固定した機器は、可用チャネルリストから特定チャネルを選択することができ

る。
【００６８】
段階Ｓ５２０で、モードＩＩ機器／固定した機器はビーコンを送信してＢＳＳを構成することができる。ビーコンフレームは送信側（例えば、モードＩＩ機器／固定した機器）の機器タイプなどを含むことができ、これによって、リンクセットアップが可能であることを受信側（例えば、モードＩ機器）に知らせることができる。また、ビーコンフレームには可用チャネルリストに関する情報などが含まれてもよい。また、ビーコンフレームは、周期的に送信することができる。
【００６９】
段階Ｓ５３０で、ＢＳＳに参加しようとするモードＩ機器は、ＴＶＷＳに対するスキャニング過程を行うことができる。仮に、モードＩ機器が現在自身の位置で使用可能なチャネルリストを知っていると、使用可能なチャネルリスト上のチャネルのみに対して受動的（ｐａｓｓｉｖｅ）又は能動的（ａｃｔｉｖｅ）スキャニングを行うことができる。
【００７０】
受動的スキャニングは、モードＩ機器がスキャニングチャネル上でモードＩＩ機器／固定した機器からのビーコン送信を聞く（ｌｉｓｔｅｎ）過程を意味する。能動的スキャニングは、モードＩ機器がスキャニングチャネル上でプローブ要請フレーム（ｐｒｏｂｅ ｒｅｑｕｅｓｔ ｆｒａｍｅ）を送信し、モードＩＩ機器／固定した機器からプローブ応答フレーム（ｐｒｏｂｅ ｒｅｓｐｏｎｓｅ ｆｒａｍｅ）を受信することを意味する。
【００７１】
モードＩＩ機器／固定した機器は、モードＩ機器のスキャニング負担を軽減するために、ビーコンフレーム、プローブ応答フレームなどに、使用可能なチャネルリストを含めることができる。本発明で、モードＩＩ機器／固定した機器がＧＤＢから取得した可用チャネルリストをＷＳＭと呼ぶことができる。
【００７２】
図６（ａ）は、ＷＳＭの一例を示す図である。
【００７３】
図６（ａ）の例示で、機器タイプ（ｄｅｖｉｃｅ ｔｙｐｅ）フィールドは、ＷＳＭを送信する端末がモードＩＩ機器か又は固定した機器かを示す。マップＩＤ（Ｍａｐ ＩＤ）フィールドは、可用チャネルリストのＩＤを示す。チャネル番号（Ｃｈａｎｎｅｌ Ｎｕｍｂｅｒ）フィールドは、ＴＶＷＳでモードＩＩ機器／固定した機器が使用可能なチャネル番号を示す。チャネル番号は、ＴＶチャネル番号、スペクトル範囲などで表現されるもので、周波数領域で可用チャネルを特定できる情報を意味する。最大電力レベル（Ｍａｘｉｍｕｍ Ｐｏｗｅｒ Ｌｅｖｅｌ）フィールドは、可用チャネルでモードＩＩ機器／固定した機器の最大送信電力を示す。有効時間（Ｖａｌｉｄ Ｔｉｍｅ）フィールドは、可用チャネルを持続して使用可能な期間を示す。有効時間フィールドは、必須ではなく選択的（ｏｐｔｉｏｎａｌ）に含まれてもよい。このようなＷＳＭは、ビーコンフレーム、プローブ応答フレーム、又は他の形態のフレームを通して送信することができる。また、図６（ａ）のＷＳＭのフォーマットは例示的なものに過ぎず、可用チャネルに関する情報を含む他の形態のＷＳＭが本発明の例示で適用されてもよい。
【００７４】
ここで、モードＩ機器がＢＳＳに参加するためには、モードＩＩ機器／固定した機器の制御を受けて動作しなければならない。そのため、モードＩ機器は、モードＩＩ機器／固定した機器とリンクセットアップを行わなければならない。
【００７５】
段階Ｓ５４０で、モードＩ機器は、スキャニング過程が完了した後、ＢＳＳに参加するために連携（ａｓｓｏｃｉａｔｉｏｎ）過程を行うことができる。そのために、モードＩ機器は、連携要請フレームをモードＩＩ機器／固定した機器に送信することができる。下記の表１に、連携要請フレームの例示的なフォーマットを示す。
【００７６】

【表１】

**【表１】**

| Order | Information | Notes |
|---|---|---|
| 1 | Capability | |
| 2 | Listen Interval | |
| 3 | SSID | |
| 4 | Supported rates | |
| 5 | Extended Supported Rates | The Extended Supported Rates element is present if there are more than eight supported rates, and it is optional otherwise. |
| 6 | Power Capability | The Power Capability element is present if dot11SpectrumManagementRequired is true or dot11RadioMeasurementActivated is true. |
| 7 | Supported Channels | The Supported Channels element is present if dot11SpectrumManagementRequired is true and dot11ExtendedChannelSwitchActivated is false. |
| 8 | RSN | The RSN element is present if dot11RSNAActivated is true. |
| 9 | QoS Capability | The QoS Capability element is present if dot11QosOption-Implemented is true. |

【００７７】

上記の表１は、連携要請フレームに含み得る情報の一部の例示を示すもので、更なる情報を含むこともできる。

【００７８】

本発明の例示では、モードＩＩ機器／固定した機器がモードＩ機器の機器タイプを確認できるように、モードＩ機器は連携要請フレームに機器ＩＤ（ｄｅｖｉｃｅ　ＩＤ）情報をさらに含めることができる。これによって、モードＩＩ機器／固定した機器は、連携を要請したモードＩ機器の機器ＩＤ（例えば、ＦＣＣ　ＩＤ、シリアル番号など）を確認し、当該モードＩ機器がＴＶＷＳ動作のために要求される規定を満たすか否か判断できる。機器ＩＤを確認した後、モードＩＩ機器／固定した機器は、連携応答フレームをモードＩ機器に送信することができる。

【００７９】

このような本発明の例示によれば、連携過程が全て完了した後にモードＩ機器がモードＩＩ機器／固定した機器に機器ＩＤを提供する方式に比べて、連携過程以降の動作が単純化し、連携過程中に連携要請を送信した機器を識別できるため、リンクセットアップの効率性、迅速性及び正確度を向上させることができる。

【００８０】

図６（ｂ）は、機器ＩＤの例示的なフォーマットを示す図である。

【００８１】

機器タイプフィールドは、連携要請を送信する機器がモードＩ機器か、モードＩＩ機器／固定した機器かを示す。ＦＣＣ　ＩＤは、連携要請を送信する機器の属する規制管理者（ｒｅｇｕｌａｔｏｒｙ　ａｄｍｉｎｉｓｔｒａｔｏｒ）によって割り当てられた機器ＩＤ値に該当する。ＦＣＣ　ＩＤフィールドは、米国の規制管理者によって割り当てられる機器ＩＤに該当する値であり、他の規制ドメインでの適切な機器識別情報を含むフィールドに置き換わってもよい。機器シリアル番号フィールドは、連携要請を送信する機器のシリアル番号（例えば、メーカー（ｍａｎｕｆａｃｔｕｒｅｒ）によって割り当てられる識別番号）に関する情報を含むことができる。

【００８２】

仮に、連携要請フレームを送信する機器がモードＩＩ機器／固定した機器であれば、リンクセットアップ過程は連携要請／応答過程だけで完了してもよい。これは、モードＩＩ機器／固定した機器はＧＤＢにアクセスして可用チャネルリスト（例えば、ＷＳＭ）を既

に有しており、他のモードＩＩ機器／固定した機器の制御を受ける必要がないためである。すなわち、モードＩＩ機器がリンクセットアップを行う場合は、段階Ｓ５４０でリンクセットアップ過程が完了してもよい。

【００８３】

一方、連携要請フレームを送信する機器がモードＩ機器である場合は、連携要請／応答過程が成功的に完了した後、段階Ｓ５５０で保安セットアップ（ｓｅｃｕｒｉｔｙ　ｓｅｔｕｐ）過程を行う。保安セットアップは、例えば、ＥＡＰＯＬ（Ｅｘｔｅｎｓｉｂｌｅ　Ａｕｔｈｅｎｔｉｃａｔｉｏｎ　Ｐｒｏｔｏｃｏｌ　ｏｖｅｒ　ＬＡＮ）フレームを通した４－ウェイハンドシェーキングによってプライベートキーセットアップ（ｐｒｉｖａｔｅ　ｋｅｙ　ｓｅｔｕｐ）をする過程を含むことができる。

【００８４】

モードＩＩ機器／固定した機器とモードＩ機器との間には保安セットアップが必ず行われなければならない。これは、モードＩＩ機器／固定した機器がモードＩ機器にＷＳＭを伝達する際に、完全性確認（ｉｎｔｅｇｒｉｔｙ　ｃｈｅｃｋ）などが要求されるためである。

【００８５】

段階Ｓ５６０で、モードＩ機器は、保安セットアップが完了した後に、モードＩＩ機器／固定した機器にチャネル可用性（Ｃｈａｎｎｅｌ　Ａｖａｉｌａｂｉｌｉｔｙ）要請フレーム（又は、チャネル可用性質疑（Ｃｈａｎｎｅｌ　Ａｖａｉｌａｂｉｌｉｔｙ　Ｑｕｅｒｙ；ＣＡＱ）要請フレーム）を送信して、使用可能なチャネルのリスト（例えば、ＷＳＭ）を要請することができる。モードＩＩ機器／固定した機器は、チャネル可用性応答フレーム（又は、ＣＡＱ応答フレーム）をモードＩ機器に送信することによって可用チャネルリスト（例えば、ＷＳＭ）を提供することができる。

【００８６】

図６（ｃ）にはチャネル可用性要請フレームの例示的なフォーマットを示し、図６（ｄ）にはチャネル可用性応答フレームの例示的なフォーマットを示す。

【００８７】

カテゴリフィールドは、当該フレームが属する分類を示す。この例示で、カテゴリフィールドは、チャネル可用性要請／応答の属するアクションフレームを示す値に設定することができる。アクションフィールドは、当該フレームがいかなる動作に関連しているかを示す。この例示で、アクションフィールドは、チャネル可用性要請／応答に対する特定値に設定することができる。ダイアローグトークンフィールドは、アクション応答とアクション要請をマッチングさせる機能を果たし、同時に複数のアクション要請が存在する場合に用いることができる。ダイアローグトークンフィールドは、要請ＳＴＡ（例えば、モードＩ機器）によって設定される値を含むことができる。

【００８８】

チャネル可用性応答フレームを通して、モードＩ機器は可用チャネルリスト（例えば、ＷＳＭ）を受信することによって、モードＩＩ機器／固定した機器とのリンクセットアップ過程を完了できる。リンクセットアップが完了すると、モードＩ機器はモードＩＩ機器／固定した機器とデータ、制御、管理フレームなどに関する相互送受信を開始することができる。

【００８９】

リンクセットアップ後には、段階Ｓ５７０に示すように、モードＩ機器はモードＩＩ機器／固定した機器からＣＶＳ（Ｃｏｎｔａｃｔ　Ｖｅｒｉｆｉｃａｔｉｏｎ　Ｓｉｇｎａｌ）を周期的に受信することができる。ＣＶＳは、リンクセットアップ状態を有効に維持する機能を持つことができる。

【００９０】

また、図６（ｅ）に示すＣＶＳフレームの例示的なフォーマットのように、モードＩＩ機器／固定した機器から送信されるＣＶＳは、モードＩＩ機器／固定した機器が有するＷＳＭのマップＩＤを含むことができる。これによって、モードＩ機器は、現在有効なチャ

ネルを周期的に確認することができ、ＣＶＳのマップＩＤで示されないＷＳＭは有効でないものと決定できる。すなわち、モードＩ機器がＣＶＳフレームを受信した場合、自身が有しているＷＳＭのマップＩＤと比較し、互いに異なると、チャネル可用性要請フレームをモードＩＩ機器／固定した機器に送信して新しい可用チャネルリスト（例えば、ＷＳＭ）を要請することができる。

【００９１】

前述した本発明の実施の形態では、ホワイトスペースで動作する機器のタイプによる効率的で迅速なリンクセットアップを実行／支援する方案について説明した。このようなリンクセットアップを行うことによって、モードＩ機器はモードＩＩ機器／固定した機器の制御を受けてＢＳＳに参加することができる。以下では、ＢＳＳを構成したモードＩＩ機器／固定した機器が、当該ＢＳＳでの動作に必要な情報を提供する方案に関する本発明の例示について説明する。

【００９２】

（ＢＳＳ動作情報）

あるＢＳＳでのＳＴＡ（又は、モードＩ機器）の動作は、当該ＢＳＳでの動作に必要な情報（例えば、動作情報要素）によって制御される。この動作情報要素は、機器タイプによって適用される動作パラメータを指定することができる。この動作情報は、ＢＳＳを構成したＡＰ（又は、モードＩＩ機器／固定した機器）によって、ビーコンフレーム、プローブ応答フレーム又は他の形態のフレームを通して送信することができる。

【００９３】

図７は、動作情報要素のフォーマットを示す図である。図７の動作情報要素は、ＴＶＷＳでの動作に関するパラメータを含む意味から、ＴＶＷＳ動作情報要素と呼ぶこともできる。また、ＴＶＷＳでの高収率（Ｈｉｇｈ　Ｔｈｒｏｕｇｈｐｕｔ；ＨＴ）ＢＳＳにおける動作に関するパラメータを含む意味から、ＴＶＨＴ動作情報要素と呼ぶこともできる。以下では、便宜上、動作情報要素又は動作要素と呼ぶものとする。

【００９４】

図７で、要素ＩＤ（Ｅｌｅｍｅｎｔ　ＩＤ）フィールドは、動作情報要素に対してあらかじめ定められた所定の値を有することができる。長さ（Ｌｅｎｇｔｈ）フィールドは、後続するフィールドの長さに該当する値を有することができる。動作情報（Ｏｐｅｒａｔｉｏｎ　Ｉｎｆｏｒｍａｔｉｏｎ）フィールドは、動作チャネルに関する帯域幅（ｂａｎｄｗｉｄｔｈ）及び中心周波数（ｃｅｎｔｅｒ　ｆｒｅｑｕｅｎｃｙ）などの情報を含み、動作情報フィールドのサブフィールド（ｓｕｂｆｉｅｌｄ）に関する具体的な内容は、表２を参照して後述する。基本ＭＣＳセット（Ｂａｓｉｃ　ＭＣＳ　Ｓｅｔ）フィールドは、ＢＳＳ内の全ＳＴＡによって支援されるＭＣＳ（Ｍｏｄｕｌａｔｉｏｎ　ａｎｄ　ｃｏｄｉｎｇ　ｓｃｈｅｍｅ）に該当する値を有することができる。

【００９５】

下記の表２を参照して、図７の動作情報フィールドのフォーマット及びサブフィールドの内容について説明する。図７の動作情報フィールドは、ＴＶＷＳ動作情報フィールド又はＴＶＨＴ動作情報フィールドと呼ぶこともできる。

【００９６】

【表２－１】
【表２】

| | |
|---|---|
| Primary Channel width<br>(2 bits) | Indicate the primary channel bandwidth (W).<br>Set to 0 for 6 MHz<br>Set to 1 for 7 MHz.<br>Set to 2 for 8 MHz.<br>The value 3 is reserved. |
| Channel Width<br>(3 bits) | Set to 0 for W operating channel width.<br>Set to 1 for 2W operating channel width.<br>Set to 2 for W+W operating channel width.<br>Set to 3 for 4W operating channel width.<br>Set to 4 for 2W+2W operating channel width.<br>Values in the range 5 to 7 are reserved. |
| Primary Channel Offset<br>(2bits) | Indicates the offset of the primary channel between the contiguous operating channel width.<br>Set to 0 if the first W MHz of the frequency segment 0 is the primary channel.<br>Set to 1 if the second W MHz of the frequency segment 0 is the primary channel.<br>Set to 2 if the third W MHz of the frequency segment 0 is the primary channel.<br>Set to 2 if the fourth W MHz of the frequency segment 0 is the primary channel. |

【００９７】

【表２－２】

| | |
|---|---|
| Secondary Channel offset (2bits) | Indicates the offset of the secondary channel relative to the primary channel.<br>Set to 1 (SCA) if the secondary channel is above the primary channel<br>Set to 3 (SCB) if the secondary channel is below the primary channel<br>Set to 0 (SCN) if no secondary channel is present<br>The value 2 is reserved |
| Channel Center Frequency Segment 0 (8 bits) | For W MHz or 2W MHz or 4W MHz operating channel width, indicates the channel center frequency index for the W MHz or 2W MHz or 4W MHz channel on which the TV White Space BSS operates.<br>For W+W MHz or 2W+2W MHz operating channel width, indicates the channel center frequency index for the W MHz or 2W MHz channel of frequency segment 0 on which the VHT BSS operates.<br>Reserved otherwise. |
| Channel Center Frequency Segment 1 (8 bits) | For an W+W MHz or 2W+2W MHz operating channel width, indicates the channel center frequency index of the W MHz or 2W MHz channel of frequency segment 1 on which the VHT BSS operates.<br>Reserved otherwise. |
| Allowed Device Type (8 bits) | Bit 0: Indicate that fixed device is allowd to use Channel Center Frequency Segment 0.<br>Bit 1: Indicate that peronal portable device is allowd to use Channel Center Frequency Segment 0.<br>Bit 2: Indicate that fixed device is allowd to use Channel Center Frequency Segment 1.<br>Bit 3: Indicate that peronal portable device is allowd to use Channel Center Frequency Segment 1.<br>Bit 4 – Bit 7: Reserved. |

【００９８】

上記の表２で示す動作情報フィールドの具体的な内容について説明するに先立ち、本発明で説明するＷＬＡＮチャネルの構造を表現するための用語について説明する。

【００９９】

まず、ＢＳＳの動作チャネルは、ＷＬＡＮチャネルと表現でき、ＷＬＡＮチャネルを構成する基本的な単位のチャネルは、Ｗ　ＭＨｚサイズの帯域幅と定義される。以下の説明

では、基本的な単位のチャネルを”Ｗチャネル”と称する。ＷＬＡＮチャネルは、一つのＷチャネル又は複数個のＷチャネルで構成することができる。複数個のＷチャネルが周波数軸上で連続して（ｃｏｎｔｉｇｕｏｕｓ）位置してもよく、不連続して（ｎｏｎ－ｃｏｎｔｉｇｕｏｕｓ）位置してもよい。セグメント（ｓｅｇｍｅｎｔ）は、一つのＷチャネル又は連続した複数個のＷチャネルで構成される。

【０１００】

また、プライマリチャネル（ｐｒｉｍａｒｙ　ｃｈａｎｎｅｌ）は、データユニット（例えば、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ）　Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ））の送信のために基本的に用いられるチャネルであって、ビーコンなどの基本的な信号送信のために使用可能である。プライマリチャネルは、一つのＷチャネルに対応してもよく、２個の連続したＷチャネル（すなわち、２Ｗチャネル）に対応してもよい。一方、セカンダリ（ｓｅｃｏｎｄａｒｙ）チャネルは、プライマリチャネル以外のチャネルを意味する。

【０１０１】

上記の表２で、プライマリチャネル幅（Ｐｒｉｍａｒｙ　Ｃｈａｎｎｅｌ　Ｗｉｄｔｈ）サブフィールドは、プライマリチャネルの帯域幅を示す。各国別にＴＶチャネルの帯域幅は異なっているため、ＴＶＷＳで定義されるＷＬＡＮ動作チャネルのうちプライマリチャネルの幅も国別に異なるように定義できる。したがって、ＢＳＳ内でＳＴＡが正しく動作するためには、プライマリチャネルの幅を知らせることが必要である。上記の表２では、プライマリチャネルがＷ　ＭＨｚの幅を有し、Ｗの値は６、７又は８ＭＨｚのいずれか一つであることを例示している。

【０１０２】

上記の表２のチャネル幅（Ｃｈａｎｎｅｌ　Ｗｉｄｔｈ）サブフィールドは、ＢＳＳが支援する動作チャネルのチャネル帯域幅を示す。ＴＶＷＳの場合、可用チャネルは周波数軸上で必ずしも連続して存在しない。そのため、ＴＶＷＳでのＷＬＡＮ動作チャネルは、連続した構造も、不連続した構造も支援しなければならない。

【０１０３】

図８は、ＴＶＷＳにおいてＷＬＡＮ動作チャネルの例示的な形態を示す図である。

【０１０４】

図８及び上記の表２で例示的に示すように、ＢＳＳが支援する動作チャネルは、次の５つの形態の構造を有することができる。第一の例示は、動作チャネルが一つのＷチャネルで構成される場合であり、これを”Ｗ動作チャネル幅”と表現できる（図８（ａ））。第二の例示は、動作チャネルが連続した２個のＷチャネルで構成される場合であり、これを”２Ｗ動作チャネル幅”と表現できる（図８（ｂ））。第三の例示は、動作チャネルが不連続した２個のＷチャネルで構成される場合であり、これを”Ｗ＋Ｗ動作チャネル幅”と表現できる（図８（ｃ））。第四の例示は、動作チャネルが連続した４個のＷチャネルで構成される場合であり、これを”４Ｗ動作チャネル幅”と表現できる（図８（ｄ））。第五の例示は、動作チャネルが不連続した２個の周波数単位（すなわち、セグメント）で構成されるとともに、それぞれの周波数単位が連続した２個のＷチャネルで構成される場合であり、これを”２Ｗ＋２Ｗ動作チャネル幅”と表現できる（図８（ｅ））。

【０１０５】

上記のチャネル幅サブフィールドに基づいて、次のＰＰＤＵ送信規則（ｔｒａｎｓｍｉｓｓｉｏｎ　ｒｕｌｅ）を適用することができる。

【０１０６】

ＰＰＤＵ送信規則の第一の例示は、次の表３のように定義できる。

【０１０７】

【表３】

**【表３】**

| 動作チャネル幅 | 許容されるＰＰＤＵ送信 |
|---|---|
| Ｗ | Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ | Ｗ ＭＨｚ又は２Ｗ ＭＨｚ ＰＰＤＵ送信 |
| Ｗ＋Ｗ | Ｗ ＭＨｚ又はＷ＋Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ４Ｗ | Ｗ ＭＨｚ、２Ｗ ＭＨｚ又は４Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ＋２Ｗ | Ｗ ＭＨｚ、２Ｗ ＭＨｚ又は２Ｗ＋２Ｗ ＭＨｚ ＰＰＤＵ送信 |

【０１０８】

ＰＰＤＵ送信規則の第二の例示は、次の表４のように定義できる。

【０１０９】

【表４】

**【表４】**

| 動作チャネル幅 | 許容されるＰＰＤＵ送信 |
|---|---|
| Ｗ | Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ | Ｗ ＭＨｚ又は２Ｗ ＭＨｚ ＰＰＤＵ送信 |
| Ｗ＋Ｗ | Ｗ ＭＨｚ又はＷ＋Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ４Ｗ | Ｗ ＭＨｚ、Ｗ＋Ｗ ＭＨｚ又は４Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ＋２Ｗ | Ｗ ＭＨｚ、Ｗ＋Ｗ ＭＨｚ又は２Ｗ＋２Ｗ ＭＨｚ ＰＰＤＵ送信 |

【０１１０】

上記の第一及び第二のＰＰＤＵ送信規則は、４Ｗ動作チャネル幅を支援するＢＳＳと２Ｗ＋２Ｗ動作チャネル幅を支援するＢＳＳにおいて、２Ｗ ＭＨｚ ＰＰＤＵ送信が許容されるか或いはＷ＋Ｗ ＭＨｚ ＰＰＤＵ送信が許容されるかという点で異なる。可用チャネルで連続したチャネルが多い場合には第一のＰＰＤＵ送信規則（すなわち、上記の表３の規則）を選択することが好ましく、不連続したチャネルが多い場合には、第二のＰＰＤＵ送信規則（すなわち、上記の表４の規則）を選択することが好ましい。

【０１１１】

前述した通り、２Ｗ、Ｗ＋Ｗ、４Ｗ、２Ｗ＋２Ｗ動作チャネル幅では、複数個の許容されるＰＰＤＵ送信が存在する。それらのうちどのタイプのＰＰＤＵが用いられるかを明確に決定することが要求される。本発明では、ＢＳＳが支援する動作チャネル幅及びＰＰＤＵ帯域幅に基づいてＰＰＤＵタイプ（すなわち、許容されるＰＰＤＵ送信タイプ）を決定する方案を提案する。

【０１１２】

まず、ＰＰＤＵは、ＰＬＣＰプリアンブルフィールド、ＰＬＣＰヘッダーフィールド及びデータフィールドを含むことができる。ＰＬＣＰプリアンブルフィールドは、トレーニングフィールド（ｔｒａｉｎｉｎｇ ｆｉｅｌｄ）などを含む。ＰＬＣＰヘッダーフィールドは、ＳＩＧ（Ｓｉｇｎａｌ）フィールドなどを含む。データフィールドはＰＳＤＵなどを含む。ここで、ＰＬＣＰヘッダーフィールドに含まれるＳＩＧフィールドは、ＢＷ（Ｂａｎｄｗｉｄｔｈ）フィールドを含む。ＢＷフィールドは２ビットサイズと定義され、基本的にはＸ、２Ｘ、４Ｘ又は８Ｘ／４Ｘ＋４ＸのＰＰＤＵ帯域幅を示す機能を持つ（例えば、Ｘ＝２０ＭＨｚ）。

【０１１３】

また、前述したように、ＴＶＷＳでは、Ｗ（＝６、７又は８ＭＨｚ）サイズのプライマリチャネルに基づいてＢＳＳ動作チャネル幅がＷ、２Ｗ、Ｗ＋Ｗ、４Ｗ又は２Ｗ＋２Ｗの形態に設定され、それぞれの動作チャネル幅に対して許容されるＰＰＤＵ送信は、上記の表３又は表４のように設定可能である。

【０１１４】

要するに、上記のＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドによって定

義されるＰＰＤＵ帯域幅は、Ｘ、２Ｘ、４Ｘ又は８Ｘ／４Ｘ＋４Ｘの形態と定義されるが、ＴＶＷＳで動作するＢＳＳで支援可能な動作チャネル幅によるＰＰＤＵ送信の帯域幅は、Ｗ、２Ｗ、Ｗ＋Ｗ、４Ｗ又は２Ｗ＋２Ｗの形態を有する。すなわち、上記のＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドによって定義されるＰＰＤＵ帯域幅をそのまま使用する場合に、ＴＶＷＳでのＢＳＳ動作チャネル幅によって許容されるＰＰＤＵ送信帯域幅を正しく示すことができない。例えば、ＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドによってはＸ＋Ｘ又は２Ｘ＋２Ｘのような形態のＰＰＤＵタイプを設定することができない。

【０１１５】

したがって、本発明では、ＢＳＳが支援する動作チャネル幅（すなわち、上記の表２のＣｈａｎｎｅｌ　Ｗｉｄｔｈサブフィールドの値）及びＰＰＤＵ帯域幅（すなわち、ＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドの値）に基づいてＰＰＤＵタイプを決定する新しい方案を提案する。

【０１１６】

具体的な例示として、ＳＩＧフィールドのＢＷフィールドが第１値（又は、００）である場合に、Ｗ　ＭＨｚ帯域幅のＰＰＤＵタイプが設定されると定義できる。また、ＳＩＧフィールドのＢＷフィールドが第２値（又は、０１）である場合に、２Ｗ又はＷ＋Ｗ　ＭＨｚのＰＰＤＵタイプが設定されると定義できる。また、ＳＩＧフィールドのＢＷフィールドが第３値（又は、１０）である場合に、４Ｗ又は２Ｗ＋２Ｗ　ＭＨｚのＰＰＤＵタイプが設定されると定義できる。これをまとめると、下記の表５の通りである。

【０１１７】

【表５】

**【表５】**

| ＳＩＧフィールドのＢＷ値 | ＰＰＤＵタイプ |
|---|---|
| 第１値 | Ｗ ＭＨｚ |
| 第２値 | ２Ｗ ＭＨｚ又はＷ＋Ｗ ＭＨｚ |
| 第３値 | ４Ｗ ＭＨｚ又は２Ｗ＋２Ｗ ＭＨｚ |

【０１１８】

上記の表５のように、ＳＩＧフィールドのＢＷ値によるＰＰＤＵタイプが定義される場合に、ＢＳＳで支援する動作チャネル幅を考慮すると、特定ＰＰＤＵタイプ（すなわち、許容されるＰＰＤＵ送信タイプ）を明確に決定することができる。

【０１１９】

例えば、上記の表３のような動作チャネル幅によって許容されるＰＰＤＵ送信のタイプと、上記の表５のようなＢＷフィールドによるＰＰＤＵタイプを同時に考慮することを仮定する。この場合、動作チャネル幅がＷのとき、Ｗ　ＭＨｚのＰＰＤＵ送信のみが許容されるため、ＢＷは第１値のみが関連する。動作チャネル幅が２Ｗのとき、Ｗ　ＭＨｚ又は２Ｗ　ＭＨｚのＰＰＤＵ送信が許容され、ＢＷが第１値であれば、Ｗ　ＭＨｚ　ＰＰＤＵ送信を示し、ＢＷが第２値であれば、２Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、Ｗ＋Ｗ　ＭＨｚ　ＰＰＤＵ送信は２Ｗ動作チャネル幅で許容されない）を示す。動作チャネル幅がＷ＋Ｗのとき、Ｗ　ＭＨｚ又はＷ＋Ｗ　ＭＨｚのＰＰＤＵ送信が許容され、ＢＷが第１値であれば、Ｗ　ＭＨｚ　ＰＰＤＵ送信を示し、ＢＷが第２値であれば、Ｗ＋Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、２Ｗ　ＭＨｚ　ＰＰＤＵ送信はＷ＋Ｗ動作チャネル幅で許容されない）を示す。動作チャネル幅が４Ｗのとき、Ｗ　ＭＨｚ、２Ｗ　ＭＨｚ又は４Ｗ　ＭＨｚのＰＰＤＵ送信が許容され、ＢＷが第１値であれば、Ｗ　ＭＨｚ　ＰＰＤＵ送信を示し、ＢＷが第２値であれば、２Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、Ｗ＋Ｗ　ＭＨｚ　ＰＰＤＵ送信は４Ｗ動作チャネル幅で許容されない）を示し、ＢＷが第３値であれば、４Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、２Ｗ＋２Ｗ　ＭＨｚ　ＰＰＤＵ送信は４Ｗ動作チャネル幅で許容されない）を示す。動作チャネル幅が２Ｗ＋２Ｗのとき、Ｗ　ＭＨｚ、２Ｗ　ＭＨｚ又は２Ｗ＋２Ｗ　ＭＨｚのＰＰＤＵ送信が許容され、ＢＷが第１値であれば、

Ｗ　ＭＨｚ　ＰＰＤＵ送信を示し、ＢＷが第２値であれば、２Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、Ｗ＋Ｗ　ＭＨｚ　ＰＰＤＵ送信は２Ｗ＋２Ｗ動作チャネル幅で許容されない）を示し、ＢＷが第３値であれば、２Ｗ＋２Ｗ　ＭＨｚ　ＰＰＤＵ送信（なぜなら、４Ｗ　ＭＨｚ　ＰＰＤＵ送信は２Ｗ＋２Ｗ動作チャネル幅で許容されない）を示す。これをまとめると、次の表６の通りである。

【０１２０】

【表６】

【表６】

| 動作チャネル幅 | ＳＩＧフィールドのＢＷ値 | ＰＰＤＵタイプ |
|---|---|---|
| Ｗ | 第１値 | Ｗ ＭＨｚ |
| ２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| Ｗ＋Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | Ｗ＋Ｗ ＭＨｚ |
| ４Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| | 第３値 | ４Ｗ ＭＨｚ |
| ２Ｗ＋２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| | 第３値 | ２Ｗ＋２Ｗ ＭＨｚ |

【０１２１】

また、本発明は、上記の表３及び表４の組合せによってＰＰＤＵタイプを決定する方案を含む。これをまとめると、表７の通りであり、その具体的な説明は省略する。

【０１２２】

【表７】

【表７】

| 動作チャネル幅 | ＳＩＧフィールドのＢＷ値 | ＰＰＤＵタイプ |
|---|---|---|
| Ｗ | 第１値 | Ｗ ＭＨｚ |
| ２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| Ｗ＋Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | Ｗ＋Ｗ ＭＨｚ |
| ４Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | Ｗ＋Ｗ ＭＨｚ |
| | 第３値 | ４Ｗ ＭＨｚ |
| ２Ｗ＋２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | Ｗ＋Ｗ ＭＨｚ |
| | 第３値 | ２Ｗ＋２Ｗ ＭＨｚ |

【０１２３】

上記の表６及び表７の例示に示すように、ＢＳＳが支援する動作チャネル幅（すなわち、上記の表２のＣｈａｎｎｅｌ　Ｗｉｄｔｈサブフィールドの値）及びＰＰＤＵ帯域幅（すなわち、ＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドの値）に基づいて、ＢＳＳが支援する動作チャネル幅によって許容される特定ＰＰＤＵタイプを明確に示すことができ、既存のＢＷフィールドで示されない形態（例えば、Ｗ＋Ｗ又は２Ｗ＋２Ｗ）のＰＰＤＵタイプを明確に示すことができる。

【０１２４】

一方、上記の表５の例示とは違い、上記ＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドの４個の状態（ｓｔａｔｅ）を全て用いる場合に、動作チャネル幅によって許

容されるＰＰＤＵタイプを示す方案を、上記の例示と異なるように定義することができる。例えば、ＢＷフィールドが第１値（又は、００）である場合に、Ｗ　ＭＨｚ帯域幅のＰＰＤＵタイプが設定されると定義できる。また、ＢＷフィールドが第２値（又は、０１）である場合に、２Ｗ　ＭＨｚのＰＰＤＵタイプが設定されると定義できる。また、ＳＩＧフィールドのＢＷフィールドが第３値（又は、１０）である場合に、４Ｗ又は２Ｗ＋２Ｗ　ＭＨｚのＰＰＤＵタイプが設定されると定義できる。また、ＢＷフィールドが第４値（又は、１１）である場合に、Ｗ＋Ｗ　ＭＨｚのＰＰＤＵタイプが設定されると定義できる。これをまとめると、下記の表８の通りである。

【０１２５】

【表８】

**【表８】**

| ＳＩＧフィールドのＢＷ値 | ＰＰＤＵタイプ |
|---|---|
| 第１値 | Ｗ ＭＨｚ |
| 第２値 | ２Ｗ ＭＨｚ |
| 第３値 | ４Ｗ ＭＨｚ又は２Ｗ＋２Ｗ ＭＨｚ |
| 第４値 | Ｗ＋Ｗ ＭＨｚ |

【０１２６】

この場合、上記の表３及び表４の例示とは違い、動作チャネル幅によって許容されるＰＰＤＵ送信を、次の表９のように定義できる。

【０１２７】

【表９】

**【表９】**

| 動作チャネル幅 | 許容されるＰＰＤＵ送信 |
|---|---|
| Ｗ | Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ | Ｗ ＭＨｚ又は２Ｗ ＭＨｚ ＰＰＤＵ送信 |
| Ｗ＋Ｗ | Ｗ ＭＨｚ又はＷ＋Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ４Ｗ | Ｗ ＭＨｚ、２Ｗ ＭＨｚ、Ｗ＋Ｗ ＭＨｚ又は４Ｗ ＭＨｚ ＰＰＤＵ送信 |
| ２Ｗ＋２Ｗ | Ｗ ＭＨｚ、２Ｗ ＭＨｚ、Ｗ＋Ｗ ＭＨｚ又は２Ｗ＋２Ｗ ＭＨｚ ＰＰＤＵ送信 |

【０１２８】

この場合、ＢＳＳが支援する動作チャネル幅（すなわち、上記の表２のＣｈａｎｎｅｌ　Ｗｉｄｔｈサブフィールドの値）及びＰＰＤＵ帯域幅（すなわち、ＰＬＣＰヘッダーのＳＩＧフィールド内のＢＷフィールドの値）に基づいて、ＢＳＳが支援する動作チャネル幅によって許容される特定ＰＰＤＵタイプを、下記の表１０のように明確に示すことができる。

【０１２９】

【表１０】

【表１０】

| 動作チャネル幅 | ＳＩＧフィールドのＢＷ値 | ＰＰＤＵタイプ |
|---|---|---|
| Ｗ | 第１値 | Ｗ ＭＨｚ |
| ２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| Ｗ＋Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | Ｗ＋Ｗ ＭＨｚ |
| ４Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| | 第３値 | ４Ｗ ＭＨｚ |
| | 第４値 | Ｗ＋Ｗ ＭＨｚ |
| ２Ｗ＋２Ｗ | 第１値 | Ｗ ＭＨｚ |
| | 第２値 | ２Ｗ ＭＨｚ |
| | 第３値 | ２Ｗ＋２Ｗ ＭＨｚ |
| | 第４値 | Ｗ＋Ｗ ＭＨｚ |

【０１３０】

上記の表２を再び参照すると、プライマリチャネルオフセット（Ｐｒｉｍａｒｙ　Ｃｈａｎｎｅｌ　Ｏｆｆｓｅｔ）サブフィールドは、周波数セグメントの帯域幅が２Ｗ　ＭＨｚ又は４Ｗ　ＭＨｚである場合にプライマリチャネルの位置を示す。

【０１３１】

例えば、図８（ｅ）の例示のように、一つの周波数セグメントが２Ｗ帯域幅と定義され、２個の周波数セグメント（周波数セグメント０及び１）が定義され、プライマリチャネルが周波数セグメント０に位置する場合を仮定できる。この場合、プライマリチャネルオフセットが０値を有すると、プライマリチャネルは周波数セグメント０の一番目のＷチャネルに位置し、プライマリチャネルオフセットが１値を有すると、プライマリチャネルは周波数セグメント０の二番目のＷチャネルに位置することを示すことができる。

【０１３２】

他の例示として、図８（ｄ）の例示のように、プライマリチャネルが４ＭＨｚ帯域幅の周波数セグメントに存在する場合に、プライマリチャネルオフセットが０値を有すると、プライマリチャネルは周波数セグメント０の一番目のＷチャネルに位置し、プライマリチャネルオフセットが１値を有すると、プライマリチャネルは周波数セグメント０の二番目のＷチャネルに位置し、プライマリチャネルオフセットが２値を有すると、プライマリチャネルは周波数セグメント０の三番目のＷチャネルに位置し、プライマリチャネルオフセットが３値を有すると、プライマリチャネルは周波数セグメント０の四番目のＷチャネルに位置することを示すことができる。

【０１３３】

上記の表２のセカンダリチャネルオフセット（Ｓｅｃｏｎｄａｒｙ　Ｃｈａｎｎｅｌ　Ｏｆｆｓｅｔ）サブフィールドは、プライマリチャネルの位置を基準にセカンダリチャネルの相対的な位置を示す。セカンダリチャネルオフセットが１値を有すると、セカンダリチャネルは、プライマリチャネルに比べて高い周波数に位置し、セカンダリチャネルオフセットが３値を有すると、セカンダリチャネルはプライマリチャネルに比べて低い周波数に位置し、セカンダリチャネルオフセットが０値を有すると、セカンダリチャネルが存在しないことを示すことができる。

【０１３４】

上記の表２のチャネル中心周波数セグメント０（Ｃｈａｎｎｅｌ　Ｃｅｎｔｅｒ　Ｆｒｅｑｕｅｎｃｙ　Ｓｅｇｍｅｎｔ　０）サブフィールドは、周波数セグメント０のチャネル中心周波数値を示す。周波数セグメント０は、プライマリチャネルを含むセグメントを意味する。例えば、動作チャネル幅がＷ、２Ｗ又は４Ｗ　ＭＨｚである場合は、一つの周

波数セグメントが存在するため、チャネル中心周波数セグメント０サブフィールドは、当該周波数セグメントの中心周波数を示すことができる。一方、動作チャネル幅がＷ＋Ｗ又は２Ｗ＋２Ｗ　ＭＨｚである場合は、２個の周波数セグメント（周波数セグメント０及び１）が存在するため、チャネル中心周波数セグメント０サブフィールドは、そのうち周波数セグメント０の中心周波数を示すことができる。

【０１３５】

上記の表２のチャネル中心周波数セグメント１（Ｃｈａｎｎｅｌ　Ｃｅｎｔｅｒ　Ｆｒｅｑｕｅｎｃｙ　Ｓｅｇｍｅｎｔ　１）サブフィールドは、周波数セグメント１のチャネル中心周波数値を示す。連続したチャネルでは一つの周波数セグメント（すなわち、周波数セグメント０）のみが存在するため、チャネル中心周波数セグメント１サブフィールドは、不連続したチャネルのみに対して定義される。例えば、動作チャネル幅がＷ＋Ｗ又は２Ｗ＋２Ｗ　ＭＨｚの場合に２個の周波数セグメント（周波数セグメント０及び１）が存在するため、チャネル中心周波数セグメント１サブフィールドは、そのうち周波数セグメント１の中心周波数を示すことができる。

【０１３６】

上記の表２で、許容される機器タイプ（Ａｌｌｏｗｅｄ　Ｄｅｖｉｃｅ　Ｔｙｐｅ）サブフィールドは、それぞれの周波数セグメントに対して、機器のタイプ別に使用が許容されるか否かを示す。具体的に、それぞれの周波数セグメントに対して、固定した機器の使用が許容されるか、又はＰ／Ｐ機器の使用が許容されるかを、許容される機器タイプサブフィールドで示すことができる。例えば、ＴＶチャネルに隣接した可用チャネルに対しては、固定した機器（例えば、送信電力の高い機器）の使用は許容されないが、Ｐ／Ｐ機器の使用は許容されることがある。仮に、周波数セグメント１がＴＶチャネルに隣接した場合には、固定した機器の使用は許容されないが、Ｐ／Ｐ機器の使用は許容されることがある。したがって、ＢＳＳを構成するＡＰは、それぞれの周波数セグメントに対していかなるタイプの機器の使用が許容されるかを知らせることができる。

【０１３７】

上記のように、図７の動作情報要素に含まれる上記表２の動作情報フィールドのサブフィールドによって、ＢＳＳが動作するチャネルの帯域幅、周波数軸上での位置、機器別に使用可能か否かなどが定義される。また、上記の表３乃至表１０で説明した例示によって、上記動作チャネルで許容されるＰＰＤＵタイプを明確に決定することができる。

【０１３８】

以上の本発明の様々な実施例で説明した事項は独立して適用されてもよく、２つ以上の実施例が同時に適用されるように具現されてもよい。

【０１３９】

図９は、本発明の一実施例に係る無線装置の構成を示すブロック図である。

【０１４０】

ＡＰ　１０は、プロセッサ１１、メモリー１２、送受信器１３を含むことができる。ＳＴＡ　２０はプロセッサ２１、メモリー２２、送受信器２３を含むことができる。送受信器１３，２３は、無線信号を送信／受信することができ、例えば、ＩＥＥＥ　８０２システムに基づく物理層を具現することができる。プロセッサ１１，２１は、送受信器１３，２１に接続し、ＩＥＥＥ　８０２システムに基づく物理層及び／又はＭＡＣ層を具現することができる。プロセッサ１１，２１は、上述した本発明の諸実施例に係る動作を行うように構成することができる。また、上述した本発明の諸実施例に係るＡＰ及びＳＴＡの動作を具現するモジュールはメモリー１２，２２に保存され、プロセッサ１１，２１によって実行されるようにすることができる。メモリー１２，２２は、プロセッサ１１，２１の内部に含まれてもよく、又はプロセッサ１１，２１の外部に設けられ、プロセッサ１１，２１に公知の手段によって接続されてもよい。

【０１４１】

このような装置の具体的な構成は、上述した本発明の諸実施例で説明した事項が独立的に適用されたり、又は２つ以上が同時に適用されるように具現すればよく、重複する内容

は明確性のために説明を省略する。

【０１４２】

上述した本発明の実施例は様々な手段を用いて具現することができる。例えば、本発明の実施例は、ハードウェア、ファームウェア（ｆｉｒｍｗａｒｅ）、ソフトウェア又はそれらの結合などによって具現することができる。

【０１４３】

ハードウェアによる具現の場合、本発明の実施例に係る方法は、一つ又はそれ以上のＡＳＩＣｓ（Ａｐｐｌｉｃａｔｉｏｎ Ｓｐｅｃｉｆｉｃ Ｉｎｔｅｇｒａｔｅｄ Ｃｉｒｃｕｉｔｓ）、ＤＳＰｓ（Ｄｉｇｉｔａｌ Ｓｉｇｎａｌ Ｐｒｏｃｅｓｓｏｒｓ）、ＤＳＰＤｓ（Ｄｉｇｉｔａｌ Ｓｉｇｎａｌ Ｐｒｏｃｅｓｓｉｎｇ Ｄｅｖｉｃｅｓ）、ＰＬＤｓ（Ｐｒｏｇｒａｍｍａｂｌｅ Ｌｏｇｉｃ Ｄｅｖｉｃｅｓ）、ＦＰＧＡｓ（Ｆｉｅｌｄ Ｐｒｏｇｒａｍｍａｂｌｅ Ｇａｔｅ Ａｒｒａｙｓ）、プロセッサ、コントローラ、マイクロコントローラ、マイクロプロセッサなどによって具現することができる。

【０１４４】

ファームウェアやソフトウェアによる具現の場合、本発明の実施例に係る方法は、以上で説明された機能又は動作を実行するモジュール、手順又は関数などの形態で具現することができる。ソフトウェアコードは、メモリーユニットに保存され、プロセッサによって駆動されてよい。メモリーユニットは、プロセッサの内部又は外部に設けられ、既に公知の様々な手段によってプロセッサとデータを交換することができる。

【０１４５】

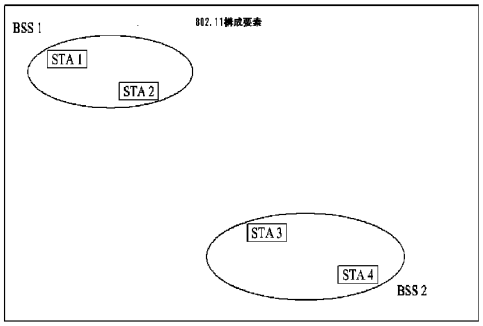
上述したような本発明の好適な実施の形態に関する詳細な説明は、当業者が本発明を具現して実施できるように提供された。上記では本発明の好適な実施の形態を参照して説明したが、当該技術の分野における熟練された当業者にとっては、添付の特許請求の範囲に記載された本発明の思想及び領域から逸脱しない範囲内で本発明の様々な修正及び変更が可能であるということが理解されるであろう。したがって、本発明は、ここに開示された実施の形態に制限しようとするものではなく、ここに開示された原理及び新規な特徴などと一致する最広の範囲を与えようとするものである。

【産業上の利用可能性】

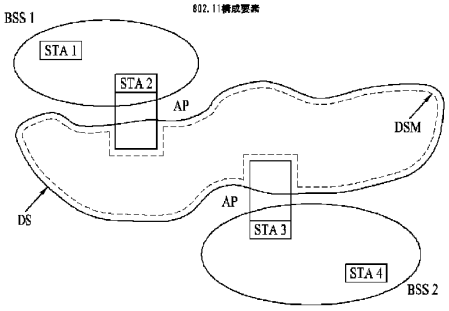
【０１４６】

上述した本発明の様々な実施の形態は、ＩＥＥＥ ８０２．１１システムを中心にして説明したが、様々な移動通信システムに同様の適用が可能である。

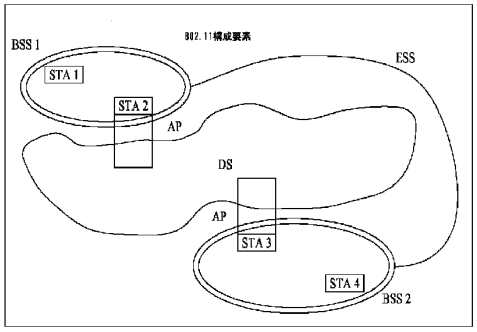
【図１】
[Fig. 1]



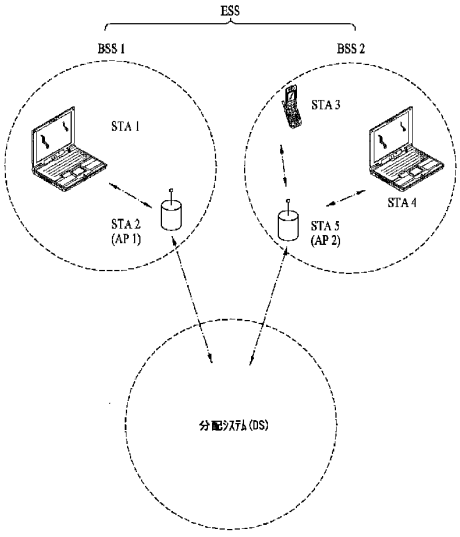

【図２】
[Fig. 2]



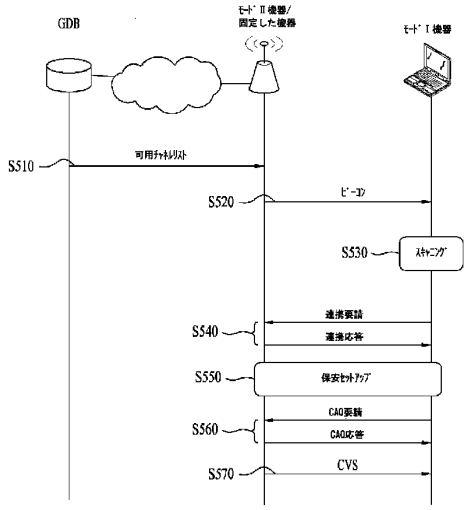

【図３】
[Fig. 3]



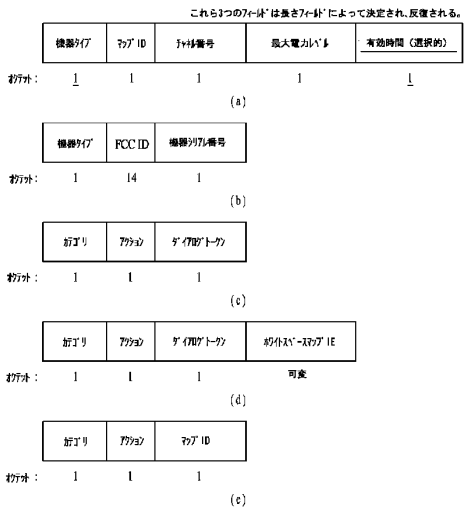

【図４】
[Fig. 4]



【図５】
[Fig. 5]




【図６】
[Fig. 6]



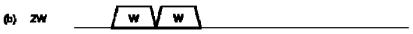

【図７】
[Fig. 7]

| 要素 ID | 長さ | 動作情報 | 基本MCSセット |
|---|---|---|---|
| 1 オクテット | 1 オクテット | 4 オクテット | 2 オクテット |

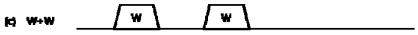
【図８（ａ）】



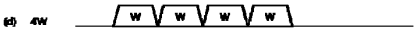

【図８（ｂ）】



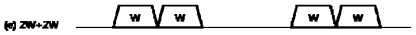

【図８（ｃ）】



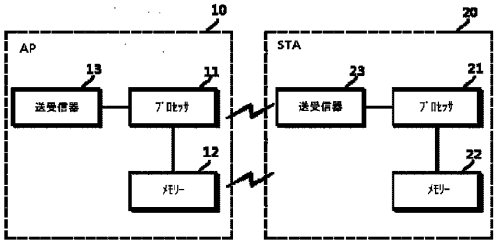

【図８（ｄ）】




【図８（ｅ）】




【図９】
[Fig. 9]



【手続補正書】
【提出日】平成26年12月17日(2014.12.17)
【手続補正１】
【補正対象書類名】特許請求の範囲
【補正対象項目名】全文
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する方法であって、前記方法は、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信することと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））のプリアンブル内のＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信することと、
を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅サブフィールド及び前記ＢＷフィールドに基づいて決定される、方法。
【請求項２】
前記チャネル幅サブフィールドの値は、
一つのＷチャネルに対する第１タイプ動作チャネル幅、
２個の連続したＷチャネルに対する第２タイプ動作チャネル幅、
２個の不連続のＷチャネルに対する第３タイプ動作チャネル幅、
４個の連続したＷチャネルに対する第４タイプ動作チャネル幅、又は
それぞれの周波数ブロックが２個の連続したＷチャネルを含む２個の不連続の周波数ブロックに対する第５タイプ動作チャネル幅
を示し、
前記Ｗチャネルは、基本的なチャネル単位を指す、請求項１に記載の方法。
【請求項３】
前記チャネル幅サブフィールド値が前記第１タイプ動作チャネル幅を示し、前記ＢＷフィールドが第１値を有する場合に、前記ＰＰＤＵタイプは、一つの周波数セグメントに対応する、請求項２に記載の方法。
【請求項４】
前記チャネル幅サブフィールド値が前記第２タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第１値を有する場合に、前記ＰＰＤＵタイプは、一つの周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第２タイプ動作チャネル幅を示し、前記ＢＷフィールドが第２値を有する場合に、前記ＰＰＤＵタイプは、２個の連続した周波数セグメントに対応する、請求項３に記載の方法。
【請求項５】
前記チャネル幅サブフィールド値が前記第３タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第１値を有する場合に、前記ＰＰＤＵタイプは、一つの周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第３タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第２値を有する場合に、前記ＰＰＤＵタイプは、２個の不連続の周波数セグメントに対応する、請求項４に記載の方法。
【請求項６】
前記チャネル幅サブフィールド値が前記第４タイプ動作チャネル幅を示し、前記ＢＷフ

ィールドが前記第１値を有する場合に、前記ＰＰＤＵタイプは、一つの周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第４タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第２値を有する場合に、前記ＰＰＤＵタイプは、２個の連続した周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第４タイプ動作チャネル幅を示し、前記ＢＷフィールドが第３値を有する場合に、前記ＰＰＤＵタイプは、４個の連続した周波数セグメントに対応する、請求項５に記載の方法。
【請求項７】
前記チャネル幅サブフィールド値が前記第５タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第１値を有する場合に、前記ＰＰＤＵタイプは一つの周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第５タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第２値を有する場合に、前記ＰＰＤＵタイプは、２個の連続した周波数セグメントに対応し、
前記チャネル幅サブフィールド値が前記第５タイプ動作チャネル幅を示し、前記ＢＷフィールドが前記第３値を有する場合に、前記ＰＰＤＵタイプは、それぞれの周波数単位が２個の連続した周波数セグメントを含む２個の不連続の周波数単位に対応する、請求項６に記載の方法。
【請求項８】
前記ＢＷフィールドが第１値を有し、前記チャネル幅サブフィールド値が前記第１、第２、第３、第４又は第５タイプのうちの１つの動作チャネル幅を示す場合に、前記ＰＰＤＵタイプは、一つの周波数セグメントに対応する、請求項２に記載の方法。
【請求項９】
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールド値が前記第２、第４又は第５タイプのうちの１つの動作チャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の連続した周波数セグメントに対応する、請求項２に記載の方法。
【請求項１０】
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールド値が前記第３タイプ動作チャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の不連続の周波数セグメントに対応する、請求項２に記載の方法。
【請求項１１】
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールド値が前記第４タイプ動作チャネル幅を示す場合に、前記ＰＰＤＵタイプは、４個の連続した周波数セグメントに対応する、請求項２に記載の方法。
【請求項１２】
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールド値が前記第５タイプ動作チャネル幅を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数単位が２個の連続した周波数セグメントを含む２個の不連続の周波数単位に対応する、請求項２に記載の方法。
【請求項１３】
非免許スペクトルにおいて動作するステーション（ＳＴＡ）に対する動作パラメータを受信する方法であって、前記方法は、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信することと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））のプリアンブル内のＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信することと、
を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、

前記ＰＰＤＵのタイプは、前記チャネル幅サブフィールド及び前記ＢＷフィールドに基づいて決定される、方法。
【請求項１４】
非免許スペクトルにおいて動作するステーション（ＳＴＡ）に対して動作パラメータを提供する装置であって、前記ステーションは、
他の機器との送受信を行うように構成された送受信器と、
前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を用いて、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））のプリアンブル内のＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅サブフィールド及び前記ＢＷフィールドに基づいて決定される、装置。
【請求項１５】
非免許スペクトルにおいて動作するステーション（ＳＴＡ）に対する動作パラメータを受信する装置であって、前記ステーションは、
他の機器との送受信を行うように構成された送受信器と、
前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を用いて、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））のプリアンブル内のＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅サブフィールド及び前記ＢＷフィールドに基づいて決定される、装置。

【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００３１
【補正方法】変更
【補正の内容】
【００３１】
本発明について前述した一般的な説明と後述する詳細な説明は、例示的なもので、請求項に記載の発明に関するさらなる説明のためのものである。
例えば、本願発明は以下の項目を提供する。
（項目１）
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する方法であって、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信するステップと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するステップと、

を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ提供方法。
（項目２）
前記チャネル幅は一つ以上のＷチャネルを含み、
前記チャネル幅サブフィールドの値は、
一つのＷチャネルに対する第１タイプチャネル幅、
２個の連続したＷチャネルに対する第２タイプチャネル幅、
２個の不連続したＷチャネルに対する第３タイプチャネル幅、
４個の連続したＷチャネルに対する第４タイプチャネル幅、又は
それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対する第５タイプチャネル幅
のうち一つを示す、項目１に記載の動作パラメータ提供方法。
（項目３）
前記チャネル幅サブフィールドが前記第１タイプチャネル幅を示し、前記ＢＷフィールドが第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応する、項目２に記載の動作パラメータ提供方法。
（項目４）
前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第２タイプチャネル幅を示し、前記ＢＷフィールドが第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応する、項目３に記載の動作パラメータ提供方法。
（項目５）
前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第３タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応する、項目４に記載の動作パラメータ提供方法。
（項目６）
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第４タイプチャネル幅を示し、前記ＢＷフィールドが前記第３値を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応する、項目５に記載の動作パラメータ提供方法。
（項目７）
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが前記第１値を示す場合に、前記ＰＰＤＵタイプは一つのＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが前記第２値を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応し、
前記チャネル幅サブフィールドが前記第５タイプチャネル幅を示し、前記ＢＷフィールドが第３値を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応する、項目６に記載の動作パラメータ提供方法。
（項目８）

前記ＢＷフィールドが第１値を有し、前記チャネル幅サブフィールドが第１、第２、第３、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、一つのＷチャネルに対応する、項目２に記載の動作パラメータ提供方法。
（項目９）
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第２、第４又は第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の連続したＷチャネルに対応する、項目２に記載の動作パラメータ提供方法。
（項目１０）
前記ＢＷフィールドが第２値を有し、前記チャネル幅サブフィールドが第３タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、２個の不連続したＷチャネルに対応する、項目２に記載の動作パラメータ提供方法。
（項目１１）
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第４タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、４個の連続したＷチャネルに対応する、項目２に記載の動作パラメータ提供方法。
（項目１２）
前記ＢＷフィールドが第３値を有し、前記チャネル幅サブフィールドが第５タイプチャネル幅を示す場合に、前記ＰＰＤＵタイプは、それぞれの周波数セグメントが２個の連続したＷチャネルを含む２個の不連続した周波数セグメントに対応する、項目２に記載の動作パラメータ提供方法。
（項目１３）
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する方法であって、
チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信するステップと、
ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するステップと、
を含み、
前記ＳＩＧフィールドは、ＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ受信方法。
（項目１４）
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対して動作パラメータを提供する装置であって、
他の機器との送受信を行うように構成された送受信器と、
前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを送信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを送信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ提供装置。
（項目１５）
ホワイトスペース帯域で動作するステーション（ＳＴＡ）に対する動作パラメータを受信する装置であって、
他の機器との送受信を行うように構成された送受信器と、

前記送受信器を含む前記装置を制御するように構成されたプロセッサと、
を備え、
前記プロセッサは、前記送受信器を介して、チャネル幅サブフィールドを含む動作情報フィールドを含むフレームを受信し、ＰＰＤＵ（Ｐｈｙｓｉｃａｌ ｌａｙｅｒ ｃｏｎｖｅｒｇｅｎｃｅ ｐｒｏｃｅｄｕｒｅ（ＰＬＣＰ） Ｐｒｏｔｏｃｏｌ Ｄａｔａ Ｕｎｉｔ））プリアンブルのＳＩＧ（Ｓｉｇｎａｌ）フィールドを受信するようにさらに構成され、
前記ＳＩＧフィールドはＢＷ（ＢａｎｄＷｉｄｔｈ）フィールドを含み、
前記ＰＰＤＵのタイプは、前記チャネル幅下位フィールド及び前記ＢＷフィールドに基づいて決定される、動作パラメータ受信装置。

【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】００３４
【補正方法】変更
【補正の内容】
【００３４】
本明細書に添付する図面は、本発明に関する理解を提供するためのもので、本発明の様々な実施の形態を示し、明細書の記載と共に本発明の原理を説明するためのものである。
【図１】図１は、本発明を適用することができるＩＥＥＥ ８０２．１１システムの例示的な構造を示す図である。
【図２】図２は、本発明を適用することができるＩＥＥＥ ８０２．１１システムの他の例示的な構造を示す図である。
【図３】図３は、本発明を適用することができるＩＥＥＥ ８０２．１１システムの更に他の例示的な構造を示す図である。
【図４】図４は、ＷＬＡＮシステムの例示的な構造を示す図である。
【図５】図５は、本発明の一例に係る例示的なリンクセットアップ過程を説明するためのフローチャートである。
【図６】図６（ａ）は、ＷＳＭの一例を示す図である。図６（ｂ）は、機器ＩＤの例示的なフォーマットを示す図である。図６（ｃ）は、チャネル可用性要請フレームの例示的なフォーマットを示す図である。図６（ｄ）は、チャネル可用性応答フレームの例示的なフォーマットを示す図である。図６（ｅ）は、ＣＶＳフレームの例示的なフォーマットを示す図である。
【図７】図７は、動作情報要素のフォーマットを示す図である。
【図８】図８は、ＴＶＷＳにおいてＷＬＡＮ動作チャネルの例示的な形態を示す図である。
【図９】図９は、本発明の一実施例に係る無線装置の構成を示すブロック図である。

【国際調査報告】

**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/KR2012/008433**

A. CLASSIFICATION OF SUBJECT MATTER

***H04B 7/26(2006.01)i, H04W 28/16(2009.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04B 7/26; H04W 28/16; H04B 7/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: wireless LAN, IEEE 802. 11 af standard, BSS, white space, PPDU, SIG, BW

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y<br>A | KR 10-2011-0093559 A (LG ELECTRONICS INC.) 18 August 2011<br>See claims 1-3; paragraphs [0001], [0013], [0026] and [0063]-[0074]; and figures 4-5 and 9. | 1,13-15<br>2-12 |
| Y<br>A | KR 10-2009-0124881 A (LG ELECTRONICS INC.) 03 December 2009<br>See claim 1; paragraphs [0012]-[0018], [0034]-[0042] and [0046]-[0050]; and figures 3-6. | 1,13-15<br>2-12 |
| A | JP 2012-060470 A (NATIONAL INSTITUTE OF INFORMATION & COMMUNICATION TECHNOLOGY) 22 March 2012<br>See claims 1-3; paragraphs [0007] and [0011]-[0014]; and figure 1. | 1-15 |
| A | WO 2011-112054 A2 (ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE) 15 September 2011<br>See claims 1-3; paragraphs [9]-[15]; and figure 25. | 1-15 |
| A | US 2012-0170563 A1 (ABRAHAM, Santosh Paul et al.) 05 July 2012<br>See paragraphs [0065]-[0068]; claim 1; and figures 4 and 7-8. | 1-15 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 27 FEBRUARY 2013 (27.02.2013) | **28 FEBRUARY 2013 (28.02.2013)** |
| Name and mailing address of the ISA/KR<br>Korean Intellectual Property Office<br>Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea<br>Facsimile No. 82-42-472-7140 | Authorized officer<br><br>Telephone No. |

Form PCT/ISA/210 (second sheet) (July 2009)

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
**PCT/KR2012/008433**

| Patent document cited in search report | Publication date | Patent family member | Publication date |
|---|---|---|---|
| KR 10-2011-0093559 A | 18.08.2011 | CA 2789315 A1 | 18.08.2011 |
| | | EP 2534769 A1 | 19.12.2012 |
| | | EP 2534919 A2 | 19.12.2012 |
| | | KR 10-2011-0085836 A | 27.07.2011 |
| | | KR 10-2011-0093566 A | 18.08.2011 |
| | | US 2011-0194542 A1 | 11.08.2011 |
| | | US 2012-0307685 A1 | 06.12.2012 |
| | | US 2012-0320856 A1 | 20.12.2012 |
| | | WO 2011-090257 A1 | 28.07.2011 |
| | | WO 2011-099687 A1 | 18.08.2011 |
| | | WO 2011-099729 A2 | 18.08.2011 |
| | | WO 2011-099729 A3 | 24.11.2011 |
| | | WO 2011-099791 A2 | 18.08.2011 |
| | | WO 2011-099791 A3 | 15.12.2011 |
| KR 10-2009-0124881 A | 03.12.2009 | EP 2281353 A2 | 09.02.2011 |
| | | US 2011-0075759 A1 | 31.03.2011 |
| | | WO 2009-145585 A2 | 03.12.2009 |
| | | WO 2009-145585 A3 | 11.03.2010 |
| JP 2012-060470 A | 22.03.2012 | NONE | |
| WO 2011-112054 A2 | 15.09.2011 | KR 10-1202197 B1 | 16.11.2012 |
| | | KR 10-2011-0103357 A | 20.09.2011 |
| | | US 2012-0213305 A1 | 23.08.2012 |
| | | WO 2011-112054 A3 | 23.02.2012 |
| US 2012-0170563 A1 | 05.07.2012 | WO 2012-094505 A1 | 12.07.2012 |

Form PCT/ISA/210 (patent family annex) (July 2009)

국제조사보고서

국제출원번호
**PCT/KR2012/008433**

**A.** 발명이 속하는 기술분류(국제특허분류(IPC))

***H04B 7/26(2006.01)i, H04W 28/16(2009.01)i***

**B.** 조사된 분야

조사된 최소문헌(국제특허분류를 기재)
H04B 7/26; H04W 28/16; H04B 7/02

조사된 기술분야에 속하는 최소문헌 이외의 문헌
한국등록실용신안공보 및 한국공개실용신안공보: 조사된 최소문헌란에 기재된 IPC
일본등록실용신안공보 및 일본공개실용신안공보: 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))
eKOMPASS(특허청 내부 검색시스템) & 키워드: 무선랜, IEEE 802.11 af 표준, BSS, 화이트스페이스, PPDU, SIG, BW

**C.** 관련 문헌

| 카테고리* | 인용문헌명 및 관련 구절(해당하는 경우)의 기재 | 관련 청구항 |
|---|---|---|
| Y | KR 10-2011-0093559 A (엘지전자 주식회사) 2011.08.18 | 1,13-15 |
| A | 청구항 1-3; 단락 [0001], [0013], [0026]과 [0063]-[0074]; 및 도면 4-5와 9 참조. | 2-12 |
| Y | KR 10-2009-0124881 A (엘지전자 주식회사) 2009.12.03 | 1,13-15 |
| A | 청구항 1; 단락 [0012]-[0018], [0034]-[0042]와 [0046]-[0050]; 및 도면 3-6 참조. | 2-12 |
| A | JP 2012-060470 A (NATIONAL INSTITUTE OF INFORMATION & COMMUNICATION TECHNOLOGY) 2012.03.22<br>청구항 1-3; 단락 [0007]과 [0011]-[0014]; 및 도면 1 참조. | 1-15 |
| A | WO 2011-112054 A2 (한국전자통신연구원) 2011.09.15<br>청구항 1-3; 단락 [9]-[15]; 및 도면 25 참조. | 1-15 |
| A | US 2012-0170563 A1 (SANTOSH PAUL ABRAHAM 외 1명) 2012.07.05<br>단락 [0065]-[0068]; 청구항 1; 및 도면 4와 7-8 참조. | 1-15 |

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

☒ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허 문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허문헌에 속하는 문헌

| 국제조사의 실제 완료일 | 국제조사보고서 발송일 |
|---|---|
| 2013년 02월 27일 (27.02.2013) | **2013년 02월 28일 (28.02.2013)** |
| ISA/KR의 명칭 및 우편주소<br>팩스 번호 82-42-472-7140 | 심사관<br>노지명<br>전화번호 82-42-481-8528 |

서식 PCT/ISA/210 (두 번째 용지) (2009년 7월)

국제조사보고서
대응특허에 관한 정보

국제출원번호
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## Method And Apparatus Supporting Improved Wide Bandwidth Transmissions

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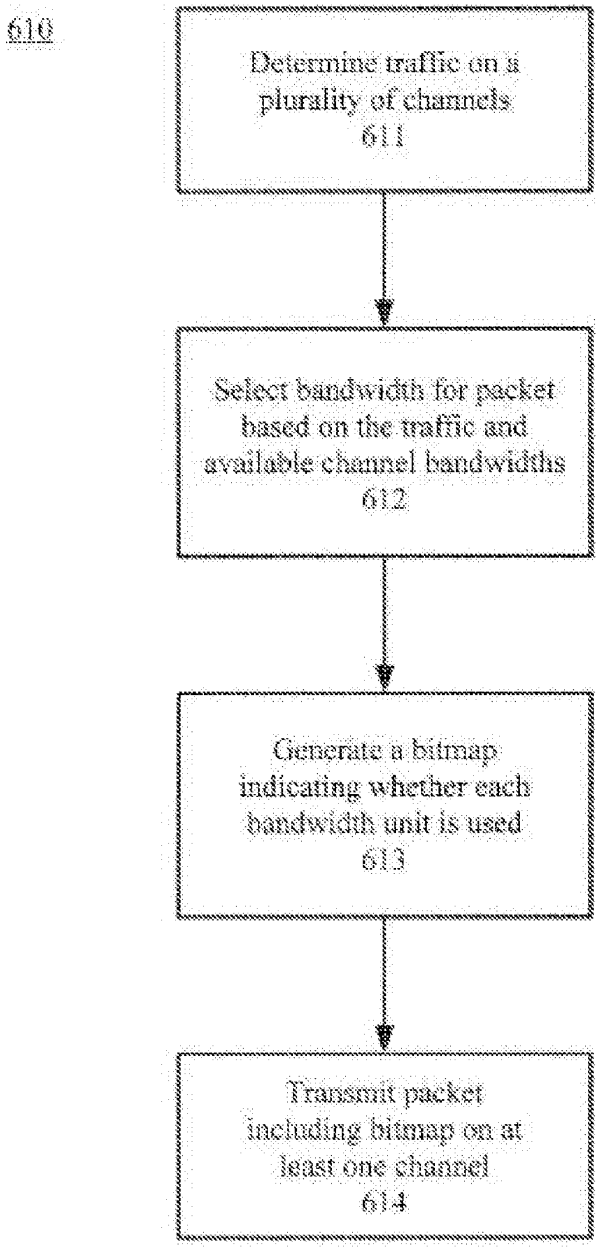
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**Abstract not available for JP2014511651 (A)**
**Abstract of corresponding document: US2012224612 (A1)**

A method for transmitting information in a wireless system is provided. In this method, the traffic on a plurality of channels can be determined. A bandwidth for a packet can be selected based on the traffic and available channel bandwidths. A modulation and a coding rate can be selected from a plurality of modulations and associated coding rates. The modulation and coding rate can be applied to a segment of the packet, wherein each segment includes one or more bandwidth units. The packet including the selected modulation and coding rate therein can be transmitted on at least one channel


610
Determine traffic on a plurality of channels
611
Select bandwidth for packet based on the traffic and available channel bandwidths
612
Generate a bitmap indicating whether each bandwidth unit is used
613
Transmit packet including bitmap on at least one channel
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# Claims: JP2014511651 (A) — 2014-05-15

## Method And Apparatus Supporting Improved Wide Bandwidth Transmissions

**Claims not available for JP2014511651 (A)**
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**A high quality text as facsimile in your desired language may be available amongst the following family members:**

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- Original claims
- Claims tree

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1. 1. A method for transmitting information in a wireless system, the method comprising:
determining traffic on a plurality of channels;
selecting a bandwidth for a packet based on the traffic and available channel bandwidths;
selecting a modulation and a coding rate from a plurality of modulations and associated coding rates, the modulation and coding rate applied to a segment of the packet, each segment including one or more bandwidth units; and
transmitting the packet on at least one channel, the packet including the selected modulation and coding rate.

2. 2. The method of claim 1, further including adjusting the selected modulation and coding rate, as necessary, on a per packet basis.

3. 3. The method of claim 1, wherein the bandwidth of the packet is provided on a contiguous spectrum.

4. 4. The method of claim 1, wherein the bandwidth of the packet is provided on a non-contiguous spectrum, and wherein the method further includes:
correlating phases of any synthesizers; and
positioning two segments of the packet adjacent to each other on a waveform.

5. 5. The method of claim 1, wherein at least one bandwidth unit is 40 MHz and the packet has a maximum of four bandwidth units.

6. 6. The method of claim 1, wherein one bandwidth unit, provided on a primary channel, includes a symbol specifying the selected modulation and coding rate.

7. 7. The method of claim 6, further including using unequal bandwidths in the bandwidth units.

8. 8. The method of claim 4, further including:
providing a bit map that specifies whether each bandwidth unit is used in the packet.

9. 9. The method of claim 8, wherein an order of bandwidth units in the bit map is independent from an actual transmission of the bandwidth units.

10. 10. The method of claim 1, wherein the packet comprises multiple segments.

11. 11. The method of claim 1, further including:
providing information regarding a predetermined number of subsequent, sequentially transmitted packets having the selected modulation and coding rate in a data field of the packet.

12. 12. A method for transmitting information in a wireless system, the method comprising:
determining traffic on a plurality of channels;
selecting a bandwidth for a packet based on the traffic and available channel bandwidths, the bandwidth being dividable into a maximum allowed number of bandwidth units;
generating a bitmap that indicates whether each bandwidth unit is used; and
transmitting the packet including the bitmap on at least one channel.

13. 13. The method of claim 12, wherein an order of bandwidth units in the bit map is independent from an actual transmission of the bandwidth units.

14. 14. A wireless device comprising:
a transmitter,
wherein the transmitter is configured to determine traffic on a plurality of channels,
wherein the transmitter is configured to select a bandwidth based on the traffic and available channel bandwidths,
wherein the transmitter is configured to select a modulation and coding rate from a plurality of modulations,
wherein the transmitter is configured to apply the selected modulation and coding rate to a segment of the packet, each segment including one or more bandwidth units, and
wherein the transmitter is configured to transmit the packet on at least one channel.

15. 15. The wireless device of claim 14, wherein the transmitter is further configured to change the selected modulation, as necessary, on a per packet basis.

16. 16. The wireless device of claim 14, wherein the transmitter is configured to provide

the bandwidth of the packet on a contiguous spectrum.

17. 17. The wireless device of claim 14, wherein the transmitter is configured to provide the bandwidth of the packet on a non-contiguous spectrum.

18. 18. The wireless device of claim 14, wherein the transmitter is configured to limit the packet to a maximum of four bandwidth units.

19. 19. The wireless device of claim 14, wherein transmitter is configured to include a symbol specifying the modulation and coding rate in one bandwidth unit, and provide the one bandwidth unit on a primary channel.

20. 20. The wireless device of claim 14, wherein the transmitter is further configured to transmit a bit map that indicates use of the bandwidth units.

21. 21. The wireless device of claim 14, wherein the transmitter includes a synthesizer having a turn-around time of less than 2·s.

22. 22. The wireless device of claim 14, wherein the transmitter includes a synthesizer having a frequency offset from a transmission frequency.

23. 23. The wireless device of claim 14, wherein the transmitter supports Very High Throughput (VET) packets.

24. 24. A wireless device comprising:
a transmitter,
wherein the transmitter is configured to determine traffic on a plurality of channels,
wherein the transmitter is configured to select a bandwidth for a packet based on the traffic and available channel bandwidths, the bandwidth being dividable into a maximum allowed number of bandwidth units,
wherein the transmitter is configured to generate a bitmap that indicates whether each bandwidth unit is used, and
wherein the transmitter is configured to transmit the packet including the bitmap on at least one channel.

25. 25. The device of claim 24, wherein an order of bandwidth units in the bit map is independent from an actual transmission of the bandwidth units.

26. 26. A wireless system comprising:
first and second transceivers; and
switches for selectively configuring the first and second transceivers for one of non-contiguous frequency operation and multiple-input multiple-output (MIMO) operation.

27. 27. A method of transmitting a packet from a transmitter to a known receiver, the transmitter configured for at least non-contiguous frequency operation and the receiver configured for only contiguous frequency operation, the method comprising:
correlating phases of any synthesizers in the transmitter;
positioning any segments of the packet adjacent to each other on a waveform; and
transmitting the waveform to the receiver.

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# Description: JP2014511651 (A) — 2014-05-15

## Method And Apparatus Supporting Improved Wide Bandwidth Transmissions

**Description not available for JP2014511651 (A)**
**Description of corresponding document: US2012224612 (A1)**

**A high quality text as facsimile in your desired language may be available amongst the following family members:**

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RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Ser. No. 61/449,449 entitled “Mechanisms To Support Dynamic Bandwidth Selection And Noncontiguous Transmissions” filed Mar. 4, 2011 and U.S. Provisional Patent Application Ser. No. 61/485,525 entitled “Mechanisms To Support Dynamic Bandwidth Selection And Noncontiguous Transmissions” filed May 12, 2011.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present specification is directed to improving the performance of a wireless communication system and in particular to a wireless local area network (WLAN) that can dynamically select and utilize wide channel bandwidths.

[0004] 2. Related Art

[0005] The performance of wireless local area networks (WLANs) is constantly being reviewed and enhanced to accommodate and/or anticipate new user applications. Much of this activity is driven by the IEEE 802.11 standards organization. This organization has developed a number of standards for the 2.4 GHz frequency band,

including IEEE 802.11 (DSSS (direct sequence spread spectrum), 1-2 Mbps), IEEE 802.11b (CCK (complementary code keying), 11 Mbps), and IEEE.11g (OFDM (orthogonal frequency division multiplexing), 54 Mbps). The latest standard is IEEE 802.11n (MIMO-OFDM (multiple input multiple output OFDM), 600 Mbps), which supports both the 2.4 GHz and 5 GHz frequency bands.

[0006] In furtherance of this progress, the industry now seeks to improve the throughput performance of WLANs to exceed 1 Gbps. Therefore, a need arises for methods and apparatus that may allow the performance of WLAN systems to achieve this performance objective.

## SUMMARY OF THE INVENTION

[0007] A method for transmitting information in a wireless system is provided. In this method, the traffic on a plurality of channels can be determined. A bandwidth for a packet can be selected based on the traffic and available channel bandwidths. A modulation and a coding rate can be selected from a plurality of modulations and associated coding rates. The modulation and coding rate can be applied to a segment of the packet, wherein each segment includes one or more bandwidth units. The packet including the selected modulation and coding rate therein can be transmitted on at least one channel.

[0008] The method can further include adjusting the selected modulation and coding rate, as necessary, on a per packet basis. The bandwidth of the packet can be provided on a contiguous or a non-contiguous spectrum. When the bandwidth of the packet is provided on a non-contiguous spectrum, the method can further include correlating phases of any synthesizers, and positioning two segments of the packet adjacent to each other on a waveform for transmission.

[0009] In one embodiment, at least one bandwidth unit is 40 MHz and the packet has a maximum of four bandwidth units. One bandwidth unit, provided on a primary channel, can include a symbol specifying the selected modulation and coding rate. Note that unequal bandwidths in the bandwidth units can be used. A bit map that specifies whether each bandwidth unit is used in the packet can be provided. Notably, an order of the bandwidth units in the bit map can be independent from actual transmission of the bandwidth units. In one embodiment, the method can further include providing information regarding a predetermined number of subsequent, sequentially transmitted packets having the selected modulation and coding rate in a data field of the packet.

[0010] A method for transmitting bitmap information in a wireless system is also provided. In this method, the traffic on a plurality of channels can be determined. A bandwidth for a packet can be selected based on the traffic and available channel bandwidths. The bandwidth can be dividable into a maximum allowed number of bandwidth units. A bitmap that indicates whether each bandwidth unit is used can be generated. The packet including the bitmap can be transmitted on at least one channel. Notably, an order of the bandwidth units in the bit map can be independent from actual transmission of the bandwidth units.

[0011] A wireless device is also provided, wherein the wireless device includes a transmitter configured to perform the above-described steps. A wireless system

including first and second transceivers is provided. Notably, the wireless system can also include switches for selectively configuring the first and second transceivers for one of non-contiguous frequency operation and multiple-input multiple-output (MIMO) operation.

[0012] A method of transmitting a packet from a transmitter configured for at least non-contiguous frequency operation to a known receiver configured for only contiguous frequency operation is provided. In this method, phases of any synthesizers in the transmitter can be correlated. Then, any segments of the packet can be positioned adjacent to each other on a waveform. At this point, the waveform can be transmitted to the receiver.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIGS. 1A and 1B illustrate exemplary single-user MIMO (802.11n) and multi-user MIMO (proposed 802.11ac) transmissions, respectively.

[0014] FIG. 2A illustrates a crowded frequency spectrum and a non-contiguous bandwidth operation for that spectrum.

[0015] FIG. 2B illustrates available channels and associated bandwidths in the 5 GHz band according to various IEEE 802.11 standards.

[0016] FIG. 3 illustrates various embodiments of contiguous and non-contiguous spectrums.

[0017] FIGS. 4A and 4B illustrate an exemplary transmission technique in proposed 802.11ac.

[0018] FIG. 5A illustrates an exemplary BWU structure having two segments.

[0019] FIG. 5B illustrates three packet embodiments in which transmission of segment 1 (BWU 1 and BWU 2) precedes that of segment 2 (BWU 3 and BWU 4).

[0020] FIG. 5C illustrates three packet embodiments in which transmission of segment 2 (BWU 3) precedes that of segment 1 (BWU 1 and BWU 2).

[0021] FIG. 5D illustrates two embodiments in which only one segment is transmitted.

[0022] FIG. 6A illustrates an exemplary bit map table showing five bandwidth unit configurations for contiguous or non-contiguous transmissions.

[0023] FIG. 6B illustrates a method for transmitting bitmap information in a wireless system.

[0024] FIG. 7A illustrates a frequency segment associated with multiple channels.

[0025] FIG. 7B illustrates a simplified packet including training and signal information and a data portion.

[0026] FIG. 8A shows a 40 MHz BSS (BSS1) overlapping with a 20 MHz BSS (BSS2) in a secondary channel, which could occur in 802.11n.

[0027] FIG. 8B illustrates a first solution in which BSS1 waits for its transmission until the entire 40 MHz is available, i.e. after the transmission of BSS2.

[0028] FIG. 8C illustrates a second solution in which BSS1 can transmit its PPDU using 20 MHz only (after the end of random backoff) on the primary channel while BSS2 uses the secondary channel for its 20 MHz transmission (which was initiated before the transmission by BSS1).

[0029] FIG. 8D illustrates a BSS1 having an 80 MHz transmission overlapping with multiple 20 MHz BSSs, i.e. BSS2, BSS3, and BSS4.

[0030] FIG. 8E illustrates that, when using a static bandwidth transmission, BSS1 may need to wait a significant time for the entire 80 MHz to be free.

[0031] FIG. 8F illustrates a transmitter being configured to sense which portion of the BSS bandwidth is available, and to dynamically adjust the bandwidth to take advantage of an available channel.

[0032] FIGS. 9A and 9B respectively illustrate a contiguous transmission including multiple modulations and coding rates, and a non-contiguous transmission including the same modulations and coding rates.

[0033] FIG. 9C illustrates an exemplary technique for providing different modulations and coding rates in a packet for improved transmission.

[0034] FIGS. 10A, 10B, and 10C illustrate exemplary modulation schemes for an improved transmission.

[0035] FIG. 11 illustrates how a synthesizer with a very short settling time can be used to meet various performance requirements.

[0036] FIG. 12 illustrates an improved calibration method to compensate for analog impairments.

[0037] FIG. 13A illustrates a WLAN system with a 160 MHz BSS that may transmit a packet having a bandwidth of 20, 40, 80 or 160 MHz.

[0038] FIG. 13B illustrates an exemplary WLAN configuration including multiple synthesizers and a synthesizer selection component.

[0039] FIG. 14A illustrates an exemplary transmitter that facilitates improved intermediate frequency (IF) generation.

[0040] FIG. 14B illustrates that a digital IF, i.e. with a proper frequency input selection in the digital portion of a transmitter, may minimize actual amount of interference being emitted outside the intended transmit spectrum.

[0041] FIG. 15 illustrates an embodiment in which a single synthesizer and a few mixers can effectively implement two synthesizers.

[0042] FIGS. 16A and 16B illustrate an exemplary WLAN system in which the transmitter is a non-contiguous device and the receiver is a contiguous device.

[0043] FIG. 17 illustrates an exemplary configurable transceiver that can provide both non-contiguous and MIMO operation.

DETAILED DESCRIPTION OF THE DRAWINGS

[0044] Currently, a new IEEE 802.11 standard is being developed. This standard, which will be designated as 802.11ac, has an objective to improve the throughput performance beyond the 802.11n standard, i.e. to exceed 1 Gbps. The Draft D0.1 of 802.11ac uses specific terminology, which will also be used herein for ease of reference. Exemplary terms are defined below.

[0045] "Frequency spectrum" generally refers to the entire frequency spectrum that may be required to support the transmission of a packet. The frequency spectrum may comprise one or more frequency segments (see below).

[0046] "Packet" refers to data in the frequency spectrum at any point in time.

[0047] "Bandwidth unit (BWU)", in proposed 802.11ac, refers to 40 MHz of frequency spectrum. A packet may have up to 4 BWUs, which are designated BWU 1, BWU 2, BWU 3, and BWU 4.

[0048] "Slot" refers to a designated frequency spectrum within a BWU. A BWU of 40 MHz may have two slots of 20 MHz. The primary channel (20 MHz) and the secondary channel (20 MHz) use the two slots in BWU 1.

[0049] "Segment" refers to a set of one or more BWUs. If there is no gap in frequency between the two BWUs, then the two BWUs are part of one segment. If there is a gap in frequency between the two BWUs, then each BWU is a segment. In proposed 802.11ac, a maximum of two segments per packet is allowed.

[0050] The broad objective for proposed 802.11ac includes ensuring Very High Throughput (VHT) (<6 GHz) by utilizing wide channel bandwidths (BW) (80 or 160 MHz) and multi-user, multiple input, multiple output (MU-MIMO) antennas. Another objective includes backward compatibility with 802.11a and 802.11n systems that operate at 5 GHz. Yet another objective includes the following target MAC throughput: single user throughput >500 Mbps and multi-user aggregate throughput >1 Gbps.

[0051] FIGS. 1A and 1B illustrate exemplary single-user MIMO (802.11n) and multi-user MIMO (proposed 802.11ac) transmissions, respectively. As shown in FIG. 1A, in the single-user MIMO transmission, a device 100 (e.g. an access point (AP)) can transmit multiple streams of data (i.e. streams 101, 102, 103, and 104) to a single device 105 (e.g. a station (STA)). In contrast, as shown in FIG. 1B, in the multi-user MIMO transmission), device 100 can transmit streams of data to multiple devices, such as devices 105, 106, and 107. In this embodiment, device 105 can receive streams 101

and 102, whereas devices 106 and 107 can receive streams 103 and 104, respectively. This transmission targeting capability may allow device 100 to maintain high total downlink throughput even when communicating with simple (and inexpensive) devices.

[0052] In previous WLAN standards, bandwidths were limited to 20 MHz and 40 MHz. In contrast, with the proposed 802.11ac standard, higher throughput may be achieved with bandwidth modes of 80 MHz and 160 MHz. Table 1 describes various options for the number of streams, the type of QAM modulation and associated coding rates (Modulation and Coding Scheme (MCS)), and bandwidth selections. The options listed in Table 1 may achieve a TCP/IP (Transmission Control Protocol/Internet Protocol) throughput greater than 1 GHz.

[0000]

TABLE 1

# STREAMS MCS BW

8 256-QAM 3/4 40 MHz

4 256-QAM 3/4 80 MHz

3 64-QAM 2/3 160 MHz

2 256-QAM 3/4 160 MHz

[0053] Table 2 indicates the potential data rates (in Mbps) for a variety of MCSs and for 1 and 3 streams (wherein Nss refers to the number of spatial streams or streams).

[0000]

TABLE 2

Nss = 1 Nss = 3

40 80 160 40 80 160

MCS MHz MHz MHz MHz MHz MHz

BPSK 1/2 15.0 32.5 65.0 45.0 97.5 195.0

QPSK 1/2 30.0 65.0 130.0 90.0 195.0 390.0

QPSK 3/4 45.0 97.5 195.0 135.0 292.5 585.0

16-QAM 1/2 60.0 130.0 260.0 180.0 390.0 780.0

16-QAM 3/4 90.0 195.0 390.0 270.0 585.0 1170.0

64-QAM 2/3 120.0 260.0 520.0 360.0 780.0 1560.0

64-QAM 3/4 135.0 292.5 585.0 405.0 — 1755.0

64-QAM 5/6 150.0 325.0 650.0 450.0 975.0 1950.0

256-QAM 3/4 180.0 390.0 780.0 540.0 1170.0 2340.0

256-QAM 5/6 200.0 433.3 866.7 600.0 1300.0 —

[0054] As bandwidth increases, it becomes more difficult to locate a contiguous frequency spectrum available for higher bandwidth applications. For example, the frequency spectrum may be divided into slices that do not easily accommodate wide bandwidth transmissions. FIG. 2A illustrates an exemplary environment in which a new WLAN (160 MHz) 200 needs to share the frequency spectrum with existing narrower WLANs 201, 202, and 203 (e.g. 40 MHz) and radio devices (e.g. radar) 205 and 206.

[0055] A possible solution to a crowded spectrum (as shown in FIG. 2A) is a non-contiguous bandwidth mode of operation in which the bandwidth of WLAN 200 is split up into two frequency segments, e.g. segment 210 (80 MHz) and segment 211 (80 MHz), thereby increasing the probability of finding available channels for transmission. In one embodiment, a non-contiguous 160 MHz transmission may use any two 80 MHz channels. In FIG. 2A, segment 210 is transmitted in an available, low frequency portion of a U-NII Worldwide band, whereas segment 211 is transmitted in the U-NII 3 band. Segments can be located in any available channels in the operating environment.

[0056] FIG. 2B illustrates the available channels in the 5 GHz band in the United States. Note that the 20 MHz channels are designated in 802.11a (with the exception of channel 144), the 40 MHz channels are designated in 802.11n (with the exception of the 40 MHz channel having primaries at 140 and 144), and the 20+40+80+160 MHz channels are proposed to be designated in 802.11ac. Note that only the channel numbers for the 20 MHz channels are shown in FIG. 2B. The channel numbers for the other bandwidth channels (i.e. 40, 80, and 160 MHz) used herein are based on the 20 MHz channels closest in frequency. For example, the lowest frequency 40 MHz channel has a channel number of 38 referenced herein, which can be discerned by its location relative to the 20 MHz channels 36 and 40.

[0057] Referring back to FIG. 2A, note that segments 210 and 211 are used synchronously, i.e. both segments are in transmitter (TX) mode or both segments are in

receiver (RX) mode. Moreover, in a non-contiguous transmission, the signals on segments 210 and 211 are coupled to the same receiver(s).

[0058] Note that in prior WLAN standards, the BSS (basic service set) bandwidth is essentially static, i.e. it was very rare or uncommon for the BSS bandwidth to change. In contrast, proposed WLAN standard IEEE 802.11ac allows the bandwidth to dynamically change packet to packet. In accordance with one aspect of improved transmissions in proposed 802.11ac and described in further detail below, the protocol data unit (PPDU) may be modified to support this capability. Moreover, the PPDU may also be modified to support different modulations (MCS) and transmit power levels on a per packet basis, and even on a per segment basis.

[0059] FIG. 3 illustrates exemplary contiguous spectrums 301 and non-contiguous spectrums 302 for a BSS (basic service set) to be setup in its network. When operating with contiguous spectrums 301, the selected BSS bandwidth may be 20 MHz, 40 MHz, 80 MHz, or 160 MHz. When operating in non-contiguous spectrums 302, the selected BSS bandwidth may be one of the following combinations of primary and secondary segments, wherein the first bandwidth is listed in the primary segment and the second bandwidth is listed in the secondary segment: 40 MHz+40 MHz, 40 MHz+80 MHz, 80 MHz+40 MHz, and 80 MHz+80 MHz. Note that non-contiguous transmission modes are not limited to the above bandwidth combinations, and may be a combination of any arbitrary bandwidth in general.

[0060] If tones between contiguous 40 MHz units (mid-tones) are filled with data, then there may be 7 different rates for a given MCS results. The 7 different rates (i.e. cases) are illustrated in Table 3.

[0000]

TABLE 3

| Case | Total BW (MHz) | Segment 1 (MHz) | Segment 2 (MHz) |
|---|---|---|---|
| 1 | 40 | 40 | — |
| 2 | 80 | 80 | — |
| 3 | 80 | 40 | 40 |
| 4 | 120 | 120 | — |
| 5 | 120 | 80 | 40 |

6 160 160 —

7 160 80 80

[0061] FIGS. 4A and 4B illustrate an exemplary transmission technique in proposed 802.11ac. To achieve high throughput performance, the WLAN system may determine the available channel bandwidths and the bandwidth required for the packet to be transmitted to appropriately select the contiguous or non-contiguous mode of operation. For example, FIG. 4A illustrates a WLAN system transmitting message A (401), wherein message A requires 160 MHz of bandwidth. The WLAN system may determine, based on the available spectrum, whether message A may be transmitted with a contiguous transmission (a preferred embodiment) or must be transmitted with a non-contiguous transmission. Message A can be processed, spread into the appropriate number of segments, and then located on the available spectrum (402). Assuming that non-contiguous transmission is appropriate, message A can be processed and spread into two segments of 80 MHz (A1:403 and A2:404) and then located on available spectrum for a non-contiguous transmission (405), as illustrated in FIG. 4B.

[0062] In proposed 802.11ac, the BWUs may be setup or structured in a variety of ways. For example, a VHT Information Element can indicate available BWUs in the BSS via the following information. The "primary channel" is the channel number for the primary 20 MHz channel. The "secondary channel offset" is the offset of the secondary 20 MHz channel relative to the primary channel, wherein the offset is one of (−1, 0, +1). The BWU 2 channel is the channel number of the 40 MHz BW unit 2. The BWU 3 channel is the channel number of the 40 MHz BW unit 3. The BWU 4 channel is the channel number of the 40 MHz BW unit 4. Note that the channel number "0" indicates an unused band.

[0063] In proposed 802.11ac, a VHT capability element can indicate station (STA) capability with the following information. The "maximum bandwidth" indicates the maximum bandwidth of packets the receiving device is capable of receiving (e.g. 40/80/160 MHz). The "support for non-contiguous bandwidth" may be "0" or "1". If 0, then the receiving device is not capable of receiving packets using non-contiguous frequency segments. If 1, then the receiving device is capable of receiving packets using non-contiguous frequency segments. If the maximum BW=80 MHz, then the receiving device may choose either 0 or 1 for "support non-contiguous". If the maximum BW>80 MHz, then the receiving device must set "support non-contiguous" to 1.

[0064] FIG. 5A illustrates an exemplary BWU structure having two segments, segments 1 and 2 (which imply a non-contiguous transmission). Segment 1 includes BWU 1 and BWU 2. BWU 1 includes a primary channel (20 MHz) and a secondary channel (20 MHz). BWU 2 has 40 MHz of spectrum. Segment 2 includes BWU 3 and BWU 4, which each have 40 MHz of spectrum.

[0065] In accordance with one aspect of an improved wireless transmission, a bit map can be used to indicate whether each of BWU 1, BWU 2, BWU 3, or BWU 4 is being

used. Specifically, each BWU may be assigned a bit number, i.e. bit 0 for BWU 1, bit 1 for BWU 2, bit 2 for BWU 3, and bit 3 for BWU 4. Each of bits 1-3 has a value of "0" if the BWU is not used and "1" if the BWU is used in the packet, as indicated in Table 4. Because BWU 1 includes both the primary and secondary channels, a "0" indicates that only the primary channel is being used and a "1" indicates that both the primary and second channels are being used. In one embodiment, this bit map is transmitted as 4 bits in the VHT-SIG-A field, which is provided in proposed 802.11ac. In one embodiment, for any packet bandwidth greater than 40 MHz, BWU 1 must use 40 MHz (Bit 0=1).

[0000]

TABLE 4

| Bit 0 Value | Bit 1 (BWU 1) | Bit 2 (BWU 2) | Bit 3 (BWU 3) | (BWU 4) |
|---|---|---|---|---|
| 0 | 20 MHz (Primary Channel only) | Not used | Not used | Not used |
| 1 | 40 MHz (Primary & Secondary Channels) | Used | Used | Used |

[0066] FIG. 5B illustrates three packet embodiments in which transmission of segment 1 (BWU 1 and BWU 2) precedes that of segment 2 (BWU 3 and BWU 4) (i.e. the same BWU structure as FIG. 5A). Packet 501 is a 20 MHz packet that only occupies the primary channel, which is located at channel 36. Thus, the bandwidth bits for packet 501 are "0000". Packet 502 is a 120 MHz packet in which 40 MHz is located in each of BWU 1 (channels 36, 40), BWU 2 (channel 46), and BWU 4 (channel 159). Thus, the bandwidth bits for packet 502 are "1101". Packet 503 is a 160 MHz packet in which 40 MHz is located in each of BWU 1 (channels 36, 40), BWU 2 (channel 46), BWU 3 (channel 151), and BWU 4 (channel 159). Thus, the bandwidth bits for this embodiment are "1111". Note that the secondary channel offset (in relation to the primary channel, and referring to FIG. 2B) is equal to 1.

[0067] Note that the bit order in the bit map remains the same irrespective of the actual spectrum locations for the BWUs. For example, FIG. 5C illustrates three packet embodiments in which transmission of segment 2 (BWU 3) precedes that of segment 1 (BWU 1 and BWU 2). Packet 505 is a 120 MHz packet in which 40 MHz is located in

BWU 3 (channel 54), and 40 MHz is located in each of BWU 2 (channel 102) and BWU 1 (channels 108, 112). Thus, the bandwidth bits for packet 505 are "1110". Note that, in packet 505, BWU 1 is located at the highest frequency in the packet and BWU 3 is located at the lowest frequency in the packet. Therefore, BWU 1 can be characterized as defining the least significant bit (LSB) and BWU 3 can be characterized as defining the most significant bit (MSB). Note further that the secondary channel is a lower frequency than the primary channel. Therefore, the secondary channel offset is equal to −1. Packet 506 is a 40 MHz packet located in BWU 1 (channels 108, 112). Thus, the bandwidth bits for packet 506 are "1000". Packet 507 is an 80 MHz packet in which 40 MHz is located in BWU 1 (channels 108, 112) and 40 MHz is located in BWU 2 (102). Thus, the bandwidth bits for packet 507 are "1100".

[0068] Notably, the bit map is equally applicable to single segment transmissions. For example, FIG. 5D illustrates two embodiments in which only one segment is transmitted. In both embodiments, segment 1 includes the following bandwidth units listed from low to high frequency: BWU 2, BWU 1, BWU 3 and BWU 4. In these embodiments, the primary channel is lower than the secondary channel. Therefore, the secondary channel offset is equal to 1. Packet 510 is a 120 MHz packet in which 40 MHz is located in each of BWU 1 (channels 108, 112), BWU 3 (channel 118), and BWU 4 (channels 126). Thus, the bandwidth bits for this embodiment are "1011". Note that packet 510 transmits using a contiguous spectrum. Packet 511 is a 120 MHz packet in which 40 MHz is located in each of BWU 2 (channel 102), BWU 1 (channels 108, 112), and BWU 4 (channel 126). Thus, the bandwidth bits for packet 511 are "1101". Note that packet 511 transmits using a non-contiguous spectrum.

[0069] FIG. 6A illustrates an exemplary bit map table showing five bandwidth unit configurations for contiguous or non-contiguous transmissions. The coding of this bit map table can be detected by a receiver, thereby allowing the receiver to determine the bandwidth of the packet being received. Note that for any packet, the primary channel P20 is used. Specifically, BWU 1 includes the 20 MHz primary channel (P20), which is located in the first slot. If the transmission is 20 MHz, then only the primary channel P20 is used and the bit map coding is "0000". This coding reflects that the bit value in the second slot is 0, i.e. no transmission in the second slot. On the other hand, if the transmission is 40 MHz, then the bit map coding is "1000". This bit coding reflects that the bit value of the second slot of BMW 1 is 1.

[0070] If the transmission is 80 MHz, then the bit map coding is 1100 or 1010 depending on the BWUs utilized (case 3 or case 4). If the transmission is 160 MHz, then the bit map coding is 1111. BWUs can be listed in the column order (e.g. BWU 2, BWU 1, BWU 3 and BWU 4) to indicate their order in the frequency spectrum. As noted above, the bits of the bit map reflect whether data is present in the ordered BWUs, i.e. BWU 1, BWU 2, BWU 3, BWU4 (and therefore do not provide information regarding the actual transmission order of the BWUs). Note that FIG. 6 shows exemplary, not exhaustive, combinations for a transmitted PPDU.

[0071] Note that the bandwidth of the BSS corresponds to the maximum bandwidth of any PPDU transmission allowed in the BSS. Thus, the bandwidth of each PPDU transmission may be less than or equal to the BSS bandwidth. In case of PPDU transmissions in a non-contiguous BSS, the BWUs may be positioned in different portions of a first segment or a second segment (see, FIG. 5C).

[0072] FIG. 6B illustrates a method 610 for transmitting bitmap information in a wireless system. Step 611 determines the traffic on a plurality of channels. Step 612 selects the bandwidth for a packet based on the traffic and available channel bandwidths. Step 613 generates a bitmap indicating whether each bandwidth unit is used. Step 614 transmits the packet with the bitmap on at least one channel.

[0073] In prior WLAN systems, the receiver generally does not need know the bandwidth of the packet that it is receiving because the bandwidth of the packet is generally static. In proposed 802.11ac, the receiver should know the bandwidths of the BWUs to efficiently process the received packet. In one embodiment, a receiver may look at the energy per each bandwidth portion (e.g. each 20 MHz sub-bands) and may determine the bandwidth of the signal based on how many of the bandwidth portions have meaningful energy. For example, if there is a 160 MHz packet, the energy detection system may detect a rise in energy in the entire 160 MHz band or all of the eight 20 MHz sub-bands. Alternatively, if there is a 20 MHz packet, the energy detection system may only detect a rise in energy in the 20 MHz sub-band. In one embodiment, an automatic gain control (AGC) unit may be used to detect energy to determined bandwidth.

[0074] In another embodiment, the receiver can use time domain decoding or preamble signature detection to decode the bandwidth information from the signal portion of the message. In IEEE 802.11 terminology, this technique is a type of STF pattern detection in the VHT preamble.

[0075] FIG. 7A illustrates a frequency segment 701 associated with multiple channels, each channel represented by A. Frequency segment 701 has a maximum bandwidth equal to the sum of the bandwidths that are required for all A channels, which includes a primary channel Ap 702. In one embodiment, each of channels A and Ap have the same bandwidth (e.g. 20 MHz). Transmitted information associated with any channel, i.e. the A or the Ap channel, in the time domain has a training portion (including information in both the legacy and VHT training fields), a signal portion, and a data portion, as shown in FIG. 7B. In proposed 802.11ac, the primary channel Ap includes within the signal (SIG) portion, information regarding the maximum bandwidth of frequency segment 701. This signal portion may also be referred to as the VHT Information Element. Hence, by decoding the signal portion of the information associated with the primary channel Ap, the maximum bandwidth of the message may be determined. As described herein, in accordance with an improved transmission, the VHT Information Element may also provide information regarding the used BWUs in the BSS.

[0076] Notably, the above-described packet structure with segments and multiple BWUs may be extended to other wireless systems. This structure may offer solutions where there may be a large spectrum required for the packet transmission, but only small slices (or pieces) of spectrum available. These environments suggest a non-contiguous solution may be required. Wireless examples of this environment may include, but are not limited to: (1) proposed standard IEEE 802.11ah for a sensor network, e.g. smart metering, (2) proposed standard IEEE 802.11af for cognitive radio operating in the TV White Spaces (~900 MHz), i.e. the spectrum already allocated to the TV broadcasters and at the same time not used, and (3) WiFi applications in the 900

MHz band.

[0077] In these applications (and others), the protocol structure may have the following considerations. First, a BWU may be any value that is compatible with the wireless standard. For example, in proposed 802.11ac, the BWU is 40 MHz, whereas for 802.11ah, the BWU may be 5 MHz. In other applications the BWU may be greater than or less than 40 MHz. Second, there may be any number of BWUs and/or any number of segments per packet. Third, the packet may be transmitted in more than two contiguous spectrums. Fourth, the BWUs may not be in contiguous spectrum. Fifth, specifying the center frequency of the BWU determines the segmentation.

[0078] There are various techniques to transmit a physical layer convergence procedure (PLCP) protocol data unit (PPDU) when BSSs overlap. For example, FIG. 8A shows a 40 MHz BSS (BSS1) overlapping with a 20 MHz BSS (BSS2) in a secondary channel, which could occur in 802.11n. FIG. 8B illustrates a first solution in which BSS1 waits for its transmission until the entire 40 MHz is available, i.e. after the transmission of BSS2. FIG. 8C illustrates a second solution in which BSS1 can transmit its PPDU using 20 MHz only (after the end of random backoff) on the primary channel while BSS2 uses the secondary channel for its 20 MHz transmission (which was initiated before the transmission by BSS1). Note that once 20 MHz transmission is commenced for BSS1, the transmission must remain at 20 MHz irrespective of the availability of 40 MHz after BSS2 completes its transmission.

[0079] Notably, in proposed 802.11ac for a WLAN supporting 80 or 160 MHz, resolving transmission overlap is significantly more challenging. For example, FIG. 8D illustrates a BSS1 having an 80 MHz transmission overlapping with multiple 20 MHz BSSs, i.e. BSS2, BSS3, and BSS4. As shown in FIG. 8E, using a static bandwidth transmission, BSS1 may need to wait a significant time for the entire 80 MHz to be free. As a result, significant degradation of throughput may result using static bandwidth transmission.

[0080] In general, as the BSS bandwidth increases, there is an increased probability that the BSS is sharing the wide spectrum with one or more BSSs that overlap in frequency.

[0081] The overlapping BSSs may have narrower bandwidths than the BSS of interest, BSS X. If a transmission in BSS X is made without first checking if any of the overlapping BSSs has an on-going transmission, then collision may occur and degrade the link throughput. Hence, sensing the channel first to see if the channel is free to be used is recommended. In proposed 802.11ac, and referring to FIG. 8F, the transmitter has the ability to sense which portion of the BSS bandwidth is available, and to dynamically adjust the bandwidth to take advantage of an available channel. For example, in FIG. 8F, the 80 MHz BSS1 can be dynamically adjusted to 20 MHz, which can start transmission after the end of random backoff in BSS1, thereby allowing concurrent transmission with BSS2, BSS3, and BSS4.

[0082] In accordance with one aspect of an improved, proposed 802.11ac WLAN, different modulations can be used in packets and may be applied on either contiguous or non-contiguous transmissions. For example FIG. 9A illustrates a waveform 901, which is a contiguous transmission including a first portion of the frequency spectrum transmitted with QPSK modulation and a second portion of the frequency spectrum

transmitted with 64 QAM modulation. FIG. 9B illustrates a waveform 902, which is a non-contiguous transmission with QPSK modulation and 64 QAM modulation. Note that one portion of the transmission may also have a different power level than the other portion of the transmission. For example, in both FIGS. 9A and 9B, the 64 QAM portion of the frequency spectrum has a higher power level than the QPSK power level. Also, the two portions of the frequency spectrum may be different bandwidths, such as 20, 40, or 80 MHz.

[0083] FIG. 9C illustrates an exemplary technique 920 for providing different modulations and coding rates for improved transmission. Step 921 determines the traffic on a plurality of channels. Step 922 selects the bandwidth for a packet based on the traffic and available channel bandwidths. Step 923 selects the modulation and coding rate from a plurality of modulations and associated coding rates. Step 924 transmits the packet with the modulation and coding rate information on at least one channel.

[0084] In summary, the MCS, transmitted power, and/or bandwidth may be different between different segments.

[0085] FIGS. 10A, 10B, and 10C illustrate exemplary modulation schemes for an improved transmission. Note that the proposed 802.11ac packet format includes a legacy portion, a VHT portion, and data. The legacy portion has training fields L-STF and L-LTF, as well as a signal field (L-SIG). The VHT portion has training fields VHT-STF and VHT-LTFs, which are sandwiched between signal fields VHT-SIG-A and VHT-SIG.B. FIG. 10A illustrates a contiguous spectrum for an 802.11ac packet including 20 MHz×4 legacy and VHT symbols followed by 80 MHz×1 data. Note that the VHT-SIG-A (which forms part of the VHT set of symbols in FIGS. 10A-10C) includes the bandwidth and the MCS (modulation) information.

[0086] FIGS. 10B and 10C illustrate two segments, segment 1 and segment 2 respectively, of a non-contiguous packet. Each segment may have a bandwidth of 40 MHz. In one embodiment, a transmitter in a WLAN system, generically named "11ax", can select and designate the modulation for each segment. For example, in segment 1 (FIG. 10B), modulation MCS1 is selected from the available modulations of MCS1 and MCS2. In contrast, modulation MCS2 is selected for segment 2 (FIG. 10C) from the available modulations of MCS1 and MCS2. In other embodiments, more than two modulations can be provided in the set of available modulations. Exemplary modulations include BPSK 1/2, QPSK 1/2, QPSK 3/4, 16-QAM 1/2, 16-QAM 3/4, 64-QAM 2/3, 64-QAM 3/4, 64-QAM 5/6, and 256-QAM. Note that the set of available modulations may vary from segment to segment in other embodiments. In one embodiment, irrespective of contiguous or non-contiguous transmission, the legacy and VHT symbols are repeated for each minimal bandwidth increment. In FIGS. 10A-10C, the minimal bandwidth increment is 20 MHz. Other embodiments may provide larger minimal bandwidth increments.

[0087] Additional methods and circuits to provide improved performance for dynamic PPDU bandwidth transmission are disclosed below.

[0088] FIG. 11 illustrates how a synthesizer with a very short settling time (e.g. <2 microsecond) can be used to meet various performance requirements (described in

reference to FIG. 12 and also shown in Table 4). In one embodiment, the carrier frequency for PPDU transmission is changed from the synthesizer frequency to avoid transmitting impairments outside the intended bandwidth of transmission.

[0089] FIG. 12 illustrates an improved calibration method to compensate for analog impairments. In this method, in-phase and out-of-phase signals are compared as shown by "TX IQ mismatch". In one preferred embodiment, this error can be pre-measured and pre-compensated in the digital domain. Note that the synthesizer frequency is fixed at the center of the BSS bandwidth, i.e. "TX LO leakage" (which always has some leakage). However, because of the synthesizer frequency offset, the actual transmission and its IQ mismatch will be symmetrically located on either side of the TX LO leakage (i.e. the synthesizer frequency). As shown in FIG. 12, in the worst case, the transmitting 20 MHz PPDU is located near the edge of BSS bandwidth.

[0000]

TABLE 4

| 802.11 ac requirement | After calibration |
|---|---|
| TX LO leakage | −45 dBr | −5 dBr |
| TX IQ mismatch | −45 dBr | −35 to −40 dBr |

[0090] When in a 160 MHz BSS, a WLAN system may transmit a message having a bandwidth of 20, 40, 80 or 160 MHz, as shown in FIG. 13A. For these bandwidths, the optimal carrier may be fc20, fc40, fc80, or fc160, respectively (wherein "fc" indicates the center frequency of the related bandwidth). In one embodiment, to provide that optimal carrier, a wireless system can include four synthesizers, e.g. synthesizers 1301, 1302, 1303, and 1304, as illustrated in FIG. 13B. Synthesizers 1301-1304 each receive an output of the VCO and provide their synthesized outputs to a multiplexer 1305. Using a frequency select control signal to multiplexer 1305, the wireless system can select the synthesized signal that provides the optimal carrier depending on the bandwidth of the packet. Moreover, because synthesizers 1301-1304 operate in parallel, the issues of settling time are minimized. The selected signal is then mixed with an RF signal, thereby generating an output baseband signal.

[0091] FIG. 14A illustrates an exemplary transmitter that facilitates improved intermediate frequency (IF) generation. Specifically, in the configuration shown, I and Q baseband outputs of an IFFT 1401 are digitally mixed in mixer 1402 with a first

frequency fl before being provided to digital-to-analog converters (DACs) 1403. DACs 1403 generate signals in first IF1. Low pass filters 1404 receive the signal in IF1 and generate signals in second IF2. Mixers 1405 receive the outputs in IF2 and generate inputs for adder 1406, which in turn generate a signal in IF3. A bandpass filter 1407 receives the output in IF3 and generates a signal in IF4. A mixer 1408 mixes the signal in IF4 with a third frequency f3 and generates an RF frequency. FIG. 14B illustrates that a digital IF, i.e. with a proper frequency f1 selection, may minimize actual amount of interference being emitted outside the intended transmit spectrum. Specifically, the lower frequency f1 is, the sharper bandpass filter 1407 must be to optimally filter the signal at IF3. Therefore, in one embodiment, frequency f1 is made as high as possible. In one embodiment in proposed 802.11ac, f1 is 352 MHz, f2 is 1.8 GHz, and f3 is 2.748-3.698 GHz.

[0092] In case of operating within a non-contiguous BSS (such as 80+80 MHz BSS), the bandwidth of a packet to be transmitted in each frequency segment may vary from packet to packet. In this case, each frequency segment may need to support dynamic bandwidth through any combination of the options described above. For example, the transmitter may employ two synthesizers, one for each frequency segment, each of which may have very short (e.g. <2 us) settling time. In another embodiment, one frequency segment may employ a frequency synthesizer that has a very short settling time, while the other frequency segment may select one of multiple concurrently running synthesizers (see, e.g. FIG. 13B).

[0093] Non-contiguous transmissions have two frequency segments that have an arbitrary frequency separation. In one embodiment, the signals for those frequency segments can be up-converted to their respective RF frequency using separate mixers. However, in another simpler embodiment, two synthesizers can be provided, one for each frequency segment. In yet another embodiment, shown in FIG. 15, a single synthesizer 1501 and a few mixers effectively implement two synthesizers. In one configuration, the circuit comprises synthesizer 1501 and three mixers 1502, 1503, and 1504. Synthesizer 1501 generates a signal at frequency fs, which is provided to mixer 1502. Mixer 1502 mixes the signal at fs with another signal at first frequency f1, and generates two signals at frequencies fc1 and fc2. Mixer 1503 mixes the signal at fc1 with the signal for frequency segment 1 to generate the RF signal of frequency segment 1. Similarly, mixer 1504 mixes the signal at fc2 with the signal for frequency segment 2 to generate the RF signal of frequency segment 2.

[0094] In FIG. 15, frequencies fc1 and fc2 indicate the center frequencies of the related bandwidths for frequency segments 1 and 2, respectively. In one preferred embodiment, fs=(fc1+fc2)/2 and f1=(fc1−fc2)/2, wherein fc1 is higher than fc2. In this case, fc1=fs+f1 and fc2=fs−f1. Thus, by a proper selection of frequency fs, the two carrier signals at fc1 and fc2 can optimize the performance of the WLAN system. Moreover, in this configuration, synthesizer 1501 and mixers 1502, 1503, and 1504 can effectively operate as two synthesizers.

[0095] In one embodiment of a WLAN system, the transmitter is a non-contiguous device (e.g. 80 MHz+80 MHz), but the receiver is a contiguous device (e.g. 160 MHz). To minimize this difference, the transmitter can transmit a waveform 1601 with two non-contiguous frequency segments positioned next to each other, as shown in FIG. 16A. However, as noted above, each frequency segment may have a separate carrier (and

hence a separate synthesizer). As a result, each carrier may have a separate phase shown as φ1 and φ2. Thus, although the transmit spectrum may look like a contiguous 160 MHz, the phase of the two carriers of the transmitter may not be correlated because of different phase noise for each synthesizer.

[0096] As a contiguous device, the receiver typically has only one carrier and thus only one phase, shown as φ on a waveform 1602 in FIG. 16B. Also as shown on waveform 1602, the received frequency segments have a phase φ1 and φ2, respectively. Designing a receiver to effectively operate may be a challenge because, as noted above, the phase (and the phase noise) of the two carriers of the transmitter may not be correlated. Thus, the receiver (a contiguous device) may not properly receive the signal from the transmitter (a non-contiguous device).

[0097] In one embodiment utilizing a digital solution, the receiver can perform phase tracking per each 80 MHz. In another embodiment, all synthesizers of the transmitter can be designed to have correlated phase and phase noise, as indicated by step 1603.

[0098] Note that additional analog circuitry may be required for a WLAN device to support two spectrums when transmitting or receiving a packet. In one embodiment, to reduce the cost of this device, it can be designed to support more than one application. For example, the requirements for non-contiguous and multiple-input multiple-output (MIMO) operation may be very similar. FIG. 17 illustrates a transceiver 1700 that can support both non-contiguous and MIMO operation using switches 1701, 1702, and 1703.

[0099] Switch 1701 determines whether the mixers receive signals from only a first synthesizer Synth1 or whether half of the mixers receive signals from first synthesizer Synth1 and the other half of the mixers receive signals from a second synthesizer Synth2. Switch 1702 determines whether the outputs of power amplifiers PA1 and PA2 are summed and provided to only a first antenna (ANT1) or provided respectively to first antenna ANT1 and a second antenna ANT2. Switch 1703 determines whether outputs of low noise amplifiers LNA1 and LNA2 are provided to only one mixer or to two mixers for subsequent receive processing.

[0100] Using switches 1701, 1702, and 1703, transceiver 1700 can selectively support 3×3 non-contiguous 160 MHz, 6×6 contiguous 80 MHz transmission, 2×2 80 MHz MIMO operation, and 1×1 non-contiguous 80+80 MHz transmission. Using similar switching configurations, WLAN systems may also implement WLAN spatial modes, or implement WLAN modes that may require wider bandwidth.

[0101] While various embodiments have been described, it may be apparent to those of ordinary skill in the art that other embodiments and implementations may be possible that are within the scope of the embodiments. For example, any combination of any of the systems or methods described in this disclosure may be possible. In addition, the systems and methods described above may be directed to WLAN systems or to other wireless systems. In one embodiment, referring back to FIG. 7B, the selected modulation and coding rate for a predetermined number of subsequent, sequentially transmitted packets can be provided in the data field 703 of the packet. Therefore, it should be appreciated that the invention should not be construed as limited by such embodiments, but rather construed according to the below claims.

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最終頁に続く

(54)【発明の名称】広帯域幅送信のための適応型パケットベース変調およびコーディングレート選択

(57)【要約】
無線システムにおいて情報を送信するための方法が提供される。この方法では、複数のチャネル上のトラフィックが決定されうる。パケットのための帯域幅が、トラフィックと利用可能なチャネル帯域幅とに基づいて選択されうる。変調およびコーディングレートが、複数の変調および関連するコーディングレートから選択されうる。変調およびコーディングレートは、パケットのセグメントに適用されることができ、ここで、各セグメントは、１つまたは複数の帯域幅ユニットを含む。選択された変調およびコーディングレートをその中に含むパケットは、少なくとも１つのチャネル上で送信されうる。

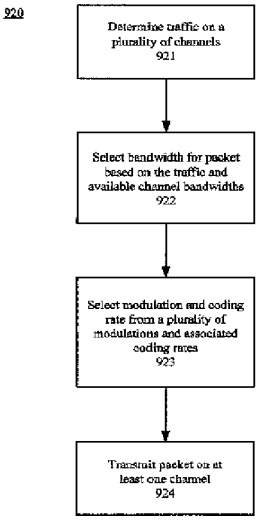



FIG. 9C

【特許請求の範囲】
【請求項１】
無線システムにおいて情報を送信するための方法であって、
複数のチャネル上のトラフィックを決定することと、
前記トラフィックおよび利用可能なチャネル帯域幅に基づいて、パケットのための帯域幅を選択することと、
複数の変調および関連するコーディングレートから変調およびコーディングレートを選択することであって、前記変調およびコーディングレートは、前記パケットのセグメントに適用され、各セグメントは、１つまたは複数の帯域幅ユニットを含む、選択することと、
少なくとも１つのチャネル上で前記パケットを送信することであって、前記パケットは、前記選択された変調およびコーディングレートを含む、送信することと、
を備える方法。
【請求項２】
パケットごとに、必要に応じて、前記選択された変調およびコーディングレートを調整することをさらに含む、請求項１に記載の方法。
【請求項３】
前記パケットの前記帯域幅は、連続したスペクトル上で提供される、請求項１に記載の方法。
【請求項４】
前記パケットの前記帯域幅は、不連続なスペクトル上で提供され、前記方法はさらに、
任意のシンセサイザの位相を相関させることと、
前記パケットの２つのセグメントを波形上で互いに隣接して配置することと
を含む、請求項１に記載の方法。
【請求項５】
少なくとも１つの帯域幅ユニットは、４０ＭＨｚであり、前記パケットは、最大４つの帯域幅ユニットを有する、請求項１に記載の方法。
【請求項６】
プライマリ・チャネル上で提供される１つの帯域幅ユニットは、前記選択された変調およびコーディングレートを指定するシンボルを含む、請求項１に記載の方法。
【請求項７】
前記帯域幅ユニットにおける等しくない帯域幅を使用することをさらに含む、請求項６に記載の方法。
【請求項８】
前記パケットにおいて各帯域幅ユニットが使用されるかどうかを指定するビットマップを提供すること
をさらに含む、請求項４に記載の方法。
【請求項９】
前記ビットマップにおける帯域幅ユニットの順序は、前記帯域幅ユニットの実際の送信とは無関係である、請求項８に記載の方法。
【請求項１０】
前記パケットは、複数のセグメントを備える、請求項１に記載の方法。
【請求項１１】
前記パケットのデータフィールドにおいて、前記選択された変調およびコーディングレートを有する所定の数の後続する順次送信されたパケットに関する情報を提供すること
をさらに含む、請求項１に記載の方法。
【請求項１２】
無線システムにおいて情報を送信するための方法であって、
複数のチャネル上のトラフィックを決定することと、
前記トラフィックおよび利用可能なチャネル帯域幅に基づいて、パケットのための帯域

幅を選択することであって、前記帯域幅は、最大許容数の帯域幅ユニットに分割可能である、選択することと、
各帯域幅ユニットが使用されているかどうかを示すビットマップを生成することと、
少なくとも１つのチャネル上で前記ビットマップを含む前記パケットを送信することとを備える方法。
【請求項１３】
前記ビットマップにおける帯域幅ユニットの順序は、前記帯域幅ユニットの実際の送信とは無関係である、請求項１２に記載の方法。
【請求項１４】
無線デバイスであって、
送信機を備え、
前記送信機は、複数のチャネル上のトラフィックを決定するように構成され、
前記送信機は、前記トラフィックおよび利用可能なチャネル帯域幅に基づいて、帯域幅を選択するように構成され、
前記送信機は、複数の変調から変調およびコーディングレートを選択するように構成され、
前記送信機は、前記選択された変調およびコーディングレートを前記パケットのセグメントに適用するように構成され、各セグメントは、１つまたは複数の帯域幅ユニットを含む、
前記送信機は、少なくとも１つのチャネル上で前記パケットを送信するように構成される、無線デバイス。
【請求項１５】
前記送信機はさらに、パケットごとに、必要に応じて、前記選択された変調を変更するように構成される、請求項１４に記載の無線デバイス。
【請求項１６】
前記送信機は、前記パケットの前記帯域幅を、連続したスペクトル上で提供するように構成される、請求項１４に記載の無線デバイス。
【請求項１７】
前記送信機は、前記パケットの前記帯域幅を、不連続なスペクトル上で提供するように構成される、請求項１４に記載の無線デバイス。
【請求項１８】
前記送信機は、最大４つの帯域幅ユニットに前記パケットを限定するように構成される、請求項１４に記載の無線デバイス。
【請求項１９】
前記送信機は、１つの帯域幅ユニットにおいて、前記変調およびコーディングレートを指定するシンボルを含み、プライマリ・チャネル上で前記１つの帯域幅ユニットを提供するように構成される、請求項１４に記載の無線デバイス。
【請求項２０】
前記送信機はさらに、前記帯域幅ユニットの使用を示すビットマップを送信するように構成される、請求項１４に記載の無線デバイス。
【請求項２１】
前記送信機は、２μｓ未満のターンアラウンドタイムを有するシンセサイザを含む、請求項１４に記載の無線デバイス。
【請求項２２】
前記送信機は、送信周波数からの周波数オフセットを有するシンセサイザを含む、請求項１４に記載の無線デバイス。
【請求項２３】
前記送信機は、超高速スループット（ＶＨＴ）パケットをサポートする、請求項１４に記載の無線デバイス。
【請求項２４】

無線デバイスであって、
送信機を備え、
前記送信機は、複数のチャネル上のトラフィックを決定するように構成され、
前記送信機は、前記トラフィックおよび利用可能なチャネル帯域幅に基づいて、パケットのための帯域幅を選択するように構成され、前記帯域幅は、最大許容数の帯域幅ユニットに分割可能であり、
前記送信機は、各帯域幅ユニットが使用されているかどうかを示すビットマップを生成するように構成され、
前記送信機は、少なくとも１つのチャネル上で前記ビットマップを含む前記パケットを送信するように構成される、無線デバイス。

【請求項２５】
前記ビットマップにおける帯域幅ユニットの順序は、前記帯域幅ユニットの実際の送信から独立したものである、請求項２４に記載のデバイス。

【請求項２６】
無線システムであって、
第１および第２のトランシーバと、
不連続な周波数動作および多入力多出力（ＭＩＭＯ）動作のうちの１つのために前記第１および第２のトランシーバを選択的に構成するためのスイッチと
を備える無線システム。

【請求項２７】
送信機からのパケットを既知の受信機に送信する方法であって、前記送信機は、少なくとも不連続な周波数動作のために構成され、前記受信機は、連続した周波数動作のみのために構成され、前記方法は、
前記送信機における任意のシンセサイザの位相を相関させることと、
前記パケットの任意のセグメントを波形上で互いに隣接して配置することと
前記波形を前記受信機に送信することと
を備える、方法。

【発明の詳細な説明】
【関連出願】
【０００１】
本願は、２０１１年３月４日に出願された、「動的帯域幅選択および不連続な送信をサポートするためのメカニズム（"Mechanisms To Support Dynamic Bandwidth Selection And Noncontiguous Transmissions"）」と題された、米国仮特許出願第６１／４４９，４４９号、および２０１１年５月１２日に出願された、「動的帯域幅選択および不連続な送信をサポートするためのメカニズム（"Mechanisms To Support Dynamic Bandwidth Selection And Noncontiguous Transmissions"）」と題された、米国仮特許出願第６１／４８５，５２５号の優先権を主張する。

【技術分野】
【０００２】
本明細書は、無線通信システムのパフォーマンスを改善することに関し、特に、ワイドチャネル帯域幅を動的に選択および利用しうる無線ローカル・エリア・ネットワーク（ＷＬＡＮ）に関する。

【背景技術】
【０００３】
無線ローカル・エリア・ネットワーク（ＷＬＡＮ）のパフォーマンスは、新たなユーザアプリケーションに適合および／または事前に対処するために、絶えず見直しと向上が行なわれている。この活動の多くは、ＩＥＥＥ ８０２．１１標準化組織によって推進される。この組織は、ＩＥＥＥ ８０２．１１（ＤＳＳＳ：direct sequence spread spectrum（直接シーケンス・スペクトラム拡散）、１－２Ｍｂｐｓ）、ＩＥＥＥ ８０２．１１ｂ（ＣＣＫ：complementary code keying（相補コード・キーイング））、１１Ｍｂｐｓ）

、およびＩＥＥＥ．１１ｇ（ＯＦＤＭ：orthogonal frequency division multiplexing（直交周波数分割多重化））、５４Ｍｂｐｓ）を含む、２．４ＧＨｚの周波数帯域のための多数の規格を開発してきた。最新の規格は、ＩＥＥＥ ８０２．１１ｎ（ＭＩＭＯ－ＯＦＤＭ：multiple input multiple output OFDM（多入力多出力ＯＦＤＭ）、６００Ｍｂｐｓ）であり、これは、２．４ＧＨｚの周波数帯域と５ＧＨｚの周波数帯域との両方をサポートする。

【０００４】

この進歩の促進において、業界では、今日、ＷＬＡＮのスループット・パフォーマンスを、１Ｇｂｐｓを超えるように改善することを目指している。したがって、ＷＬＡＮシステムのパフォーマンスがこのパフォーマンス目標を達成することを可能にしうる方法および装置が必要とされている。

【発明の概要】

【０００５】

無線システムにおいて情報を送信するための方法が提供される。この方法では、複数のチャネル上のトラフィックが決定されうる。パケットのための帯域幅が、トラフィックと利用可能なチャネル帯域幅とに基づいて選択されうる。変調およびコーディングレートが、複数の変調および関連するコーディングレートから選択されうる。変調およびコーディングレートは、パケットのセグメントに適用されることができ、ここで、各セグメントは、１つまたは複数の帯域幅ユニットを含む。選択された変調およびコーディングレートをその中に含むパケットは、少なくとも１つのチャネル上で送信されうる。

【０００６】

この方法はさらに、パケットごとに（on a per packet basis）、必要に応じて、選択された変調およびコーディングレートを調整することを含みうる。パケットの帯域幅は、連続したスペクトルまたは不連続なスペクトル上で提供されうる。パケットの帯域幅が、不連続なスペクトル上で提供される場合、この方法はさらに、任意のシンセサイザの位相を相関させることと、パケットの２つのセグメントを送信のための波形上で互いに隣接して配置する（positioning）こととを含みうる。

【０００７】

一実施形態では、少なくとも１つの帯域幅ユニットが４０ＭＨｚであり、パケットは、最大４つの帯域幅ユニットを有する。プライマリ・チャネル上で提供される１つの帯域幅ユニットは、選択された変調およびコーディングレートを指定するシンボルを含みうる。帯域幅ユニットにおける等しくない帯域幅が使用されうることに留意されたい。パケットにおいて各帯域幅ユニットが使用されるかどうかを指定するビットマップが提供されうる。特に、ビットマップにおける帯域幅ユニットの順序（order）は、帯域幅ユニットの実際の送信から独立したものでありうる。一実施形態では、この方法はさらに、パケットのデータフィールドにおいて、選択された変調およびコーディングレートを有する、所定の数の後続する順次送信されたパケットに関する情報を提供することを含みうる。

【０００８】

また、無線システムにおいてビットマップ情報を送信するための方法が提供される。この方法では、複数のチャネル上のトラフィックが決定されうる。パケットのための帯域幅が、トラフィックと利用可能なチャネル帯域幅とに基づいて選択されうる。帯域幅は、最大許容数の帯域幅ユニットに分割可能でありうる。各帯域幅ユニットが使用されているかどうかを示すビットマップが生成されうる。ビットマップを含むパケットが、少なくとも１つのチャネル上で送信されうる。特に、ビットマップにおける帯域幅ユニットの順序は、帯域幅ユニットの実際の送信から独立したものでありうる。

【０００９】

無線デバイスがまた提供され、ここで、この無線デバイスは、上記のステップを実行するように構成された送信機を含む。第１および第２のトランシーバを含む無線システムが提供される。特に、無線システムはまた、不連続な周波数動作および多入力多出力（ＭＩＭＯ）動作のうちの１つのために、第１および第２のトランシーバを選択的に構成するた

めのスイッチを含みうる。
【００１０】
パケットを、少なくとも不連続な周波数動作のために構成された送信機から、連続周波数動作のみのために構成された既知の受信機に送信する方法が提供される。この方法では、送信機における任意のシンセサイザの位相が相関されうる。その後、パケットの任意のセグメントが、波形上で互いに隣接して配置されうる。この時点で、波形は、受信機へ送信されうる。
【図面の簡単な説明】
【００１１】
【図１Ａ】図１Ａは、例示的なシングルユーザＭＩＭＯ（８０２．１１ｎ）送信を示す図である。
【図１Ｂ】図１Ｂは、例示的なマルチユーザＭＩＭＯ（提案された８０２．１１ａｃ）送信を示す図である。
【図２Ａ】図２Ａは、輻輳した周波数スペクトルおよびこのスペクトルに関する不連続な帯域幅動作を示す図である。
【図２Ｂ】図２Ｂは、様々なＩＥＥＥ ８０２．１１規格にしたがう、５ＧＨｚ帯における利用可能なチャネルおよび関連する帯域幅を示す図である。
【図３】図３は、連続したスペクトルおよび不連続なスペクトルの様々な実施形態を示す図である。
【図４Ａ】図４Ａは、提案された８０２．１１ａｃにおける例示的な送信技術を示す図である。
【図４Ｂ】図４Ｂは、提案された８０２．１１ａｃにおける例示的な送信技術を示す図である。
【図５Ａ】図５Ａは、２つのセグメントを有する例示的なＢＷＵ構造を示す図である。
【図５Ｂ】図５Ｂは、セグメント１（ＢＷＵ １およびＢＷＵ ２）の送信が、セグメント２（ＢＷＵ ３およびＢＷＵ ４）の送信に先行する、３つのパケットの実施形態を示す図である。
【図５Ｃ】図５Ｃは、セグメント２（ＢＷＵ ３）の送信が、セグメント１（ＢＷＵ １およびＢＷＵ ２）の送信に先行する、３つのパケットの実施形態を示す図である。
【図５Ｄ】図５Ｄは、１つのセグメントのみが送信される２つの実施形態を示す図である。
【図６Ａ】図６Ａは、連続した送信または不連続な送信に関する５つの帯域幅ユニット構成を示す例示的なビットマップ表を示す図である。
【図６Ｂ】図６Ｂは、無線システムにおいてビットマップ情報を送信するための方法を示す図である。
【図７Ａ】図７Ａは、マルチプルなチャネルと関連付けられた周波数セグメントを示す図である。
【図７Ｂ】図７Ｂは、トレーニングおよび信号情報とデータ部分とを含む簡単化されたパケットを示す図である。
【図８Ａ】図８Ａは、８０２．１１ｎで起こりうる、セカンダリ・チャネルにおいて２０ＭＨｚ ＢＳＳ（ＢＳＳ２）とオーバーラップする４０ＭＨｚ ＢＳＳ（ＢＳＳ１）を示す図である。
【図８Ｂ】図８Ｂは、ＢＳＳ１が、４０ＭＨｚ全体が利用可能になるまで、すなわち、ＢＳＳ２の送信後まで、その送信を待つ、第１の解決策を示す図である。
【図８Ｃ】図８Ｃは、ＢＳＳ１が、プライマリ・チャネル上で（ランダム・バックオフの終了後の）２０ＭＨｚのみを使用してそのＰＰＤＵを送信できるとともに、ＢＳＳ２が、（ＢＳＳ１による送信よりも前に開始された）その２０ＭＨｚ送信のためにセカンダリ・チャネルを使用する、第２の解決策を示す図である。
【図８Ｄ】図８Ｄは、マルチプルな２０ＭＨｚ ＢＳＳ、すなわち、ＢＳＳ２、ＢＳＳ３、およびＢＳＳ４とオーバーラップする８０ＭＨｚ送信を有するＢＳＳ１を示す図である

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【図８Ｅ】図８Ｅは、静的帯域幅送信（static bandwidth transmission）を使用するときには、ＢＳＳ１が、８０ＭＨｚ全体が解放されるまでかなりの時間を待つ必要がありうることを示す図である。
【図８Ｆ】図８Ｆは、ＢＳＳ帯域幅のどの部分が利用可能であるかを感知し、利用可能なチャネルを活用するために帯域幅を動的に調整するように構成されている送信機を示す図である。
【図９Ａ】図９Ａは、複数の変調およびコーディングレートを含む連続した送信を示す図である。
【図９Ｂ】図９Ｂは、同じ変調およびコーディングレートを含む不連続な送信を示す図である。
【図９Ｃ】図９Ｃは、改善された送信のためにパケットにおいて異なる変調およびコーディングレートを提供するための例示的な技術を示す図である。
【図１０Ａ】図１０Ａは、改善された送信のための例示的な変調スキームを示す図である。
【図１０Ｂ】図１０Ｂは、改善された送信のための例示的な変調スキームを示す図である。
【図１０Ｃ】図１０Ｃは、改善された送信のための例示的な変調スキームを示す図である。
【図１１】図１１は、非常に短い整定時間を有するシンセサイザが、どのように様々なパフォーマンス要件を満たすために使用されうるかを示す図である。
【図１２】図１２は、アナログ障害を補償するための改善された較正方法を示す図である。
【図１３Ａ】図１３Ａは、２０ＭＨｚ、４０ＭＨｚ、８０ＭＨｚまたは１６０ＭＨｚの帯域幅を有するパケットを送信しうる１６０ＭＨｚ ＢＳＳを有するＷＬＡＮシステムを示す図である。
【図１３Ｂ】図１３Ｂは、複数のシンセサイザおよびシンセサイザ選択コンポーネントを含む例示的なＷＬＡＮ構成を示す図である。
【図１４Ａ】図１４Ａは、改善された中間周波数（ＩＦ）生成を促進する例示的な送信機を示す図である。
【図１４Ｂ】図１４Ｂは、デジタルＩＦが、すなわち、送信機のデジタル部分における適切な周波数入力選択により、意図された送信スペクトルの外部に放射される実際の干渉量を最小化しうることを示す図である。
【図１５】図１５は、単一のシンセサイザと少数のミキサが、２つのシンセサイザを有効にインプリメントしうる実施形態を示す図である。
【図１６Ａ】図１６Ａは、送信機が不連続デバイスであり、受信機が連続デバイスである例示的なＷＬＡＮシステムを示す図である。
【図１６Ｂ】図１６Ｂは、送信機が不連続デバイスであり、受信機が連続デバイスである例示的なＷＬＡＮシステムを示す図である。
【図１７】図１７は、不連続動作およびＭＩＭＯ動作の両方を提供しうる例示的な構成可能トランシーバを示す図である。
【詳細な説明】
【００１２】
現在、新しいＩＥＥＥ ８０２．１１規格が開発されている。８０２．１１ａｃとして指定されるこの規格は、８０２．１１ｎ規格を超えて、すなわち、１Ｇｂｐｓを超えるように、スループット・パフォーマンスを改善する目的を有する。８０２．１１ａｃのドラフトＤ０．１は、特定の用語を使用し、それらの用語は本明細書でも参照を容易にするために使用される。例示的な用語が、以下に定義される。
【００１３】
「周波数スペクトル」は、一般に、パケットの送信をサポートするのに必要とされうる

周波数スペクトル全体を指す。周波数スペクトルは、１つまたは複数の周波数セグメントを備えうる（以下参照）。

【００１４】

「パケット」は、時間の任意の点での周波数スペクトルにおけるデータを指す。

【００１５】

提案された８０２．１１ａｃにおいて、「帯域幅ユニット（ＢＷＵ）」は、４０ＭＨｚの周波数スペクトルを指す。パケットは、最大４つのＢＷＵを有することができ、それらは、ＢＷＵ １、ＢＷＵ ２、ＢＷＵ ３、およびＢＷＵ ４で示される。

【００１６】

「スロット」は、ＢＷＵ内の指定された周波数スペクトルを指す。４０ＭＨｚのＢＷＵは、２０ＭＨｚの２つのスロットを有しうる。プライマリ・チャネル（２０ＭＨｚ）およびセカンダリ・チャネル（２０ＭＨｚ）は、ＢＷＵ １において２つのスロットを使用する。

【００１７】

「セグメント」は、１つ以上のＢＷＵのセットを指す。２つのＢＷＵ間に周波数におけるギャップがない場合には、２つのＢＷＵは、１つのセグメントの一部である。２つのＢＷＵ間に周波数におけるギャップがある場合には、各ＢＷＵがセグメントである。提案された８０２．１１ａｃでは、１パケット当たり最大２つのセグメントが許容される。

【００１８】

提案された８０２．１１ａｃの幅広い目的は、広いチャネル帯域幅（ＢＷ）（８０ＭＨｚまたは１６０ＭＨｚ）とマルチユーザ多入力多出力（ＭＵ－ＭＩＭＯ）アンテナを利用することによって、超高速スループット（ＶＨＴ：Very High Throughput）（＜６ＧＨｚ）を保証することを含む。別の目的は、５ＧＨｚで動作する８０２．１１ａシステムおよび８０２．１１ｎシステムとの下位互換性を含む。さらに別の目的は、次のターゲットＭＡＣスループットを含む：シングルユーザ・スループット＞５００Ｍｂｐｓおよびマルチユーザアグリゲートスループット（multi-user aggregate throughput）＞１Ｇｂｐｓ。

【００１９】

図１Ａおよび図１Ｂは、それぞれ、例示的なシングルユーザＭＩＭＯ（８０２．１１ｎ）送信およびマルチユーザＭＩＭＯ（提案された８０２．１１ａｃ）送信を示す。図１Ａに示されるように、シングルユーザＭＩＭＯ送信では、デバイス１００（例えば、アクセスポイント（ＡＰ））が、単一のデバイス１０５（例えば、局（ＳＴＡ））にデータのマルチプルなストリーム（すなわち、ストリーム１０１、１０２、１０３、および１０４）を送信することができる。一方、図１Ｂに示されるように、マルチユーザＭＩＭＯ送信では、デバイス１００は、デバイス１０５、１０６、および１０７などの複数のデバイスにデータのストリームを送信することができる。この実施形態では、デバイス１０５は、ストリーム１０１および１０２を受信することができ、一方、デバイス１０６および１０７は、それぞれ、ストリーム１０３および１０４を受信することができる。この送信ターゲティング能力（transmission targeting capability）は、デバイス１００が、単純（および安価）なデバイスと通信するときでさえ、高い総ダウンリンク・スループットを維持することを可能にしうる。

【００２０】

以前のＷＬＡＮ規格では、帯域幅は、２０ＭＨｚと４０ＭＨｚに限定されていた。一方、提案された８０２．１１ａｃ規格では、８０ＭＨｚおよび１６０ＭＨｚの帯域幅モードで、より高いスループットが達成されうる。表１は、ストリームの数、ＱＡＭ変調のタイプと関連するコーディングレート（変調およびコーディングスキーム（ＭＣＳ））、および帯域幅の選択についての様々なオプションを説明する。表１にリストされるオプションは、１ＧＨｚよりも大きいＴＣＰ／ＩＰ（伝送制御プロトコル/インターネット・プロトコル）スループットを達成しうる。

【表１】

**表1**

| # ストリーム | MCS | BW |
|---|---|---|
| 8 | 256-QAM 3/4 | 40 MHz |
| 4 | 256-QAM 3/4 | 80 MHz |
| 3 | 64-QAM 2/3 | 160 MHz |
| 2 | 256-QAM 3/4 | 160 MHz |

【００２１】

表２は、様々なＭＣＳと、１ストリームおよび３ストリームとに関して、（Ｍｂｐｓ単位で）ポテンシャルデータレートを示す（ここで、Ｎｓｓは、ストリームまたは空間ストリームの数を指す）。

【表２】

**表2**

| MCS | Nss=1 | | | Nss=3 | | |
|---|---|---|---|---|---|---|
| | 40 MHz | 80 MHz | 160 MHz | 40 MHz | 80 MHz | 160 MHz |
| BPSK 1/2 | 15.0 | 32.5 | 65.0 | 45.0 | 97.5 | 195.0 |
| QPSK 1/2 | 30.0 | 65.0 | 130.0 | 90.0 | 195.0 | 390.0 |
| QPSK 3/4 | 45.0 | 97.5 | 195.0 | 135.0 | 292.5 | 585.0 |
| 16-QAM 1/2 | 60.0 | 130.0 | 260.0 | 180.0 | 390.0 | 780.0 |
| 16-QAM 3/4 | 90.0 | 195.0 | 390.0 | 270.0 | 585.0 | 1170.0 |
| 64-QAM 2/3 | 120.0 | 260.0 | 520.0 | 360.0 | 780.0 | 1560.0 |
| 64-QAM 3/4 | 135.0 | 292.5 | 585.0 | 405.0 | -- | 1755.0 |
| 64-QAM 5/6 | 150.0 | 325.0 | 650.0 | 450.0 | 975.0 | 1950.0 |
| 256-QAM 3/4 | 180.0 | 390.0 | 780.0 | 540.0 | 1170.0 | 2340.0 |
| 256-QAM 5/6 | 200.0 | 433.3 | 866.7 | 600.0 | 1300.0 | -- |

【００２２】

帯域幅が増大するにつれて、より高い帯域幅のアプリケーションのために利用可能な連続した周波数スペクトルの位置を特定する（locate）ことがより難しくなる。例えば、周波数スペクトルは、広い帯域幅の送信に容易には適応（accommodate）しないスライスに分割されうる。図２Ａは、新しいＷＬＡＮ（１６０ＭＨｚ）２００が、既存のより狭いＷＬＡＮ ２０１、２０２、および２０３（例えば、４０ＭＨｚ）および無線デバイス（例えば、レーダー）２０５および２０６と周波数スペクトルを共用する必要がある例示的な環境を示す。

【００２３】

（図２Ａに示されるような）輻輳したスペクトルに対する可能な解決策は、ＷＬＡＮ ２００の帯域幅が２つの周波数セグメント、例えば、セグメント２１０（８０ＭＨｚ）およびセグメント２１１（８０ＭＨｚ）に分割される不連続な帯域幅モードの動作であり、それによって、送信のために利用可能なチャネルを見つける確率を増大させる。一実施形態では、不連続な１６０ＭＨｚ送信は、任意の２つの８０ＭＨｚチャネルを使用しうる。

図２Ａでは、セグメント２１０は、利用可能な、Ｕ－ＮＩＩ ワールドワイドバンドの低周波数部分で送信され、一方、セグメント２１１は、Ｕ－ＮＩＩ ３バンドで送信される。セグメントは、動作環境において任意の利用可能なチャネルに配置（located）されうる。

【００２４】

図２Ｂは、アメリカ合衆国での５ＧＨｚ帯における利用可能なチャネルを例示する。８０２．１１ａでは、（チャネル１４４を除く）２０ＭＨｚチャネルが指定され、８０２．１１ｎでは、（４０ＭＨｚチャネルが１４０および１４４においてプライマリを有することを除く）４０ＭＨｚチャネルが指定され、８０２．１１ａｃでは、２０＋４０＋８０＋１６０ＭＨｚチャネルが指定されるように提案されることに留意されたい。図２Ｂでは、２０ＭＨｚチャネルについてのチャネル番号のみが示されていることに留意されたい。ここで使用される他の帯域幅のチャネル（すなわち、４０ＭＨｚ、８０ＭＨｚ、および１６０ＭＨｚ）についてのチャネル番号は、周波数において最も近い２０ＭＨｚチャネルに基づく。例えば、最も低い周波数の４０ＭＨｚチャネルは、ここで参照される３８というチャネル番号を有し、これは、２０ＭＨｚチャネル３６および４０に対するその位置により識別されうる。

【００２５】

図２Ａに戻って参照すると、セグメント２１０および２１１は、同期的に使用されることに留意されたい、すなわち、両方のセグメントが送信機（ＴＸ）モードにあり、または両方のセグメントが受信機（ＲＸ）モードにある。さらに、不連続な送信では、セグメント２１０および２１１上の信号は、同じ（１つまたは複数の）受信機に結合される。

【００２６】

従来のＷＬＡＮ規格では、ＢＳＳ（基本サービスセット）帯域幅は、本質的に静的であり、すなわち、ＢＳＳ帯域幅が変化することは、非常にまれな、またはめったにないことであったことに留意されたい。一方、提案されたＷＬＡＮ規格ＩＥＥＥ ８０２．１１ａｃは、パケットごとに帯域幅が動的に変化することを可能にする。提案された８０２．１１ａｃにおける改善された送信の一態様によれば、そして、以下でより詳細に説明されるように、プロトコル・データ・ユニット（ＰＰＤＵ）は、この能力をサポートするために修正されうる。さらに、ＰＰＤＵはまた、パケットごとに、またセグメントごとでさえも、異なる変調（ＭＣＳ）および送信電力レベルをサポートするように修正されうる。

【００２７】

図３は、ＢＳＳ（基本サービスセット）がそのネットワークにおいてセットアップされるための例示的な連続したスペクトル３０１および不連続なスペクトル３０２を例示する。連続したスペクトル３０１で動作する場合、選択されたＢＳＳ帯域幅は、２０ＭＨｚ、４０ＭＨｚ、８０ＭＨｚ、または１６０ＭＨｚでありうる。不連続なスペクトル３０２で動作するときには、選択されたＢＳＳ帯域幅は、プライマリ・セグメントおよびセカンダリ・セグメントの次の組み合わせのうちの１つであることができ、ここで、第１の帯域幅は、プライマリ・セグメントにおいてリストされ、第２の帯域幅は、セカンダリ・セグメントにおいてリストされる：４０ＭＨｚ＋４０ＭＨｚ、４０ＭＨｚ＋８０ＭＨｚ、８０ＭＨｚ＋４０ＭＨｚ、および８０ＭＨｚ＋８０ＭＨｚ。不連続な送信モードは、上記帯域幅の組み合わせに限定されず、一般にいずれの任意の帯域幅の組み合わせでもありうることに留意されたい。

【００２８】

連続した４０ＭＨｚユニットの間のトーン（中間トーン）がデータで満たされている場合、所与のＭＣＳ結果について７つの異なるレートが存在しうる。７つの異なるレート（すなわち、ケース）が、表３に例示される。

【表３】

表3

| ケース | 合計BW (MHz) | セグメント1 (MHz) | セグメント2 (MHz) |
|---|---|---|---|
| 1 | 40 | 40 | -- |
| 2 | 80 | 80 | -- |
| 3 | 80 | 40 | 40 |
| 4 | 120 | 120 | -- |
| 5 | 120 | 80 | 40 |
| 6 | 160 | 160 | -- |
| 7 | 160 | 80 | 80 |

【００２９】

図４Ａおよび図４Ｂは、提案された８０２．１１ａｃにおける例示的な送信技術を示す。高いスループット・パフォーマンスを達成するために、ＷＬＡＮシステムは、動作の連続モードまたは不連続モードを適切に選択するために、利用可能なチャネル帯域幅とパケットが送信されるのに必要とされる帯域幅とを決定しうる。例えば、図４Ａは、メッセージＡ（４０１）を送信するＷＬＡＮシステムを例示し、ここで、メッセージＡは、１６０ＭＨｚの帯域幅を必要とする。ＷＬＡＮシステムは、利用可能なスペクトルに基づいて、メッセージＡが、連続した送信で送信されうるか（好ましい実施形態）、あるいは不連続な送信で送信されなければならないかを決定しうる。メッセージＡは、処理され、適切な数のセグメントへと拡散され、その後、利用可能なスペクトル上に配置されることができる（４０２）。不連続な送信が適切であると仮定して、メッセージＡは、処理され、８０ＭＨｚの２つのセグメント（Ａ１：４０３およびＡ２：４０４）へと拡散され、その後、図４Ｂに例示されるように、不連続な送信のために利用可能なスペクトル上に配置される（４０５）ことができる。

【００３０】

提案された８０２．１１ａｃでは、これらＢＷＵは、様々な方法でセットアップまたは構造化されうる。例えば、ＶＨＴ情報要素は、以下の情報を介して、ＢＳＳにおける利用可能なＢＷＵを示しうる。「プライマリ・チャネル」は、プライマリ２０ＭＨｚチャネルのためのチャネル番号である。「セカンダリ・チャネル・オフセット」は、プライマリ・チャネルに対するセカンダリ２０ＭＨｚチャネルのオフセットであり、ここで、オフセットは、（－１、０、＋１）のうちの１つである。ＢＷＵ ２チャネルは、４０ＭＨｚのＢＷユニット２のチャネル番号である。ＢＷＵ ３チャネルは、４０ＭＨｚのＢＷユニット３のチャネル番号である。ＢＷＵ ４チャネルは、４０ＭＨｚのＢＷユニット４のチャネル番号である。チャネル番号「０」は、未使用の帯域を示すことに留意されたい。

【００３１】

提案された８０２．１１ａｃでは、ＶＨＴ能力要素は、以下の情報によって局（ＳＴＡ）の能力を示すことができる。「最大帯域幅」は、受信デバイスが受信することができる

パケットの最大帯域幅を示す（例えば、４０ＭＨｚ／８０ＭＨｚ／１６０ＭＨｚ）。「不連続な帯域幅のサポート」は、「０」または「１」でありうる。０である場合には、受信デバイスは、不連続な周波数セグメントを使用するパケットを受信することができない。１である場合には、受信デバイスは、不連続な周波数セグメントを使用するパケットを受信することができる。最大ＢＷ＝８０ＭＨｚである場合には、受信デバイスは、「不連続をサポートする」について、０または１のいずれかを選択しうる。最大ＢＷ＞８０ＭＨｚである場合には、受信デバイスは、「不連続をサポートする」を１にセットしなければならない。

【００３２】

図５Ａは、２つのセグメント、すなわち、セグメント１およびセグメント２、を有する例示的なＢＷＵ構造（これは、不連続な送信を意味する）を例示する。セグメント１は、ＢＷＵ １およびＢＷＵ ２を含む。ＢＷＵ １は、プライマリ・チャネル（２０ＭＨｚ）およびセカンダリ・チャネル（２０ＭＨｚ）を含む。ＢＷＵ ２は、４０ＭＨｚのスペクトルを有する。セグメント２は、ＢＷＵ ３およびＢＷＵ ４を含み、それらは、４０ＭＨｚのスペクトルをそれぞれ有する。

【００３３】

改善された無線送信の一態様によれば、ＢＷＵ １、ＢＷＵ ２、ＢＷＵ ３、またはＢＷＵ ４の各々が使用されているかどうかを示すために、ビットマップが使用されうる。具体的には、各ＢＷＵは、ビット番号を割り当てられうる、すなわち、ＢＷＵ １にはビット０、ＢＷＵ ２にはビット１、ＢＷＵ ３にはビット２、およびＢＷＵ ４にはビット３が割り当てられうる。表４に示されるように、各々のビット１－３は、ＢＷＵが未使用である場合は「０」の値、およびＢＷＵがパケットにおいて使用されている場合は「１」の値を有する。ＢＷＵ １は、プライマリ・チャネルとセカンダリ・チャネルの両方を含むので、「０」は、プライマリ・チャネルのみが使用されていることを示し、「１」は、プライマリ・チャネルとセカンダリ・チャネルの両方が使用されていることを示す。一実施形態では、このビットマップは、ＶＨＴ－ＳＩＧ－Ａフィールドにおける４ビットとして送信され、これは、提案された８０２．１１ａｃで提供される。一実施形態では、４０ＭＨｚよりも大きい任意のパケット帯域幅については、ＢＷＵ １は、４０ＭＨｚ（ビット０＝１）を使用しなければならない。

【表４】

表4

| 値 | ビット0 (BWU 1) | ビット1 (BWU 2) | ビット2 (BWU 3) | ビット3 (BWU 4) |
|---|---|---|---|---|
| 0 | 20MHz（プライマリ・チャネルのみ） | 未使用 | 未使用 | 未使用 |
| 1 | 40MHz（プライマリ＆セカンダリ・チャネル） | 使用済み | 使用済み | 使用済み |

【００３４】

図５Ｂは、セグメント１（ＢＷＵ １およびＢＷＵ ２）の送信が、セグメント２（ＢＷＵ ３およびＢＷＵ ４）の送信に先行する、３つのパケットの実施形態（すなわち、図５Ａと同じＢＷＵ構造）を例示する。パケット５０１は、プライマリ・チャネルのみを占有する２０ＭＨｚのパケットであり、これは、チャネル３６に位置する。したがって、パケ

ット５０１に関する帯域幅ビットは、「０００００」である。パケット５０２は、４０ＭＨｚがＢＷＵ １（チャネル３６、４０）、ＢＷＵ ２（チャネル４６）、およびＢＷＵ ４（チャネル１５９）の各々に位置する、１２０ＭＨｚのパケットである。したがって、パケット５０２のための帯域幅ビットは、「１１０１」である。パケット５０３は、４０ＭＨｚがＢＷＵ １（チャネル３６、４０）、ＢＷＵ ２（チャネル４６）、ＢＷＵ ３（チャネル１５１）、およびＢＷＵ ４（チャネル１５９）の各々に位置する、１６０ＭＨｚのパケットである。したがって、この実施形態に関する帯域幅ビットは、「１１１１」である。（図２Ｂを参照し、プライマリ・チャネルに関して）セカンダリ・チャネル・オフセットは、１に等しいことに留意されたい。

【００３５】

ビットマップにおけるビット順序が、ＢＷＵについての実際のスペクトル位置に関係なく同じままであることに留意されたい。例えば、図５Ｃは、セグメント２（ＢＷＵ ３）の送信が、セグメント１（ＢＷＵ １およびＢＷＵ ２）の送信に先行する、３つのパケットの実施形態を例示する。パケット５０５は、４０ＭＨｚがＢＷＵ ３（チャネル５４）に位置し、また、４０ＭＨｚがＢＷＵ ２（チャネル１０２）およびＢＷＵ １（チャネル１０８、１１２）の各々に位置する、１２０ＭＨｚのパケットである。したがって、パケット５０５に関する帯域幅ビットは、「１１１０」である。パケット５０５では、ＢＷＵ １は、パケットにおける最も高い周波数のところに位置し、ＢＷＵ ３は、パケットにおける最も低い周波数のところに位置することに留意されたい。したがって、ＢＷＵ １は、最下位ビット（ＬＳＢ）を定義するとして特徴付けられることができ、ＢＷＵ ３は、最上位ビット（ＭＳＢ）を定義するとして特徴付けられることができる。さらに、セカンダリ・チャネルは、プライマリ・チャネルよりも低い周波数であることに留意されたい。したがって、セカンダリ・チャネル・オフセットは、－１に等しい。パケット５０６は、ＢＷＵ １（チャネル１０８、１１２）に位置する４０ＭＨｚのパケットである。したがって、パケット５０６に関する帯域幅ビットは、「１０００」である。パケット５０７は、４０ＭＨｚがＢＷＵ １（チャネル１０８、１１２）に位置し、また、４０ＭＨｚがＢＷＵ ２（１０２）に位置する、８０ＭＨｚのパケットである。したがって、パケット５０７に関する帯域幅ビットは、「１１００」である。

【００３６】

特に、ビットマップは、単一のセグメント送信に等しく適用可能ある。例えば、図５Ｄは、１つのセグメントのみが送信される２つの実施形態を示す。両方の実施形態において、セグメント１は、低い周波数から高い周波数へとリストされる次の帯域幅ユニットを含む：ＢＷＵ ２、ＢＷＵ １、ＢＷＵ ３およびＢＷＵ ４。これらの実施形態では、プライマリ・チャネルは、セカンダリ・チャネルよりも低い。したがって、セカンダリ・チャネル・オフセットは、１に等しい。パケット５１０は、４０ＭＨｚがＢＷＵ １（チャネル１０８、１１２）、ＢＷＵ ３（チャネル１１８）、およびＢＷＵ ４（チャネル１２６）の各々に位置する、１２０ＭＨｚのパケットである。したがって、この実施形態のための帯域幅ビットは、「１０１１」である。パケット５１０は、連続したスペクトルを使用して送信することに留意されたい。パケット５１１は、４０ＭＨｚがＢＷＵ ２（チャネル１０２）、ＢＷＵ １（チャネル１０８、１１２）、およびＢＷＵ ４（チャネル１２６）の各々に位置する、１２０ＭＨｚのパケットである。したがって、パケット５１１のための帯域幅ビットは、「１１０１」である。パケット５１１は、不連続なスペクトルを使用して送信することに留意されたい。

【００３７】

図６Ａは、連続した送信または不連続な送信に関する５つの帯域幅ユニット構成を示す例示的なビットマップ表を例示する。このビットマップ表のコーディング（coding）は、受信機によって検出されることができ、それによって、受信されているパケットの帯域幅を受信機が決定することを可能にする。任意のパケットのためにプライマリ・チャネルＰ２０が使用されることに留意されたい。具体的には、ＢＷＵ １は、２０ＭＨｚのプライマリ・チャネル（Ｐ２０）を含み、それは、第１のスロット内に位置する。送信が２０Ｍ

Ｈｚである場合には、プライマリ・チャネルＰ２０のみが使用され、ビットマップコーディングは「００００」である。このコーディングは、第２のスロットにおけるビット値が０であることを示し、すなわち、第２のスロットにおける送信はない。他方では、送信が４０ＭＨｚである場合には、ビットマップコーディングは「１０００」である。このビットコーディングは、ＢＭＷ １の第２のスロットのビット値が１であることを示す。

【００３８】

送信が８０ＭＨｚである場合には、ビットマップコーディングは、利用されるＢＷＵに応じて１１００または１０１０である（ケース３またはケース４）。送信が１６０ＭＨｚである場合には、ビットマップコーディングは、１１１１である。ＢＷＵは、周波数スペクトルにおけるそれらの順序を示すために、列の順序（例えば、ＢＷＵ ２、ＢＷＵ １、ＢＷＵ ３およびＢＷＵ ４）でリストされうる。上述したように、ビットマップのビットは、順序づけられたＢＷＵ、すなわち、ＢＷＵ １、ＢＷＵ ２、ＢＷＵ ３、ＢＷＵ ４においてデータが存在するかどうかを示す（したがって、ＢＷＵの実際の送信順序に関する情報を提供しない）。図６は、包括的ではなく、例示的な、送信されたＰＰＤＵに関する組み合わせを示すことに留意されたい。

【００３９】

ＢＳＳの帯域幅は、ＢＳＳにおいて許可される任意のＰＰＤＵ送信の最大帯域幅に対応することに留意されたい。したがって、各ＰＰＤＵ送信の帯域幅は、ＢＳＳ帯域幅以下になりうる。不連続なＢＳＳにおけるＰＰＤＵ送信のケースでは、これらＢＷＵは、第１のセグメントまたは第２のセグメントの異なる部分に配置されうる（図５Ｃを参照）。

【００４０】

図６Ｂは、無線システムにおいてビットマップ情報を送信するための方法６１０を例示する。ステップ６１１は、複数のチャネル上のトラフィックを決定する。ステップ６１２は、トラフィックおよび利用可能なチャネル帯域幅に基づいて、パケットのための帯域幅を選択する。ステップ６１３は、各帯域幅ユニットが使用されているかどうかを示すビットマップを生成する。ステップ６１４は、少なくとも１つのチャネル上でビットマップを有するパケットを送信する。

【００４１】

従来のＷＬＡＮシステムでは、受信機は、一般に、パケットの帯域幅が概して静的であるので、それが受信しているパケットの帯域幅を知る必要がない。提案された８０２．１１ａｃでは、受信機は、受信されたパケットを効率よく処理するために、ＢＷＵの帯域幅を知るべきである。一実施形態では、受信機は、各帯域幅部分（例えば、各２０ＭＨｚサブバンド）ごとのエネルギーを調べることができ、帯域幅部分のうちのいくつが有意なエネルギーを有するかに基づいて、信号の帯域幅を決定することができる。例えば、１６０ＭＨｚのパケットがある場合、エネルギー検出システムは、１６０ＭＨｚ帯域全体または８個の２０ＭＨｚサブバンドのすべてにおけるエネルギーの上昇を検出しうる。あるいは、２０ＭＨｚのパケットがある場合、エネルギー検出システムは、２０ＭＨｚサブバンドにおけるエネルギーの上昇のみを検出しうる。一実施形態では、自動利得制御（ＡＧＣ）ユニットが、決定された帯域幅に対するエネルギーを検出するために使用されうる。

【００４２】

別の実施形態では、受信機は、メッセージの信号部分から帯域幅情報を復号するために、時間領域復号またはプリアンブル・シグネチャ検出を使用することができる。ＩＥＥＥ ８０２．１１用語において、この技術は、ＶＨＴプリアンブルにおける、あるタイプのＳＴＦパターン検出である。

【００４３】

図７Ａは、マルチプルなチャネルと関連付けられた周波数セグメント７０１を例示し、各チャネルは、Ａによって表される。周波数セグメント７０１は、プライマリ・チャネル$Ａ_{p}$ ７０２を含むすべてのＡチャネルのために必要とされる帯域幅の合計に等しい最大帯域幅を有する。一実施形態では、チャネルＡおよび$Ａ_{p}$の各々は、同じ帯域幅（例えば、２０ＭＨｚ）を有する。図７Ｂに示されるように、時間領域において、任意のチャネル

、すなわち、Ａチャネルまたは$A_p$チャネルに関連付けられた送信された情報は、トレーニング部分（レガシーおよびＶＨＴのトレーニング・フィールドの両方における情報を含む）、信号部分、およびデータ部分を有する。提案された８０２．１１ａｃでは、プライマリ・チャネル$A_p$は、信号（ＳＩＧ）部分内に、周波数セグメント７０１の最大帯域幅に関する情報を含む。また、この信号部分は、ＶＨＴ情報要素とも呼ばれうる。したがって、プライマリ・チャネル$A_p$と関連付けられた情報の信号部分を復号することによって、メッセージの最大帯域幅が決定されうる。ここで説明されるように、改善された送信に従って、ＶＨＴ情報要素もまた、ＢＳＳにおいて使用されたＢＷＵに関する情報を提供しうる。

【００４４】

特に、セグメントとマルチプルなＢＷＵを備える上記に説明されたパケット構造は、その他の無線システムに拡張されうる。この構造は、パケット送信のために大きなスペクトルが必要とされうるが、スペクトルの小さなスライス（または、断片（pieces））のみが利用可能である場合の解決策を提供しうる。これらの環境は、不連続な解決策が必要とされうることを示唆する。この環境についての無線の例は、これらに限定されるものではないが、次のものを含みうる：（１）例えば、スマート・メータリング（smart metering）のようなセンサ・ネットワーク用に提案された規格ＩＥＥＥ ８０２．１１ａｈ、（２）ＴＶホワイトスペース（約９００ＭＨｚ）、すなわち、ＴＶブロードキャスタに既に割り当てられており、同時に使用されていないスペクトル、において動作するコグニティブ無線用に提案された規格ＩＥＥＥ ８０２．１１ａｆ、および（３）９００ＭＨｚ帯におけるＷｉＦｉアプリケーション。

【００４５】

これらのアプリケーション（およびその他）において、プロトコル構造は、以下の考慮すべき事項を有しうる。第１に、ＢＷＵは、無線規格と互換性がある任意の値をとりうる。例えば、提案された８０２．１１ａｃでは、ＢＷＵは４０ＭＨｚであり、一方、８０２．１１ａｈについては、ＢＷＵは５ＭＨｚでありうる。他のアプリケーションでは、ＢＷＵは、４０ＭＨより大きく、または４０ＭＨｚより小さくなりうる。第２に、パケットあたり任意の数のセグメントおよび／または任意の数のＢＷＵが存在しうる。第３に、パケットは、２つより多くの連続したスペクトルで送信されうる。第４に、これらＢＷＵは、連続したスペクトルにはない場合がある。第５に、ＢＷＵの中心周波数を指定することが、セグメンテーションを決定する。

【００４６】

ＢＳＳがオーバーラップするときには、物理層コンバージェンス・プロシージャ（ＰＬＣＰ）プロトコル・データ・ユニット（ＰＰＤＵ）を送信するための様々な技術が存在する。例えば、図８Ａは、セカンダリ・チャネルにおいて２０ＭＨｚ ＢＳＳ（ＢＳＳ２）とオーバーラップする４０ＭＨｚ ＢＳＳ（ＢＳＳ１）を示し、これは、８０２．１１ｎで起こりうる。図８Ｂは、４０ＭＨｚ全体が利用可能になるまで、すなわち、ＢＳＳ２の送信後まで、ＢＳＳ１がその送信を待つ、第１の解決策を例示する。図８Ｃは、ＢＳＳ１が、プライマリ・チャネル上の（ランダム・バックオフの終了後に）２０ＭＨｚのみを使用してそのＰＰＤＵを送信できるとともに、ＢＳＳ２が、（ＢＳＳ１による送信よりも前に開始された）その２０ＭＨｚ送信のためにセカンダリ・チャネルを使用する、第２の解決策を例示する。２０ＭＨｚ送信がＢＳＳ１のために開始されると、この送信は、ＢＳＳ２がその送信を完了した後の４０ＭＨｚのアベイラビリティに関係なく、２０ＭＨｚに留まらなければならないことに留意されたい。

【００４７】

特に、８０ＭＨｚまたは１６０ＭＨｚをサポートするＷＬＡＮのために提案された８０２．１１ａｃでは、送信のオーバーラップを解消することは、より一層著しく困難である。例えば、図８Ｄは、マルチプルな２０ＭＨｚ ＢＳＳ、すなわち、ＢＳＳ２、ＢＳＳ３、およびＢＳＳ４とオーバーラップする８０ＭＨｚ送信を有するＢＳＳ１を例示する。図８Ｅに示されるように、静的帯域幅送信を使用すると、ＢＳＳ１は、８０ＭＨｚ全体が解

放されるまでかなりの時間を待つ必要がありうる。この結果、静的帯域幅送信を使用すると、スループットの著しい低下が生じうる。

【００４８】

一般的には、ＢＳＳ帯域幅が増大するにつれて、ＢＳＳが、周波数においてオーバーラップする１つまたは複数のＢＳＳと広いスペクトルを共用する確率が増大する。オーバーラップするＢＳＳは、関心のあるＢＳＳ、すなわちＢＳＳ Ｘよりも狭い帯域幅を有しうる。ＢＳＳ Ｘにおける送信が、任意のオーバーラップするＢＳＳに進行中の送信があるかを検査することなく行われた場合には、衝突が発生し、リンク・スループットを低下させうる。したがって、最初にチャネルをセンシングして、チャネルが使用のために解放されているかを確かめることが推奨される。図８Ｆを参照すると、提案された８０２．１１ａｃでは、送信機は、ＢＳＳ帯域幅のどの部分が利用可能であるかを感知し、利用可能なチャネルを活用するために帯域幅を動的に調整する能力を有する。例えば、図８Ｆでは、８０ＭＨｚ ＢＳＳ１は、２０ＭＨｚに動的に調整されることができ、これは、ＢＳＳ１におけるランダム・バックオフの終了後に送信を開始することができ、それによって、ＢＳＳ２、ＢＳＳ３、およびＢＳＳ４との同時並行送信（concurrent transmission）を可能にする。

【００４９】

改善された、提案された８０２．１１ａｃ ＷＬＡＮの一態様によれば、異なる変調は、パケットにおいて使用されることができ、連続した送信または不連続な送信のいずれかに適用されることができる。例えば、図９Ａは、波形９０１を例示し、これは、ＱＰＳＫ変調により送信される周波数スペクトルの第１の部分と、６４ＱＡＭ変調により送信される周波数スペクトルの第２の部分とを含む連続した送信である。図９Ｂは、波形９０２を例示し、これは、ＱＰＳＫ変調と６４ＱＡＭ変調による不連続な送信である。また、送信の一部分は、送信の他の部分とは異なる電力レベルを有しうることに留意されたい。例えば、図９Ａおよび図９Ｂの両方において、周波数スペクトルの６４ＱＡＭ部分は、ＱＰＳＫ電力レベルよりも高い電力レベルを有する。また、周波数スペクトルの２つの部分は、２０ＭＨｚ、４０ＭＨｚ、または８０ＭＨｚのような、異なる帯域幅でありうる。

【００５０】

図９Ｃは、改善された送信のために異なる変調およびコーディングレートを提供するための例示的な技術９２０を例示する。ステップ９２１は、複数のチャネル上のトラフィックを決定する。ステップ９２２は、トラフィックおよび利用可能なチャネル帯域幅に基づいて、パケットのための帯域幅を選択する。ステップ９２３は、複数の変調および関連するコーディングレートから変調およびコーディングレートを選択する。ステップ９２４は、少なくとも１つのチャネル上で変調およびコーディングレート情報を有するパケットを送信する。

【００５１】

要約すると、ＭＣＳ、送信電力、および／または帯域幅は、異なるセグメントの間で異なりうる。

【００５２】

図１０Ａ、図１０Ｂ、および図１０Ｃは、改善された送信のための例示的な変調スキームを例示する。提案された８０２．１１ａｃパケット・フォーマットは、レガシー部分、ＶＨＴ部分、およびデータを含むことに留意されたい。レガシー部分は、トレーニング・フィールドＬ－ＳＴＦおよびＬ－ＬＴＦを有するとともに、信号フィールド（Ｌ－ＳＩＧ）を有する。ＶＨＴ部分は、トレーニング・フィールドＶＨＴ－ＳＴＦおよびＶＨＴ－ＬＴＦを有し、これらは、信号フィールドＶＨＴ－ＳＩＧ－ＡとＶＨＴ－ＳＩＧ．Ｂの間に挟まれる。図１０Ａは、２０ＭＨｚ×４のレガシーおよびＶＨＴのシンボルに続く８０ＭＨｚ×１のデータを含む、８０２．１１ａｃパケットのための連続したスペクトルを例示する。（図１０Ａ－図１０Ｃにおけるシンボルの ＶＨＴセットの一部を形成する）ＶＨＴ－ＳＩＧ－Ａは、帯域幅およびＭＣＳ（変調）情報を含むことに留意されたい。

【００５３】

図１０Ｂおよび図１０Ｃは、不連続なパケットの２つのセグメント、すなわちセグメント１およびセグメント２をそれぞれ例示する。各セグメントは、４０ＭＨｚの帯域幅を有しうる。一実施形態では、一般的に「１１ａｘ」と命名されたＷＬＡＮシステムにおける送信機は、各セグメントのための変調を選択および指定しうる。例えば、セグメント１（図１０Ｂ）では、変調ＭＣＳ１は、利用可能な変調であるＭＣＳ１とＭＣＳ２から選択される。一方、変調ＭＣＳ２は、利用可能な変調であるＭＣＳ１とＭＣＳ２からセグメント２（図１０Ｃ）のために選択される。他の実施形態では、利用可能な変調のセットにおいて、２つより多くの変調が提供されうる。例示的な変調は、ＢＰＳＫ １／２、ＱＰＳＫ １／２、ＱＰＳＫ ３／４、１６－ＱＡＭ １／２、１６－ＱＡＭ ３／４、６４－ＱＡＭ ２／３、６４－ＱＡＭ ３／４、６４－ＱＡＭ ５／６、および２５６－ＱＡＭを含む。他の実施形態において、利用可能な変調のセットは、セグメントによって異なりうることに留意されたい。一実施形態では、連続した送信または不連続な送信に関係なく、レガシーおよびＶＨＴのシンボルは、最小の帯域幅インクリメント（increment）ごとに繰り返される。図１０Ａ～図１０Ｃでは、最小の帯域幅インクリメントは２０ＭＨｚである。他の実施形態は、より大きな最小の帯域幅インクリメントを提供しうる。

【００５４】

動的ＰＰＤＵ帯域幅送信のために改善されたパフォーマンスを提供するさらなる方法および回路が、以下に開示される。

【００５５】

図１１は、非常に短い整定時間（例えば、＜２マイクロ秒）を有するシンセサイザが、どのように、（図１２を参照して説明され、また、表４にも示される）様々なパフォーマンス要件を満たすために使用されうるかを例示する。一実施形態では、ＰＰＤＵ送信のためのキャリア周波数は、送信の意図された帯域幅の外部での送信障害（transmitting impairments）を回避するために、シンセサイザ周波数から変更される。

【００５６】

図１２は、アナログ障害を補償するための改善された較正方法を例示する。この方法では、同相（in-phase）信号と位相がずれた（out-of-phase）信号は、「ＴＸ ＩＱミスマッチ」によって示されるように比較される。好ましい一実施形態では、この誤差（error）は、デジタル領域において予め測定されて予め補償されうる。シンセサイザ周波数は、ＢＳＳ帯域幅の中心において固定されていることに留意されたい、すなわち、「ＴＸ ＬＯ漏洩」（これは、常にいくらかの漏洩を有する）である。しかしながら、シンセサイザ周波数オフセットゆえに、実際の送信およびそのＩＱミスマッチは、ＴＸ ＬＯ漏洩（すなわち、シンセサイザ周波数）の両側に対称的に位置することになる。図１２に示されるように、最悪のケースでは、送信されている２０ＭＨｚ ＰＰＤＵは、ＢＳＳ帯域幅の端の近くに位置する。

【表５】

**表4**

| | 802.11ac<br>要件 | 較正後 |
|---|---|---|
| TX LO 漏洩 | -45 dBr | -5 dBr |
| TX IQ ミスマッチ | -45 dBr | -35 ～ -40 dBr |

【００５７】

１６０ＭＨｚ ＢＳＳの場合、ＷＬＡＮシステムは、図１３Ａに示されるように、２０ＭＨｚ、４０ＭＨｚ、８０ＭＨｚまたは１６０ＭＨｚの帯域幅を有するメッセージを送信

しうる。これらの帯域幅について、最適なキャリアは、それぞれｆｃ２０、ｆｃ４０、ｆｃ８０、またはｆｃ１６０でありうる（ここで、「ｆｃ」は、関連する帯域幅の中心周波数を示す）。一実施形態では、その最適なキャリアを提供するために、無線システムは、図１３Ｂに例示されるように、４つのシンセサイザ、例えば、シンセサイザ１３０１、１３０２、１３０３、および１３０４を含みうる。シンセサイザ１３０１－１３０４は、それぞれ、ＶＣＯの出力を受信して、それらの合成された出力をマルチプレクサ１３０５に提供する。マルチプレクサ１３０５への周波数選択制御信号を使用して、無線システムは、パケットの帯域幅に応じて最適なキャリアを提供する合成された信号を選択しうる。さらに、シンセサイザ１３０１－１３０４は、並列に動作するので、整定時間の問題は、最小限に抑えられる。その後、選択された信号は、ＲＦ信号とミックスされ、それによって、出力ベースバンド信号を生成する。

【００５８】

図１４Ａは、改善された中間周波数（ＩＦ）の生成を容易にする例示的な送信機を示す。具体的には、示される構成において、ＩＦＦＴ １４０１のＩおよびＱのベースバンド出力は、デジタル／アナログ変換器（ＤＡＣ）１４０３に提供される前に、ミキサ１４０２において第１の周波数ｆ１とデジタル方式でミックスされる。ＤＡＣ １４０３は、第１のＩＦ１における信号を生成する。ローパスフィルタ１４０４は、ＩＦ１における信号を受信して、第２のＩＦ２における信号を生成する。ミキサ１４０５は、ＩＦ２における出力を受信して、加算器１４０６のための入力を生成し、次にそれがＩＦ３における信号を生成する。バンドパスフィルタ１４０７は、ＩＦ３における出力を受信して、ＩＦ４における信号を生成する。ミキサ１４０８は、ＩＦ４における信号を第３の周波数ｆ３とミックスして、ＲＦ周波数を生成する。図１４Ｂは、デジタルＩＦが、すなわち、適切な周波数ｆ１の選択により、意図された送信スペクトルの外部に放出されている実際の干渉量を最小化しうることを例示する。具体的には、周波数ｆ１が低いほど、バンドパスフィルタ１４０７は、ＩＦ３において信号を最適にフィルタするためによりシャープ（sharper）でなければならない。したがって、一実施形態では、周波数ｆ１は、可能な限り高くされる。提案された８０２．１１ａｃにおける一実施形態では、ｆ１は、３５２ＭＨｚであり、ｆ２は、１．８ＧＨｚであり、ｆ３は、２．７４８－３．６９８ＧＨｚである。

【００５９】

（８０＋８０ＭＨｚ ＢＳＳのような）不連続なＢＳＳ内で動作するケースでは、各周波数セグメントで送信されるべきパケットの帯域幅は、パケットによって異なりうる。このケースでは、各周波数セグメントは、上記に説明したオプションの任意の組み合わせを通じて、動的帯域幅をサポートする必要がありうる。例えば、送信機は、各周波数セグメントにつき１つの、２つのシンセサイザを用いることができ、その各々は、非常に短い（例えば、＜２μｓ）整定時間を有することができる。別の実施形態では、１つの周波数セグメントは、非常に短い整定時間を有する周波数シンセサイザを用いることができ、一方、他の周波数セグメントは、複数の同時並行して動作しているシンセサイザ（例えば、図１３Ｂを参照）のうちの１つを選択することができる。

【００６０】

不連続な送信は、任意の周波数分離を有する２つの周波数セグメントを有する。一実施形態では、これらの周波数セグメントのための信号は、別箇のミキサを使用してそれぞれのＲＦ周波数にアップコンバートされうる。しかしながら、別のより単純な実施形態では、各周波数セグメントにつき１つの、２つのシンセサイザが提供されうる。なお別の実施形態では、図１５に示されるように、単一のシンセサイザ１５０１と少数のミキサとが、２つのシンセサイザを有効にインプリメントする。１つの構成では、回路は、シンセサイザ１５０１と、３つのミキサ１５０２、１５０３、および１５０４とを備える。シンセサイザ１５０１は、周波数ｆｓにおいて信号を生成し、それは、ミキサ１５０２に提供される。ミキサ１５０２は、ｆｓにおける信号を、第１の周波数ｆ１における別の信号とミックスして、周波数ｆｃ１およびｆｃ２における２つの信号を生成する。ミキサ１５０３は、ｆｃ１における信号を、周波数セグメント１のための信号とミックスして、周波数セグ

メント１のＲＦ信号を生成する。同様に、ミキサ１５０４は、ｆｃ２における信号を、周波数セグメント２のための信号とミックスして、周波数セグメント２のＲＦ信号を生成する。

【００６１】

図１５では、周波数ｆｃ１およびｆｃ２は、それぞれ、周波数セグメント１および２についての関連する帯域幅の中心周波数を示す。好ましい一実施形態では、ｆｓ＝（ｆｃ１＋ｆｃ２）／２およびｆ１＝（ｆｃ１－ｆｃ２）／２であり、ここで、ｆｃ１は、ｆｃ２よりも高い。このケースでは、ｆｃ１＝ｆｓ＋ｆ１およびｆｃ２＝ｆｓ－ｆ１である。したがって、周波数ｆｓの適切な選択により、ｆｃ１およびｆｃ２における２つのキャリア信号は、ＷＬＡＮシステムのパフォーマンスを最適化しうる。さらに、この構成では、シンセサイザ１５０１とミキサ１５０２、１５０３、および１５０４は、２つのシンセサイザとして有効に動作しうる。

【００６２】

ＷＬＡＮシステムの一実施形態では、送信機は、不連続デバイス（例えば、８０ＭＨｚ＋８０ＭＨｚ）であるが、受信機は、連続デバイス（例えば、１６０ＭＨｚ）である。この差異を最小化するために、送信機は、図１６Ａに示されるように、互いに隣り合って位置する２つの不連続な周波数セグメントを有する波形１６０１を送信しうる。しかしながら、上述したように、各周波数セグメントは、別個のキャリア（したがって、別個のシンセサイザ）を有しうる。この結果、各キャリアは、φ１およびφ２として示される別個の位相を有しうる。したがって、送信スペクトルは、連続した１６０ＭＨｚのように見えるかもしれないが、送信機の２つのキャリアの位相は、各シンセサイザについての異なる位相雑音ゆえに、相関付けられない場合がある。

【００６３】

連続デバイスとして、受信機は、通常、１つのキャリアのみを有し、したがって、図１６Ｂの波形１６０２上でφとして示される１つの位相のみを有する。また、波形１６０２上に示されるように、受信された周波数セグメントは、位相φ１およびφ２をそれぞれ有する。上述されたように、送信機の２つのキャリアの位相（および位相雑音）は、相関付けられない場合があるので、受信機を有効に動作するように設計することは困難でありうる。したがって、受信機（連続デバイス）は、送信機（不連続デバイス）からの信号を適切に受信できない場合がある。

【００６４】

デジタル解決策を利用する一実施形態では、受信機は、８０ＭＨｚごとの位相トラッキングを実行しうる。別の実施形態では、ステップ１６０３によって示されるように、送信機のすべてのシンセサイザが、相関された位相および位相雑音を有するように設計されうる。

【００６５】

ＷＬＡＮデバイスについて、パケットを送信または受信するときに２つのスペクトルをサポートするために、追加のアナログ回路が必要とされうることに留意されたい。一実施形態では、このデバイスのコストを低減させるために、それは、１つより多くのアプリケーションをサポートするように設計されうる。例えば、不連続および多入力多出力（ＭＩＭＯ）の動作に関する要件は、非常に似ていることがある。図１７は、スイッチ１７０１、１７０２、および１７０３を使用して、不連続およびＭＩＭＯ動作の両方をサポートしうるトランシーバ１７００を例示する。

【００６６】

スイッチ１７０１は、ミキサが、第１のシンセサイザＳｙｎｔｈ１のみから信号を受信するか、あるいは半分のミキサが、第１のシンセサイザＳｙｎｔｈ１から信号を受信し、残りの半分のミキサが、第２のシンセサイザＳｙｎｔｈ２から信号を受信するかを決定する。スイッチ１７０２は、電力増幅器ＰＡ１およびＰＡ２の出力が、合計されて第１のアンテナ（ＡＮＴ１）のみに提供されるか、あるいは第１のアンテナＡＮＴ１と第２のアンテナＡＮＴ２とにそれぞれ提供されるかを決定する。スイッチ１７０３は、低雑音増幅器

ＬＮＡ１およびＬＮＡ２の出力が、後続する受信処理のために、１つのミキサのみに提供されるか、あるいは２つのミキサに提供されるかを決定する。

【００６７】

スイッチ１７０１、１７０２、および１７０３を使用して、トランシーバ１７００は、３×３の不連続な１６０ＭＨｚ、６×６の連続した８０ＭＨｚ送信、２×２の８０ＭＨｚＭＩＭＯ動作、および１×１の不連続な８０＋８０ＭＨｚ送信を選択的にサポートしうる。同様のスイッチング構成を使用して、ＷＬＡＮシステムはまた、ＷＬＡＮ空間モードをインプリメントすることができ、あるいは、より広い帯域幅を必要としうるＷＬＡＮモードをインプリメントすることができる。

【００６８】

様々な実施形態が説明されてきた一方で、これら実施形態の範囲内にあるその他の実施形態およびインプリメンテーションが可能であることは、当業者にとって明らかであろう。例えば、本開示で説明された任意のシステムまたは方法の任意の組み合わせが可能でありうる。加えて、上記に説明されたシステムおよび方法は、ＷＬＡＮシステムまたはその他の無線システムに向けられることができる。一実施形態では、図７Ｂに戻って参照すると、所定の数の後続する順次送信されたパケットに関する選択された変調およびコーディングレートは、パケットのデータフィールド７０３において提供されうる。したがって、本発明は、このような実施形態によって限定されるようには解釈されるべきでなく、むしろ特許請求の範囲にしたがって解釈されることが理解されるべきである。

【図１Ａ】

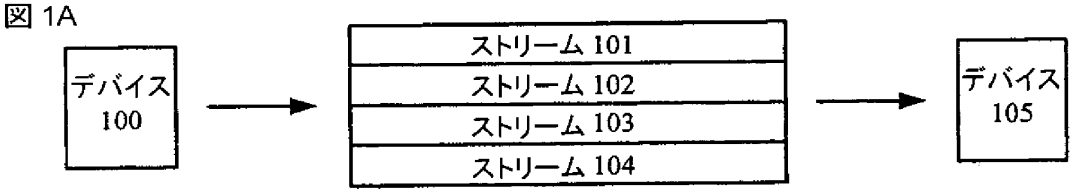



FIG. 1A
従来技術

【図１Ｂ】

図 1B

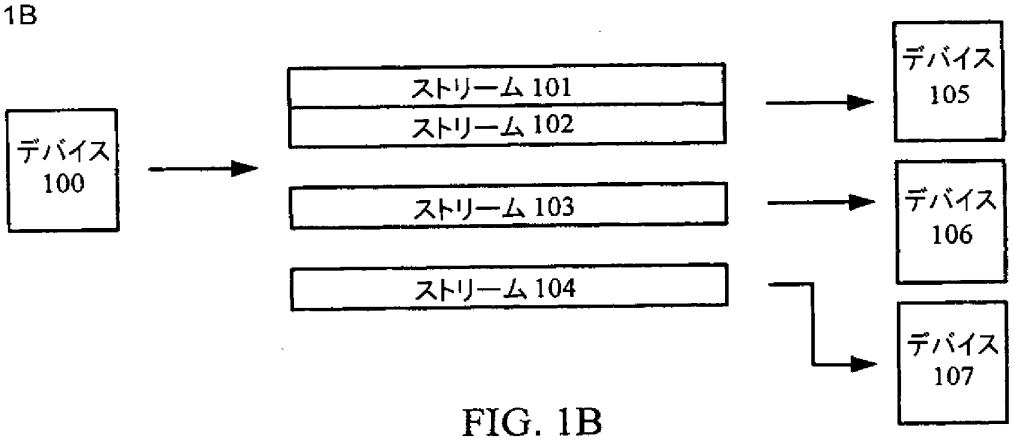



FIG. 1B
従来技術

【図２Ａ】

図 2A

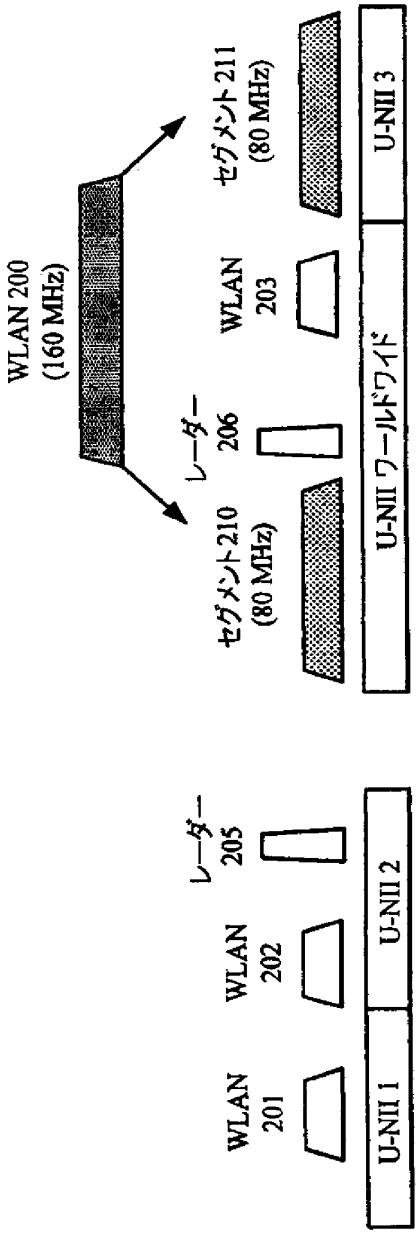



FIG. 2A

【図２Ｂ】

**図2B**

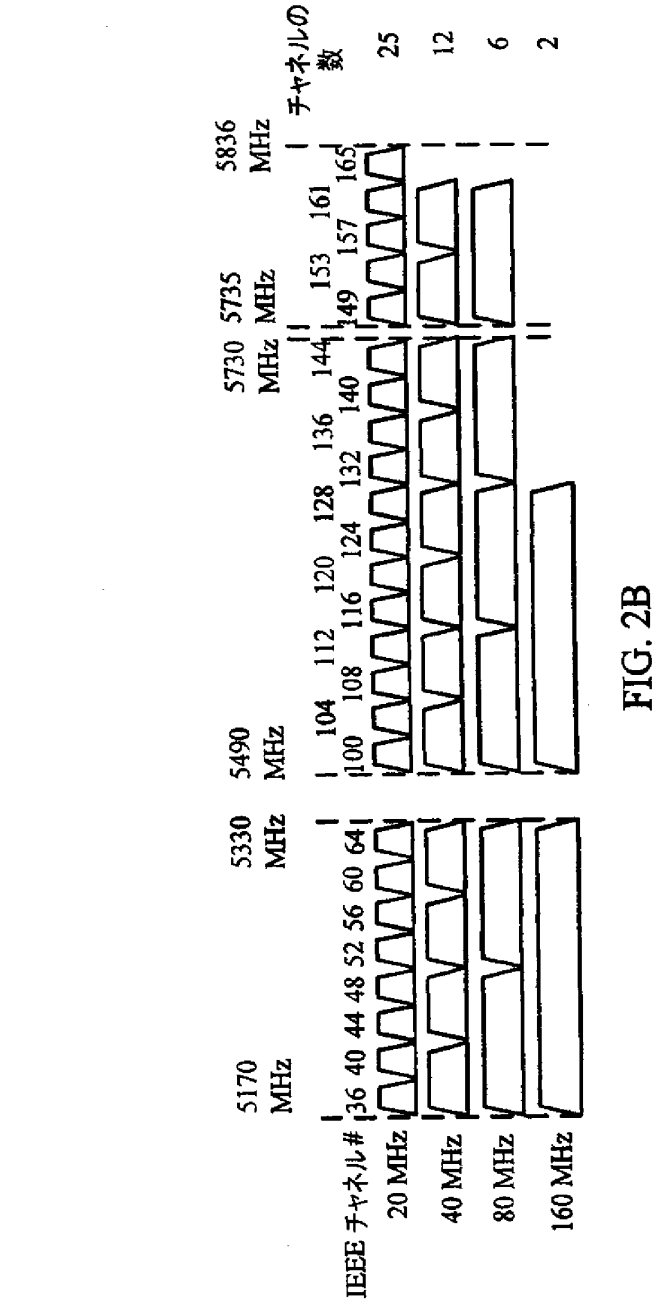



FIG. 2B

【図３】

図３

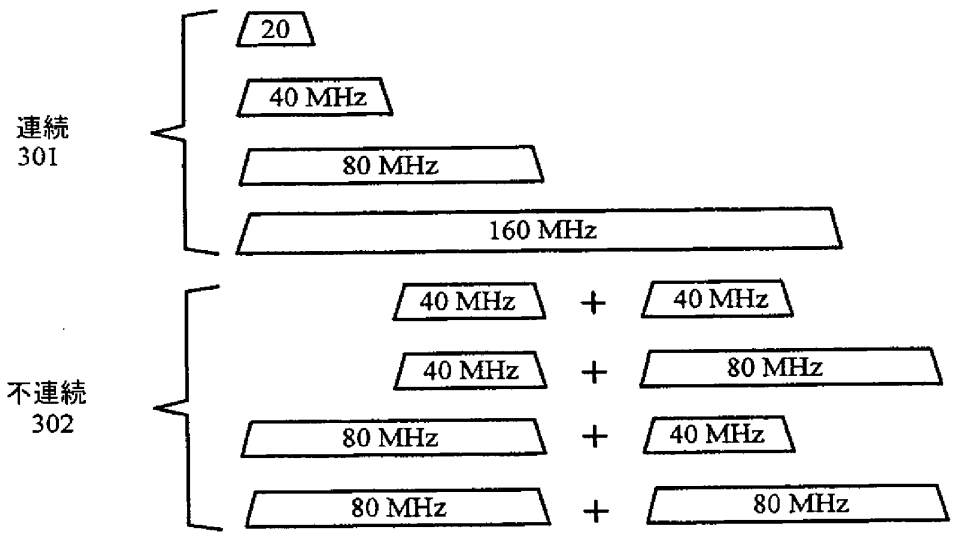



FIG. 3

【図４Ａ】

図4A

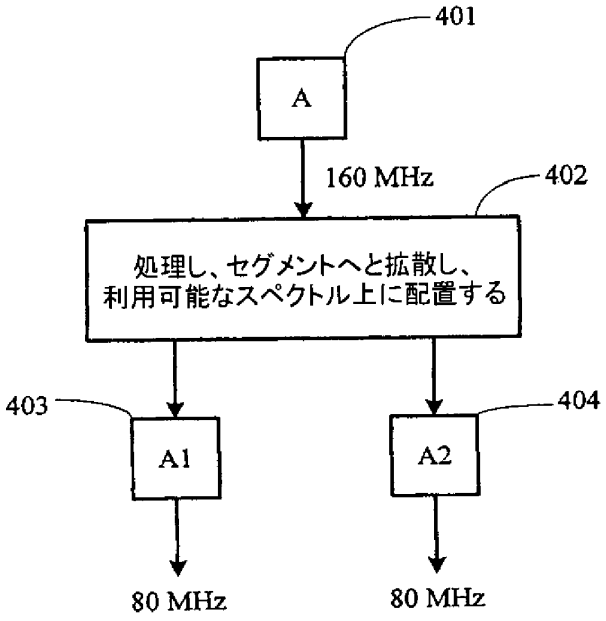



FIG. 4A

【図４Ｂ】

図4B

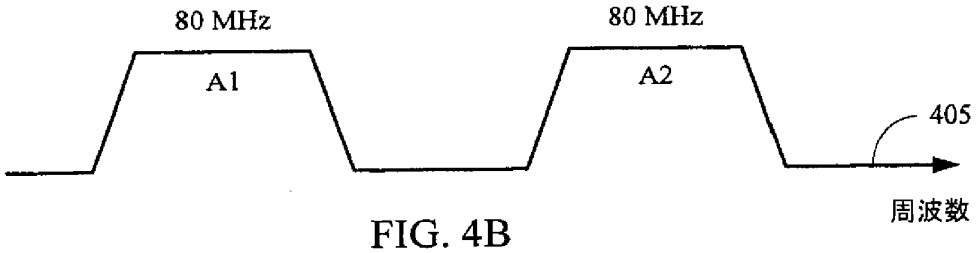



FIG. 4B

【図５Ａ】

図 5A

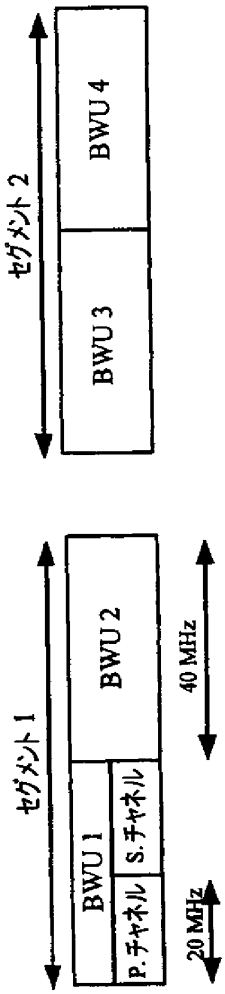



FIG. 5A

【図５Ｂ】

図 5B

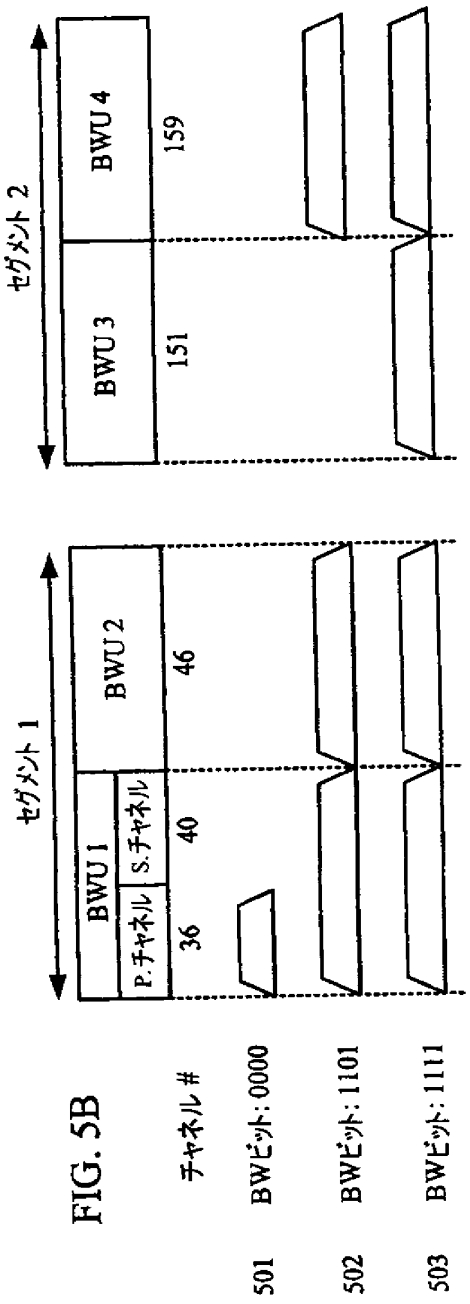



FIG. 5B

【図５Ｃ】

**図 5C**

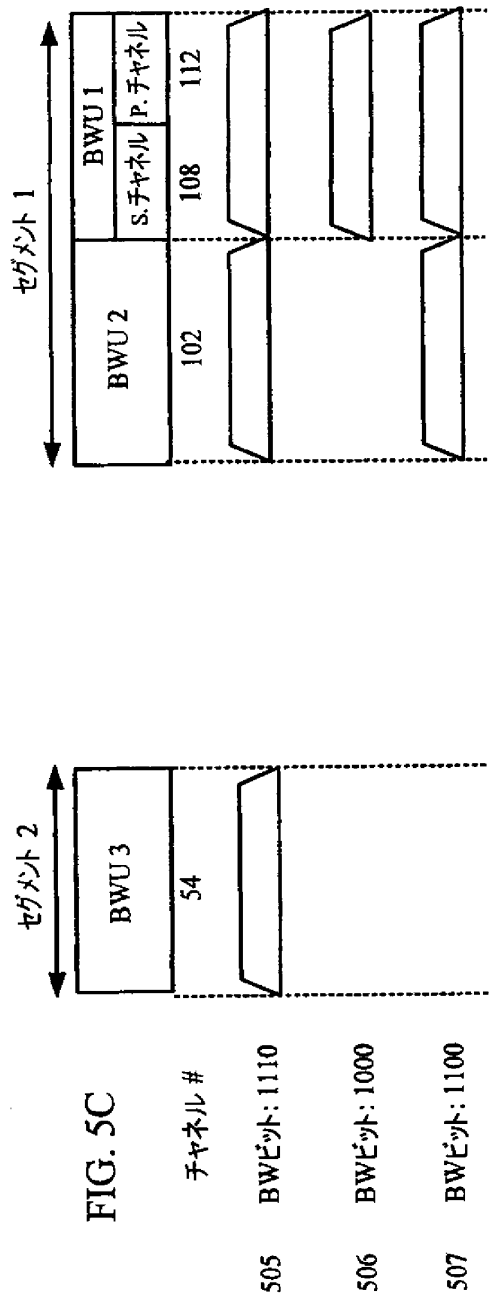



FIG. 5C

【図５Ｄ】

図5D

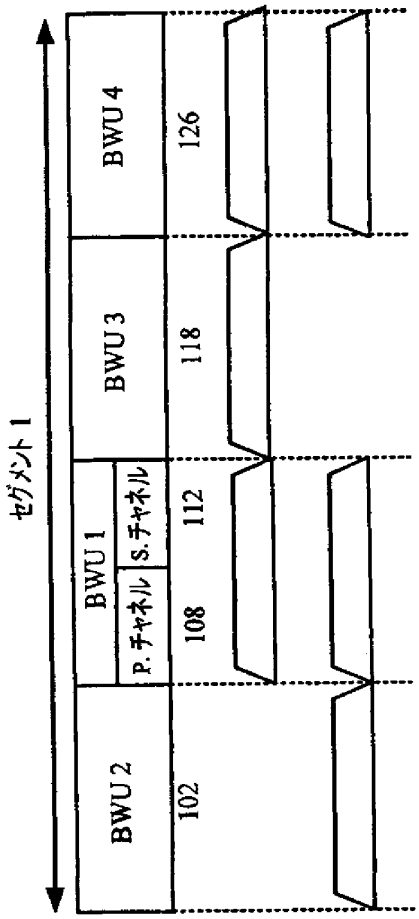
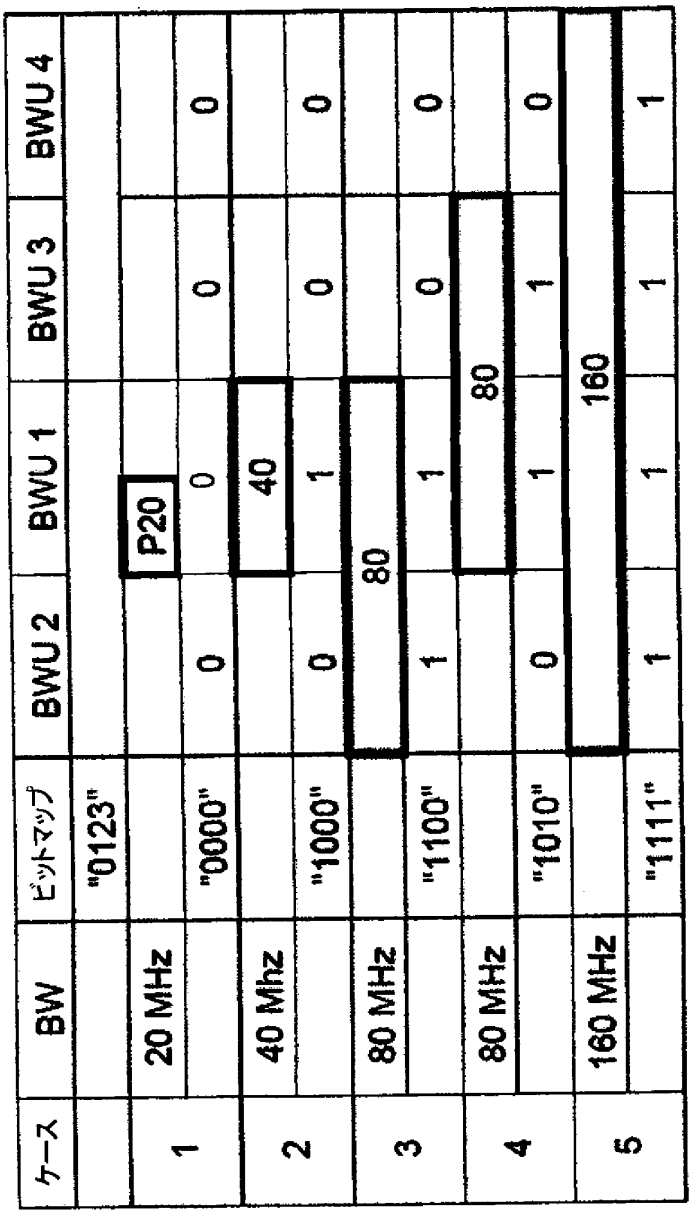



FIG. 5D

【図６Ａ】

図6A



| ケース | BW | ビットマップ | BWU 2 | BWU 1 | BWU 3 | BWU 4 |
|---|---|---|---|---|---|---|
| 1 | 20 MHz | "0123" | | P20 | | |
| | | "0000" | 0 | 0 | 0 | 0 |
| 2 | 40 Mhz | "1000" | 0 | 40 | 0 | 0 |
| | | | 0 | 1 | | |
| 3 | 80 MHz | "1100" | 80 | | 0 | 0 |
| | | | 1 | 1 | | |
| 4 | 80 MHz | "1010" | | 80 | | |
| | | | 0 | 1 | 1 | 0 |
| 5 | 160 MHz | "1111" | | 160 | | |
| | | | 1 | 1 | 1 | 1 |

FIG. 6A

【図６Ｂ】

図 6B

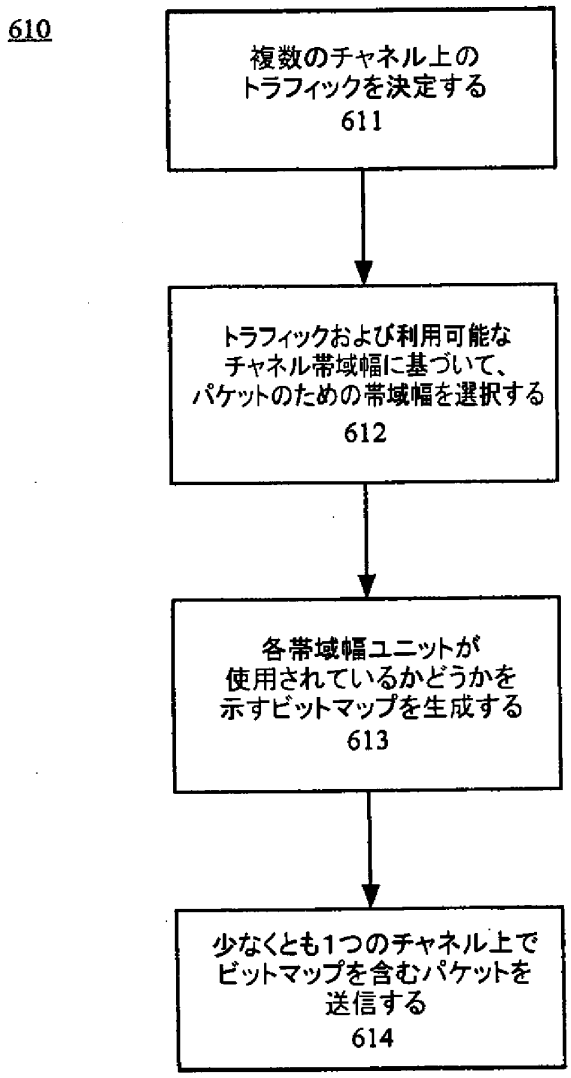



FIG. 6B

【図７Ａ】

図7A

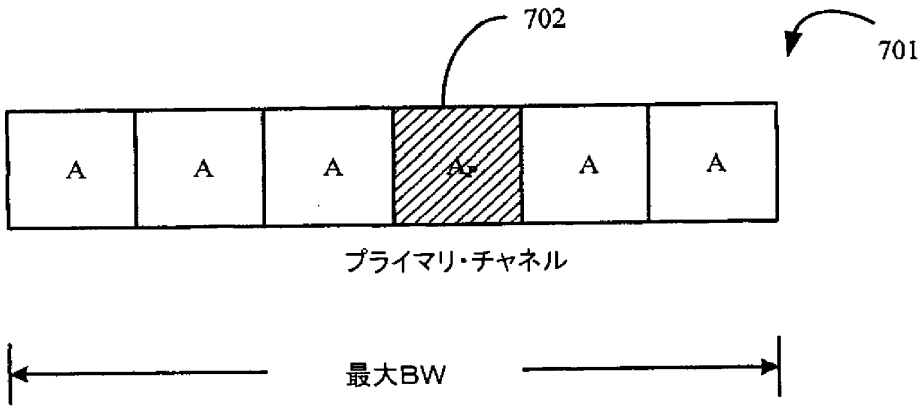



FIG. 7A

【図７Ｂ】

図7B

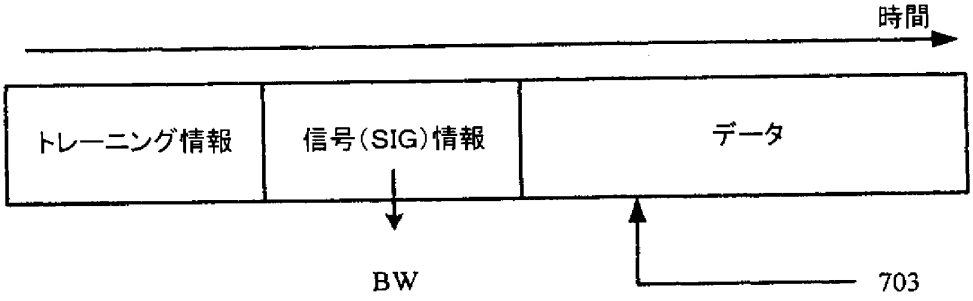



FIG. 7B

【図８Ａ】

図8A

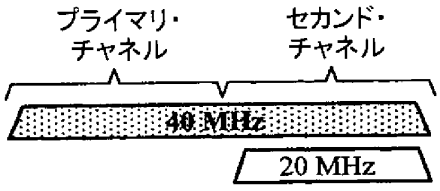



FIG. 8A

BSS1

BSS2

【図８Ｂ】

図8B

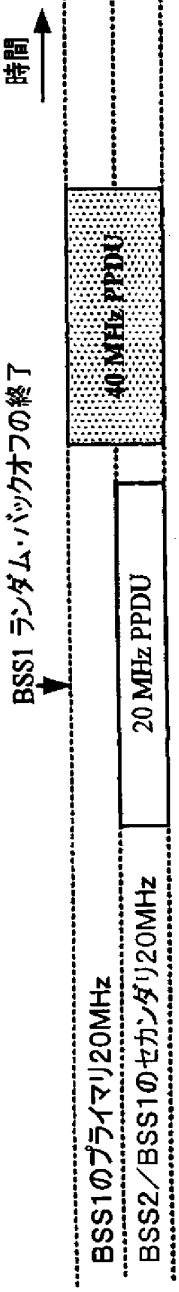



FIG. 8B

【図８Ｃ】

図 8C

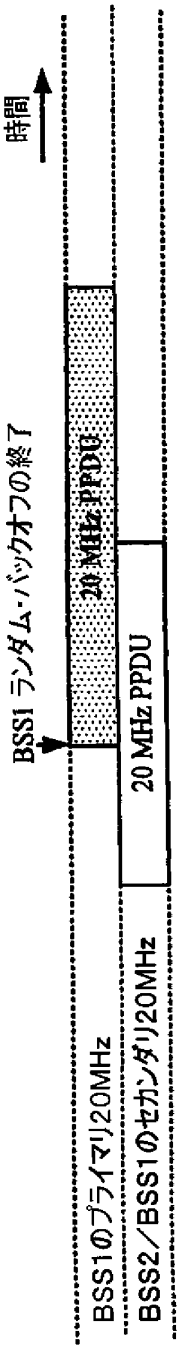
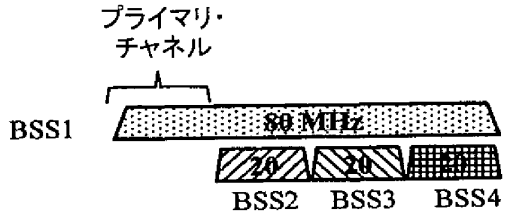



FIG. 8C

【図８Ｄ】
図8D

FIG. 8D



【図８Ｅ】

図 8E

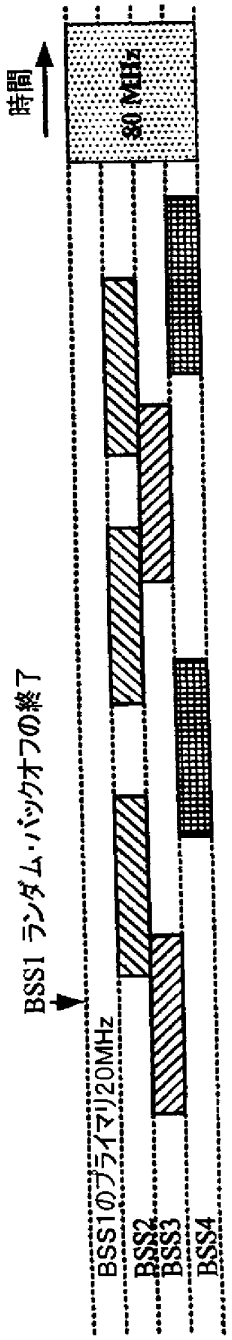



FIG. 8E

【図８Ｆ】

図 8F

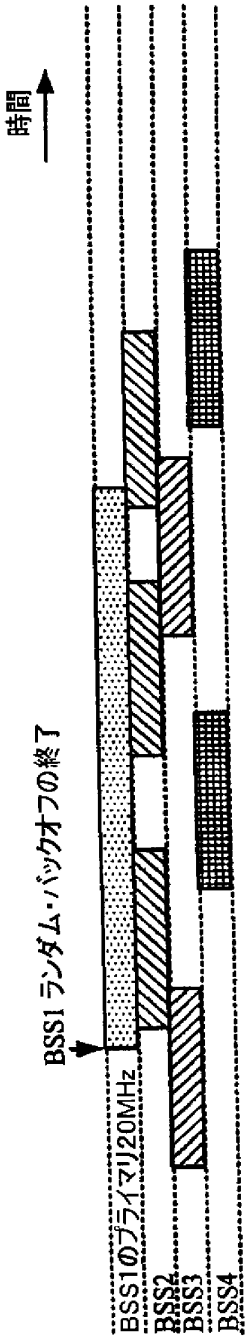



FIG. 8F

【図９Ａ】

図 9A

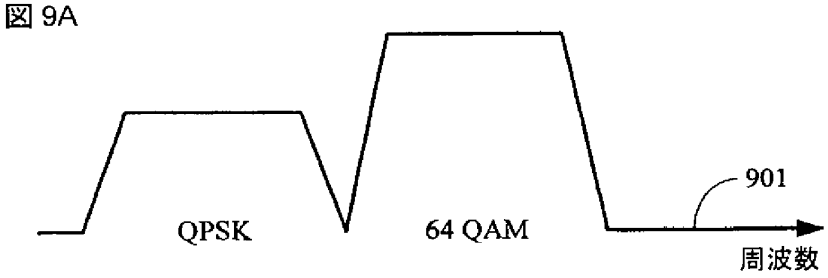



FIG. 9A

【図９Ｂ】

図 9B

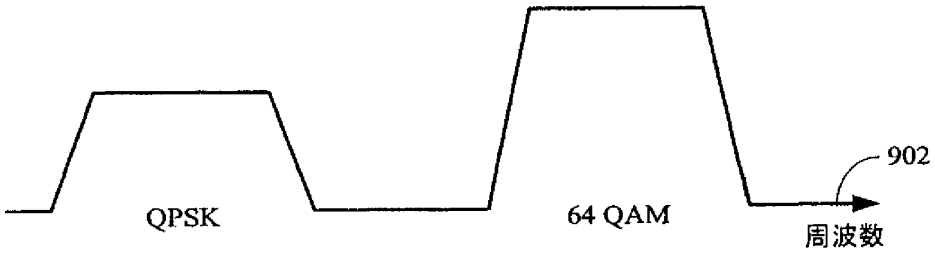



FIG. 9B

【図９Ｃ】

図 9C

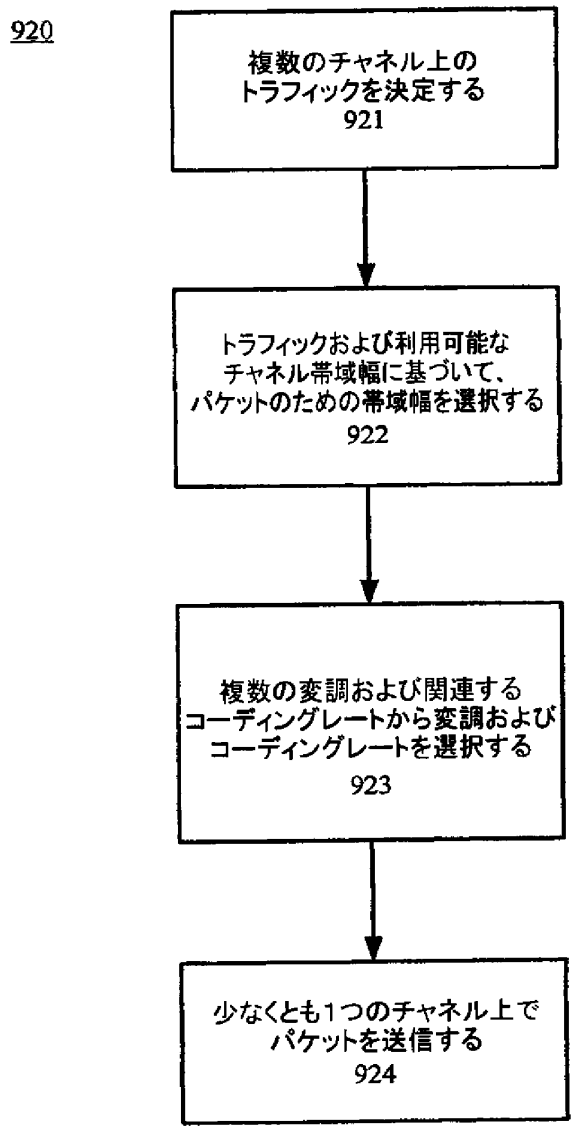



FIG. 9C

【図１０Ａ】

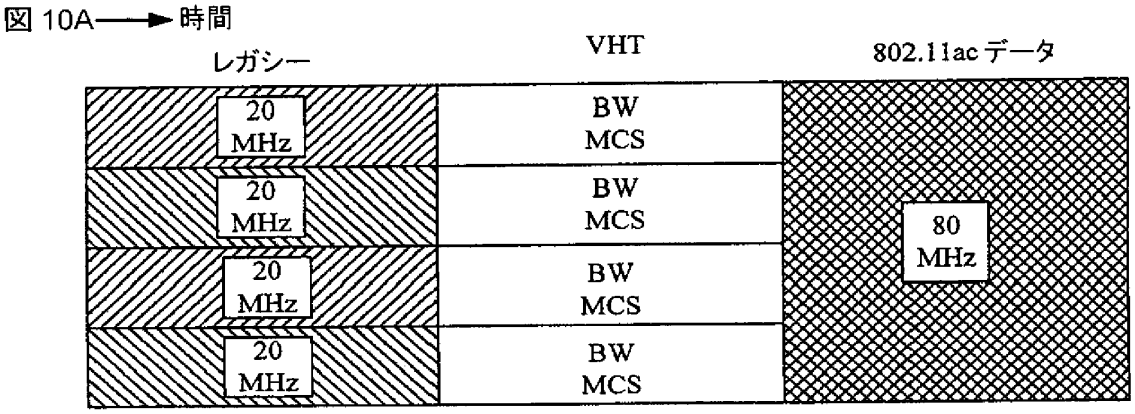



FIG. 10A

【図１０Ｂ】

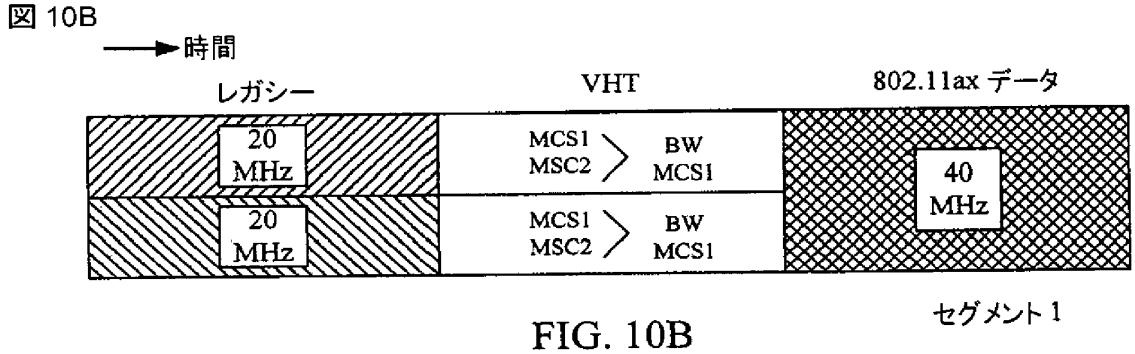



FIG. 10B

【図１０Ｃ】

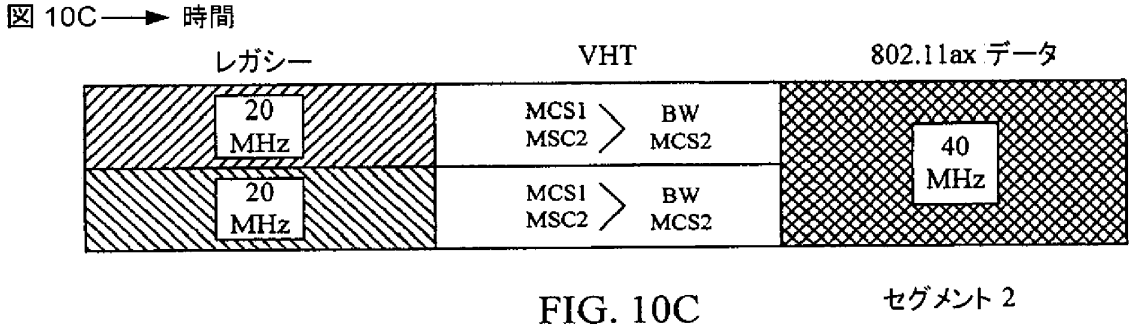



FIG. 10C

【図１１】

図 11

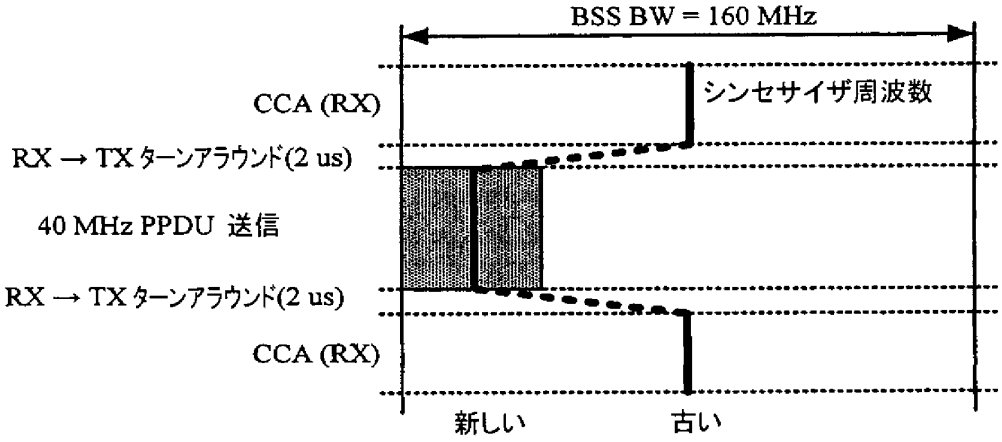



FIG. 11

【図１２】

図 12

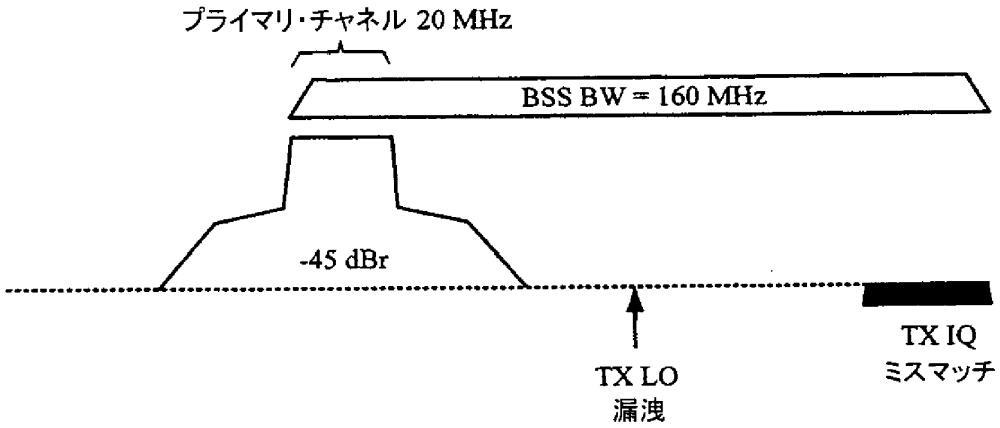



FIG. 12

【図１３Ａ】

図 13A

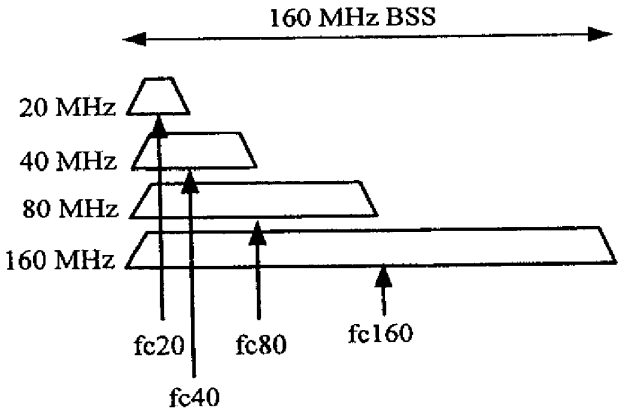
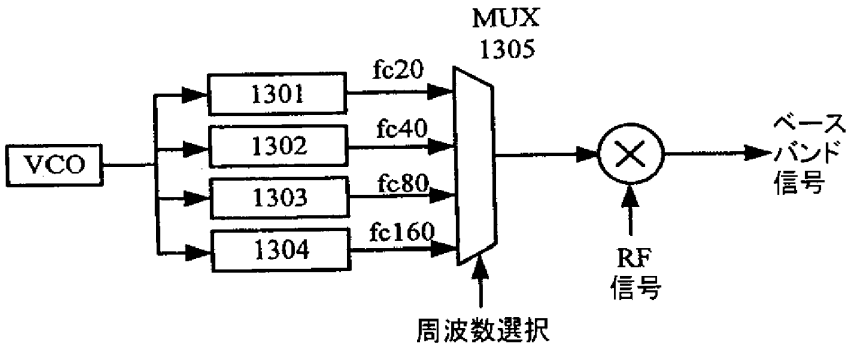



FIG. 13A

【図１３Ｂ】

図 13B

FIG. 13B



【図１４Ａ】

図 14A

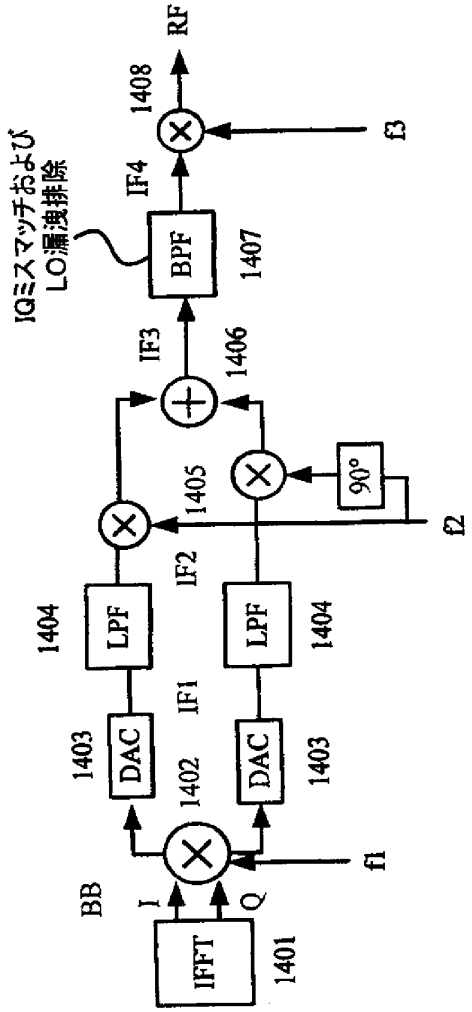



FIG. 14A

【図１４Ｂ】

**図 14B**

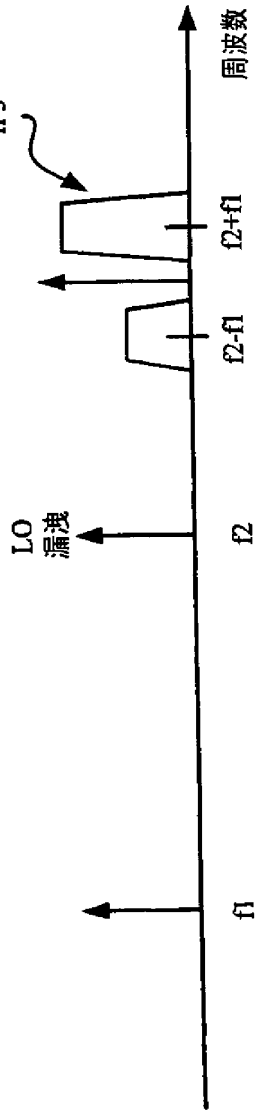



FIG. 14B

【図１５】

図 15

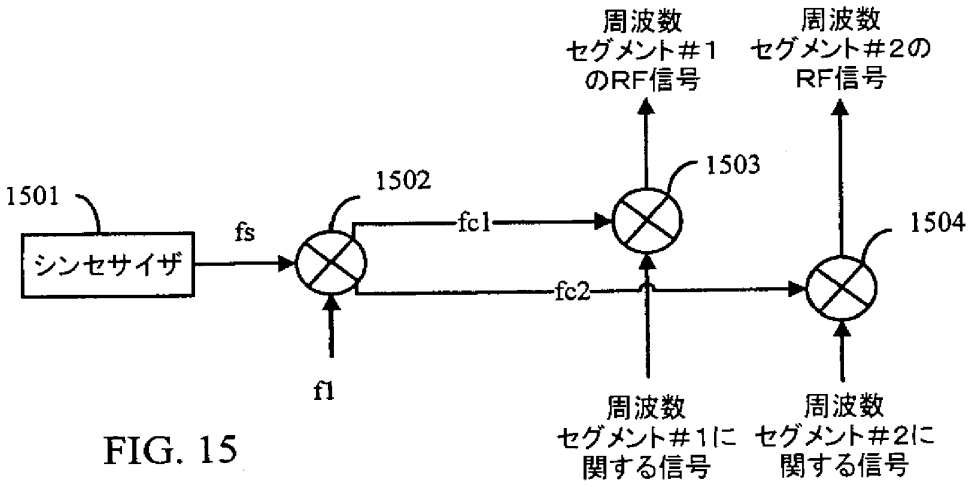



FIG. 15

【図１６Ａ】

図 16A

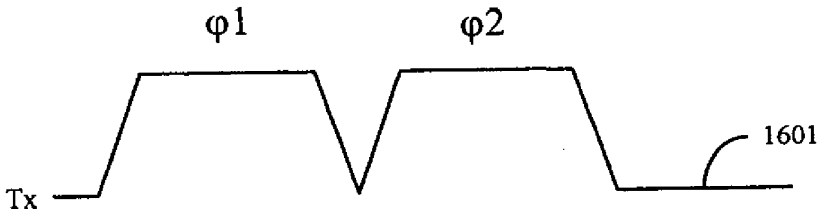



FIG. 16A

【図１６Ｂ】

図 16B

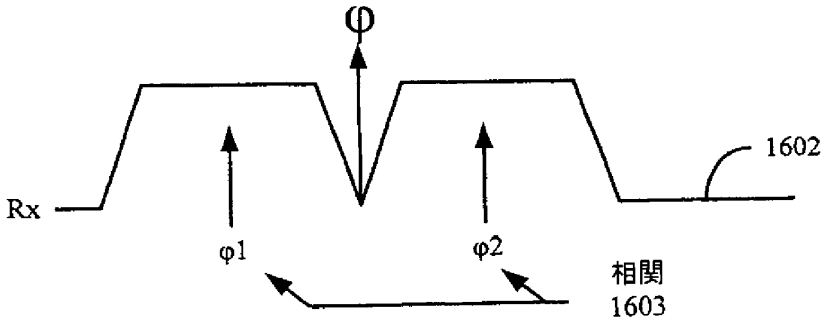



FIG. 16B

【図１７】

図 17

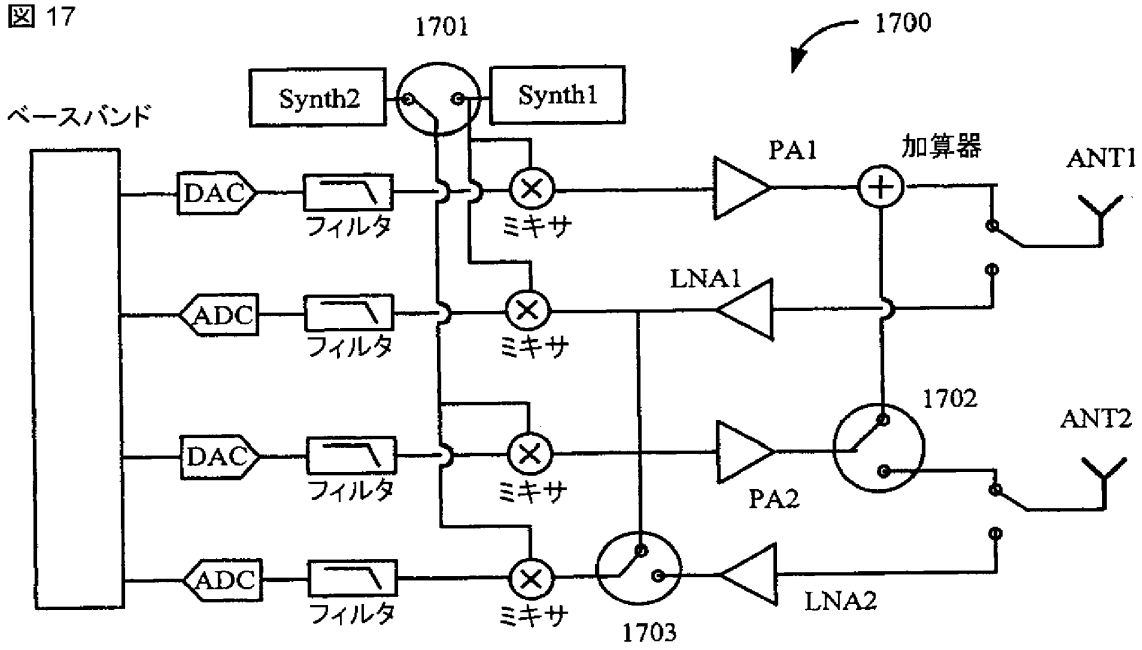



FIG. 17

【国際調査報告】

## INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/026651

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L1/00 H04L5/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2011/026623 A1 (SRINIVASA SUDHIR [US] ET AL) 3 February 2011 (2011-02-03)<br><br>abstract<br>paragraph [0011] - paragraph [0015]<br>paragraph [0040] - paragraph [0049]<br>paragraph [0054] - paragraph [0056]<br>paragraph [0061] - paragraph [0065]<br>paragraph [0070] - paragraph [0110]<br>paragraph [0124] - paragraph [0150]<br>paragraph [0155] - paragraph [0159]<br>paragraph [0171] - paragraph [0210]<br>figures 1,<br>3,4A-F,5A-B,6A-B,7A-B,8A-C,11-23<br>-----<br>-/-- | 1-3,5-7,<br>10,11,<br>14-19,<br>23,26 |

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 10 October 2012 | 17/10/2012 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Dhibi, Youssef |

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page 1 of 2

**INTERNATIONAL SEARCH REPORT**

International application No
PCT/US2012/026651

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | KATSUHIKO HIRAMATSU ET AL: "Technology evolutions in LTE/LTE-advanced and its applications", IEEE INTERNATIONAL CONFERENCE ON COMMUNICATION SYSTEMS (ICCS), 17 November 2010 (2010-11-17), pages 161-165, XP031848284, NJ, USA ISBN: 978-1-4244-7004-4 | 26 |
| A | abstract Sections I-V | 1-3,5-7, 10,11, 14-19,23 |
| | ----- | |
| A | REDIETEAB G ET AL: "Cross-layer multichannel aggregation for future WLAN systems", IEEE INTERNATIONAL CONFERENCE ON COMMUNICATION SYSTEMS - ICCS 2010, 17 November 2010 (2010-11-17), pages 740-745, XP031848376, NJ, USA ISBN: 978-1-4244-7004-4 abstract Sections I-V | 1-3,5-7, 10,11, 14-19, 23,26 |
| | ----- | |
| A | US 2003/002495 A1 (SHAHAR MENASHE [IL] ET AL) 2 January 2003 (2003-01-02) abstract paragraph [0002] - paragraph [0015] paragraph [0022] - paragraph [0079] | 1-3,5-7, 10,11, 14-19, 23,26 |
| | ----- | |

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Form PCT/ISA/210 (continuation of second sheet) (April 2005)

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## INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/026651

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

1-3, 5-7, 10, 11, 14-19, 23, 26

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

International Application No. PCT/US2012/026651

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-3, 5-7, 10, 11, 14-19, 23

Method and corresponding device for Modulation and Coding Rate selection for transmission of data packets comprising different segments of data in a wireless communication system, wherein for each segment a different modulation and coding rate is selected.

---

2. claims: 8, 9, 12, 13, 20, 24, 25

Method and corresponding device for Bitmap Generation for indication of used selected bandwidth units for packet data transmission in a wireless communications system.

---

3. claims: 4, 21, 22, 27

Method and corresponding device for Data packet transmission from a transmitter configured for non-contiguous frequency operation to a receiver configured for only contiguous frequency operation, wherein phases of synthesizers in the transmitter are correlated.

---

4. claim: 26

Wireless communication system comprising swithches for selection between a non-contiguous and a MIMO operation

---

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2012/026651

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2011026623 A1 | 03-02-2011 | CN 102474386 A | 23-05-2012 |
| | | EP 2460298 A2 | 06-06-2012 |
| | | KR 20120060821 A | 12-06-2012 |
| | | US 2011026623 A1 | 03-02-2011 |
| | | WO 2011014685 A2 | 03-02-2011 |
| US 2003002495 A1 | 02-01-2003 | AU 4347601 A | 17-09-2001 |
| | | US 2003002495 A1 | 02-01-2003 |
| | | WO 0167702 A1 | 13-09-2001 |

Form PCT/ISA/210 (patent family annex) (April 2005)

フロントページの続き

(81)指定国 AP(BW,GH,GM,KE,LR,LS,MW,MZ,NA,RW,SD,SL,SZ,TZ,UG,ZM,ZW),EA(AM,AZ,BY,KG,KZ,MD,RU,TJ,TM),EP(AL,AT,BE,BG,CH,CY,CZ,DE,DK,EE,ES,FI,FR,GB,GR,HR,HU,IE,IS,IT,LT,LU,LV,MC,MK,MT,NL,NO,PL,PT,RO,RS,SE,SI,SK,SM,TR),OA(BF,BJ,CF,CG,CI,CM,GA,GN,GQ,GW,ML,MR,NE,SN,TD,TG),AE,AG,AL,AM,AO,AT,AU,AZ,BA,BB,BG,BH,BR,BW,BY,BZ,CA,CH,CL,CN,CO,CR,CU,CZ,DE,DK,DM,DO,DZ,EC,EE,EG,ES,FI,GB,GD,GE,GH,GM,GT,HN,HR,HU,ID,IL,IN,IS,JP,KE,KG,KM,KN,KP,KR,KZ,LA,LC,LK,LR,LS,LT,LU,LY,MA,MD,ME,MG,MK,MN,MW,MX,MY,MZ,NA,NG,NI,NO,NZ,OM,PE,PG,PH,PL,PT,QA,RO,RS,RU,RW,SC,SD,SE,SG,SK,SL,SM,ST,SV,SY,TH,TJ,TM,TN,TR,TT,TZ,UA,UG,US,UZ,VC,VN

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Ｆターム(参考) 5K067 AA13 CC02 DD34 EE02 EE10 EE63 JJ12

**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/KR2016/015297**

A. CLASSIFICATION OF SUBJECT MATTER
***H04L 29/08(2006.01)i, H04L 1/00(2006.01)i, H04W 84/12(2009.01)i, H04L 27/26(2006.01)i, H04L 5/00(2006.01)i, H04W 74/00(2009.01)i, H04W 74/08(2009.01)i***
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L 29/08; H04W 28/16; H04B 7/26; H04W 88/08; H04W 16/10; H04J 11/00; H04W 56/00; H04W 16/14; H04L 1/00; H04W 84/12; H04L 27/26; H04L 5/00; H04W 74/00; H04W 74/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: wireless, discontinuity, channel, packet, decoding

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | KR 10-2015-0143748 A (QUALCOMM INCORPORATED) 23 December 2015<br>See paragraphs [0025], [0027], [0054]-[0061], [0093]; and<br>figures 1-12, 14, 17-22, 24-30, 35. | 1-3,23 |
| A | | 4-22 |
| Y | KR 10-2015-0035569 A (LG ELECTRONICS INC.) 06 April 2015<br>See claims 1, 2; and figure 8. | 1-3,23 |
| A | KR 10-2014-0070528 A (LG ELECTRONICS INC.) 10 June 2014<br>See paragraphs [0074]-[0102]; claims 1-8; and figures 7-11. | 1-23 |
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 10 APRIL 2017 (10.04.2017) | **13 APRIL 2017 (13.04.2017)** |
| Name and mailing address of the ISA/KR<br>Korean Intellectual Property Office<br>Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea<br>Facsimile No. +82-42-481-8578 | Authorized officer<br><br>Telephone No. |

Form PCT/ISA/210 (second sheet) (January 2015)

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
**PCT/KR2016/015297**

| Patent document cited in search report | Publication date | Patent family member | Publication date |
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| KR 10-2015-0143748 A | 23/12/2015 | AU 2014-254272 A1 | 23/10/2014 |
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| | | US 9344238 B2 | 17/05/2016 |
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| | | WO 2014-010786 A1 | 16/01/2014 |
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| KR 10-2015-0044875 A | 27/04/2015 | CN 104584576 A | 29/04/2015 |
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| | | AU 2010-319452 B2 | 11/12/2014 |
| | | CN 102696270 A | 26/09/2012 |
| | | CN 102696270 B | 29/06/2016 |
| | | CN 105897325 A | 24/08/2016 |
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Form PCT/ISA/210 (patent family annex) (January 2015)

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
**PCT/KR2016/015297**

| Patent document cited in search report | Publication date | Patent family member | Publication date |
|---|---|---|---|
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Form PCT/ISA/210 (patent family annex) (January 2015)

# 특 허 협 력 조 약

# PCT

## 국 제 조 사 보 고 서

(PCT 제 18 조 및 PCT규칙 43 및 44)

| 출원인 또는 대리인의 서류참조기호<br>WILP160168WO | 추가적인 조치 | 서식 PCT/ISA/220 및<br>아래 5.(해당하는경우) 참조 |
|---|---|---|
| 국제출원번호<br>**PCT/KR2016/015297** | 국제출원일 *(일/월/년)*<br>26 December 2016 (26.12.2016) | (최) 우선일 *(일/월/년)*<br>24 December 2015 (24.12.2015) |
| 출원인<br>주식회사 윌러스표준기술연구소 | | |

본 국제조사보고서는 본 국제조사기관에 의하여 작성되었으며 PCT 제18조의 규정에 따라 출원인에게 송부됩니다. 이 국제조사보고서의 사본은 국제사무국에 송부됩니다.

본 국제조사보고서는 총 **4** 매로 구성되어 있습니다.

☒ 본 보고서에서 인용된 각 선행기술 문헌의 사본도 첨부되어 있습니다.

1. **보고서의 기초**
   a. **언어**와 관련하여, 국제조사는 아래에 기초하여 수행되었습니다.
      ☒ 출원시의 언어로 된 국제출원
      ☐ 국제조사를 위해 _____ 로 번역되어 제출된 국제출원의 번역문(PCT규칙 12.3(a) 및 23.1(b))
   b. ☐ 본 국제조사보고서는 PCT규칙 91의 규정에 따라 당해 기관이 허가하였거나 또는 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43.6의2(a)).
   c. ☐ 국제출원에 개시된 **핵산염기 및/또는 아미노산 서열**에 관하여는 제1기재란을 참조하십시오.
2. ☐ **일부 청구항은 조사할 수 없습니다**(제2기재란 참조).
3. ☐ **발명의 단일성이 결여되어 있습니다**(제3기재란 참조).
4. **발명의 명칭**과 관련하여,
   ☒ 출원인이 제출한 대로 승인합니다.
   ☐ 본 국제조사기관이 다음과 같이 발명의 명칭을 작성하였습니다:
5. **요약서**와 관련하여,
   ☒ 출원인이 제출한 대로 승인합니다.
   ☐ PCT규칙 38.2의 규정에 따라 본 기관이 제4기재란에 표시된 대로 요약서를 작성하였습니다. 출원인은 본 국제조사보고서의 발송일부터 1월 이내에 본 기관에 의견를 제출할 수 있습니다.
6. **도면**과 관련하여,
   a. 요약서와 함께 공개될 **도면**은 제 33 도이며
      ☒ 출원인이 제안하였습니다.
      ☐ 출원인이 도면의 번호를 제안하지 않았기 때문에 본 기관이 선택하였습니다.
      ☐ 본 도면이 발명의 특징을 더 잘 나타내고 있기 때문에 본 기관이 선택하였습니다.
   b. ☐ 요약서와 함께 공개될 도면이 없습니다.

# 국 제 조 사 보 고 서

국제출원번호
**PCT/KR2016/015297**

**A. 발명이 속하는 기술분류(국제특허분류(IPC))**

**H04L 29/08(2006.01)i, H04L 1/00(2006.01)i, H04W 84/12(2009.01)i, H04L 27/26(2006.01)i, H04L 5/00(2006.01)i, H04W 74/00(2009.01)i, H04W 74/08(2009.01)i**

**B. 조사된 분야**

조사된 최소문헌(국제특허분류를 기재)
H04L 29/08; H04W 28/16; H04B 7/26; H04W 88/08; H04W 16/10; H04J 11/00; H04W 56/00; H04W 16/14; H04L 1/00; H04W 84/12; H04L 27/26; H04L 5/00; H04W 74/00; H04W 74/08

조사된 기술분야에 속하는 최소문헌 이외의 문헌
한국등록실용신안공보 및 한국공개실용신안공보: 조사된 최소문헌란에 기재된 IPC
일본등록실용신안공보 및 일본공개실용신안공보: 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))
eKOMPASS(특허청 내부 검색시스템) & 키워드: 무선, 불연속, 채널, 패킷, 디코딩

**C. 관련 문헌**

| 카테고리* | 인용문헌명 및 관련 구절(해당하는 경우)의 기재 | 관련 청구항 |
|---|---|---|
| Y | KR 10-2015-0143748 A (퀄컴 인코포레이티드) 2015.12.23<br>단락 [0025], [0027], [0054]-[0061], [0093]; 및 도면 1-12, 14, 17-22, 24-30, 35 참조. | 1-3,23 |
| A | | 4-22 |
| Y | KR 10-2015-0035569 A (엘지전자 주식회사) 2015.04.06<br>청구항 1, 2; 및 도면 8 참조. | 1-3,23 |
| A | KR 10-2014-0070528 A (엘지전자 주식회사) 2014.06.10<br>단락 [0074]-[0102]; 청구항 1-8; 및 도면 7-11 참조. | 1-23 |
| A | KR 10-2015-0044875 A (엘지전자 주식회사) 2015.04.27<br>단락 [0180]-[0216]; 청구항 1-12; 및 도면 9-11 참조. | 1-23 |
| A | KR 10-2012-0097514 A (인터디지탈 패튼 홀딩스, 인크) 2012.09.04<br>단락 [0044]-[0067]; 청구항 1-18; 및 도면 2-8 참조. | 1-23 |

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

☒ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허 문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허문헌에 속하는 문헌

| 국제조사의 실제 완료일 | 국제조사보고서 발송일 |
|---|---|
| 2017년 04월 10일 (10.04.2017) | 2017년 04월 13일 (13.04.2017) |


ISA/KR의 명칭 및 우편주소
대한민국 특허청
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서식 PCT/ISA/210 (두 번째 용지) (2015년 1월)

**국 제 조 사 보 고 서**
대응특허에 관한 정보

국제출원번호
**PCT/KR2016/015297**

| 국제조사보고서에서 인용된 특허문헌 | 공개일 | 대응특허문헌 | 공개일 |
|---|---|---|---|
| KR 10-2015-0143748 A | 2015/12/23 | AU 2014-254272 A1 | 2014/10/23 |
| | | AU 2014-272164 A1 | 2014/12/04 |
| | | KR 10-2015-0143747 A | 2015/12/23 |
| | | KR 10-2015-0144327 A | 2015/12/24 |
| | | US 2014-0307612 A1 | 2014/10/16 |
| | | US 2014-0307649 A1 | 2014/10/16 |
| | | US 2014-0307650 A1 | 2014/10/16 |
| | | US 9344238 B2 | 2016/05/17 |
| | | US 9397805 B2 | 2016/07/19 |
| | | WO 2014-172198 A1 | 2014/10/23 |
| | | WO 2014-172201 A1 | 2014/10/23 |
| | | WO 2014-193547 A1 | 2014/12/04 |
| KR 10-2015-0035569 A | 2015/04/06 | CA 2877484 A1 | 2014/01/16 |
| | | CN 104471873 A | 2015/03/25 |
| | | EP 2871785 A1 | 2015/05/13 |
| | | JP 2015-527780 A | 2015/09/17 |
| | | JP 6045690 B2 | 2016/12/14 |
| | | US 2015-0139115 A1 | 2015/05/21 |
| | | US 9516647 B2 | 2016/12/06 |
| | | WO 2014-010786 A1 | 2014/01/16 |
| KR 10-2014-0070528 A | 2014/06/10 | CN 103959679 A | 2014/07/30 |
| | | EP 2742617 A2 | 2014/06/18 |
| | | EP 2742617 B1 | 2016/04/06 |
| | | EP 2742618 A2 | 2014/06/18 |
| | | EP 2742618 B1 | 2016/07/06 |
| | | JP 2014-522196 A | 2014/08/28 |
| | | JP 5686929 B2 | 2015/03/18 |
| | | WO 2013-022293 A2 | 2013/02/14 |
| | | WO 2013-022293 A3 | 2013/04/25 |
| | | WO 2013-022294 A2 | 2013/02/14 |
| | | WO 2013-022294 A3 | 2013/04/25 |
| KR 10-2015-0044875 A | 2015/04/27 | CN 104584576 A | 2015/04/29 |
| | | EP 2883362 A1 | 2015/06/17 |
| | | JP 2015-524638 A | 2015/08/24 |
| | | WO 2014-027808 A1 | 2014/02/20 |
| KR 10-2012-0097514 A | 2012/09/04 | AU 2010-319452 A1 | 2011/05/19 |
| | | AU 2010-319452 B2 | 2014/12/11 |
| | | CN 102696270 A | 2012/09/26 |
| | | CN 102696270 B | 2016/06/29 |
| | | CN 105897325 A | 2016/08/24 |
| | | CN 105897326 A | 2016/08/24 |
| | | EP 2499868 A1 | 2012/09/19 |
| | | EP 2499868 B1 | 2014/07/16 |
| | | EP 2782264 A1 | 2014/09/24 |
| | | JP 2013-511216 A | 2013/03/28 |

**국 제 조 사 보 고 서**
대응특허에 관한 정보

국제출원번호
**PCT/KR2016/015297**

| 국제조사보고서에서 인용된 특허문헌 | 공개일 | 대응특허문헌 | 공개일 |
|---|---|---|---|
| | | JP 2016-086446 A | 2016/05/19 |
| | | US 2011-0116488 A1 | 2011/05/19 |
| | | US 8711821 B2 | 2014/04/29 |
| | | WO 2011-060175 A1 | 2011/05/19 |

# PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

**PCT**

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 13.04.2017 |
| Applicant's or agent's file reference: WILP160168WO | **FOR FURTHER ACTION** See paragraph 2 below |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/KR2016/015297 | 26.12.2016 | 24.12.2015 |

International Patent Classification (IPC) or both national classification and IPC

H04L29/08(2006.01)i, H04L1/00(2006.01)i, H04W84/12(2009.01)i, H04L27/26(2006.01)i, H04L5/00(2006.01)i, H04W74/00(2009.01)i, H04W74/08(2009.01)i

Applicant

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☒ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

| Name and mailing address of the ISA/KR | Date of completion of this opinion | Authorized officer |
|---|---|---|
| Facsimile No. | | Telephone No. |

Form PCT/ISA/237 (cover sheet) (January 2015)

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/KR2016/015297

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/KR2016/015297

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 1-23 | YES |
| | Claims | None | NO |
| Inventive step (IS) | Claims | 4-22 | YES |
| | Claims | 1-3, 23 | NO |
| Industrial applicability (IA) | Claims | 1-23 | YES |
| | Claims | None | NO |

2. Citations and explanations:

Reference is made to the following documents:

D1: KR 10-2015-0143748 A (QUALCOMM INCORPORATED) 23 December 2015

D2: KR 10-2015-0035569 A (LG ELECTRONICS INC.) 06 April 2015

D3: KR 10-2014-0070528 A (LG ELECTRONICS INC.) 10 June 2014

D4: KR 10-2015-0044875 A (LG ELECTRONICS INC.) 27 April 2015

D5: KR 10-2012-0097514 A (INTERDIGITAL PATENT HOLDINGS, INC.) 04 September 2012

2.1 Novelty and Inventive Step

2.1.1 Independent Claim: Claim 1

Document D1, which is the closest prior art to claim 1, discloses "a wireless device comprising a processor, a transmitter, and a receiver, wherein the processor acquires information of an SIG field, which includes 4

bits describing a modulation scheme of data in a packet and 12 bits for a packet length, the acquired information is used to decode the data in the packet, and the data is included on two or more sub-bands (see D1: paragraphs [0025], [0027], [0054]-[0061], and [0093]; and figures 1-12, 14, 17-22, 24-30, and 35)". There is a difference in that document D1 does not disclose "the discontinuous channel allocation information" set forth in claim 1. However, said difference could be easily derived from "the step of transmitting a frame including an operation information field that includes a channel width subfield, wherein a channel width includes one or more W channels and indicates one among a first type channel width for one W channel, a second type channel width for two contiguous W channels, a third type channel width for two non-contiguous W channels, a fourth type channel width for four contiguous W channels, and a fifth type channel width for two non-contiguous frequency segments each of which includes two contiguous W channels (see D2: claims 1 and 2; and figure 8)", disclosed in document D2. Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and the invention as set forth in claim 1 lacks an inventive step (PCT Article 33(3)).

2.1.2 Dependent Claims: Claims 2 to 22

The additional feature of the invention as set forth in claim 2 could be easily derived from the feature disclosed in document D1 wherein "one or more bits of information may be embedded in a different part of a

packet preamble, such as an HE-SIG (see D1: paragraph [0093])". Therefore, the invention as set forth in claim 2 would be obvious in view of a combination of documents D1 and D2, and thus lacks an inventive step (PCT Article 33(3)).

The additional feature of the invention as set forth in claim 3 could be easily derived from the feature, disclosed in document D1, of "supporting a plurality of channels having different sizes, such as 5, 10, 20, 40, 80, and 160 MHz channels (see D1: paragraph [0025])". Therefore, the invention as set forth in claim 3 would be obvious in view of a combination of documents D1 and D2, and thus lacks an inventive step (PCT Article 33(3)).

The invention as set forth in claim 4 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is indicated through a bandwidth field of HE-SIG-A, and the bandwidth field indicates information of a total bandwidth over which a packet is transmitted and channel information punctured within the total bandwidth". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 4 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claim 5 is dependent on claim 4, and is thus novel and involves an inventive step (PCT Article 33(2) and (3)).

The invention as set forth in claim 6 is different from

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is indicated through a preset index of a resource unit allocation field of HE-SIG-B". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 6 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 7 and 8 are directly or indirectly dependent on claim 6, and are thus novel and lack an inventive step (PCT Article 33(2) and (3)).

The invention as set forth in claim 9 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is acquired through resource unit arrangement information indicated by the resource unit allocation field of HE-SIG-B and a null STA ID inserted in a user field corresponding to a specific resource unit in the resource unit arrangement". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 9 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 10 to 16 are directly or indirectly dependent on claim 9, and are thus novel and involve an inventive step (PCT Article 33(2) and (3)).

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The invention as set forth in claim 17 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "when a packet is transmitted over a total bandwidth of 80 MHz or more, the discontinuous channel allocation information further includes information of a field (C26) indicating whether a central 26-tone resource unit at 80 MHz has been allocated to a user". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 17 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 18 to 22 are directly or indirectly dependent on claim 17, and are thus novel and involve an inventive step (PCT Article 33(2) and (3)).

2.1.3 Claim 23

The invention as set forth in claim 23 relates to a wireless communication method which has the same technical feature as that of the invention as set forth in claim 1, differing only in the category of the invention. Therefore, since the invention as set forth in claim 1 lacks an inventive step, the invention as set forth in claim 23 lacks an inventive step in view of documents D1 and D2 (PCT Article 33(3)).

2.2 Industrial Applicability

The invention as set forth in claims 1 to 23 is industrially applicable (PCT Article 33(4)).

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2016/015297

**Box No. VIII Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 9 refers to the "HE-SIG-B" in claim 1, but the HE-SIG-B is not set forth in claim 1 (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that claim 9 refers to claim 2.)

Claim 9 includes a wording "said resource unit arrangement", before which "resource unit arrangement" is not mentioned, and is thus unclear (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that the wording "said resource unit arrangement" in claim 9 is "said resource unit arrangement information".)

Claim 11 refers to the "HE-SIG-A" and the "HE-SIG-B" in claim 1, but the HE-SIG-A and the HE-SIG-B are not set forth in claim 1 (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that claim 11 refers to claim 2.)

The wording "said packet is ~ over a total bandwidth of 80 MHz or more" in claim 17 does not include an upper limit value, and is thus unclear (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that the wording a "total bandwidth of 80 MHz or more" in claim 17 is a "total bandwidth of 80 MHz".)

# 특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 06776 서울시 서초구 마방로 48, 2층

# PCT

## 국제조사기관의 견해서

(PCT규칙 43의2.1)

| | |
|---|---|
| 발송일 *(일/월/년)* | 2017년 04월 13일 (13.04.2017) |
| 출원인 또는 대리인의 서류참조기호<br>WILP160168WO | **추가적인 조치**<br>아래 2를 참조 |

| 국제출원번호 | 국제출원일 *(일/월/년)* | 우선일 *(일/월/년)* |
|---|---|---|
| **PCT/KR2016/015297** | 2016년 12월 26일 (26.12.2016) | 2015년 12월 24일 (24.12.2015) |

국제특허분류(IPC)

***H04L 29/08(2006.01)i, H04L 1/00(2006.01)i, H04W 84/12(2009.01)i, H04L 27/26(2006.01)i, H04L 5/00(2006.01)i, H04W 74/00(2009.01)i, H04W 74/08(2009.01)i***

출원인
주식회사 윌러스표준기술연구소

1. 본 견해서는 다음 기재란에 관한 내용을 포함합니다.

- ☒ 제1기재란 견해서의 기초
- ☐ 제2기재란 우선권
- ☐ 제3기재란 신규성, 진보성 및 산업상이용가능성에 관한 견해 부작성
- ☐ 제4기재란 발명의 단일성 결여
- ☒ 제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명
- ☐ 제6기재란 특이 인용문헌
- ☐ 제7기재란 국제출원의 흠결
- ☒ 제8기재란 국제출원에 관한 의견

2. **추가적인 조치**

국제예비심사가 청구되면, 본 견해서는 국제예비심사기관("IPEA")의 견해서로 간주될 것입니다. 다만, 출원인이 본 기관 이외의 기관을 IPEA로 선택하고, 그 선택된 IPEA가 PCT규칙 66.1의2(b)에 따라 본 국제조사기관의 견해서가 위와 같이 간주되지 않을 것임을 국제사무국에 통보한 경우에는 그러하지 않습니다.

본 견해서가 상기와 같이 IPEA의 견해서로 간주되는 경우, 출원인은 서식 PCT/ISA/220의 발송일로부터 3월 또는 우선일부터 22월 중 늦게 만료되는 날 이전에 의견서 및 보정서(해당하는 경우)를 IPEA에 제출할 수 있습니다.

다른 선택사항에 대하여는 서식 PCT/ISA/220에 대한 안내문을 참조하십시오.

| ISA/KR의 명칭 및 우편주소 | 본 견해서의 완료일 | 심사관 |
|---|---|---|
| 대한민국 특허청<br>(35208) 대전광역시 서구 청사로 189, 4동 (둔산동, 정부대전청사)<br>팩스번호 +82-42-481-8578 | 2017년 04월 10일 (10.04.2017) | 김성우<br>전화번호 +82-42-481-3348 |

서식 PCT/ISA/237 (표지) (2015년 1월)

# 국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제1기재란 본 견해서의 기초**

1. **언어**와 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

☒ 출원시의 언어로 된 국제출원

☐ 국제조사를 위하여 _____ 로 번역되어 제출된 국제출원의 번역문
(PCT규칙 12.3(a) 및 23.1(b))

2. ☐ 본 견해서는 PCT규칙 91에 따라 당해 기관이 허가하였거나 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43의2.1(a)).

3. ☐ 국제출원에 개시된 핵산염기 및/또는 아미노산 서열과 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

a. ☐ 아래의 형태로 출원시 국제출원의 일부를 구성하는 서열목록
- ☐ 부록 C/ST.25 텍스트 파일
- ☐ 서면 혹은 이미지 파일

b. ☐ PCT 규칙 13의3.1(a)에 따라 국제출원과 함께 국제조사만을 목적으로 부록 C/ST.25 텍스트 파일의 형태로 제출된 서열목록

c. ☐ 국제조사만을 목적으로 국제출원일 이후에 아래 형태로 제출된 서열목록
- ☐ 부록 C/ST.25 텍스트 파일 (규칙 13의3.1(a))
- ☐ 서면 혹은 이미지 파일 (규칙 13의3.1(b) 및 시행세칙 713)

4. ☐ 추가로 서열목록에 대하여 하나 이상의 버전이나 사본이 제출된 경우, 후속 버전 또는 추가된 사본에 기재되어 있는 정보가 출원시 출원의 일부를 구성하는 정보와 동일하거나 또는 출원시의 개시범위를 벗어나지 않는다는 진술서가 제출되었습니다.

5. 추가 의견:

국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명**

1. 견해

| | | | |
|---|---|---|---|
| 신규성 (N) | 청구항 | 1-23 | 있음 |
| | 청구항 | 없음 | 없음 |
| 진보성 (IS) | 청구항 | 4-22 | 있음 |
| | 청구항 | 1-3,23 | 없음 |
| 산업상 이용가능성 (IA) | 청구항 | 1-23 | 있음 |
| | 청구항 | 없음 | 없음 |

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: KR 10-2015-0143748 A (퀄컴 인코포레이티드) 2015.12.23
D2: KR 10-2015-0035569 A (엘지전자 주식회사) 2015.04.06
D3: KR 10-2014-0070528 A (엘지전자 주식회사) 2014.06.10
D4: KR 10-2015-0044875 A (엘지전자 주식회사) 2015.04.27
D5: KR 10-2012-0097514 A (인터디지탈 패튼 홀딩스, 인크) 2012.09.04

2.1 신규성 및 진보성

2.1.1 독립항: 청구항 제1항

청구항 제1항에 가장 근접한 인용문헌 D1에는 '프로세서; 및 송신기 및 수신기를 포함하고, 프로세서는 패킷의 데이터의 변조 방식을 설명하는 4 비트 및 패킷 길이에 대한 12 비트를 포함하는 SIG 필드의 정보를 획득하고, 획득된 정보를 이용하여 패킷의 데이터를 디코딩하기 위해 이용하고, 데이터는 2 이상의 서브-대역들 상에 포함되는 무선 디바이스 (D1: 단락 [0025], [0027], [0054]-[0061], [0093]; 및 도면 1-12, 14, 17-22, 24-30, 35 참조)'가 제시되어 있습니다. 다만 상기 인용문헌 D1에는 청구항 제1항의 '불연속 채널 할당 정보'가 기재되어 있지 않다는 점에서 차이가 있지만, 상기 차이는 인용문헌 D2의 '채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계, 채널 폭은 하나 이상의 W 채널을 포함하고, 하나의 W 채널에 대한 제 1 타입 채널 폭, 2 개의 연속적인 (contiguous) W 채널들에 대한 제 2 타입 채널 폭, 2 개의 불연속적인 (non-contiguous) W 채널들에 대한 제 3 타입 채널 폭, 4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭 또는 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭 중에서 하나를 지시하는 것 (D2: 청구항 1, 2; 및 도면 8 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진 자에게

추가 기재란에 계속

# 국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제8기재란 국제출원에 관한 의견**

청구범위, 발명의설명 및 도면의 명료성에 관하여 또는 청구범위가 발명의설명에 의하여 충분히 뒷받침되고 있는지에 관하여 다음과 같은 의견을 제시합니다.

청구항 제9항은 청구항 제1항의 'HE-SIG-B'를 인용하고 있으나, 상기 HE-SIG-B는 청구항 제1항에 기재되어 있지 않습니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제9항이 청구항 제2항을 인용하는 것으로 가정하여 작성되었습니다.)

청구항 제9항에는 앞서 언급되지 않은 리소스 유닛 배열이 "상기 리소스 유닛 배열"로 기재되어 있으므로 불명확합니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제9항의 "상기 리소스 유닛 배열"을 '상기 리소스 유닛 배열 정보'로 가정하여 작성되었습니다.)

청구항 제11항은 청구항 제1항의 'HE-SIG-A' 및 'HE-SIG-B'를 인용하고 있으나, 상기 HE-SIG-A 및 HE-SIG-B는 청구항 제1항에 기재되어 있지 않습니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제11항이 청구항 제2항을 인용하는 것으로 가정하여 작성되었습니다.)

청구항 제17항의 "상기 패킷이 80MHz 이상의 총 대역폭으로 ~"에서 상한 값이 기재되지 않아 발명이 불명확 합니다(PCT 제 6 조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제17항의 "80MHz 이상의 총 대역폭"을 '80MHz의 총 대역폭'으로 가정하여 작성되었습니다.)

추가 기재란

**이전 기재란의 공간이 충분하지 아니**한 경우.
제5 기재란의 연속

자명하므로, 청구항 제1항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

2.1.2 종속항: 청구항 제2항 내지 제22항
청구항 제2항에 기재된 발명의 추가적인 특징은 인용문헌 D1에 제시된 '정보의 하나 이상의 비트들이 HE-SIG와 같은 패킷 프리앰블의 다른 부분에 임베드될 수 있는 것 (D1: 단락 [0093] 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제2항에 기재된 발명은 인용문헌 D1과 D2의 결합에 의하여 자명하므로 진보성이 없습니다(PCT 제33조(3)).

청구항 제3항에 기재된 발명의 추가적인 특징은 인용문헌 D1에 제시된 '5, 10, 20, 40, 80 및 160 MHz 채널들과 같은 다수의 상이한 크기들의 채널들을 지원하는 것 (D1: 단락 [0025] 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제3항에 기재된 발명은 인용문헌 D1과 D2의 결합에 의하여 자명하므로 진보성이 없습니다(PCT 제33조(3)).

청구항 제4항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-A의 대역폭 필드를 통해 지시되며, 대역폭 필드는 패킷이 전송되는 총 대역폭 정보 및 총 대역폭 내에서 펑처링되는 채널 정보를 지시하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제4항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제5항은 청구항 제4항의 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제6항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-B의 리소스 유닛 할당 필드의 기 설정된 인덱스를 통해 지시하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제6항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제7항 및 제8항은 청구항 제6항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제9항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-B의 리소스 유닛 할당 필드가 지시하는 리소스 유닛 배열 정보 및 리소스 유닛 배열에서 특정 리소스 유닛에 대

다음 페이지에 계속

추가 기재란

**이전 기재란의 공간이 충분하지 아니**한 경우.
이전 기재란의 연속

응하는 사용자 필드에 삽입된 널 STA ID를 통해 획득하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제9항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제10항 내지 제16항은 청구항 제9항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제17항에 기재된 발명은 '패킷이 80MHz 이상의 총 대역폭으로 전송될 경우, 불연속 채널 할당 정보는 80MHz에서의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 필드 (C26)의 정보를 더 포함하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제17항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제18항 내지 제22항은 청구항 제17항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

2.1.3 청구항 제23항
청구항 제23항에 기재된 발명은 청구항 제1항에 기재된 발명의 기술적 특징을 카테고리만 달리하여 무선 통신 방법으로 기재하고 있습니다. 따라서 청구항 제1항에 기재된 발명이 진보성이 없으므로, 청구항 제23항에 기재된 발명은 인용문헌 D1과 D2에 의해서 진보성이 없습니다(PCT 제33조 (3)).

2.2 산업상 이용가능성

청구항 제1항 내지 제23항에 기재된 발명은 산업상 이용가능합니다(PCT 제33조 (4)).

**PATENT COOPERATION TREATY**

# PCT

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

| | | |
|---|---|---|
| Applicant's or agent's file reference<br>WILP160168WO | **FOR FURTHER ACTION** | See item 4 below |
| International application No.<br>PCT/KR2016/015297 | International filing date *(day/month/year)*<br>26 December 2016 (26.12.2016) | Priority date *(day/month/year)*<br>24 December 2015 (24.12.2015) |
| International Patent Classification (8th edition unless older edition indicated)<br>See relevant information in Form PCT/ISA/237 | | |
| Applicant<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. | | |

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the report |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☒ | Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

| | |
|---|---|
| | Date of issuance of this report<br>26 June 2018 (26.06.2018) |
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br>Facsimile No. +41 22 338 82 70 | Authorized officer<br>Kihwan Moon<br>e-mail: pct.team1@wipo.int |

Form PCT/IB/373 (January 2004)

# PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

**PCT**

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 13.04.2017 |
| Applicant's or agent's file reference: WILP160168WO | **FOR FURTHER ACTION** See paragraph 2 below |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/KR2016/015297 | 26.12.2016 | 24.12.2015 |

International Patent Classification (IPC) or both national classification and IPC

H04L29/08(2006.01)i, H04L1/00(2006.01)i, H04W84/12(2009.01)i, H04L27/26(2006.01)i, H04L5/00(2006.01)i, H04W74/00(2009.01)i, H04W74/08(2009.01)i

Applicant

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☒ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

| Name and mailing address of the ISA/KR | Date of completion of this opinion | Authorized officer |
|---|---|---|
| Facsimile No. | | Telephone No. |

Form PCT/ISA/237 (cover sheet) (January 2015)

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/KR2016/015297

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/KR2016/015297

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 1-23 | YES |
| | Claims | None | NO |
| Inventive step (IS) | Claims | 4-22 | YES |
| | Claims | 1-3, 23 | NO |
| Industrial applicability (IA) | Claims | 1-23 | YES |
| | Claims | None | NO |

2. Citations and explanations:

Reference is made to the following documents:

D1: KR 10-2015-0143748 A (QUALCOMM INCORPORATED) 23 December 2015

D2: KR 10-2015-0035569 A (LG ELECTRONICS INC.) 06 April 2015

D3: KR 10-2014-0070528 A (LG ELECTRONICS INC.) 10 June 2014

D4: KR 10-2015-0044875 A (LG ELECTRONICS INC.) 27 April 2015

D5: KR 10-2012-0097514 A (INTERDIGITAL PATENT HOLDINGS, INC.) 04 September 2012

2.1 Novelty and Inventive Step

2.1.1 Independent Claim: Claim 1

Document D1, which is the closest prior art to claim 1, discloses "a wireless device comprising a processor, a transmitter, and a receiver, wherein the processor acquires information of an SIG field, which includes 4

bits describing a modulation scheme of data in a packet and 12 bits for a packet length, the acquired information is used to decode the data in the packet, and the data is included on two or more sub-bands (see D1: paragraphs [0025], [0027], [0054]-[0061], and [0093]; and figures 1-12, 14, 17-22, 24-30, and 35)". There is a difference in that document D1 does not disclose "the discontinuous channel allocation information" set forth in claim 1. However, said difference could be easily derived from "the step of transmitting a frame including an operation information field that includes a channel width subfield, wherein a channel width includes one or more W channels and indicates one among a first type channel width for one W channel, a second type channel width for two contiguous W channels, a third type channel width for two non-contiguous W channels, a fourth type channel width for four contiguous W channels, and a fifth type channel width for two non-contiguous frequency segments each of which includes two contiguous W channels (see D2: claims 1 and 2; and figure 8)", disclosed in document D2. Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and the invention as set forth in claim 1 lacks an inventive step (PCT Article 33(3)).

2.1.2 Dependent Claims: Claims 2 to 22

The additional feature of the invention as set forth in claim 2 could be easily derived from the feature disclosed in document D1 wherein "one or more bits of information may be embedded in a different part of a

packet preamble, such as an HE-SIG (see D1: paragraph [0093])". Therefore, the invention as set forth in claim 2 would be obvious in view of a combination of documents D1 and D2, and thus lacks an inventive step (PCT Article 33(3)).

The additional feature of the invention as set forth in claim 3 could be easily derived from the feature, disclosed in document D1, of "supporting a plurality of channels having different sizes, such as 5, 10, 20, 40, 80, and 160 MHz channels (see D1: paragraph [0025])". Therefore, the invention as set forth in claim 3 would be obvious in view of a combination of documents D1 and D2, and thus lacks an inventive step (PCT Article 33(3)).

The invention as set forth in claim 4 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is indicated through a bandwidth field of HE-SIG-A, and the bandwidth field indicates information of a total bandwidth over which a packet is transmitted and channel information punctured within the total bandwidth". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 4 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claim 5 is dependent on claim 4, and is thus novel and involves an inventive step (PCT Article 33(2) and (3)).

The invention as set forth in claim 6 is different from

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is indicated through a preset index of a resource unit allocation field of HE-SIG-B". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 6 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 7 and 8 are directly or indirectly dependent on claim 6, and are thus novel and lack an inventive step (PCT Article 33(2) and (3)).

The invention as set forth in claim 9 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "the discontinuous channel allocation information is acquired through resource unit arrangement information indicated by the resource unit allocation field of HE-SIG-B and a null STA ID inserted in a user field corresponding to a specific resource unit in the resource unit arrangement". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 9 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 10 to 16 are directly or indirectly dependent on claim 9, and are thus novel and involve an inventive step (PCT Article 33(2) and (3)).

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The invention as set forth in claim 17 is different from the inventions disclosed in documents D1 and D2 in that the former includes a feature wherein "when a packet is transmitted over a total bandwidth of 80 MHz or more, the discontinuous channel allocation information further includes information of a field (C26) indicating whether a central 26-tone resource unit at 80 MHz has been allocated to a user". Further, said difference is neither disclosed in the cited documents, nor would be obvious even to a person skilled in the art. Therefore, the invention as set forth in claim 17 is novel and involves an inventive step (PCT Article 33(2) and (3)).

Claims 18 to 22 are directly or indirectly dependent on claim 17, and are thus novel and involve an inventive step (PCT Article 33(2) and (3)).

2.1.3 Claim 23

The invention as set forth in claim 23 relates to a wireless communication method which has the same technical feature as that of the invention as set forth in claim 1, differing only in the category of the invention. Therefore, since the invention as set forth in claim 1 lacks an inventive step, the invention as set forth in claim 23 lacks an inventive step in view of documents D1 and D2 (PCT Article 33(3)).

2.2 Industrial Applicability

The invention as set forth in claims 1 to 23 is industrially applicable (PCT Article 33(4)).

**Box No. VIII Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 9 refers to the "HE-SIG-B" in claim 1, but the HE-SIG-B is not set forth in claim 1 (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that claim 9 refers to claim 2.)

Claim 9 includes a wording "said resource unit arrangement", before which "resource unit arrangement" is not mentioned, and is thus unclear (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that the wording "said resource unit arrangement" in claim 9 is "said resource unit arrangement information".)

Claim 11 refers to the "HE-SIG-A" and the "HE-SIG-B" in claim 1, but the HE-SIG-A and the HE-SIG-B are not set forth in claim 1 (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that claim 11 refers to claim 2.)

The wording "said packet is ~ over a total bandwidth of 80 MHz or more" in claim 17 does not include an upper limit value, and is thus unclear (PCT Article 6).
(Note: In the present international search report and written opinion, it has been assumed that the wording a "total bandwidth of 80 MHz or more" in claim 17 is a "total bandwidth of 80 MHz".)

**PATENT COOPERATION TREATY**

# PCT

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

| | | |
|---|---|---|
| Applicant's or agent's file reference<br>WILP160168WO | **FOR FURTHER ACTION** | See item 4 below |
| International application No.<br>PCT/KR2016/015297 | International filing date *(day/month/year)*<br>26 December 2016 (26.12.2016) | Priority date *(day/month/year)*<br>24 December 2015 (24.12.2015) |
| International Patent Classification (8th edition unless older edition indicated)<br>See relevant information in Form PCT/ISA/237 | | |
| Applicant<br>WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. | | |

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the report |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☒ | Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

| | |
|---|---|
| | Date of issuance of this report<br>26 June 2018 (26.06.2018) |
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br>Facsimile No. +41 22 338 82 70 | Authorized officer<br>Kihwan Moon<br>e-mail: pct.team1@wipo.int |

Form PCT/IB/373 (January 2004)

# 특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 06776 서울시 서초구 마방로 48, 2층

# PCT

## 국제조사기관의 견해서

(PCT규칙 43의2.1)

| | |
|---|---|
| 발송일 *(일/월/년)* | 2017년 04월 13일 (13.04.2017) |
| 출원인 또는 대리인의 서류참조기호<br>WILP160168WO | **추가적인 조치**<br>아래 2를 참조 |

| 국제출원번호 | 국제출원일 *(일/월/년)* | 우선일 *(일/월/년)* |
|---|---|---|
| **PCT/KR2016/015297** | 2016년 12월 26일 (26.12.2016) | 2015년 12월 24일 (24.12.2015) |

국제특허분류(IPC)

***H04L 29/08(2006.01)i, H04L 1/00(2006.01)i, H04W 84/12(2009.01)i, H04L 27/26(2006.01)i, H04L 5/00(2006.01)i, H04W 74/00(2009.01)i, H04W 74/08(2009.01)i***

출원인
주식회사 윌러스표준기술연구소

1. 본 견해서는 다음 기재란에 관한 내용을 포함합니다.

- ☒ 제1기재란 견해서의 기초
- ☐ 제2기재란 우선권
- ☐ 제3기재란 신규성, 진보성 및 산업상이용가능성에 관한 견해 부작성
- ☐ 제4기재란 발명의 단일성 결여
- ☒ 제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명
- ☐ 제6기재란 특이 인용문헌
- ☐ 제7기재란 국제출원의 흠결
- ☒ 제8기재란 국제출원에 관한 의견

2. **추가적인 조치**

국제예비심사가 청구되면, 본 견해서는 국제예비심사기관("IPEA")의 견해서로 간주될 것입니다. 다만, 출원인이 본 기관 이외의 기관을 IPEA로 선택하고, 그 선택된 IPEA가 PCT규칙 66.1의2(b)에 따라 본 국제조사기관의 견해서가 위와 같이 간주되지 않을 것임을 국제사무국에 통보한 경우에는 그러하지 않습니다.

본 견해서가 상기와 같이 IPEA의 견해서로 간주되는 경우, 출원인은 서식 PCT/ISA/220의 발송일로부터 3월 또는 우선일부터 22월 중 늦게 만료되는 날 이전에 의견서 및 보정서(해당하는 경우)를 IPEA에 제출할 수 있습니다.

다른 선택사항에 대하여는 서식 PCT/ISA/220에 대한 안내문을 참조하십시오.

| | | |
|---|---|---|
| ISA/KR의 명칭 및 우편주소<br>대한민국 특허청<br>(35208) 대전광역시 서구 청사로 189, 4동 (둔산동, 정부대전청사)<br>팩스번호 +82-42-481-8578 | 본 견해서의 완료일<br>2017년 04월 10일 (10.04.2017) | 심사관<br>김성우<br>전화번호 +82-42-481-3348 |

서식 PCT/ISA/237 (표지) (2015년 1월)

# 국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제1기재란 본 견해서의 기초**

1. **언어**와 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

☒ 출원시의 언어로 된 국제출원

☐ 국제조사를 위하여 _____ 로 번역되어 제출된 국제출원의 번역문
(PCT규칙 12.3(a) 및 23.1(b))

2. ☐ 본 견해서는 PCT규칙 91에 따라 당해 기관이 허가하였거나 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43의2.1(a)).

3. ☐ 국제출원에 개시된 핵산염기 및/또는 아미노산 서열과 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

a. ☐ 아래의 형태로 출원시 국제출원의 일부를 구성하는 서열목록
- ☐ 부록 C/ST.25 텍스트 파일
- ☐ 서면 혹은 이미지 파일

b. ☐ PCT 규칙 13의3.1(a)에 따라 국제출원과 함께 국제조사만을 목적으로 부록 C/ST.25 텍스트 파일의 형태로 제출된 서열목록

c. ☐ 국제조사만을 목적으로 국제출원일 이후에 아래 형태로 제출된 서열목록
- ☐ 부록 C/ST.25 텍스트 파일 (규칙 13의3.1(a))
- ☐ 서면 혹은 이미지 파일 (규칙 13의3.1(b) 및 시행세칙 713)

4. ☐ 추가로 서열목록에 대하여 하나 이상의 버전이나 사본이 제출된 경우, 후속 버전 또는 추가된 사본에 기재되어 있는 정보가 출원시 출원의 일부를 구성하는 정보와 동일하거나 또는 출원시의 개시범위를 벗어나지 않는다는 진술서가 제출되었습니다.

5. 추가 의견:

국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명**

1. 견해

| | | | |
|---|---|---|---|
| 신규성 (N) | 청구항 | 1-23 | 있음 |
| | 청구항 | 없음 | 없음 |
| 진보성 (IS) | 청구항 | 4-22 | 있음 |
| | 청구항 | 1-3,23 | 없음 |
| 산업상 이용가능성 (IA) | 청구항 | 1-23 | 있음 |
| | 청구항 | 없음 | 없음 |

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: KR 10-2015-0143748 A (퀄컴 인코포레이티드) 2015.12.23
D2: KR 10-2015-0035569 A (엘지전자 주식회사) 2015.04.06
D3: KR 10-2014-0070528 A (엘지전자 주식회사) 2014.06.10
D4: KR 10-2015-0044875 A (엘지전자 주식회사) 2015.04.27
D5: KR 10-2012-0097514 A (인터디지탈 패튼 홀딩스, 인크) 2012.09.04

2.1 신규성 및 진보성

2.1.1 독립항: 청구항 제1항

청구항 제1항에 가장 근접한 인용문헌 D1에는 '프로세서; 및 송신기 및 수신기를 포함하고, 프로세서는 패킷의 데이터의 변조 방식을 설명하는 4 비트 및 패킷 길이에 대한 12 비트를 포함하는 SIG 필드의 정보를 획득하고, 획득된 정보를 이용하여 패킷의 데이터를 디코딩하기 위해 이용하고, 데이터는 2 이상의 서브-대역들 상에 포함되는 무선 디바이스 (D1: 단락 [0025], [0027], [0054]-[0061], [0093]; 및 도면 1-12, 14, 17-22, 24-30, 35 참조)'가 제시되어 있습니다. 다만 상기 인용문헌 D1에는 청구항 제1항의 '불연속 채널 할당 정보'가 기재되어 있지 않다는 점에서 차이가 있지만, 상기 차이는 인용문헌 D2의 '채널 폭 서브필드를 포함하는 동작 정보 필드를 포함하는 프레임을 전송하는 단계, 채널 폭은 하나 이상의 W 채널을 포함하고, 하나의 W 채널에 대한 제 1 타입 채널 폭, 2 개의 연속적인 (contiguous) W 채널들에 대한 제 2 타입 채널 폭, 2 개의 불연속적인 (non-contiguous) W 채널들에 대한 제 3 타입 채널 폭, 4 개의 연속적인 W 채널들에 대한 제 4 타입 채널 폭 또는 각각의 주파수 세그먼트가 2 개의 연속적인 W 채널들을 포함하는 2 개의 불연속적인 주파수 세그먼트들에 대한 제 5 타입 채널 폭 중에서 하나를 지시하는 것 (D2: 청구항 1, 2; 및 도면 8 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진 자에게

추가 기재란에 계속

# 국제조사기관의 견해서

국제출원번호
**PCT/KR2016/015297**

**제8기재란 국제출원에 관한 의견**

청구범위, 발명의설명 및 도면의 명료성에 관하여 또는 청구범위가 발명의설명에 의하여 충분히 뒷받침되고 있는지에 관하여 다음과 같은 의견을 제시합니다.

청구항 제9항은 청구항 제1항의 'HE-SIG-B'를 인용하고 있으나, 상기 HE-SIG-B는 청구항 제1항에 기재되어 있지 않습니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제9항이 청구항 제2항을 인용하는 것으로 가정하여 작성되었습니다.)

청구항 제9항에는 앞서 언급되지 않은 리소스 유닛 배열이 "상기 리소스 유닛 배열"로 기재되어 있으므로 불명확합니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제9항의 "상기 리소스 유닛 배열"을 '상기 리소스 유닛 배열 정보'로 가정하여 작성되었습니다.)

청구항 제11항은 청구항 제1항의 'HE-SIG-A' 및 'HE-SIG-B'를 인용하고 있으나, 상기 HE-SIG-A 및 HE-SIG-B는 청구항 제1항에 기재되어 있지 않습니다(PCT 제6조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제11항이 청구항 제2항을 인용하는 것으로 가정하여 작성되었습니다.)

청구항 제17항의 "상기 패킷이 80MHz 이상의 총 대역폭으로 ~"에서 상한 값이 기재되지 않아 발명이 불명확 합니다(PCT 제 6 조).
(참고: 본 국제조사 보고서 및 견해서는 청구항 제17항의 "80MHz 이상의 총 대역폭"을 '80MHz의 총 대역폭'으로 가정하여 작성되었습니다.)

추가 기재란

**이전 기재란의 공간이 충분하지 아니**한 경우.
제5 기재란의 연속

자명하므로, 청구항 제1항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

2.1.2 종속항: 청구항 제2항 내지 제22항
청구항 제2항에 기재된 발명의 추가적인 특징은 인용문헌 D1에 제시된 '정보의 하나 이상의 비트들이 HE-SIG와 같은 패킷 프리앰블의 다른 부분에 임베드될 수 있는 것 (D1: 단락 [0093] 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제2항에 기재된 발명은 인용문헌 D1과 D2의 결합에 의하여 자명하므로 진보성이 없습니다(PCT 제33조(3)).

청구항 제3항에 기재된 발명의 추가적인 특징은 인용문헌 D1에 제시된 '5, 10, 20, 40, 80 및 160 MHz 채널들과 같은 다수의 상이한 크기들의 채널들을 지원하는 것 (D1: 단락 [0025] 참조)'으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제3항에 기재된 발명은 인용문헌 D1과 D2의 결합에 의하여 자명하므로 진보성이 없습니다(PCT 제33조(3)).

청구항 제4항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-A의 대역폭 필드를 통해 지시되며, 대역폭 필드는 패킷이 전송되는 총 대역폭 정보 및 총 대역폭 내에서 펑처링되는 채널 정보를 지시하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제4항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제5항은 청구항 제4항의 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제6항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-B의 리소스 유닛 할당 필드의 기 설정된 인덱스를 통해 지시하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제6항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제7항 및 제8항은 청구항 제6항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제9항에 기재된 발명은 '불연속 채널 할당 정보는 HE-SIG-B의 리소스 유닛 할당 필드가 지시하는 리소스 유닛 배열 정보 및 리소스 유닛 배열에서 특정 리소스 유닛에 대

다음 페이지에 계속

추가 기재란

**이전 기재란의 공간이 충분하지 아니**한 경우.
이전 기재란의 연속

응하는 사용자 필드에 삽입된 널 STA ID를 통해 획득하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제9항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제10항 내지 제16항은 청구항 제9항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제17항에 기재된 발명은 '패킷이 80MHz 이상의 총 대역폭으로 전송될 경우, 불연속 채널 할당 정보는 80MHz에서의 중앙 26-톤 리소스 유닛이 사용자에게 할당되었는지 여부를 지시하는 필드 (C26)의 정보를 더 포함하는 것'을 포함하는 점에서 상기 인용문헌 D1 및 인용문헌 D2에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌에도 기재되어 있지 않으며, 통상의 지식을 가진 자에게도 자명하지 않습니다. 따라서 청구항 제17항에 기재된 발명은 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

청구항 제18항 내지 제22항은 청구항 제17항의 직접 또는 간접 종속항이므로 신규성과 진보성이 있습니다(PCT 제33조 (2) 및 (3)).

2.1.3 청구항 제23항
청구항 제23항에 기재된 발명은 청구항 제1항에 기재된 발명의 기술적 특징을 카테고리만 달리하여 무선 통신 방법으로 기재하고 있습니다. 따라서 청구항 제1항에 기재된 발명이 진보성이 없으므로, 청구항 제23항에 기재된 발명은 인용문헌 D1과 D2에 의해서 진보성이 없습니다(PCT 제33조 (3)).

2.2 산업상 이용가능성

청구항 제1항 내지 제23항에 기재된 발명은 산업상 이용가능합니다(PCT 제33조 (4)).

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Filer:** | Young Seok Koo/Azatuhi Chinaryan |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| UTILITY APPLICATION FILING | 1011 | 1 | 300 | 300 |
| UTILITY SEARCH FEE | 1111 | 1 | 660 | 660 |
| UTILITY EXAMINATION FEE | 1311 | 1 | 760 | 760 |
| **Pages:** | | | | |
| UTILITY APPL SIZE FEE PER 50 SHEETS >100 | 1081 | 1 | 400 | 400 |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **2120** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 39360258 |
| **Application Number:** | 16868525 |
| **International Application Number:** | |
| **Confirmation Number:** | 6523 |
| **Title of Invention:** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |
| **First Named Inventor/Applicant Name:** | Juhyung SON |
| **Customer Number:** | 158747 |
| **Filer:** | Young Seok Koo |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | B-9493CON1 632642-0 |
| **Receipt Date:** | 06-MAY-2020 |
| **Filing Date:** | |
| **Time Stamp:** | 23:24:42 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $2120 |
| RAM confirmation Number | E202056N26289539 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Application Data Sheet | 632642_ADS1.pdf | 111728<br>6823d0db729157cad1085c90ac88466a6976d567 | no | 10 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied ADS fillable form | | | | | |
| 2 | | 631462_EngSpecs.pdf | 503830<br>6afdd224d66268c5fbf161c5660a75cb5cb9340e | yes | 103 |

| Multipart Description/PDF files in .zip description | | |
|---|---|---|
| **Document Description** | **Start** | **End** |
| Specification | 1 | 97 |
| Claims | 98 | 102 |
| Abstract | 103 | 103 |

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| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Drawings-other than black and white line drawings | 631462_EngDrawings.pdf | 5783294<br>96c5a9147c75b912d17a8d5a9d65d4f94c191cb1 | no | 32 |
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| **Information:** | | | | | |
| 4 | Oath or Declaration filed | 631462_Declaration_Signed.pdf | 612175<br>9ea19d961662b3be87831f08e89680a4b5434630 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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| 5 | Power of Attorney | 632642_POA_All.pdf | 893983<br>f0970a40298b1a98526c235dd5045a25b25e50c1 | no | 2 |
| **Warnings:** | | | | | |
| The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing | | | | | |
| **Information:** | | | | | |
| 6 | Assignee showing of ownership per 37 CFR 3.73 | 632642_Statement373c.pdf | 250388<br>04bf25f420584792f879e06863520ae1f67ec82b | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | | 632642_IDS.pdf | 163831<br>6cfcebd40f024842dfdd6abad4ebe12d0dfe77ff | yes | 5 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 3 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 4 | 5 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Foreign Reference | Ref_KR10-2015-0143748.pdf | 3059704<br>e5130558e9bab9b63b403f30504c69f11ba3e94f | no | 103 |
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| 9 | Foreign Reference | Ref_KR10-2015-0035569.pdf | 1750228<br>96c110ba3c73611b27d80e323287833b253b2cf6 | no | 58 |
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| 10 | Foreign Reference | Ref_KR10-2014-0070528.pdf | 1490915<br>6ef586bbbb944532340e48804c037afdb2d76f14 | no | 57 |
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| 11 | Foreign Reference | Ref_KR10-2015-0044875.pdf | 3749973<br>6a5678524c9f21e6ed0b097c28b2c7d4c6cf5690 | no | 78 |
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| **Information:** | | | | | |
| 12 | Foreign Reference | Ref_KR10-2012-0097514.pdf | 1309939<br>17d3c3fdfb6d8b01d8c11ce68fcaaf28dc9c60e0 | no | 49 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 13 | Foreign Reference | Ref_WO2017-111567.pdf | 10531049<br>5ac2ae2ad9261b77fb03dbc053ce8111e3a5f16b | no | 163 |
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| **Information:** | | | | | |
| 14 | Foreign Reference | Ref4_WO2015-119374.pdf | 2287476<br>d5a0c13c1374d9284ef3e79369d74ad4ff0340f9 | no | 65 |
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| 15 | Foreign Reference | Ref5_JP2015-527780.pdf | 1033665<br>4ba3086060a45a2a1ec2454cd91d071691c468b6 | no | 66 |
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| **Information:** | | | | | |
| 16 | Foreign Reference | Ref6_JP2014-511651.pdf | 1589555<br>66fb5c05efc91ccc06e3822e640e45edb5978947 | no | 77 |
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| **Information:** | | | | | |
| 17 | Other Reference-Patent/App/Search documents | Ref_PCTKR2016015297_ISR.pdf | 555090<br>daaeb50aa790649f38aa20f0f60fd15e78792fb6 | no | 7 |
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| 18 | Other Reference-Patent/App/Search documents | Ref_PCTKR2016015297_WROP.pdf | 790489<br>6db364624ac35f7b871cc39b8a3dc093fdbe5dc1 | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 19 | Other Reference-Patent/App/Search documents | Ref7_PCTKR2016-015297_IPRP.pdf | 587234<br>67ff8f8deb9d7998dadc6645ba680ca5618aa382 | no | 16 |
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| **Information:** | | | | | |
| 20 | Other Reference-Patent/App/Search documents | Ref8_JP2018-553036_1stOA.pdf | 227127<br>86a1f9e5ef098c60fe3aa5b02a7fa7055e1cc50d | no | 5 |
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| **Information:** | | | | | |
| 21 | Other Reference-Patent/App/Search documents | Ref9_EP68794345_EESR.pdf | 835917<br>1b80e9416312afa7cf64f34175d6d6eae16a2a3f | no | 14 |
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| 22 | Non Patent Literature | Ref10_SpecificationFramework_802_11-15_0132r13.pdf | 3793299<br>1ed19df4e526ed1467c17c9da2ac70fb798ec621 | no | 38 |
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| 23 | Non Patent Literature | Ref11_SupportedResource_802_11-15_1304r1.pdf | 1379967<br>2bd7d40d1b76678d41e74b0ce01bbc0ed73beb01 | no | 15 |
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| 24 | Non Patent Literature | Ref12_Considerations_802_11-15_827r2.pdf | 1443504<br>79c88dfee053710568dddb607917f6bb3df2426f | no | 14 |
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| 25 | Non Patent Literature | Ref13_KWON_NPL.pdf | 585172<br>8567ab11e7e4bea1d41c1b003badacfc4accb9b1 | no | 11 |
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| **Information:** | | | | | |
| 26 | Other Reference-Patent/App/Search documents | Ref_US16016520_NOA.pdf | 462992<br>79f170a849f9c9fa9624dfde799737dd122508e4 | no | 9 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 27 | Other Reference-Patent/App/Search documents | Ref_US16016520_OA.pdf | 436693<br>50973a5d7f7170fcc4bc4e34832967bf61d4e892 | no | 14 |
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| 28 | Fee Worksheet (SB06) | fee-info.pdf | 37041<br>cac6947976b345684f138a56235a99208347a715 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 46256258 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Inventor Information:

**Inventor 1** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Juhyung | | SON | |

**Residence Information (Select One)** ○ US Residency ◉ Non US Residency ○ Active US Military Service

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| Postal Code | 16021 | Country [i] | KR |

**Inventor 2** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
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|---|---|---|---|

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| Address 2 | Anyang-si | | |
| City | Gyeonggi-do | State/Province | |
| Postal Code | 14071 | Country [i] | KR |

**Inventor 3** Remove

**Legal Name**

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Geonjung | | KO | |

**Residence Information (Select One)** ○ US Residency ◉ Non US Residency ○ Active US Military Service

| City | Gyeonggi-do | Country of Residence [i] | KR |
|---|---|---|---|

**Mailing Address of Inventor:**

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| Address 2 | Yeongtong-gu Suwon-si | | |
| City | Gyeonggi-do | State/Province | |
| Postal Code | 16547 | Country [i] | KR |

**Inventor 4** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Woojin | | AHN | |

**Residence Information (Select One)** ○ US Residency ◉ Non US Residency ○ Active US Military Service

| City | Seoul | Country of Residence [i] | KR |
|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 18-1, Seooreung-ro 13-gil Eunpyeong-gu | | |
|---|---|---|---|
| Address 2 | | | |
| City | Seoul | State/Province | |
| Postal Code | 03410 | Country [i] | KR |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 158747 | | |
|---|---|---|---|
| Email Address | LA_MAIL@LA.LADAS.COM | Add Email | Remove Email |

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

## Application Information:

| | | | |
|---|---|---|---|
| **Title of the Invention** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | | |
| **Attorney Docket Number** | B-9493CON1 632642-0 | **Small Entity Status Claimed** ☐ | |
| **Application Type** | Nonprovisional | | |
| **Subject Matter** | Utility | | |
| **Total Number of Drawing Sheets (if any)** | 32 | **Suggested Figure for Publication (if any)** | |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|---|---|---|
| | | |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

| | | | |
|---|---|---|---|
| Please Select One: | ◉ Customer Number | ○ US Patent Practitioner | ○ Limited Recognition (37 CFR 11.9) |
| Customer Number | 158747 | | |

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

| Prior Application Status | Pending | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| | Continuation of | 16016520 | 2018-06-22 |
| Prior Application Status | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 16016520 | Continuation of | PCT/KR2016/015297 | 2016-12-26 |

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

| | | | Remove |
|---|---|---|---|
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| 10-2015-0186871 | KR | 2015-12-24 | |
| | | | Remove |
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| 10-2016-0004471 | KR | 2016-01-13 | |
| | | | Remove |
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| 10-2016-0005835 | KR | 2016-01-18 | |
| | | | Remove |
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| 10-2016-0026683 | KR | 2016-03-04 | |

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
|---|---|---|---|
| 10-2016-0030006 | KR | 2016-03-13 | |
| 10-2016-0059182 | KR | 2016-05-14 | |
| 10-2016-0062422 | KR | 2016-05-20 | |
| 10-2016-0083756 | KR | 2016-07-01 | |

Remove

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE**: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

**1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)**

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

**2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)**

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Applicant 1**

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| | | |
|---|---|---|
| ◉ Assignee | ○ Legal Representative under 35 U.S.C. 117 | ○ Joint Inventor |
| ○ Person to whom the inventor is obligated to assign. | ○ Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

| Organization Name | WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. |
|---|---|

**Mailing Address Information For Applicant:**

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|---|---|---|---|
| **Address 1** | 5F 216 Hwangsaeul-ro Bundang-gu Seongnam-si | | |
| Address 2 | | | |
| **City** | Gyeonggi-do | **State/Province** | |
| **Country** | KR | Postal Code | 13595 |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Applicant Data may be generated within this form by selecting the Add button.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

**Applicant 2**

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| | | |
|---|---|---|
| ◉ Assignee | ○ Legal Representative under 35 U.S.C. 117 | ○ Joint Inventor |
| ○ Person to whom the inventor is obligated to assign. | ○ Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

| Organization Name | SK TELECOM CO., LTD. |
|---|---|

**Mailing Address Information For Applicant:**

| | | | |
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| **Address 1** | 65, Eulji-ro, Jung-gu | | |
| Address 2 | | | |
| **City** | Seoul | **State/Province** | |
| **Country** | KR | Postal Code | 04539 |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Applicant Data may be generated within this form by selecting the Add button.

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | B-9493CON1 632642-0 |
|---|---|---|
| | Application Number | |
| Title of Invention | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL | |

| Organization Name | | | |
|---|---|---|---|
| **Mailing Address Information For Assignee including Non-Applicant Assignee:** | | | |
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country** i | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |
| Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. | | | |

## Signature:

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

| **Signature** | /Young Seok Koo 76255/ | | | Date (YYYY-MM-DD) | 2020-05-05 |
|---|---|---|---|---|---|
| First Name | Young Seok | Last Name | Koo | Registration Number | 76,255 |
| Additional Signature may be generated within this form by selecting the Add button. | | | | | |

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

# Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

[DESCRIPTION]

[Invention Title]

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

[Technical Field]

The present invention relates to a wireless communication method and a wireless communication terminal which use non-contiguous channel, and more particularly, to a wireless communication method and a wireless communication terminal for efficiently signaling non-contiguous channel allocation information.

[Background Art]

In recent years, with supply expansion of mobile apparatuses, a wireless LAN technology that can provide a rapid wireless Internet service to the mobile apparatuses has been significantly spotlighted. The wireless LAN technology allows mobile apparatuses including a smart phone, a smart pad, a laptop computer, a portable multimedia player, an embedded apparatus, and the like to wirelessly access the Internet in home or a company or a specific service providing area based on a wireless communication technology in a short range.

Institute of Electrical and Electronics Engineers (IEEE) 802.11 has commercialized or developed various technological standards since an initial wireless LAN technology is supported using frequencies of 2.4 GHz. First, the IEEE 802.11b supports a communication speed of a maximum of 11 Mbps while using frequencies of a 2.4 GHz band. IEEE 802.11a which is commercialized after the IEEE 802.11b uses frequencies of not the 2.4 GHz band but a 5 GHz band to reduce an influence by interference as compared with the frequencies of the 2.4 GHz band which are significantly congested and improves the communication speed up to a maximum of 54

Mbps by using an OFDM technology. However, the IEEE 802.11a has a disadvantage in that a communication distance is shorter than the IEEE 802.11b. In addition, IEEE 802.11g uses the frequencies of the 2.4 GHz band similarly to the IEEE 802.11b to implement the communication speed of a maximum of 54 Mbps and satisfies backward compatibility to significantly come into the spotlight and further, is superior to the IEEE 802.11a in terms of the communication distance.

Moreover, as a technology standard established to overcome a limitation of the communication speed which is pointed out as a weak point in a wireless LAN, IEEE 802.11n has been provided. The IEEE 802.11n aims at increasing the speed and reliability of a network and extending an operating distance of a wireless network. In more detail, the IEEE 802.11n supports a high throughput (HT) in which a data processing speed is a maximum of 540 Mbps or more and further, is based on a multiple inputs and multiple outputs (MIMO) technology in which multiple antennas are used at both sides of a transmitting unit and a receiving unit in order to minimize a transmission error and optimize a data speed. Further, the standard can use a coding scheme that transmits multiple copies which overlap with each other in order to increase data reliability.

As the supply of the wireless LAN is activated and further, applications using the wireless LAN are diversified, the need for new wireless LAN systems for supporting a higher throughput (very high throughput (VHT)) than the data processing speed supported by the IEEE 802.11n has come into the spotlight. Among them, IEEE 802.11ac supports a wide bandwidth (80 to 160 MHz) in the 5 GHz frequencies. The IEEE 802.11ac standard is defined only in the 5 GHz band, but initial 11ac chipsets will support even operations in the 2.4 GHz band for the backward compatibility with the existing 2.4 GHz band products. Theoretically, according to the standard, wireless LAN

speeds of multiple stations are enabled up to a minimum of 1 Gbps and a maximum single link speed is enabled up to a minimum of 500 Mbps. This is achieved by extending concepts of a wireless interface accepted by 802.11n, such as a wider wireless frequency bandwidth (a maximum of 160 MHz), more MIMO spatial streams (a maximum of 8), multi-user MIMO, and high-density modulation (a maximum of 256 QAM). Further, as a scheme that transmits data by using a 60 GHz band instead of the existing 2.4 GHz/5 GHz, IEEE 802.11ad has been provided. The IEEE 802.11ad is a transmission standard that provides a speed of a maximum of 7 Gbps by using a beamforming technology and is suitable for high bit rate moving picture streaming such as massive data or non-compression HD video. However, since it is difficult for the 60 GHz frequency band to pass through an obstacle, it is disadvantageous in that the 60 GHz frequency band can be used only among devices in a short-distance space.

Meanwhile, in recent years, as next-generation wireless LAN standards after the 802.11ac and 802.11ad, discussion for providing a high-efficiency and high-performance wireless LAN communication technology in a high-density environment is continuously performed. That is, in a next-generation wireless LAN environment, communication having high frequency efficiency needs to be provided indoors/outdoors under the presence of high-density stations and access points (APs) and various technologies for implementing the communication are required.

[Disclosure]

[Technical Problem]

The present invention has an object to provide high-efficiency/high-performance wireless LAN communication in a high-density environment as described above.

[Technical Solution]

In order to achieve the objects, the present invention provides a wireless communication method and a wireless communication terminal as below.

First, an exemplary embodiment of the present invention provides a wireless communication terminal, the terminal including: a processor; and a communication unit, wherein the processor receives a wireless packet through the communication unit, obtains non-contiguous channel allocation information of the received packet, and decodes the received packet based on the obtained non-contiguous channel allocation information.

In addition, an exemplary embodiment of the present invention provides a wireless communication method of a wireless communication terminal, including: receiving a wireless packet; obtaining non-contiguous channel allocation information of the received packet; and decoding the received packet based on the obtained non-contiguous channel allocation information.

Another exemplary embodiment of the present invention provides a base wireless communication terminal, the terminal including: a processor; and a communication unit, wherein the processor performs a CCA of multiple channels for a wideband packet transmission, and transmits a packet through at least one channel which is idle based on a result of performing the CCA of multiple channels, wherein when the packet is transmitted through a non-contiguous channel, the processor signals non-contiguous channel allocation information via a non-legacy preamble of the packet.

In addition, another exemplary embodiment of the present invention provides a wireless communication method of a base wireless communication terminal, including: performing a CCA of multiple channels for a wideband packet transmission, and transmitting a packet through at least one channel which is idle based on a result of performing the CCA of multiple channels, wherein when the packet is transmitted

through a non-contiguous channel, non-contiguous channel allocation information is signaled via a non-legacy preamble of the packet.

The non-contiguous channel allocation information may be indicated via at least one of a subfield of HE-SIG-A and a subfield of HE-SIG-B of the received packet.

The non-contiguous channel allocation information may indicate unassigned channel information in units of 20 MHz.

The non-contiguous channel allocation information may be indicated via a bandwidth field of the HE-SIG-A, and the bandwidth field may indicate total bandwidth information through which the packet is transmitted, and channel information to be punctured within the total bandwidth.

The bandwidth field may index puncturing of a secondary 20 MHz channel and puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel, respectively.

The non-contiguous channel allocation information may be indicated through a predetermined index of a resource unit allocation field of the HE-SIG-B.

The resource unit allocation field may indicate a specific resource unit (RU) not assigned to a user through a predetermined index.

The specific resource unit not assigned to a user may be at least one of a 242-tone resource unit, a 484-tone resource unit, and a 996-tone resource unit.

The non-contiguous channel allocation information may be obtained through resource unit arrangement information indicated by the resource unit allocation field of the HE-SIG-B and a Null STA ID contained in a user field corresponding to a specific resource unit in the resource unit arrangement.

The specific resource unit may be at least one of a 26-tone resource unit, a 52-tone resource unit, and a 106-tone resource unit.

The non-contiguous channel allocation information may be indicated via a combination of a bandwidth field of the HE-SIG-A and a resource unit allocation field of the HE-SIG-B.

The bandwidth field may indicate total bandwidth information through which the packet is transmitted and channel information to be punctured within the total bandwidth, and the resource unit allocation field may indicate additional puncturing information within the total bandwidth.

When the bandwidth field indicates puncturing of one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 80 MHz, the resource unit allocation field may indicate which 20 MHz channel in the secondary 40 MHz channel is punctured.

When the bandwidth field indicates puncturing of a secondary 20 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field may indicate additional puncturing in a secondary 80 MHz channel.

When the bandwidth field indicates puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field may indicate which 20 MHz channel in the secondary 40 MHz channel is punctured.

When the bandwidth field indicates puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field may indicate additional puncturing in a secondary 80 MHz channel.

When the packet is transmitted in a total bandwidth of 80 MHz or more, the non-contiguous channel allocation information may further include information of a field (C26 field) indicating whether a user is allocated to a center 26-tone resource unit

of 80 MHz.

An HE-SIG-B field of the packet may consist of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 in units of 20 MHz, and the C26 field may be carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2.

When the packet is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 may indicate whether a user is allocated to a center 26-tone resource unit in the total bandwidth of 80 MHz.

When the C26 field indicates assignment of the center 26-tone resource unit, the user field corresponding to the center 26-tone resource unit may be carried in a user specific field of the HE-SIG-B content channel 1.

When the packet is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth may consist of a first 80 MHz bandwidth and a second 80 MHz bandwidth, a first C26 field carried in the HE-SIG-B content channel 1 may indicate whether a user is allocated to a first center 26-tone resource unit in the first 80 MHz bandwidth, and a second C26 field carried in the HE-SIG-B content channel 2 may indicate whether a user is allocated to a second center 26-tone resource unit in the second 80 MHz bandwidth.

When the first C26 field indicates assignment of the first center 26-tone resource unit, a user field corresponding to the first center 26-tone resource unit may be carried in a user specific field of the HE-SIG-B content channel 1, and when the second C26 field indicates assignment of the second center 26-tone resource unit, a user field corresponding to the second center 26-tone resource unit may be carried in a user specific field of the HE-SIG-B content channel 2.

[Advantageous Effects]

According to the embodiment of the present invention, non-contiguous channel allocation information can be efficiently signaled.

According to an embodiment of the present invention, it is possible to increase the total resource utilization rate in the contention-based channel access system and improve the performance of the wireless LAN system.

[Description of Drawings]

FIG. 1 illustrates a wireless LAN system according to an embodiment of the present invention.

FIG. 2 illustrates a wireless LAN system according to another embodiment of the present invention.

FIG. 3 illustrates a configuration of a station according to an embodiment of the present invention.

FIG. 4 illustrates a configuration of an access point according to an embodiment of the present invention.

FIG. 5 schematically illustrates a process in which a STA and an AP set a link.

FIG. 6 illustrates a carrier sense multiple access (CSMA)/collision avoidance (CA) method used in wireless LAN communication.

FIG. 7 illustrates a method for performing a distributed coordination function (DCF) using a request to send (RTS) frame and a clear to send (CTS) frame.

FIGS. 8 and 9 illustrate multi-user transmission methods according to an embodiment of the present invention.

FIG. 10 illustrates an embodiment of a legacy PPDU format and a non-legacy PPDU format.

FIG. 11 illustrates various HE PPDU formats and an indication method thereof according to an embodiment of the present invention.

FIG. 12 illustrates HE PPDU formats according to an additional embodiment of the present invention.

FIG. 13 illustrates a power save operation scenario based on a PPDU format according to an embodiment of the present invention.

FIG. 14 illustrates an embodiment of a configuration of an HE-SIG-A field according to the HE PPDU format.

FIG. 15 illustrates a configuration of an HE-SIG-B field according to an embodiment of the present invention.

FIG. 16 illustrates an encoding structure and a transmission method of the HE-SIG-B according to an embodiment of the present invention.

FIG. 17 illustrates a subfield configuration of the HE-SIG-B when a SIG-B compression field indicates a compression mode of the HE-SIG-B.

FIGS. 18 to 20 illustrate channel extension methods according to embodiments of the present invention.

FIGS. 21 to 23 illustrate transmission sequences of a non-contiguous PPDU according to embodiments of the present invention.

FIG. 24 illustrates a method of setting a TXOP of an MU transmission process as an additional embodiment of the present invention.

FIGS. 25 to 31 illustrate methods of signaling non-contiguous channel allocation information according to various embodiments of the present invention.

FIGS. 32 to 34 illustrate non-contiguous channel allocation methods according to various embodiments of the present invention.

FIGS. 35 to 37 illustrate embodiments of a resource unit filtering according to additional embodiments of the present invention.

FIGS. 38 to 42 illustrate methods of signaling an HE MU PPDU according to

additional embodiments of the present invention.

FIGS. 43 to 44 illustrate embodiments in which a transmission using an HE MU PPDU is performed between a single STA and an AP.

FIGS. 45 to 46 illustrate methods of a non-contiguous channel allocation and a signaling thereof according to additional embodiments of the present invention.

[Detailed Description of the Invention]

Terms used in the specification adopt general terms which are currently widely used by considering functions in the present invention, but the terms may be changed depending on an intention of those skilled in the art, customs, and emergence of new technology. Further, in a specific case, there is a term arbitrarily selected by an applicant and in this case, a meaning thereof will be described in a corresponding description part of the invention. Accordingly, it should be revealed that a term used in the specification should be analyzed based on not just a name of the term but a substantial meaning of the term and contents throughout the specification.

Throughout this specification and the claims that follow, when it is described that an element is “coupled” to another element, the element may be “directly coupled” to the other element or “electrically coupled” to the other element through a third element. Further, unless explicitly described to the contrary, the word “comprise” and variations such as “comprises” or “comprising”, will be understood to imply the inclusion of stated elements but not the exclusion of any other elements. Moreover, limitations such as "or more” or “or less” based on a specific threshold may be appropriately substituted with “more than” or “less than”, respectively.

This application claims priority to and the benefit of Korean Patent Application Nos. 10-2015-0186871, 10-2016-0004471, 10-2016-0005835, 10-2016-0026683, 10-2016-00300006, 10-2016-0059182, 10-2016-0062422 and 10-2016-

0083756 filed in the Korean Intellectual Property Office and the embodiments and mentioned items described in the respective application, which forms the basis of the priority, shall be included in the Detailed Description of the present application.

FIG. 1 is a diagram illustrating a wireless LAN system according to an embodiment of the present invention. The wireless LAN system includes one or more basic service sets (BSS) and the BSS represents a set of apparatuses which are successfully synchronized with each other to communicate with each other. In general, the BSS may be classified into an infrastructure BSS and an independent BSS (IBSS) and FIG. 1 illustrates the infrastructure BSS between them.

As illustrated in FIG. 1, the infrastructure BSS (BSS1 and BSS2) includes one or more stations STA1, STA2, STA3, STA4, and STA5, access points PCP/AP-1 and PCP/AP-2 which are stations providing a distribution service, and a distribution system (DS) connecting the multiple access points PCP/AP-1 and PCP/AP-2.

The station (STA) is a predetermined device including medium access control (MAC) following a regulation of an IEEE 802.11 standard and a physical layer interface for a wireless medium, and includes both a non-access point (non-AP) station and an access point (AP) in a broad sense. Further, in the present specification, a term 'terminal' may be used to refer to a non-AP STA, or an AP, or to both terms. A station for wireless communication includes a processor and a communication unit and according to the embodiment, may further include a user interface unit and a display unit. The processor may generate a frame to be transmitted through a wireless network or process a frame received through the wireless network and besides, perform various processing for controlling the station. In addition, the communication unit is functionally connected with the processor and transmits and receives frames through the wireless network for the station. According to the present invention, a terminal may be

used as a term which includes user equipment (UE).

The access point (AP) is an entity that provides access to the distribution system (DS) via wireless medium for the station associated therewith. In the infrastructure BSS, communication among non-AP stations is, in principle, performed via the AP, but when a direct link is configured, direct communication is enabled even among the non-AP stations. Meanwhile, in the present invention, the AP is used as a concept including a personal BSS coordination point (PCP) and may include concepts including a centralized controller, a base station (BS), a node-B, a base transceiver system (BTS), and a site controller in a broad sense. In the present invention, an AP may also be referred to as a base wireless communication terminal. The base wireless communication terminal may be used as a term which includes an AP, a base station, an eNB (i.e. eNodeB) and a transmission point (TP) in a broad sense. In addition, the base wireless communication terminal may include various types of wireless communication terminals that allocate medium resources and perform scheduling in communication with a plurality of wireless communication terminals.

A plurality of infrastructure BSSs may be connected with each other through the distribution system (DS). In this case, a plurality of BSSs connected through the distribution system is referred to as an extended service set (ESS).

FIG. 2 illustrates an independent BSS which is a wireless LAN system according to another embodiment of the present invention. In the embodiment of FIG. 2, duplicative description of parts, which are the same as or correspond to the embodiment of FIG. 1, will be omitted.

Since a BSS3 illustrated in FIG. 2 is the independent BSS and does not include the AP, all stations STA6 and STA7 are not connected with the AP. The independent BSS is not permitted to access the distribution system and forms a self-

contained network. In the independent BSS, the respective stations STA6 and STA7 may be directly connected with each other.

FIG. 3 is a block diagram illustrating a configuration of a station 100 according to an embodiment of the present invention. As illustrated in FIG. 3, the station 100 according to the embodiment of the present invention may include a processor 110, a communication unit 120, a user interface unit 140, a display unit 150, and a memory 160.

First, the communication unit 120 transmits and receives a wireless signal such as a wireless LAN packet, or the like and may be embedded in the station 100 or provided as an exterior. According to the embodiment, the communication unit 120 may include at least one communication module using different frequency bands. For example, the communication unit 120 may include communication modules having different frequency bands such as 2.4 GHz, 5 GHz, and 60 GHz. According to an embodiment, the station 100 may include a communication module using a frequency band of 6 GHz or more and a communication module using a frequency band of 6 GHz or less. The respective communication modules may perform wireless communication with the AP or an external station according to a wireless LAN standard of a frequency band supported by the corresponding communication module. The communication unit 120 may operate only one communication module at a time or simultaneously operate multiple communication modules together according to the performance and requirements of the station 100. When the station 100 includes a plurality of communication modules, each communication module may be implemented by independent elements or a plurality of modules may be integrated into one chip. In an embodiment of the present invention, the communication unit 120 may represent a radio frequency (RF) communication module for processing an RF signal.

Next, the user interface unit 140 includes various types of input/output means provided in the station 100. That is, the user interface unit 140 may receive a user input by using various input means and the processor 110 may control the station 100 based on the received user input. Further, the user interface unit 140 may perform output based on a command of the processor 110 by using various output means.

Next, the display unit 150 outputs an image on a display screen. The display unit 150 may output various display objects such as contents executed by the processor 110 or a user interface based on a control command of the processor 110, and the like. Further, the memory 160 stores a control program used in the station 100 and various resulting data. The control program may include an access program required for the station 100 to access the AP or the external station.

The processor 110 of the present invention may execute various commands or programs and process data in the station 100. Further, the processor 110 may control the respective units of the station 100 and control data transmission/reception among the units. According to the embodiment of the present invention, the processor 110 may execute the program for accessing the AP stored in the memory 160 and receive a communication configuration message transmitted by the AP. Further, the processor 110 may read information on a priority condition of the station 100 included in the communication configuration message and request the access to the AP based on the information on the priority condition of the station 100. The processor 110 of the present invention may represent a main control unit of the station 100 and according to the embodiment, the processor 110 may represent a control unit for individually controlling some component of the station 100, for example, the communication unit 120, and the like. That is, the processor 110 may be a modem or a modulator/demodulator for modulating and demodulating wireless signals transmitted

to and received from the communication unit 120. The processor 110 controls various operations of wireless signal transmission/reception of the station 100 according to the embodiment of the present invention. A detailed embodiment thereof will be described below.

The station 100 illustrated in FIG. 3 is a block diagram according to an embodiment of the present invention, where separate blocks are illustrated as logically distinguished elements of the device. Accordingly, the elements of the device may be mounted in a single chip or multiple chips depending on design of the device. For example, the processor 110 and the communication unit 120 may be implemented while being integrated into a single chip or implemented as a separate chip. Further, in the embodiment of the present invention, some components of the station 100, for example, the user interface unit 140 and the display unit 150 may be optionally provided in the station 100.

FIG. 4 is a block diagram illustrating a configuration of an AP 200 according to an embodiment of the present invention. As illustrated in FIG. 4, the AP 200 according to the embodiment of the present invention may include a processor 210, a communication unit 220, and a memory 260. In FIG. 4, among the components of the AP 200, duplicative description of parts which are the same as or correspond to the components of the station 100 of FIG. 2 will be omitted.

Referring to FIG. 4, the AP 200 according to the present invention includes the communication unit 220 for operating the BSS in at least one frequency band. As described in the embodiment of FIG. 3, the communication unit 220 of the AP 200 may also include a plurality of communication modules using different frequency bands. That is, the AP 200 according to the embodiment of the present invention may include two or more communication modules among different frequency bands, for example,

2.4 GHz, 5 GHz, and 60 GHz together. Preferably, the AP 200 may include a communication module using a frequency band of 6 GHz or more and a communication module using a frequency band of 6 GHz or less. The respective communication modules may perform wireless communication with the station according to a wireless LAN standard of a frequency band supported by the corresponding communication module. The communication unit 220 may operate only one communication module at a time or simultaneously operate multiple communication modules together according to the performance and requirements of the AP 200. In an embodiment of the present invention, the communication unit 220 may represent a radio frequency (RF) communication module for processing an RF signal.

Next, the memory 260 stores a control program used in the AP 200 and various resulting data. The control program may include an access program for managing the access of the station. Further, the processor 210 may control the respective units of the AP 200 and control data transmission/reception among the units. According to the embodiment of the present invention, the processor 210 may execute the program for accessing the station stored in the memory 260 and transmit communication configuration messages for one or more stations. In this case, the communication configuration messages may include information about access priority conditions of the respective stations. Further, the processor 210 performs an access configuration according to an access request of the station. According to an embodiment, the processor 210 may be a modem or a modulator/demodulator for modulating and demodulating wireless signals transmitted to and received from the communication unit 220. The processor 210 controls various operations such as wireless signal transmission/reception of the AP 200 according to the embodiment of the present invention. A detailed embodiment thereof will be described below.

FIG. 5 is a diagram schematically illustrating a process in which a STA sets a link with an AP.

Referring to FIG. 5, the link between the STA 100 and the AP 200 is set through three steps of scanning, authentication, and association in a broad way. First, the scanning step is a step in which the STA 100 obtains access information of BSS operated by the AP 200. A method for performing the scanning includes a passive scanning method in which the AP 200 obtains information by using a beacon message (S101) which is periodically transmitted and an active scanning method in which the STA 100 transmits a probe request to the AP (S103) and obtains access information by receiving a probe response from the AP (S105).

The STA 100 that successfully receives wireless access information in the scanning step performs the authentication step by transmitting an authentication request (S107a) and receiving an authentication response from the AP 200 (S107b). After the authentication step is performed, the STA 100 performs the association step by transmitting an association request (S109a) and receiving an association response from the AP 200 (S109b). In this specification, an association basically means a wireless association, but the present invention is not limited thereto, and the association may include both the wireless association and a wired association in a broad sense.

Meanwhile, an 802.1X based authentication step (S111) and an IP address obtaining step (S113) through DHCP may be additionally performed. In FIG. 5, the authentication server 300 is a server that processes 802.1X based authentication with the STA 100 and may be present in physical association with the AP 200 or present as a separate server.

FIG. 6 is a diagram illustrating a carrier sense multiple access (CSMA)/collision avoidance (CA) method used in wireless LAN communication.

A terminal that performs a wireless LAN communication checks whether a channel is busy by performing carrier sensing before transmitting data. When a wireless signal having a predetermined strength or more is sensed, it is determined that the corresponding channel is busy and the terminal delays the access to the corresponding channel. Such a process is referred to as clear channel assessment (CCA) and a level to decide whether the corresponding signal is sensed is referred to as a CCA threshold. When a wireless signal having the CCA threshold or more, which is received by the terminal, indicates the corresponding terminal as a receiver, the terminal processes the received wireless signal. Meanwhile, when a wireless signal is not sensed in the corresponding channel or a wireless signal having a strength smaller than the CCA threshold is sensed, it is determined that the channel is idle.

When it is determined that the channel is idle, each terminal having data to be transmitted performs a backoff procedure after an inter frame space (IFS) time depending on a situation of each terminal, for instance, an arbitration IFS (AIFS), a PCF IFS (PIFS), or the like elapses. According to the embodiment, the AIFS may be used as a component which substitutes for the existing DCF IFS (DIFS). Each terminal stands by while decreasing slot time(s) as long as a random number determined by the corresponding terminal during an interval of an idle state of the channel and a terminal that completely exhausts the slot time(s) attempts to access the corresponding channel. As such, an interval in which each terminal performs the backoff procedure is referred to as a contention window interval.

When a specific terminal successfully accesses the channel, the corresponding terminal may transmit data through the channel. However, when the terminal which attempts the access collides with another terminal, the terminals which collide with each other are assigned with new random numbers, respectively to perform the backoff

procedure again. According to an embodiment, a random number newly assigned to each terminal may be decided within a range (2*CW) which is twice larger than a range (a contention window, CW) of a random number which the corresponding terminal is previously assigned. Meanwhile, each terminal attempts the access by performing the backoff procedure again in a next contention window interval and in this case, each terminal performs the backoff procedure from slot time(s) which remained in the previous contention window interval. By such a method, the respective terminals that perform the wireless LAN communication may avoid a mutual collision for a specific channel.

FIG. 7 is a diagram illustrating a method for performing a distributed coordination function using a request to send (RTS) frame and a clear to send (CTS) frame.

The AP and STAs in the BSS contend in order to obtain an authority for transmitting data. When data transmission at the previous step is completed, each terminal having data to be transmitted performs a backoff procedure while decreasing a backoff counter (alternatively, a backoff timer) of a random number assigned to each terminal after an AFIS time. A transmitting terminal in which the backoff counter expires transmits the request to send (RTS) frame to notify that corresponding terminal has data to transmit. According to an exemplary embodiment of FIG. 7, STA1 which holds a lead in contention with minimum backoff may transmit the RTS frame after the backoff counter expires. The RTS frame includes information on a receiver address, a transmitter address, and duration. A receiving terminal (i.e., the AP in FIG. 7) that receives the RTS frame transmits the clear to send (CTS) frame after waiting for a short IFS (SIFS) time to notify that the data transmission is available to the transmitting terminal STA1. The CTS frame includes the information on a receiver address and

duration. In this case, the receiver address of the CTS frame may be set identically to a transmitter address of the RTS frame corresponding thereto, that is, an address of the transmitting terminal STA1.

The transmitting terminal STA1 that receives the CTS frame transmits the data after a SIFS time. When the data transmission is completed, the receiving terminal AP transmits an acknowledgment (ACK) frame after a SIFS time to notify that the data transmission is completed. When the transmitting terminal receives the ACK frame within a predetermined time, the transmitting terminal regards that the data transmission is successful. However, when the transmitting terminal does not receive the ACK frame within the predetermined time, the transmitting terminal regards that the data transmission is failed. Meanwhile, adjacent terminals that receive at least one of the RTS frame and the CTS frame in the course of the transmission procedure set a network allocation vector (NAV) and do not perform data transmission until the set NAV is terminated. In this case, the NAV of each terminal may be set based on a duration field of the received RTS frame or CTS frame.

In the course of the aforementioned data transmission procedure, when the RTS frame or CTS frame of the terminals is not normally transferred to a target terminal (i.e., a terminal of the receiver address) due to a situation such as interference or a collision, a subsequent process is suspended. The transmitting terminal STA1 that transmitted the RTS frame regards that the data transmission is unavailable and participates in a next contention by being assigned with a new random number. In this case, the newly assigned random number may be determined within a range (2*CW) twice larger than a previous predetermined random number range (a contention window, CW).

FIGS. 8 and 9 illustrate multi-user transmission methods according to an

embodiment of the present invention. When using orthogonal frequency division multiple access (OFDMA) or multi-input multi-output (MIMO), one wireless communication terminal can simultaneously transmit data to a plurality of wireless communication terminals. Further, one wireless communication terminal can simultaneously receive data from a plurality of wireless communication terminals. For example, a downlink multi-user (DL-MU) transmission in which an AP simultaneously transmits data to a plurality of STAs, and an uplink multi-user (UL-MU) transmission in which a plurality of STAs simultaneously transmit data to the AP may be performed.

FIG. 8 illustrates a UL-MU transmission process according to an embodiment of the present invention. In order to perform the UL-MU transmission, the channel to be used and the transmission start time of each STA that performs uplink transmission should be adjusted. In order to efficiently schedule the UL-MU transmission, state information of each STA needs to be transmitted to the AP. According to an embodiment of the present invention, information for scheduling of a UL-MU transmission may be indicated through a predetermined field of a preamble of a packet and/or a predetermined field of a MAC header. For example, a STA may indicate information for UL-MU transmission scheduling through a predetermined field of a preamble or a MAC header of an uplink transmission packet, and may transmit the information to an AP. In this case, the information for UL-MU transmission scheduling includes at least one of buffer status information of each STA, and channel state information measured by each STA. The buffer status information of the STA may indicate at least one of whether the STA has uplink data to be transmitted, the access category (AC) of the uplink data and the size (or the transmission time) of the uplink data.

According to an embodiment of the present invention, the UL-MU

transmission process may be managed by the AP. The UL-MU transmission may be performed in response to a trigger frame transmitted by the AP. The STAs simultaneously transmit uplink data a predetermined IFS (e.g., SIFS) time after receiving the trigger frame. The trigger frame solicits UL-MU transmission of STAs and may inform channel (or subchannel) information allocated to the uplink STAs. Upon receiving the trigger frame from the AP, a plurality of STAs transmit uplink data through each allocated channel (or, subchannel) in response thereto. After the uplink data transmission is completed, the AP transmits an ACK to the STAs that have successfully transmitted the uplink data. In this case, the AP may transmit a predetermined multi-STA block ACK (M-BA) as an ACK for a plurality of STAs.

In the non-legacy wireless LAN system, subcarriers of a specific number, for example, 26, 52, or 106 tones may be used as a resource unit (RU) for a subchannel-based access in a channel of 20 MHz band. Accordingly, the trigger frame may indicate identification information of each STA participating in the UL-MU transmission and information of the allocated resource unit. The identification information of the STA includes at least one of an association ID (AID), a partial AID, and a MAC address of the STA. Further, the information of the resource unit includes the size and placement information of the resource unit.

On the other hand, in the non-legacy wireless LAN system, a UL-MU transmission may be performed based on a contention of a plurality of STAs for a specific resource unit. For example, if an AID field value for a specific resource unit is set to a specific value (e.g., 0) that is not assigned to STAs, a plurality of STAs may attempt random access (RA) for the corresponding resource unit.

FIG. 9 illustrates a DL-MU transmission process according to an embodiment of the present invention. According to an embodiment of the present invention, RTS

and/or CTS frames of a predetermined format may be used for NAV setting in the DL-MU transmission process. First, the AP transmits a multi-user RTS (MU-RTS) frame for NAV setting in the DL-MU transmission process. The duration field of the MU-RTS frame is set to a time until the end of the DL-MU transmission session. That is, the duration field of the MU-RTS frame is set based on a period until the downlink data transmission of the AP and ACK frame transmissions of the STAs are completed. The neighboring terminals of the AP set a NAV until the end of the DL-MU transmission session based on the duration field of the MU-RTS frame transmitted by the AP. According to an embodiment, the MU-RTS frame may be configured in the format of a trigger frame and requests simultaneous CTS (sCTS) frame transmissions of the STAs.

STAs (e.g., STA1 and STA2) receiving the MU-RTS frame from the AP transmit the sCTS frame. The sCTS frames transmitted by a plurality of STAs have the same waveform. That is, the sCTS frame transmitted by the STA1 on the first channel has the same waveform as the sCTS frame transmitted by the STA2 on the first channel. According to an embodiment, the sCTS frame is transmitted on the channel indicated by the MU-RTS frame. The duration field of the sCTS frame is set to a time until the DL-MU transmission session is terminated based on the information of the duration field of the MU-RTS frame. That is, the duration field of the sCTS frame is set based on the period until the downlink data transmission of the AP and the ACK frame transmissions of the STAs are completed. In FIG. 9, neighboring terminals of STA1 and STA2 set a NAV until the end of the DL-MU transmission session based on the duration field of the sCTS frame.

According to an embodiment of the present invention, the MU-RTS frame and the sCTS frame may be transmitted on a 20 MHz channel basis. Accordingly, the neighboring terminals including legacy terminals can set the NAV by receiving the MU-

RTS frame and/or the sCTS frame. When the transmission of the MU-RTS frame and the sCTS frame is completed, the AP performs a downlink transmission. FIG. 9 illustrates an embodiment in which the AP transmits DL-MU data to STA1 and STA2, respectively. The STAs receive the downlink data transmitted by the AP and transmit an uplink ACK in response thereto.

FIG. 10 illustrates an embodiment of a legacy PLCP Protocol Data Unit (PPDU) format and a non-legacy PPDU format. More specifically, FIG. 10(a) illustrates an embodiment of a legacy PPDU format based on 802.11a/g, and FIG. 10(b) illustrates an embodiment of a non-legacy PPDU based on 802.11ax. In addition, FIG. 10(c) illustrates the detailed field configuration of L-SIG and RL-SIG commonly used in the PPDU formats.

Referring to FIG. 10(a), the preamble of the legacy PPDU includes a legacy short training field (L-STF), a legacy long training field (L-LTF), and a legacy signal field (L-SIG). In an embodiment of the present invention, the L-STF, L-LTF and L-SIG may be referred to as a legacy preamble. Referring to FIG. 10(b), the preamble of the HE PPDU includes a repeated legacy short training field (RL-SIG), a high efficiency signal A field (HE-SIG-A), a high efficiency signal B field, a high efficiency short training field (HE-STF), and a high efficiency long training field (HE-LTF) in addition to the legacy preamble. In an embodiment of the present invention, the RL-SIG, HE-SIG-A, HE-SIG-B, HE-STF and HE-LTF may be referred to as a non-legacy preamble. The detailed configuration of the non-legacy preamble may be modified according to the HE PPDU format. For example, HE-SIG-B may only be used in some formats among the HE PPDU formats.

A 64 FFT OFDM is applied to the L-SIG included in the preamble of the PPDU and the L-SIG consists of 64 subcarriers in total. Among these, 48 subcarriers

excluding guard subcarriers, a DC subcarrier and pilot subcarriers are used for data transmission of the L-SIG. If a modulation and coding scheme (MCS) of BPSK, Rate = 1/2 is applied, the L-SIG may include information of a total of 24 bits. FIG. 10(c) illustrates a configuration of 24-bit information of the L-SIG.

Referring to FIG. 10(c), the L-SIG includes an L_RATE field and an L_LENGTH field. The L_RATE field consists of 4 bits and represents the MCS used for data transmission. More specifically, the L_RATE field represents one of the transmission rates of 6/9/12/18/24/24/36/48/54Mbps by combining the modulation scheme such as BPSK/QPSK/16-QAM/64-QAM with the code rate such as 1/2, 2/3, 3/4. When combining the information of the L_RATE field and the L_LENGTH field, the total length of the corresponding PPDU can be represented. The non-legacy PPDU sets the L_RATE field to a 6 Mbps which is the minimum rate.

The L_LENGTH field consists of 12 bits, and may represent the length of the corresponding PPDU by a combination with the L_RATE field. In this case, the legacy terminal and the non-legacy terminal may interpret the L_LENGTH field in different ways.

First, a method of interpreting the length of a PPDU using a L_LENGTH field by a legacy terminal or a non-legacy terminal is as follows. When the L_RATE field is set to 6 Mbps, 3 bytes (i.e., 24 bits) can be transmitted for 4 us, which is one symbol duration of 64 FFT. Therefore, by adding 3 bytes corresponding to the SVC field and the Tail field to the value of the L_LENGTH field and dividing it by 3 bytes, which is the transmission amount of one symbol, the number of symbols after the L-SIG is obtained on the 64FFT basis. The length of the corresponding PPDU, that is, the reception time (i.e., RXTIME) is obtained by multiplying the obtained number of symbols by 4us, which is one symbol duration, and then adding a 20us which is for

transmitting L-STF, L-LTF and L-SIG. This can be expressed by the following Equation 1.

[Equation 1]

$$\mathbf{RXTIME(us)} = \left(\left\lceil \frac{\mathbf{L\_LENGTH+3}}{\mathbf{3}} \right\rceil\right) \times \mathbf{4} + \mathbf{20}$$

In this case, $\lceil x \rceil$ denotes the smallest natural number greater than or equal to x. Since the maximum value of the L_LENGTH field is 4095, the length of the PPDU can be set up to 5.464ms. The non-legacy terminal transmitting the PPDU should set the L_LENGTH field as shown in Equation 2 below.

[Equation 2]

$$\mathbf{L\_LENGTH(byte)} = \left(\left\lceil \frac{\mathbf{TXTIME-20}}{\mathbf{4}} \right\rceil\right) \times \mathbf{3} - \mathbf{3}$$

Herein, TXTIME is the total transmission time constituting the corresponding PPDU, and is expressed by Equation 3 below. In this case, TX represents the transmission time of X.

[Equation 3]

$$\begin{aligned}\mathbf{TXTIME(us)} = {} & T_{\mathrm{L-STF}} + T_{\mathrm{L-LTF}} + T_{\mathrm{L-SIG}} + T_{\mathrm{RL-SIG}} + T_{\mathrm{HE-SIG-A}} \\ & + (T_{\mathrm{HE-SIG-B}}) + T_{\mathrm{HE-STF}} + N_{\mathrm{HE-LTF}} \cdot T_{\mathrm{HE-LTF}} + T_{\mathrm{Data}}\end{aligned}$$

With reference to the above equations, the length of the PPDU is calculated based on the round-up value of L_LENGTH/3. Therefore, for any value of k, three different values of L_LENGTH = {3k+1, 3k+2, 3(k+1)} indicate the same PPDU length. According to an embodiment of the present invention, the non-legacy terminal may perform additional signaling using three different L_LENGTH values indicating the same PPDU length information. More specifically, values corresponding to 3k+1 and 3k+2 among the three different L_LENGTH values may be used to indicate the HE

PPDU format.

FIG. 11 illustrates various HE PPDU formats and an indication method thereof according to an embodiment of the present invention. According to an embodiment of the present invention, the HE PPDU format may be indicated based on the L_LENGTH field and HE-SIG-A of the corresponding PPDU. More specifically, the HE PPDU format is indicated based on at least one of the value of the L_LENGTH field and the modulation scheme applied to the HE-SIG-A symbol.

First, referring to FIG. 11(a), when the value of the L_LENGTH field is 3k+1 (i.e., when mod3 = 1), the corresponding PPDU is an HE SU PPDU or an HE Trigger-based PPDU. The HE SU PPDU is a PPDU used for a single-user transmission between an AP and a single STA. Furthermore, the HE Trigger-based PPDU is an uplink PPDU used for a transmission that is a response to a trigger frame. HE SU PPDU and HE Trigger-based PPDU have the same preamble format. In the cases of the HE SU PPDU and the HE Trigger-based PPDU, two symbols of HE-SIG-A are modulated with BPSK and BPSK, respectively.

According to a further embodiment of the present invention illustrated in FIG. 11(b), when the value of the L_LENGTH field is 3k+1 and the two symbols of HE-SIG-A are modulated with BPSK and QBPSK, respectively, the corresponding PPDU is an extended PPDU. The extended PPDU is used as a new PPDU format other than the PPDU formats supported by 802.11ax.

Next, when the value of the L_LENGTH field is 3k+2 (i.e., when mod3 = 2), the corresponding PPDU is an HE MU PPDU or an HE Extended Range (ER) SU PPDU. The HE MU PPDU is a PPDU used for a transmission to one or more terminals. The HE MU PPDU format is illustrate in FIG. 11(c) and additionally includes HE-SIG-B in the non-legacy preamble. In the case of the HE MU PPDU, the two symbols of

HE-SIG-A are modulated with BPSK and BPSK, respectively. On the other hand, HE ER SU PPDU is used for a single-user transmission with a terminal in an extended range. The HE ER SU PPDU format is illustrated in FIG. 11(d), where HE-SIG-A of the non-legacy preamble is repeated on the time axis. In the case of the HE ER SU PPDU, the first two symbols of HE-SIG-A are modulated with BPSK and QBPSK, respectively. Thus, the non-legacy terminal can signal the PPDU format through the modulation scheme used for the two symbols of HE-SIG-A in addition to the value of the L_LENGTH field.

The HE MU PPDU illustrated in FIG. 11(c) may be used by an AP to perform a downlink transmission to a plurality of STAs. In this case, the HE MU PPDU may include scheduling information for a plurality of STAs to simultaneously receive the corresponding PPDU. In addition, the HE MU PPDU may be used by a single STA to perform an uplink transmission to the AP. In this case, the HE MU PPDU may transmit AID information of the receiver and/or the transmitter of the corresponding PPDU through a user specific field of the HE-SIG-B. Therefore, terminals receiving the HE MU PPDU may perform a spatial reuse operation based on the AID information obtained from the preamble of the corresponding PPDU. In addition, data transmission through some narrowband may be performed using the HE MU PPDU. Here, the narrowband may be a frequency band of less than 20 MHz. According to an embodiment, the HE MU PPDU may indicate allocation information of resource unit(s) to be used for a narrowband transmission through the HE-SIG-B.

More specifically, the resource unit allocation (RA) field of HE-SIG-B contains information on the resource unit partition type in a specific bandwidth (e.g., 20 MHz) of the frequency domain. Further, information of a STA assigned to each partitioned resource unit may be transmitted through the user specific field of the HE-

SIG-B. The user specific field includes one or more user fields corresponding to each partitioned resource unit.

When a narrowband transmission using a part of the partitioned resource units is performed, the resource unit used for the transmission may be indicated through the user specific field of the HE-SIG-B. According to an embodiment, an AID of a receiver or a transmitter may be contained in a user field corresponding to resource unit(s) on which data transmission is performed among a plurality of partitioned resource units. In addition, a predetermined Null STA ID may be contained in user field(s) corresponding to the remaining resource unit(s) in which data transmission is not performed. According to another embodiment of the present invention, the narrowband transmission may be signaled through a first user field corresponding to a resource unit in which data transmission is not performed and a second user field corresponding to a resource unit in which data transmission is performed. More specifically, a predetermined null STA ID may be contained in the first user field, and the placement information of the resource unit(s) on which data transmission is performed may be indicated through the remaining subfields of the corresponding user field. Next, the AID of the receiver or transmitter may be contained in the second user field. Thus, the terminal may signal the narrowband transmission through the location information contained in the first user field and the AID information contained in the second user field. In this case, since user fields less than the number of partitioned resource units are used, the signaling overhead can be reduced.

FIG. 12 illustrates HE PPDU formats according to an additional embodiment of the present invention. In each embodiment of FIG. 12, it is illustrated that, in the HE PPDU, the L_LENGTH field has a value of 3k+1 (i.e., mod3 = 1) and the two symbols of HE-SIG-A are modulated with BPSK and QBPSK, respectively, but the present

invention is not limited thereto. That is, in each embodiment of the HE PPDU, the L_LENGTH field may have a value of 3k+2 (i.e., mod3 = 2) or the two symbols of HE-SIG-A may be modulated with BPSK and BPSK, respectively,

First, FIG. 12(a) illustrates an HE ER PPDU format according to an embodiment of the present invention. In the corresponding PPDU format, HE-SIG-A and HE-SIG-B are repeated in the time domain. In this case, it is possible to obtain a reception gain of 3 dB or more due to repetitive transmission of HE-SIG-A and HE-SIG-B in the time domain, thereby enabling signal reception at a long distance. Since the PPDU format according to the embodiment of FIG. 12(a) can additionally signal HE-SIG-B, it can be used for a downlink extended range (ER) multi-user transmission. In addition, the corresponding PPDU format may be used for narrowband transmission of data in uplink/downlink ER single-user transmissions. More specifically, the PPDU format may signal, via HE-SIG-B, a transmission which uses a part of the resource units of the data area transmitted on the basis of 256 FFT / 20 MHz. Therefore, transmission using only 26-tone RU, 52-tone RU, or 106-tone RU which is less than 20 MHz band can be performed even in an uplink/downlink single-user transmission situation. Through such narrowband transmission, the terminal can perform transmission by concentrating the entire allowable transmission power in the ISM band on a narrow RU. That is, in addition to the extension of the transmission distance due to the repetitive transmission of the HE-SIG-A/B in the 64 FFT / 20 MHz domain, the transmission distance can be extended even in the data transmission in the following 256 FFT / 20 MHz domain. In addition, the corresponding PPDU format may also be used for narrowband transmission of data in a downlink multi-user transmission. For example, as shown in FIG. 12(a), the AP may indicate partition information of the 20 MHz band via HE-SIG-B of the PPDU, and use some resource units including at least two of the

partitioned resource units for the narrowband transmission. In this case, the transmission distance can be increased by concentrating the entire allowable transmission power in the ISM band to some resource units and transmitting it.

Next, FIG. 12(b) illustrates an HE ER PPDU format according to another embodiment of the present invention. In the corresponding PPDU format, HE-SIG-A is repeated in the time domain, and HE-SIG-B is not transmitted in order to reduce the preamble overhead. In this case, it is possible to obtain a reception gain of 3 dB or more due to repetitive transmission of HE-SIG-A in the time domain, thereby enabling signal reception at a long distance. According to an embodiment, the distinction between the PPDU format according to FIG. 12(a) and the PPDU format according to FIG. 12(b) may be indicated through a predetermined field of the HE-SIG-A. The PPDU format according to the embodiment of FIG. 12(b) may be used for narrowband transmission of data in uplink/downlink ER single-user transmission. In this case, the corresponding PPDU format may indicate a transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling via HE-SIG-B. For example, transmission only using some predetermined resource units within the 20 MHz bandwidth may be indicated via a specific field (e.g., Bandwidth field) of the HE-SIG-A. In this case, the some predetermined resource units may be at least one of 26-tone RU, 52-tone RU, and 106-tone RU in a specific placement. A predetermined field of the HE-SIG-A in the HE ER PPDU may indicate whether transmission using some predetermined resource units is performed or transmission using a 20 MHz full band (i.e., 242-tone RU) is performed. As described above, according to the embodiment of FIG. 12(b), the predetermined narrowband transmission may be indicated by simple signaling of the HE-SIG-A without using the HE-SIG-B in the HE ER PPDU.

Next, FIG. 12(c) illustrates an HE ER PPDU format according to yet another

embodiment of the present invention. In the corresponding PPDU format, HE-SIG-A is repeated in the time domain, and HE-SIG-B is not transmitted in order to reduce the preamble overhead. Instead, HE-SIG-C transmitted in the 256 FFT / 20 MHz domain may additionally be used. In this case, it is possible to obtain a reception gain of 3 dB or more due to repetitive transmission of HE-SIG-A in the time domain, thereby enabling signal reception at a long distance. The corresponding PPDU format may indicate a transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling via HE-SIG-B. The specific embodiments thereof are as described in the embodiment of FIG. 12(b). The HE-SIG-C may transmit information for a terminal to decode data transmitted through the corresponding resource unit, for example, MCS, whether a transmit beamforming (TxBF) is applied, binary convolutional code (BCC) / low density parity check (LDPC) coding indicator, and the like.

Finally, FIG. 12(d) illustrates an HE PPDU format according to still another embodiment of the present invention. In the corresponding PPDU format, HE-SIG-A is not repeated in the time domain, and HE-SIG-B is not transmitted. Instead, a HE-SIG-C transmitted in the 256 FFT / 20 MHz domain may additionally be used. The PPDU according to the embodiment of FIG. 12(d) may be used to allow the neighboring STAs of the AP to set a NAV using the transmission opportunity (TXOP) duration information included in the HE-SIG-A. The corresponding PPDU format may indicate a transmission using a specific resource unit of a data area transmitted on the basis of 256 FFT / 20 MHz without signaling via HE-SIG-B. The specific embodiments thereof are as described in the embodiment of FIG. 12(b). The HE-SIG-C may transmit information for a terminal to decode data transmitted through the corresponding resource unit as described above.

FIG. 13 illustrates a power save operation scenario based on a PPDU format according to an embodiment of the present invention. In a BSS operated by a non-legacy AP, a STA (i.e., ER STA) that supports an extended range (ER) mode and a STA (i.e., a non-ER STA) that does not support the ER mode may be mixed. In the embodiment of FIG. 13, STA "A" represents a non-ER STA, and STA "B" represents an ER STA.

According to the embodiment of the present invention, when the non-ER STA receives an ER PPDU of the same BSS (i.e., intra-BSS), it can enter the power save mode. In the embodiment of FIG. 13, the AP exchanges an ER SU PPDU with the STA "B", and the STA "A" receiving the corresponding PPDU enters the power save mode for the length of the received PPDU. The STA negotiates whether or not to support the ER mode when performing an association with the AP. Therefore, when the non-ER STA receives the ER PPDU of the same BSS, it can enter the power save mode without additional processing because it is obvious that the corresponding PPDU is not a PPDU transmitted to itself.

FIG. 14 illustrates an embodiment of a configuration of an HE-SIG-A field according to the HE PPDU format. HE-SIG-A consists of two symbols of 64 FFT, and indicates common information for reception of the HE PPDU. The first symbol of the HE-SIG-A is modulated with BPSK, and the second symbol of the HE-SIG-A is modulated with BPSK or QBPSK. In the HE ER SU PPDU, two symbols of the HE-SIG-A may be repeatedly transmitted. That is, the HE-SIG-A of the HE ER SU PPDU consists of four symbols, the first symbol and the second symbol of which have the same data bit, and the third symbol and the fourth symbol of which have the same data bit.

First, FIG. 14(a) illustrates a subfield configuration of the HE-SIG-A field of

the HE SU PPDU. According to an embodiment, the HE-SIG-A field of the HE ER SU PPDU may be configured similarly. The function of each field included in HE-SIG-A will be described as follows.

The UL/DL field indicates a transmission direction of the corresponding PPDU. That is, the corresponding field indicates whether the corresponding PPDU is transmitted with uplink or is transmitted with downlink. The format field is used to differentiate an HE SU PPDU from an HE Trigger-based PPDU. The BSS color field consists of 6 bits and indicates an identifier of the BSS corresponding to a terminal that transmitted the corresponding PPDU. The spatial reuse field carries information such as signal to interference plus noise ratio (SINR), transmission power, etc., which can be referred to by terminals to perform spatial reuse transmission during the transmission of the corresponding PPDU.

The TXOP duration field indicates duration information for TXOP protection and NAV setting. The corresponding field sets the duration of the TXOP interval in which consecutive transmission is to be performed after the corresponding PPDU, so that the neighboring terminals set a NAV for the corresponding duration. The bandwidth field indicates the total bandwidth in which the corresponding PPDU is transmitted. According to an embodiment, the bandwidth field may consist of 2 bits and indicate one of 20 MHz, 40 MHz, 80 MH and 160 MHz (including 80+80 MHz). The MCS field indicates an MCS value applied to the data field of the corresponding PPDU. The CP+LTF size field indicates the duration of the cyclic prefix (CP) or guard interval (GI) and the size of the HE-LTF. More specifically, the corresponding field indicates the combination of the HE-LTF size used among 1x, 2x, and 4x HE-LTF, and the CP (or GI) value used in the data field among 0.8us, 1.6us, and 3.2us.

The coding field may indicate which coding scheme is used between binary

convolutional code (BCC) and low density parity check (LDPC). In addition, the corresponding field may indicate whether an extra OFDM symbol for LDPC is present. The number of space time streams (NSTS) field indicates the number of space-time streams used for MIMO transmission. The space time block coding (STBC) field indicates whether space-time block coding is used. The transmit beamforming (TxBF) field indicates whether beamforming is applied to the transmission of the corresponding PPDU. The dual carrier modulation (DCM) field indicates whether dual carrier modulation is applied to the data field. The dual carrier modulation transmits the same information through two subcarriers in order to cope with narrowband interference. The packet extension field indicates which level of packet extension is applied to the PPDU. The beam change field indicates whether the part before the HE-STF of the corresponding PPDU is mapped spatially different from the HE-LTF. The CRC field and the tail field are used to determine the authenticity of the HE-SIG-A field information and to initialize the BCC decoder, respectively.

Next, FIG. 14(b) illustrates a subfield configuration of the HE-SIG-A field of the HE MU PPDU. Among the subfields shown in FIG. 14(b), the same subfields as those shown in FIG. 14(a) will not be described.

The UL/DL field indicates the transmission direction of the corresponding PPDU. That is, the corresponding field indicates whether the corresponding PPDU is transmitted with uplink or is transmitted with downlink. The bandwidth field of the HE MU PPDU may indicate extra bandwidths in addition to the bandwidths of the HE SU PPDU. That is, the bandwidth field of the HE MU PPDU consists of 3 bits and indicates one of 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80+80 MHz), and predetermined non-contiguous bands. The specific embodiments of the predetermined non-contiguous bands will be described later.

The SIG-B MCS field indicates the MCS applied to the HE-SIG-B field. Depending on the amount of information that requires signaling, variable MCS between MSC0 and MSC5 can be applied to the HE-SIG-B. The CP+LTF size field indicates the duration of the CP or GI and the size of the HE-LTF. The corresponding field indicates the combination of the HE-LTF size used among 2x and 4x HE-LTF, and the CP (or GI) value used in the data field among 0.8us, 1.6us, and 3.2us.

The SIG-B compression field indicates whether to use a compression mode of the HE-SIG-B field. When the HE MU PPDU is transmitted using an MU-MIMO in the full bandwidth, the resource unit allocation information for each 20 MHz band becomes unnecessary. Therefore, in the full bandwidth MU-MIMO transmission, the SIG-B compression field indicates the compression mode of the HE-SIG-B field. In this case, the common block field containing the resource unit allocation field is not present in the HE-SIG-B field. The SIG-B DCM field indicates whether the HE-SIG-B field is modulated with the DCM for reliable transmission of the HE-SIG-B field. The number of HE-SIG-B symbols field indicates information on the number of OFDM symbols in the HE-SIG-B field.

On the other hand, when the HE MU PPDU is transmitted in a band of 40 MHz or more as described later, the HE-SIG-B may consist of two kinds of content channels in units of 20 MHz. The content channels are referred to as HE-SIG-B content channel 1 and HE-SIG-B content channel 2, respectively. According to an embodiment of the present invention, the number of HE-SIG-B symbols in each channel can be kept similar by differentiating MCSs applied to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively. The HE-SIG-A field of the HE MU PPDU may include a SIG-B dual MCS field. In this case, it is indicated through the corresponding field whether the MCSs applied to the HE-SIG-B content channel 1 and the HE-SIG-B

content channel 2 are different with each other.

According to the embodiment of the present invention, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field (i.e., when the full bandwidth MU-MIMO transmission is indicated), a specific field of the HE-SIG-A may indicate information on the number of MU-MIMO users. For example, when the full bandwidth MU-MIMO transmission is performed, the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 do not need to distribute the amount of information through different MCSs. Therefore, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the SIG-B dual MCS field of the HE-SIG-A may indicate information on the number of MU-MIMO users. Likewise, when the full bandwidth MU-MIMO transmission is performed, information on the number of symbols in each HE-SIG-B content channel need not be delivered separately. Therefore, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the number of HE-SIG-B symbols field in the HE-SIG-A may indicate the information on the number of MU-MIMO users. As described above, in the compression mode in which the resource unit allocation field of the HE-SIG-B is omitted, information on the number of MU-MIMO users may be indicated through a specific subfield of the HE-SIG-A.

According to an embodiment of the present invention, the HE MU PPDU may be used for the DL-MU transmission. However, in the following additional situations, the HE MU PPDU may be used for both the downlink transmission and the uplink transmission.

According to an embodiment, an HE MU PPDU may be used for OFDMA based transmission in a downlink/uplink transmission between an AP and a single STA. More specifically, transmission between an AP and a single STA may be performed

using only some contiguous or non-contiguous channels among the entire band. For example, when only a secondary 20 MHz channel is busy as a result of the STA performing CCA to transmit an 80 MHz PPDU to the AP, the STA may transmit the PPDU through the primary 20 MHz channel and the secondary 40 MHz channel. In addition, a narrowband transmission using only some resource units within 20 MHz may be performed between an AP and a single STA. In the case where the transmission using the non-contiguous channel or the narrowband transmission is performed, the resource unit allocation information should be additionally transmitted via the HE-SIG-B field in the transmitted PPDU. Therefore, the terminal may perform such transmissions using the HE MU PPDU. The specific embodiments of the transmission using the non-contiguous channel and the narrowband transmission will be described later.

According to another embodiment, the HE MU PPDU may be used when a transmission of the HE-SIG-B field is required for the enhancement of the spatial reuse operation. Unlike the HE SU PPDU, the HE MU PPDU can indicate an AID of the recipient through the user field of the HE-SIG-B. However, according to an exemplary embodiment of the present invention, since it is obvious that the recipient of the corresponding PPDU is an AP when the HE MU PPDU is used for an uplink transmission, the user field of the HE-SIG-B may indicate an AID of the transmitter. The neighboring terminals that have received the HE MU PPDU may perform the spatial reuse operation.

For example, assume that there are arbitrary BSS1 and BSS2, and that STA1 of the BSS1 transmits an HE UL MU PPDU. A STA of the BSS2 overhearing the PPDU may estimate the distance between it and an AP of the BSS1 which is the recipient of the PPDU, through a DL PPDU of the AP of the BSS1 that has been

previously received. Therefore, the STA of the BSS2 may perform the spatial reuse operation considering the interference to the AP of the BSS1 which is the recipient. Also, when a DL PPDU transmitted by the AP of the BSS1 to the STA1 of the BSS1 is received, the STA of the BSS2 may perform the spatial reuse operation considering the interference to the STA1 of the BSS1 which is the recipient of the corresponding PPDU. In this case, the interference is considered based on the signal strength previously measured from an HE UL MU PPDU of the STA1. In the spatial reuse operation, the STA may attempt to transmit if the received PPDU is a PPDU of other BSS (OBSS) and the interference to the recipient of the corresponding PPDU is below a predetermined level.

Next, FIG. 14(c) illustrates a subfield configuration of the HE-SIG-A field of the HE trigger-based PPDU. Among the subfields shown in FIG. 14(c), the same subfields as those shown in FIG. 14(a) or 14(b) will not be described.

The format field is used to differentiate an HE SU PPDU from an HE Trigger-based PPDU. Also, the HE Trigger-based PPDU includes the above-described BSS color field and TXOP duration field. The spatial reuse field of the HE Trigger-based PPDU consists of 16 bits and carries information for spatial reuse operation in units of 20 MHz or 40 MHz according to the total bandwidth. The bandwidth field consists of 2 bits and may indicate one of 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80+80 MHz).

FIG. 15 illustrates a configuration of an HE-SIG-B field according to an embodiment of the present invention. The HE-SIG-B field is present in the HE MU PPDU and is transmitted in units of 20 MHz. In addition, the HE-SIG-B field indicates information necessary for receiving the HE MU PPDU. As illustrated in FIG. 15(a), the HE-SIG-B consists of a common block field and a user specific field.

FIG. 15(b) illustrates an embodiment of a subfield configuration of the common block field of the HE-SIG-B. First, the common block field includes a resource unit allocation (RA) field. FIG. 15(c) illustrates an embodiment of the RA field.

Referring to FIG. 15(c), the RA field contains information on resource unit allocation of a specific bandwidth (e.g., 20 MHz) in the frequency domain. More specifically, the RA field consists in units of 8 bits, and indexes the size of the resource units constituting the specific bandwidth and their placement in the frequency domain. Further, the RA field may indicate the number of users in each resource unit. When the total bandwidth through which the PPDU is transmitted is greater than a predetermined bandwidth (e.g., 40 MHz), the RA field may be set to a multiple of 8 bits to carry information in units of the specific bandwidth.

Each partitioned resource unit is generally assigned to one user. However, resource units of a certain bandwidth (e.g., 106-tones) or more can be assigned to a plurality of users using MU-MIMO. In this case, the RA field may indicate the number of users in the corresponding resource unit. In addition, the RA field may indicate, through a predetermined index, a specific resource unit in which a user specific field is not transmitted, i.e., a specific resource unit (i.e., an empty RU) that is not assigned to the user. According to an embodiment, the specific resource unit includes a resource unit (RU) having a bandwidth of a multiple of 20 MHz channels, i.e., 242-tone RU, 484-tone RU, 996-tone RU, and the like. In an empty RU indicated by the index value, data transmission is not performed. In this manner, the terminal may signal non-contiguous channel allocation information in units of 20 MHz through a predetermined index of the RA field of the HE-SIG-B.

According to an embodiment of the present invention, when a PPDU is transmitted through a total bandwidth of 80 MHz or more, the common block field

further includes a field (hereinafter, referred to as C26 field) indicating whether a user is allocated to a center 26-tone RU of 80 MHz. The C26 field may consist of a 1-bit indicator before or after the RA field in the common block field.

On the other hand, the user specific field consists of a plurality of user fields, and carries information for a designated STA to each allocated resource unit. The total number of user fields to be included in the user specific field may be determined based on the RA field and the C26 field. A plurality of user fields are transmitted in units of a user block field. The user block field is made up of an aggregation of two user fields, a CRC field and a tail field. Depending on the total number of user fields, the last user block field may contain information for one or two STAs. For example, if a total of three users (i.e., STA1, STA2, and STA3) are designated, information for STA1 and STA2 may be coded and transmitted along with the CRC/tail field in the first user block field, and information for STA3 may be coded and transmitted along with the CRC/tail field in the last user block field.

FIGS. 15(d)-1 and 15(d)-2 illustrate embodiments of the subfield configuration of the user field of the HE-SIG-B, respectively. FIG. 15(d)-1 illustrates a user field for an OFDMA transmission, and FIG. 15(d)-2 illustrates a user field for a MU-MIMO transmission. Each user field indicates a receiver AID of the corresponding resource unit. Exceptionally, when the HE MU PPDU is used for an uplink transmission, the user field may indicate a transmitter AID. When one user is allocated to one resource unit (i.e., non-MU-MIMO allocation), the user field includes a number of spatial streams (NSTS) field, a TxBF field, an MCS field, a DCM field and a coding field as illustrated in FIG. 15(d)-1. On the other hand, when a plurality of users are allocated to one resource unit (i.e., MU-MIMO allocation), the user field includes a spatial configuration field (SCF), an MCS field, a DCM field, and a coding field as

illustrated in FIG. 15(d)-2. Each STA that receives a PPDU through an MU-MIMO allocation should identify the location and number of spatial streams for it in the corresponding resource unit. To this end, the user field for the MU-MIMO transmission includes a spatial configuration field (SCF).

FIG. 15(e) illustrates an embodiment of the SCF of the HE-SIG-B. The SCF indicates the number of spatial streams for each STA and the total number of spatial streams in the MU-MIMO allocation. Each STA identifies the OFDMA and/or MIMO allocation of the corresponding PPDU through the RA field and identifies whether the STA receives data through the MU-MIMO allocation according to the order indicated in the user specific field. When the STA receives data through the non-MU-MIMO allocation, the user field is interpreted according to the format of FIG. 15(d)-1. However, when the STA receives data through the MU-MIMO allocation, the user field is interpreted according to the format of Fig. 15(d)-2. On the other hand, when the SIG-B compression field indicates the full bandwidth MU-MIMO, the RA field is not present in the HE-SIG-B. In this case, since all the STAs signaled in the user specific field receive data through the MU-MIMO allocation, the STAs interpret the user field according to the format of FIG. 15(d)-2.

FIG. 16 illustrates an encoding structure and a transmission method of the HE-SIG-B according to an embodiment of the present invention. FIG. 16(a) illustrates the encoding structure of the HE-SIG-B, and FIG. 16(b) illustrates the transmission method of the HE-SIG-B in a bandwidth of 40 MHz or more.

Referring to FIG. 16(a), the HE-SIG-B consists of a common block field and a user specific field. The detailed configuration of the common block field and the user specific field is as described in the embodiment of FIG. 15. Each user field of the user specific field is arranged in order of allocated users in the resource unit arrangement

indicated by the RA field of the common block field.

The user specific field consists of a plurality of user fields, and a plurality of user fields are transmitted in units of a user block field. As described above, the user block field is made up of an aggregation of two user fields, a CRC field, and a tail field. If the total number of user fields is odd, the last user block field may contain one user field. At the end of the HE-SIG-B, padding may be added along the OFDM symbol boundary.

Referring to FIG. 16(b), HE-SIG-B is separately encoded on each 20 MHz band. In this case, the HE-SIG-B may consist of a maximum of two contents in units of 20 MHz, that is, an HE-SIG-B content channel 1 and an HE-SIG-B content channel 2. In the embodiment of FIG. 16(b), each box represents a 20 MHz band, and "1" and "2" in the boxes represent the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively. Each HE-SIG-B content channel in the total band is arranged in order of the physical frequency band. That is, the HE-SIG-B content channel 1 is transmitted in the lowest frequency band, and the HE-SIG-B content channel 2 is transmitted in the next higher frequency band. Such a content channel configuration is then duplicated through content duplication in the next higher frequency bands. For example, for the first to fourth channels with an increasing order of the frequency constituting the entire 80 MHz band, the HE-SIG-B content channel 1 is transmitted on the first channel and the third channel, and the HE-SIG-B content channel 2 is transmitted on the second channel and the fourth channel. Likewise, for the first to eighth channels with an increasing order of the frequency constituting the entire 160 MHz band, the HE-SIG-B content channel 1 is transmitted on the first channel, the third channel, the fifth channel and the seventh channel, and the HE-SIG-B content channel 2 is transmitted on the second channel, the fourth channel, the sixth channel and the

eighth channel. When the terminal can decode the HE-SIG-B content channel 1 through at least one channel and decode the HE-SIG-B content channel 2 through the other at least one channel, information on the MU PPDU configuration of the total bandwidth can be obtained. On the other hand, when the total bandwidth is 20 MHz, only one SIG-B content channel is transmitted.

FIG. 17 illustrates a subfield configuration of the HE-SIG-B when a SIG-B compression field indicates a compression mode of the HE-SIG-B. As described above, when the SIG-B compression field indicates the compression mode (i.e., the full bandwidth MU-MIMO), the RA field is not present in the HE-SIG-B. Therefore, when an MU-MIMO transmission is performed through a bandwidth greater than 20 MHz, the number of users to be allocated to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively, should be separately determined. According to an embodiment of the present invention, when the MU-MIMO transmission is performed through a bandwidth greater than 20 MHz, user fields may be split equitably between the two content channels for load balancing. That is, the number of user fields transmitted in each SIG-B content channel is determined as a round up or down value of a half the total number of users. For example, when the total number of user fields is k, the first to the ceil(k/2)-th user fields may be transmitted through the HE-SIG-B content channel 1, and the ceil(k/2)-th to the k-th user fields may be transmitted through the HE-SIG-B content channel 2. If k is an odd number, the number of user fields included in the HE-SIG-B content channel 1 may be one more than the number of user fields included in the HE-SIG-B content channel 2.

Hereinafter, channel extension methods according to embodiments of the present invention will be described with reference to FIGS. 18 to 20. In the embodiments of FIGS. 18 to 20, CH1 to CH4 refer to respective 20 MHz channels

through which an 80 MHz PPDU is transmitted. Also, CH1 to CH8 refer to respective 20 MHz channels through which a 160 MHz PPDU or 80+80 MHz PPDU is transmitted. In this case, it is designated that CH3 is a primary 20 MHz channel (hereinafter, referred to as P20 channel), CH4 is a secondary 20 MHz channel (hereinafter, referred to as S20 channel), and CH1 and CH2 are a secondary 40 MHz secondary channel (hereinafter, referred to as S40 channel), respectively. In addition, it is designated that CH5 to CH8 are a secondary 80 MHz channel (hereinafter, referred to as S80 channel).

First, FIG. 18 illustrates a wideband access method according to an embodiment of the present invention. After the transmission of the previous PPDU is completed, the terminal having data to be transmitted performs a backoff procedure on the P20 channel. The backoff procedure may be started when the P20 channel is idle for an AIFS time. The terminal obtains a backoff counter within a range of a contention window (CW) for the backoff procedure. The terminal performs a CCA and decreases the backoff counter by one when the channel is idle. If the channel is busy, the terminal suspends the backoff procedure and resumes the backoff procedure an AIFS time after when the channel is idle again. When the backoff counter expires through the backoff procedure, the terminal may transmit data. In this case, the terminal performs a CCA for the secondary channels to transmit data for a PIFS time before the backoff counter expires. In the embodiment of FIG. 18, the terminal attempts to transmit an 80 MHz PPDU, and some secondary channels, that is, the S20 channel is detected as busy in the CCA procedure.

When at least a part of the secondary channels on which the CCA is performed are busy, the PPDU transmission bandwidth of the terminal is determined based on the wideband access method. First, FIG. 18(a) illustrates a wideband access method according to a dynamic bandwidth operation. According to the dynamic

bandwidth operation, since the S20 channel is busy, the terminal transmits data using only a certain bandwidth, that is, P20 channel according to the conventional channel extension rule. Meanwhile, FIG. 18(b) illustrates a wideband access method according to a static bandwidth operation. According to the static bandwidth operation, since some channels for transmission are busy, the data transmission in the entire bandwidth is delayed. The terminal performs the backoff procedure again using a new backoff counter, and the terminal transmits data using the entire bandwidth when all the channels for the transmission are idle in the CCA before the backoff counter expires. As described above, in the wideband access methods according to the embodiment of FIG. 18, the bandwidth of the transmitted PPDU may be greatly reduced or the transmission of the PPDU may be delayed depending on the state of some secondary channels.

FIG. 19 illustrates a wideband access method according to another embodiment of the present invention. FIGS. 19(a) to 19(e) illustrate situations in which a wideband PPDU is transmitted based on different channel extension techniques, respectively. In each embodiment of FIG. 19, a fixed channel extension method refers to a channel extension method of predetermined unit(s) according to the conventional extension rule in order of 20 MHz, 40 MHz, 80 MHz, and 160 MHz. In addition, a flexible channel extension method refers to a channel extension method of a 20 MHz unit in order of 20 MHz, 40 MHz, 60 MHz, 80 MHz, 100 MHz, 120 MHz, 140 MHz and 160 MHz. In addition, a contiguous channel extension method refers to a channel extension method in which a band occupied by a transmitted PPDU always consists of contiguous channels. Also, a non-contiguous channel extension method refers to a channel extension method in which a band occupied by a transmitted PPDU includes at least one non-contiguous channel. In the embodiment of each figure, a CCA of the secondary channels may be performed for a PIFS time before the backoff counter of the

primary channel expires, as described above in the embodiment of FIG. 18.

First, FIG. 19(a) illustrates an embodiment in which a wideband PPDU is transmitted according to a contiguous, fixed channel extension method. According to the present method, the CCA obtains up to four CCA result values for each of the P20 channel, S20 channel, S40 channel and S80 channel, and only reports information on the first channel determined to be busy among them. Since the terminal does not perform bandwidth extension from the first channel determined to be busy, the results of CCA for subsequent channels are not needed. Referring to FIG. 19(a), the S40 channel, which is the first channel determined to be busy as a CCA result, is reported. Therefore, the terminal transmits a PPDU through a 40 MHz band aggregating the P20 channel and the S20 channel. According to the present method, although the burden of report of CCA result value is reduced, there is a disadvantage that the channel utilization is poor.

Next, FIG. 19(b) illustrates an embodiment in which a wideband PPDU is transmitted according to a contiguous, flexible channel extension method. According to the present method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band. According to an embodiment, all the obtained eight CCA result values may be reported. However, according to another embodiment, only information about the first channels, which are determined to be busy, of both sides based on the P20 channel may be reported. Since the terminal does not perform bandwidth extension from the first two channels, which are determined to be busy, of the both sides, the results of CCA for the subsequent channels are not needed. Referring to FIG. 19(b), channels CH1 and CH5 (not illustrated), which are determined to be busy as a CCA result, are reported. Therefore, the terminal transmits a PPDU through a 60 MHz band including CH2, CH3 and CH4. According to the present method, it is possible to transmit a PPDU having a wider bandwidth composed of contiguous

channels, but there is a disadvantage that the transmission bandwidth of the wideband PPDU can be very limited depending on the position of the secondary channel occupied by OBSS terminals.

Next, FIG. 19(c) illustrates an embodiment in which a wideband PPDU is transmitted according to a non-contiguous, fixed channel extension method. According to the present method, the CCA obtains up to four CCA result values for each of the P20 channel, S20 channel, S40 channel and S80 channel, and reports information on all the channels determined to be busy among them. The terminal transmits a PPDU using channels that are not busy among the reported channels. Referring to FIG. 19(c), the S20 channel and the S80 channel (not illustrated), which are channels determined to be as a CCA result, are reported. Therefore, the terminal transmits a PPDU through a 60 MHz band including the P20 channel and the S40 channel. According to the present method, the channel utilization can be improved compared to the relatively small burden of report of CCA result values. That is, a maximum of one non-contiguous section occurs even in the 160 MHz bandwidth, and it is possible to transmit the wideband PPDU even when the S20 channel and/or the S40 channel is occupied by OBSS terminals.

Next, FIG. 19(d) illustrates an embodiment in which a wideband PPDU is transmitted according to a non-contiguous, flexible channel extension method. According to the present method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band, and reports all the obtained eight CCA result values. The terminal transmits a PPDU using channels that are not busy among the reported channels. Referring to FIG. 19(d), channels CH2, CH4, and CH5 (not illustrated) to CH8 (not illustrated), which are determined to be busy as a CCA result, are reported. Therefore, the terminal transmits a PPDU in a 40 MHz band including

CH1 and CH3. According to the present method, the channel utilization is the highest, but the burden of report of CCA result value is large. In addition, a plurality of non-contiguous sections may occur in the transmitted PPDU.

Finally, FIG. 19(e) illustrates an embodiment in which a wideband PPDU is transmitted according to a non-contiguous, limited flexible channel extension method. In the embodiment of the present invention, the limited flexible channel extension method follows the flexible channel extension method described above. However, in the flexible channel extension method, the band occupied by a transmitted PPDU always consists of including the predetermined core channels along with the P20 channel. In the embodiment of FIG. 19(e), a 40 MHz channel (i.e., P40 channel) including a P20 channel and an S20 channel is set as the core channels. According to the present method, the CCA obtains eight CCA result values for each channel constituting the 160 MHz band, and reports all the obtained eight CCA result values. The terminal transmits a PPDU using channels that are not busy among the reported channels. In this case, the terminal performs the PPDU transmission only when a PPDU configuration is possible through a band including the above-described core channels. According to the present method, there are advantages that the performance similar to that of the embodiment of FIG. 19(d) is achieved, and the decoding position of the HE-SIG-B can be guaranteed within the P40 channel when the P40 channel is set as the core channels.

FIG. 20 illustrates specific embodiments for transmitting a wideband PPDU according to the non-contiguous, fixed channel extension method of the embodiment of FIG. 19(c) described above. FIGS. 20(a) and 20(b) illustrate embodiments in which the terminal is equipped with one RF module and supports transmission of a PPDU of up to 160 MHz. In addition, FIGS. 20(c) and 20(d) illustrate embodiments in which the terminal is equipped with two RF modules and supports transmission of a PPDU of up

to 80+80 MHz. It is assumed that the PPDU transmitted in the embodiment of FIG. 20 is an OFDMA-based HE MU PPDU.

First, FIG. 20(a) illustrates a situation in which the terminal attempts to transmit a PPDU through a bandwidth of 160 MHz but the S40 channel is busy as a result of CCA. The terminal transmits a PPDU through a 140 MHz band including a P40 channel (i.e., P20 channel + S20 channel) and a S80 channel. In this case, the terminal postpones the transmission of data allocated to the S40 channel among the PPDU configured based on OFDMA. The S40 channel becomes a filtered channel in which no data is transmitted. In the embodiment of FIG. 20(a), the PPDU is transmitted using a 160 MHz spectral mask. Furthermore, in the S40 channel determined to be busy, filtering is performed and no data is transmitted. However, since a 40 MHz spectral mask is not applied to the signal transmitted through the P40 channel, signals of some resource units adjacent to the boundary of the S40 channel may interfere with OBSS signal transmitted through the S40 channel. Therefore, according to the embodiment of the present invention, in the non-contiguous PPDU transmission situations, some resource units of a transmission channel adjacent to an unassigned channel may be additionally filtered thereby not transmitting data.

Next, FIG. 20(b) illustrates a situation in which the terminal attempts to transmit a PPDU through a bandwidth of 80 MHz but the S20 channel is busy as a result of CCA. The terminal transmits a PPDU through a 60 MHz band including the P20 channel and the S40 channel. In this case, the terminal postpones the transmission of data allocated to the S20 channel among the PPDU configured based on OFDMA. The S20 channel becomes a filtered channel in which no data is transmitted. In the embodiment of FIG. 20(b), the PPDU is transmitted using an 80 MHz spectral mask. Furthermore, in the S20 channel determined to be busy, filtering is performed and no

data is transmitted. However, since a 20 MHz spectral mask is not applied to the signal transmitted through the P20 channel, signals of some resource units adjacent to the boundary of the S20 channel may interfere with OBSS signal transmitted through the S20 channel. Therefore, according to the embodiment of the present invention, in the non-contiguous PPDU transmission situations, some resource units of a transmission channel adjacent to an unassigned channel may be additionally filtered thereby not transmitting data.

Next, FIG. 20(c) illustrates a situation in which the terminal attempts to transmit a PPDU through a bandwidth of 80+80 MHz but the S40 channel is busy as a result of CCA. The terminal transmits a PPDU through the P40 channel (i.e., P20 channel + S20 channel) and the S80 channel, respectively, using two RF modules. In this case, the terminal postpones the transmission of data allocated to the S40 channel among the PPDU configured based on OFDMA. The terminal transmits, by using the first RF module, the PPDU to which a 40 MHz spectral mask is applied through the P40 channel. In addition, the terminal transmits, by using the second RF module, the PPDU to which an 80 MHz spectral mask is applied through the S80 channel. Therefore, in the embodiment of FIG. 20(c), no additional filtering of resource units included in the transmission channel is required since the transmission channel does not interfere with the unassigned channel S40.

Next, FIG. 20(d) illustrates a situation in which the terminal attempts to transmit a PPDU through a bandwidth of 80+80 MHz but the S20 channel and the S80 channel are busy as a result of CCA. The terminal transmits a PPDU through a 60 MHz band including the P20 channel and the S40 channel using only the first RF module. In this case, the second RF module need not be used, and the operation in the first RF module is as described in the embodiment of FIG. 20(b).

The PPDU transmission methods according to the embodiment of FIG. 20 may be implemented more easily than the wideband access method according to the dynamic bandwidth operation described in the embodiment of FIG. 18(a). According to the dynamic bandwidth operation, the PPDU should be reconfigured based on the available bandwidth according to the CCA result before the transmission of the wideband PPDU. In this case, since the PPDU is dynamically reconfigured, the implementation complexity is increased such that the length of the PPDU should be limited to the length of the allocated TXOP. However, according to the embodiment of FIG. 20, the implementation is relatively easy since the terminal configures an OFDMA-based PPDU in advance and then transmits only the data allocated to the idle channels and filters the data allocated to the remaining busy channels.

Hereinafter, transmission sequences of a non-contiguous PPDU according to embodiments of the present invention will be described with reference to FIGS. 21 to 23. In the embodiments of FIGS. 21 to 23, CH1 to CH4 refer to respective 20 MHz channels constituting the 80 MHz bandwidth. In addition, in the embodiments of FIGS. 21 and 22, it is designated that CH3 is a P20 channel, CH4 is an S20 channel, and CH1 and CH2 are an S40 channel, respectively. In the embodiments of FIGS. 21 to 23, duplicative descriptions of parts which are the same or corresponding as those of the above-described embodiments of FIGS. 8 and 9 will be omitted.

FIG. 21 illustrates a transmission sequence of a non-contiguous PPDU according to an embodiment of the present invention. FIGS. 21(a) and 21(b) illustrate downlink transmission sequences of a non-contiguous PPDU, and FIGS. 21(c) and 21(d) illustrate uplink transmission sequences of a non-contiguous PPDU.

First, FIG. 21(a) illustrates an embodiment in which an AP performs a CCA for a DL-MU transmission process but the S20 channel is busy. The AP transmits an

MU-RTS frame through the P20 channel and the S40 channel which are idle. STAs receiving the MU-RTS frame from the AP transmit a sCTS frame through the corresponding channel. The AP transmits a DL MU PPDU through the channel on which the sCTS frame is received. In this case, the MU-RTS frame should indicate non-contiguous channel allocation information, that is, the P20 channel and the S40 channel (or the unassigned S20 channel). According to an embodiment, the MU-RTS frame may signal the non-contiguous channel allocation information via a bandwidth field, an RA field, or a combination thereof.

Next, FIG. 21(b) illustrates an embodiment in which an AP transmits an MU-RTS frame through an idle P80 channel (i.e., P20 channel + S20 channel + S40 channel), but a sCTS frame of STAs is not received through the S20 channel. The AP transmits a DL MU PPDU through the P20 channel and the S40 channel on which the sCTS frame is received. In this case, the MU-RTS frame should indicate channel allocation information, i.e., the P80 channel. The channel allocation information may be signaled via a separate bandwidth field. In addition, the DL MU PPDU should indicate non-contiguous channel allocation information through which the corresponding PPDU is transmitted, that is, the P20 channel and the S40 channel (or the unassigned S20 channel). The non-contiguous channel allocation information may be signaled via a bandwidth field, an RA field, or a combination thereof.

Next, FIG. 21(c) illustrates an embodiment in which an AP performs a CCA for a UL-MU transmission process but the S20 channel is busy. The AP transmits a trigger frame through the P20 channel and the S40 channel which are idle. STAs receiving the trigger frame from the AP transmit a UL MU PPDU through designated channel(s). In this case, the trigger frame should indicate non-contiguous channel allocation information, that is, the P20 channel and the S40 channel (or the unassigned

S20 channel), for the UL MU PPDU transmission of STAs. In addition, the trigger frame should not assign the busy S20 channel to the uplink transmission of the STAs. According to an embodiment, the trigger frame may signal the non-contiguous channel allocation information via a bandwidth field, an RA field, or a combination thereof.

Finally, FIG. 21(d) illustrates a sequence in which an AP transmits a trigger frame through an idle P80 channel and STAs transmit a UL MU PPDU in response thereto. In this case, among the STAs receiving the trigger frame, STAs allocated to the S20 channel do not perform a transmission for the reason that the corresponding channel is detected as busy or a NAV has been set.

FIG. 22 illustrates a transmission sequence of a non-contiguous PPDU according to another embodiment of the present invention. FIGS. 22(a) and 22(b) illustrate downlink transmission sequences of a non-contiguous PPDU, and FIGS. 22(c) and 22(d) illustrate uplink transmission sequences of a non-contiguous PPDU. In the embodiment of FIG. 22 and the following embodiments, an S40A channel refers to the first 20 MHz channel (i.e., CH1) that constitutes the S40 channel, and an S40B channel refers to the second 20 MHz channel (i.e., CH2) that constitutes the S40 channel.

First, FIG. 22(a) illustrates an embodiment in which an AP performs a CCA for a DL-MU transmission process but the S40B channel is busy. The AP transmits an MU-RTS frame through the P40 channel and the S40A channel which are idle. STAs receiving the MU-RTS frame from the AP transmit a sCTS frame through the corresponding channel. In this case, the MU-RTS frame should indicate the non-contiguous channel allocation information, that is, the P40 channel and the S40A channel (or the unassigned S40B channel). According to an embodiment, the MU-RTS frame may signal the non-contiguous channel allocation information via a bandwidth field, an RA field, or a combination thereof. Meanwhile, in the embodiment of FIG.

22(a), among the STAs that have received the MU-RTS, STAs indicated to transmit the sCTS frame through the S40A channel do not transmit the sCTS for the reason that the corresponding channel is detected as busy or a NAV has been set. In this case, the AP transmits a DL MU PPDU only through the P20 channel and the S20 channel on which the sCTS is received.

Next, FIG. 22(b) illustrates an embodiment in which an AP transmits an MU-RTS frame through an idle P80 channel, but the sCTS frame of the STAs is not received on the S40A channel. The AP transmits a DL MU PPDU through the P40 channel and the S40B channel on which the sCTS frame is received. In this case, the MU-RTS frame should indicate the P80 channel as channel allocation information, and the DL MU PPDU should indicate non-contiguous channel allocation information, that is, the P40 channel and the S40B channel (or the unassigned S40A channel). The signaling method of the channel allocation information is as described above in the embodiment of FIG. 21(b).

Next, FIG. 22(c) illustrates an embodiment in which an AP performs a CCA for the UL-MU transmission process but the S40B channel is busy. The AP transmits a trigger frame through the P40 channel and the S40A channel which are idle. In this case, the trigger frame indicates non-contiguous channel allocation information, i.e., the P40 channel and the S40A channel (or the unassigned S40B channel), for the UL MU PPDU transmission of STAs. The trigger frame may signal the non-contiguous channel allocation information via a bandwidth field, an RA field, or a combination thereof. Meanwhile, among the STAs receiving the trigger frame in the embodiment of FIG. 22(c), STAs indicated to transmit uplink data through the S20 channel do not transmit uplink data for the reason that the channel is detected as busy or a NAV has been set. Thus, the AP may receive a UL MU PPDU through a band that is equal to or narrower

than the band on which the trigger frame has been transmitted.

Finally, FIG. 22(d) illustrates an embodiment in which an AP transmits a trigger frame through an idle P80 channel, but STAs allocated to the S20 channel do not perform a transmission for the reason that the corresponding channel is detected as busy or a NAV has been set.

FIG. 23 illustrates an embodiment of an ACK frame transmission method in a PPDU transmission sequence. In the embodiment of FIG. 23, it is designated that CH1 is a P20 channel, CH2 is an S20 channel, and CH3 and CH4 are an S40 channel, respectively.

First, FIG. 23(a) illustrates an embodiment of an ACK frame transmission method in a transmission sequence of a contiguous PPDU. The AP transmits a DL MU PPDU using a contiguous bandwidth of 80 MHz, and the receiving STAs transmit a UL MU response. In this case, the STAs transmit an immediate uplink response according to scheduling information included in the A-MPDU of the received DL MU PPDU. The scheduling information is obtained from a trigger frame included in the A-MPDU or a UL MU response scheduling field included in a MAC header of a specific MPDU constituting the A-MPDU. Also, the uplink response transmitted by the STAs includes uplink ACK, uplink data, and the like. According to an embodiment of the present invention, the scheduling information, that is, the resource units through which the STAs perform the UL MU response may be indicated via a separate resource unit allocation (RA) field. FIG. 23(d) illustrates an embodiment in which resource units for uplink transmission are assigned through the separate RA field.

Referring to FIG. 23(d), the RA field consists of 8 bits in total, and the first bit indicates whether the corresponding resource unit(s) is located at the primary 80 MHz or the secondary 80 MHz. The remaining 7 bits of the RA field indicate resource unit

allocation within the corresponding 80 MHz band. That is, a size of a predetermined resource unit and a placement of the corresponding resource unit are indicated according to the index value of the RA field. In the embodiment of FIG. 23(a), STAs may transmit an uplink ACK through a designated resource unit within an 80 MHz band on which the DL MU PPDU has been transmitted.

However, as in the embodiment of FIG. 23(b), a problem may occur in a resource unit allocation for ACK frame transmission in the transmission sequence of a non-contiguous PPDU. More specifically, as illustrated in FIG. 23(b), when there is no constraint on the resource unit through which the ACK frame for the non-contiguous PPDU is transmitted, an uplink ACK may be transmitted through a channel (i.e., CH3) which is not used for the DL MU PPDU transmission. This may cause interference with OBSS signal transmitted through CH3. As described above in the embodiment of FIGS. 21 and 22, the transmission of the non-contiguous PPDU may be determined immediately before the PPDU transmission according to the CCA results for multiple channels. Thus, it may be impossible to adjust the scheduling information for the resource units on which the UL MU response of the STAs is to be performed, immediately before the transmission of the non-contiguous PPDU.

In order to solve such a problem, as illustrated in FIG. 23(c), a constraint may be applied to resource unit allocation for the ACK frame transmission. According to the embodiment of the present invention, STAs receiving the DL MU PPDU from the AP transmit an uplink ACK within a 20 MHz channel where the resource unit on which the corresponding PPDU has been received is located. If a STA receives a DL MU PPDU with MU-MIMO through a 40 MHz channel or an 80 MHz channel, the STA may transmit an uplink ACK within the corresponding 40 MHz channel or 80 MHz channel. The AP signals such scheduling information for the ACK frame transmission of STAs.

Referring to FIG. 23(c), the AP transmits a DL MU PPDU through the P40 channel and the S40B channel. In this case, STAs receiving the PPDU through the S40B channel (i.e., a 20 MHz channel) transmit an ACK frame within the S40B channel. If a full bandwidth MU-MIMO transmission is performed on the P40 channel (i.e., a 40 MHz channel), STAs may transmit an ACK frame within the P40 channel. However, if an OFDMA transmission is performed on the P40 channel, STAs transmit an ACK frame within a 20 MHz channel where a resource unit on which the PPDU has been received is located.

Meanwhile, although an embodiment of the ACK frame transmission method in the DL-MU transmission process has been described with reference to FIG. 23, the present invention is not limited thereto and may be similarly applied to the UL-MU transmission process. That is, in response to a trigger frame of the AP, STAs may transmit an HE Trigger-based PPDU through the allocated resource unit. The AP transmits a downlink ACK in response to the HE Trigger-based PPDU(s) transmitted by the STAs. In this case, the AP transmits an ACK frame for each STA within a 20 MHz channel where a resource unit on which the corresponding STA has transmitted the HE Trigger-based PPDU is located. Therefore, a STA that has transmitted the HE Trigger-based PPDU may receive the ACK frame within the 20 MHz channel where the resource unit on which the PPDU has been transmitted is located.

FIG. 24 illustrates a method of setting a TXOP of an MU transmission process as an additional embodiment of the present invention. According to the embodiment of the present invention, a TXOP may be set using both of TXOP information of the HE-SIG-A and duration field information of the MAC header.

FIG. 24(a) illustrates an embodiment of an arrangement situation of terminals adjacent to a specific BSS. In the embodiment of FIG. 24(a), an AP communicates with

STA1 and STA2, and hidden nodes L1, H1, L2 and H2 are present based on a specific terminal. Here, L1 and L2 refer to a legacy STA, respectively, and H1 and H2 refer to a non-legacy STA, respectively. L1 and H1 can sense messages of the AP, but cannot receive messages of STA1 and STA2. Thus, L1 and H1 may interfere with the AP when the AP receives messages from STA1 and STA2. On the other hand, L2 and H2 can sense messages of STA2, but cannot receive messages of AP. Thus, L2 and H2 may interfere with STA2 when STA2 receives messages from the AP. Therefore, in order to protect the MU transmission process, a NAV should be set in the hidden nodes L1, H1, L2 and H2.

FIG. 24(b) illustrates a method in which a TXOP of a UL-MU transmission process is set in the arrangement situation of the terminals of FIG. 24(a). First, the AP transmits an MU-RTS frame on multiple channels (for example, 40 MHz). In this case, the legacy preambles such as L-STF, L-LTF, and L-SIG are transmitted in duplicate for each 20 MHz channel. If the MU-RTS frame is transmitted in the legacy format, H1 and L1 which have received the MU-RTS frame set a NAV based on a duration field of a MAC header of the MU-RTS frame.

Next, STA1 and STA2 receiving the MU-RTS frame transmit a sCTS frame after a SIFS time. In this case, the sCTS frame may be transmitted in units of 20 MHz channel. STAs receiving the MU-RTS may restrict a transmission of the sCTS frame considering a NAV already set in the corresponding terminal. H2 and L2 receiving the sCTS frame set a NAV based on a duration field of a MAC header of the sCTS frame.

The AP receiving the sCTS frame may transmit a trigger frame in HE PPDU format. In this case, in the trigger frame, the TXOP duration field of the HE-SIG-A and the duration field of the MAC header indicate duration information, respectively. The two duration fields may have different bit configurations with each other. For example,

the number of bits in the TXOP duration field may be less than the number of bits in the duration field of the MAC header. In this case, the setting method of each duration field and/or the interpretation method of each duration field should be determined in order to set a correct NAV of the neighboring terminals.

According to an embodiment of the present invention, when the TXOP duration field consists of t bits and the duration field of the MAC header consists of m bits (where t < m), the value of the duration field of the MAC header may be set to not exceed the value of the TXOP duration field. For example, if the TXOP duration field consists of 12 bits and the duration field of the MAC header consists of 15 bits, the value of the duration field of the MAC header shall not exceed the maximum value that the TXOP duration field can represent, that is, 2^12 = 4096 us. In this case, the interpretation of each duration field may be performed in the same way.

According to another embodiment of the present invention, when the number of bits in the TXOP duration field and the number of bits in the duration field of the MAC header are different from each other, a predetermined scaling factor may be multiplied when performing an interpretation of any one of the above fields. For example, if the TXOP duration field consists of 12 bits and the duration field of the MAC header consists of 15 bits, the value of the TXOP duration field may be used after a scaling factor 8 is multiplied. In this way, by using the predetermined scaling factor, duration information indicated by the duration fields of different number of bits may have similar range.

However, if the value of the TXOP duration field is used after the scaling factor 8 is multiplied, duration information obtained from the two duration fields may have a difference of up to 7us. According to an embodiment of the present invention, a STA that has interpreted all of the two duration fields may set a NAV based on the

duration field of the MAC header having a larger number of bits. However, a STA which can only interpret the TXOP duration field of the HE-SIG-A among the two duration fields sets a NAV based on the TXOP duration field. In preparation for this situation, the value of the TXOP duration field in a PPDU may be set to a value which is larger or smaller than the value of the duration field of the MAC header by the maximum offset (e.g., 7us).

In the embodiment of FIG. 24(b), since H1 receiving the trigger frame can interpret both the TXOP duration field of the HE-SIG-A and the duration field of the MAC header, it may update a NAV using both the two fields. However, L1 cannot update a NAV because it cannot interpret the non-legacy preamble and MPDU of the HE PPDU.

On the other hand, STA1 and STA2 receiving the trigger frame transmit an HE Trigger-based PPDU. In this case, since H2 receiving the HE Trigger-based PPDU can interpret both the duration field of the HE-SIG-A TXOP and the duration field of the MAC header, it may update a NAV using both the two fields. However, L2 cannot update a NAV because it cannot interpret the non-legacy preamble and MPDU of the HE Trigger-based PPDU.

FIGS. 25 to 31 illustrate methods of signaling non-contiguous channel allocation information according to various embodiments of the present invention. In the embodiment of the present invention, non-contiguous channel allocation refers to channel allocation in which a band occupied by the transmitted packet (i.e., PPDU) includes at least one non-contiguous channel (or non-contiguous resource unit). However, a full bandwidth 80+80 MHz channel is regarded as a contiguous channel like a full bandwidth 160 MHz channel. Thus, a non-contiguous channel (or non-contiguous PPDU) in the embodiments of the present invention may refer to non-contiguous

channels except for the full bandwidth 80+80 MHz channel. In the embodiments of FIGS. 25 to 31, channel A to channel D refer to each 20 MHz channel through which an 80 MHz PPDU is transmitted. In this case, it is designated that channel A is a P20 channel, channel B is an S20 channel, and channel C and channel D are an S40 channel, respectively. Also, in each embodiment, an S40A channel may refer to channel C, and an S40B channel may refer to channel D.

In the embodiment of the present invention, a transmitter (e.g., an AP) signals non-contiguous channel allocation information through embodiments illustrated in each figure or combinations thereof. The transmitter may perform a CCA of multiple channels for a wideband packet transmission. In this case, the wideband may refer to a band having a total bandwidth of 40 MHz or more, but the present invention is not limited thereto. The transmitter transmits a packet through at least one channel which is idle based on the result of performing the CCA of multiple channels. In this case, when the packet is transmitted through a non-contiguous channel, the transmitter signals non-contiguous channel allocation information via a non-legacy preamble of the packet. As such, the transmitter transmits a wireless packet in which non-contiguous channel allocation information is signaled. A receiver (e.g., a STA) receives the wireless packet and obtains the non-contiguous channel allocation information from the received packet. The receiver decodes the received packet based on the obtained non-contiguous channel allocation information. In this case, the received packet may be an HE MU PPDU, but the present invention is not limited thereto.

FIG. 25 illustrates a signaling method of non-contiguous channel allocation information according to an embodiment of the present invention. In the embodiment of FIG. 25, the AP performs a CCA of channel A to channel D to transmit a DL MU PPDU through a total bandwidth of 80 MHz, and the S40B channel is determined to be

busy. The AP transmits a PPDU through the P40 channel and the S40A channel which are idle. The AP performs nulling of data tones of the busy S40B channel and does not transmit any signal. In this case, non-contiguous channel allocation information, that is, allocation information of the P40 channel and the S40A channel (or information of the unassigned S40B channel) should be signaled on the transmitted PPDU.

First, the non-contiguous channel allocation information may be indicated via the bandwidth field of the HE-SIG-A. The bandwidth field may indicate specific non-contiguous channel allocation information through a predetermined index. According to an embodiment, the bandwidth field may explicitly indicate specific non-contiguous channel allocation information. Therefore, the allocation information of the P40 channel and the S40A channel may be indicated via the bandwidth field.

Also, the non-contiguous channel allocation information may be indicated via the RA field of the HE-SIG-B. The RA field may indicate a specific resource unit not assigned to a user through a predetermined index. For example, the RA field may indicate that a resource unit of a multiple of a 20 MHz channel, i.e. 242-tone, 484-tone or 996-tone, is not assigned to a user. Data transmission is not performed in an empty resource unit indicated by a predetermined index value.

Also, the non-contiguous channel allocation information may be indicated by carrying a null STA ID in a specific user field of the HE-SIG-B. That is, a predetermined null STA ID is contained in a user field corresponding to an unassigned resource unit in which data is not transmitted. Therefore, no STA receives data through the unassigned resource unit.

FIG. 26 illustrates a method of signaling non-contiguous channel allocation information via the bandwidth field of the HE-SIG-A according to an embodiment of the present invention. The bandwidth field of an HE MU PPDU may indicate

predetermined non-contiguous channel bandwidths in addition to the contiguous channel bandwidths of 20 MHz, 40 MHz, 80 MHz, and 160 MHz (including 80+80 MHz). If the bandwidth field indicates a predetermined non-contiguous channel bandwidth, additional allocation information of the non-contiguous channel may be indicated via a subfield of the HE-SIG-B.

As described above, the HE-SIG-B may consist of a maximum of two content channels, i.e., the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 in units of 20 MHz. Each HE-SIG-B content channel in the total band is arranged in order of the physical frequency band. That is, the HE-SIG-B content channel 1 is transmitted in the lowest frequency band, and the HE-SIG-B content channel 2 is transmitted in the next higher frequency band. Such a content channel configuration is then duplicated through content duplication in the next higher frequency bands. In the embodiment of FIG. 26, the HE-SIG-B content channel 1 signals resource unit allocation information of channel A and channel C, and the HE-SIG-B content channel 2 signals resource unit allocation information of channel B and channel D. The HE-SIG-B content channel 1 is transmitted through channel A and channel C. However, since a PPDU transmission is not performed in channel D, the HE-SIG-B content channel 2 is transmitted only through channel B. In this case, the HE-SIG-B content channel 2 transmitted through the channel B may indicate that channel D is not used.

FIG. 27 illustrates a method of signaling non-contiguous channel allocation information via the RA field of the HE-SIG-B according to an embodiment of the present invention. As described above, the RA field consists in units of 8 bits, and indexes the sizes of the resource units constituting the specific bandwidth and their placement in the frequency domain. Further, the RA field may indicate the number of users in each resource unit. In this case, the RA field may indicate a specific resource

unit (i.e., an unassigned RU) not assigned to a user through a predetermined index. According to an embodiment, the specific resource unit includes a resource unit (RU) having a bandwidth of a multiple of a 20 MHz channel, i.e., 242-tone RU, 484-tone RU, 996-tone RU, and the like. Data transmission is not performed in the unassigned RU indicated by the index value.

As shown in FIG. 27(a), when the total bandwidth through which a PPDU is transmitted is 80 MHz, two RA fields are transmitted in each HE-SIG-B content channel. That is, the first RA field (i.e., 8 bits) of the HE-SIG-B content channel 1 signals resource unit allocation information of channel A, and the second RA field (i.e., 8 bits) of the HE-SIG-B content channel 1 signals resource unit allocation information of channel C. Similarly, the first RA field (i.e., 8 bits) of the HE-SIG-B content channel 2 signals resource unit allocation information of channel B, and the second RA field (i.e., 8 bits) of the HE-SIG-B content channel 2 signals resource unit allocation information of channel D. If the channel D is busy as in the embodiment of FIG. 27(a), the HE-SIG-B content channel 2 is transmitted only through channel B, and the HE-SIG-B content channel 1 is transmitted through channel A and channel C. In this case, specific embodiments of signaling through the RA field of the HE-SIG-B that the channel D is not assigned to a user will be described with reference to FIGS. 27(b) to 27(d).

First, according to an embodiment of the present invention, as shown in FIG. 27(b), the RA field corresponding to the unassigned 20 MHz channel, that is, the second RA field of the HE-SIG-B content channel 2 may indicate a nulling of 242-tone RU. However, the second RA field of the HE-SIG-B content channel 1 indicates a 242-tone RU or indicates RUs partitioned into smaller sizes according to resource allocation information of channel C. As above, the RA field may perform independent and explicit

signaling for each channel. Therefore, the RA field corresponding to the unassigned channel D indicates that the corresponding resource unit is not assigned to a user (i.e. nulling).

Next, according to another embodiment of the present invention, as shown in FIG. 27(c), the RA field corresponding to the unassigned 20 MHz channel, that is, the second RA field of the HE-SIG-B content channel 2 may indicate a nulling of 484-tone RU. However, since the second RA field of the HE-SIG-B content channel 1 indicates resource allocation information of the channel C, it can be identified that the unassigned channel is channel D of a 20 MHz bandwidth.

Next, according to yet another embodiment of the present invention, as shown in FIG. 27(d), the RA field corresponding to the unassigned 20 MHz channel may indicate a general nulling rather than a nulling of resource units of a specific bandwidth such as 242-tone RU, 484-tone RU, 996-tone RU, and the like. In this case, the nulling indicated by the RA field may implicitly be interpreted as a nulling of 242-tone RU (i.e., 20 MHz channel), and information of resource units assigned to users may be obtained via another RA field.

As such, when the RA field indicates that a specific resource unit is not assigned to a user, a user specific field corresponding to the resource unit is not transmitted. Thus, as shown in FIG. 27(a), the HE-SIG-B content channel 2 signaling resource unit allocation information of channel D does not carry the user specific field 410 corresponding to channel D.

FIG. 28 illustrates a method of signaling non-contiguous channel allocation information via the user field of the HE-SIG-B according to an embodiment of the present invention. As described above, the non-contiguous channel allocation information may be indicated by carrying a null STA ID in a specific user field of the

HE-SIG-B. The RA field of the HE-SIG-B may indicate resource allocation information corresponding to an unassigned resource unit, and a predetermined null STA ID may be contained in a user field corresponding to the unassigned resource unit.

If channel D is not used as in the embodiment of FIG. 28, the second RA field of the HE-SIG-B content channel 2 corresponding to channel D indicates a 242-tone resource unit and one user. Thus, the second RA field indicates that one user field 420 is carried for the corresponding 242-tone resource unit. The user specific field of the HE-SIG-B content channel 2 carries user fields of the total number of users indicated in the first RA field and the second RA field of the HE-SIG-B content channel 2. In this case, a predetermined null STA ID is contained in the user field 420 corresponding to the unassigned channel i.e., channel D. According to the embodiment of the present invention, the null STA ID may be an unassigned AID among AIDs from 1 to 2007 of the corresponding BSS, a reserved AID (e.g., 2046) which has a value greater than 2007, or a predetermined AID among AIDs from 1 to 2007. When a null STA ID is contained in the user field 420, a non-contiguous channel allocation may be performed since no STA in the BSS receives data through the corresponding resource unit.

FIG. 29 illustrates a signaling method of non-contiguous channel allocation information according to a further embodiment of the present invention. According to the embodiment of FIG. 29, whether a user is allocated to a center 26-tone resource unit 502 may be signaled via a user field 422 of the HE-SIG-B. In an embodiment of the present invention, the center 26-tone resource unit (RU) refers to the RU 502 located at the center of an 80 MHz bandwidth. As described below, whether or not a user is allocated to the center 26-tone RU 502 may be determined according to various embodiments.

According to the embodiment of the present invention, the user field 422

corresponding to the center 26-tone RU 502 may be carried in the HE-SIG-B content channel 1 as shown in FIG. 29. In this case, the user field 422 may be carried as the last user field in the HE-SIG-B content channel 1. According to an embodiment of the present invention, whether a user is allocated to the center 26-tone RU 502 may be indicated via a STA ID contained in the corresponding user field 422. That is, when the center 26-tone RU 502 is not assigned to a user, a null STA ID may be contained in the corresponding user field 422. A specific embodiment of the null STA ID is as described in the embodiment of FIG. 28. However, when the center 26-tone RU 502 is assigned to a particular user, a STA ID of the particular user may be contained in the corresponding user field 422.

FIG. 30 illustrates a signaling method of non-contiguous channel allocation information according to a further embodiment of the present invention. According to the embodiment of FIG. 30, whether or not an arbitrary resource unit 504 is assigned to a user may be signaled via a user field 424 of the HE-SIG-B. An OFDMA-based DL MU PPDU includes resource units up to nine within a 20 MHz bandwidth, each of which consists of 26 subcarriers. In this case, data may be transmitted through only eight resource units among the nine RUs, and data may not be transmitted through one resource unit. In addition, a PPDU in a total bandwidth of 80 MHz may include resource units up to 37, some of which may not transmit data. As such, when some of the resource units constituting the total bandwidth are not assigned to a user, a method of indicating the unassigned resource unit is required.

According to an embodiment of the present invention, such non-contiguous channel allocation information may be indicated via the RA field and the user field of the HE-SIG-B. As described above, the RA field indicates information on the arrangement of resource units constituting a specific bandwidth and the number of users.

The user fields corresponding to each resource unit are carried in the user specific field of the HE-SIG-B according to the order of resource unit allocation indicated by the RA field. According to the embodiment of the present invention, the unassigned resource unit may be indicated via a null STA ID contained in the user field 424 corresponding to the specific resource unit 504 in the resource unit arrangement indicated by the RA field. In this case, the unassigned resource unit that can be indicated includes at least one of 26-tone RU, 52-tone RU, and 106-tone RU, but the present invention is not limited thereto. That is, as described in FIG. 28, the unassigned resource unit that can be indicated via the null STA ID may include 242-tone RU, 484-tone RU, and 996-tone RU of a 20 MHz bandwidth or more. A specific embodiment of the null STA ID is as described in the embodiment of FIG. 28.

Next, with reference to FIG. 31, matters that can be considered when signaling the non-contiguous channel allocation information will be described. The HE MU PPDU performs signaling through the HE-SIG-A and the HE-SIG-B. The HE-SIG-A carries overall information including bandwidth information of the PPDU, and the HE-SIG-B carries information for a simultaneous multi-user transmission. In a total PPDU bandwidth of 40 MHz or more, the HE-SIG-B may consist of HE-SIG-B content channel 1 and HE-SIG-B content channel 2. According to the embodiment of the present invention, when a transmission of a non-contiguous PPDU is performed, the following matters can be considered.

First, all types of non-contiguous PPDUs should assign the P20 channel. That is, the non-contiguous PPDU may include one or more unassigned channels (or unassigned resource units), but the P20 channel should be assigned to one or more users.

Second, the HE-SIG-A of the non-contiguous PPDU should be able to indicate channel information on which the content channel(s) of the HE-SIG-B of the

PPDU is transmitted. Referring to FIG. 31(a), channels of an 80 MHz bandwidth consist of channel A, channel B, channel C and channel D in an increasing order of the frequency, and a non-contiguous PPDU may be transmitted through channel A, channel B and channel D except a busy channel C. In this case, the HE-SIG-B content channel 1 is transmitted through channel A, and the HE-SIG-B content channel 2 is transmitted through channel B and channel D. In this case, the bandwidth field of the HE-SIG-A may indicate information about at least which channel each of the HE-SIG-B content channels of the corresponding PPDU is transmitted through. As described below, the bandwidth field of the HE-SIG-A may index puncturing of the S20 channel, and puncturing of at least one of two channels of the S40 channel, respectively. When the bandwidth field indicates puncturing of the S20 channel, at least one content channel of the two HE-SIG-B content channels may be transmitted through the S40 channel. On the other hand, when the bandwidth field indicates puncturing of at least one of two 20 MHz channels in the S40 channel as shown in FIG. 31(a), all of the two HE-SIG-B content channels may be transmitted through at least the P40 channel.

Finally, the HE-SIG-A may explicitly or implicitly indicate the size information of the common block field of the HE-SIG-B in the corresponding PPDU. As illustrated in FIG. 31(b), the HE-SIG-B consists of a common block field 430 and a user specific field 440, and the common block field 430 includes an RA field. When a total bandwidth of the PPDU is 20 MHz or 40 MHz, each HE-SIG-B content channel carries one RA field. However, when the total bandwidth of the PPDU is 80 MHz or 160 MHz (80+80 MHz), each HE-SIG-B content channel may carry multiple RA fields 432 as shown in FIG. 31(c). That is, when the total bandwidth of the PPDU is 80 MHz, each HE-SIG-B content channel carries two RA fields 432. Furthermore, when the total bandwidth of the PPDU is 160 MHz (or 80+80 MHz), each HE-SIG-B content channel

carries four RA fields 432. Therefore, the number of RA fields 432 carried in the common block field 430 of the HE-SIG-B varies according to the information indicated by the bandwidth field 452 of the HE-SIG-A. The bandwidth field 452 of the HE-SIG-A may indicate the number of RA fields 432 carried in the common block field 430 of the HE-SIG-B, thereby explicitly or implicitly indicating the size information of the common block field 430.

According to the embodiment of the present invention, the non-contiguous channel allocation information may be indicated via any one of subfield(s) of the HE-SIG-A, subfield(s) of the HE-SIG-B, and a combination thereof. The non-contiguous channel allocation information may be signaled as the following specific embodiments.

First, the non-contiguous channel allocation information may be signaled solely via subfield(s) of the HE-SIG-A. The bandwidth field 452 of the HE-SIG-A may indicate specific non-contiguous channel allocation information through a predetermined index. When the non-contiguous channel allocation information is signaled through the subfield of the HE-SIG-A, the receiver may promptly obtain the entire configuration information of the PPDU. In addition, the additional signaling overhead through the HE-SIG-B is reduced when the non-contiguous channel allocation information is signaled via only the subfield of the HE-SIG-A.

However, due to the limitation of the available number of bits in the HE-SIG-A, various non-contiguous channel allocation information may not be signaled. Thus, according to an embodiment of the present invention, the bandwidth field 452 may explicitly indicate only some non-contiguous channel allocation information among the various options of the non-contiguous channel allocation. According to another embodiment of the present invention, some subfields of the HE-SIG-A that are unnecessary when non-contiguous channel allocation is performed may be used for

additional signaling of the non-contiguous channel allocation information. For example, when the non-contiguous channel allocation is performed, a SIG-B compression field 454 indicating whether to use the full bandwidth MU-MIMO is unnecessary. Thus, when the non-contiguous channel allocation is performed, the SIG-B compression field 454 may be used for other purposes. For example, the HE-SIG-A may indicate non-contiguous channel allocation information using both the bandwidth field 452 and the SIG-B compression field.

Next, the non-contiguous channel allocation information may be signaled solely via subfield(s) of the HE-SIG-B. In this case, the bandwidth field of the HE-SIG-A indicates the existing contiguous bandwidths, and information of the unassigned channel (or unassigned resource unit) may be indicated via the RA field 432 and/or the user field of the HE-SIG-B. In this case, the signaling overhead of the HE-SIG-A may be reduced, but the signaling overhead of the HE-SIG-B may increase.

Finally, the non-contiguous channel allocation information may be signaled via a combination of subfield(s) of the HE-SIG-A and subfield(s) of the HE-SIG-B. The subfield(s) of the HE-SIG-A may signal at least a portion of the non-contiguous channel allocation information, and the subfield(s) of the HE-SIG-B may signal the remaining information. According to an embodiment, a subfield of the HE-SIG-A may signal the detailed information of the PPDU configuration of the P80 channel and information on whether to transmit the S80 channel. If the subfield of the HE-SIG-A indicates transmission of the S80 channel, the subfield(s) of the HE-SIG-B may signal the detailed information of the PPDU configuration of the S80 channel. According to another embodiment, the subfield of the HE-SIG-A may signal channel information on which the HE-SIG-B content channel(s) of the corresponding PPDU is transmitted and size information of the common block field 430. The subfield(s) of the HE-SIG-B signal

additional information of the corresponding PPDU configuration. According to yet another embodiment, when the transmission band of the non-contiguous PPDU always includes the P40 channel, the size information of the common block field 430 of the HE-SIG-B may be signaled via the subfield of the HE-SIG-A.

FIGS. 32 to 34 illustrate non-contiguous channel allocation methods according to various embodiments of the present invention. The non-contiguous channel allocation information according to the embodiments of FIGS. 32-34 may be signaled via a combination of at least one of the various embodiments described in FIGS. 25 to 31.

FIG. 32 illustrates a non-contiguous channel allocation method according to an embodiment of the present invention. According to an embodiment of the present invention, the non-contiguous channel allocation information may be signaled solely via the bandwidth field of the HE-SIG-A. FIG. 32 illustrates an embodiment in which the P40 channel is always allocated in a non-contiguous PPDU to fix the decoding position of the HE-SIG-B content channel. In this case, both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 may be transmitted through at least the P40 channel. In the embodiment of 32 and the following embodiments, an S80A channel, an S80B channel, an S80C channel, and an S80D channel refer to the first, second, third and fourth 20 MHz channels, respectively, constituting the S80 channel.

The bandwidth field of the HE-SIG-A may basically index information of four contiguous channels 510, that is, 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80+80 MHz), respectively. When the bandwidth field consists of 3 bits, the bandwidth field may index information of four additional non-contiguous channels 520. First, the bandwidth field may index each puncturing of one of two 20 MHz channels in the S40 channel. In addition, the bandwidth field may index whether the S80 channel is

allocated, in combination with the configuration of the S40 channel. Therefore, the bandwidth field may index four non-contiguous channel configurations in total by combining two configurations of P40+S40A and P40+S40B in the P80 channel and two configurations according to whether the S80 channel is allocated.

Next, when the bandwidth field consists of 4 bits, the bandwidth field may additionally index information of eight non-contiguous channels 530 in addition to the information of the four non-contiguous channels 520. First, the bandwidth field may index each puncturing of two 20 MHz channels in the S40 channel. In addition, the bandwidth field may index information of six non-contiguous channels in the S80 channel in combination with the configuration of the S40 channel. In this case, the information of the six non-contiguous channels includes whether the S80 channel is allocated, and may include four puncturing options that may allocate a contiguous 40 MHz band as shown in FIG. 32.

FIG. 33 illustrates a non-contiguous channel allocation method according to another embodiment of the present invention. According to the embodiment of FIG. 33, the location where at least one of the HE-SIG-B content channels is transmitted may be variable. In this case, the receiver should be able to variably set the decoding channel for receiving the HE-SIG-B content channel. In the embodiment of FIG. 33, it is assumed that the HE-SIG-B content channel 1 is transmitted through the P20 channel and the channel through which the HE-SIG-B content channel 2 is transmitted may vary. However, depending on the physical frequency order of the P20 channel within the P40 channel, the HE-SIG-B content channel 2 may be transmitted through the P20 channel. In this case, the channel through which the HE-SIG-B content channel 1 is transmitted may vary depending on the channel configuration. The non-contiguous channel allocation information according to the embodiment of the present invention may

support at least some configurations among the channel configurations listed in FIG. 33.

FIG. 33(a) illustrates a channel configuration in which only the P20 channel is allocated among the P80 (i.e., primary 80 MHz) band. In this case, the HE-SIG-B content channel 2 is not transmitted in the P80 band. FIG. 33(b) illustrates a channel configuration in which the P40 channel is basically allocated among the P80 band. In this case, both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 may be transmitted through at least the P40 channel. According to the embodiment, a non-contiguous channel in which any one among the two 20 MHz channels, that is, the S40A channel and the S40B channel of the S40 channel is allocated may be used. When both the S40A channel and the S40B channel are allocated, a contiguous channel of 80 MHz or 160 MHz bandwidth is configured.

FIG. 33(c) illustrates a channel configuration in which only the P20 channel and the S40A channel are allocated among the P80 band. According to an embodiment, the HE-SIG-B content channel 1 may be transmitted through the P20 channel and the HE-SIG-B content channel 2 may be transmitted through the S40A channel. The S40A channel is originally a channel through which the HE-SIG-B content channel 1 is transmitted. However, if there is no other channel through which the HE-SIG-B content channel 2 is to be transmitted in the P80 band configuration of the non-contiguous PPDU, the HE-SIG-B content channel 2 may be transmitted through the S40A channel. However, since the change of the HE-SIG-B content channel increases the burden of the PPDU configuration, the channel configuration of FIG. 33(c) may not be used depending on the embodiment.

FIG. 33(d) illustrates a channel configuration in which only the P20 channel and the S40 channel are allocated among the P80 band. In this case, the HE-SIG-B content channel 1 may be transmitted through the P20 channel and the S40A channel,

and the HE-SIG-B content channel 2 may be transmitted through the S40B channel. In addition, FIG. 33(e) illustrates a channel configuration in which only the P20 channel and the S40B channel are allocated among the P80 band. In this case, the HE-SIG-B content channel 1 may be transmitted through the P20 channel, and the HE-SIG-B content channel 2 may be transmitted through the S40B channel. In the embodiments of FIGS. 33(d) and 33(e), the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 may be transmitted based on the HE-SIG-B content channel transmission rule according to the embodiment of the present invention

Meanwhile, due to the limitation of the number of bits in the bandwidth field of the HE-SIG-A, the bandwidth field may indicate some configurations among the above channel configurations. When the bandwidth field consists of 3 bits, the bandwidth field may index four additional non-contiguous channel allocation information. According to the embodiment of the present invention, the bandwidth field may indicate the total bandwidth information through which the PPDU is transmitted and some channel information to be punctured within the total bandwidth. In this case, the total bandwidth may be either 80 MHz bandwidth or 160 MHz (or 80+80 MHz) bandwidth. According to an embodiment of the present invention, the bandwidth field may index puncturing of the S20 channel shown in FIG. 33(d), and puncturing of at least one of two 20 MHz channels in the S40 channel shown in FIG. 33(b), respectively.

According to the embodiment of the present invention, in the channel configuration indicated by the bandwidth field of the HE-SIG-A, additional puncturing information may be indicated via the RA field of the HE-SIG-B. For example, when the bandwidth field indicates puncturing of one of two 20 MHz channels in the S40 channel at the total bandwidth of 80 MHz (e.g., the third and fifth channel configuration in FIG. 33(b)), the resource unit allocation field may indicate which 20 MHz channel in the S40

channel is punctured. Also, when the bandwidth field indicates puncturing of at least one of two 20 MHz channels in the S40 channel at the total bandwidth of 160 MHz or 80+80 MHz (e.g., the second, fourth and sixth channel configurations in FIG. 33(b)), the resource unit allocation field may indicate which 20 MHz channel in the S40 channel is punctured. In addition, when the bandwidth field indicates puncturing of at least one of two 20 MHz channels in the S40 channel in a total bandwidth of 160 MHz or 80+80 MHz (e.g., the second, fourth and sixth channel configurations in FIG. 33(b)), the resource unit allocation field may indicate additional puncturing in the S80 channel. Further, when the bandwidth field indicates puncturing of the S20 channel in the total bandwidth of 160 MHz or 80+80 MHz (e.g., the second channel configuration in FIG. 33(d)), the resource unit allocation field may indicate additional puncturing in the S80 channel.

Channels in which puncturing is indicated as described above are not assigned to the user. A terminal receiving the non-contiguous PPDU may obtain the total bandwidth information through which the PPDU is transmitted and the channel information to be punctured within the total bandwidth via the bandwidth field of the HE-SIG-A of the corresponding PPDU. Further, the terminal may obtain additional channel puncturing information via the RA field of the HE-SIG-B of the corresponding PPDU. The terminal decodes the PPDU based on the obtained non-contiguous channel allocation information.

FIG. 34 illustrates a non-contiguous channel allocation method according to yet another embodiment of the present invention. Also in the embodiment of FIG. 34, the location where at least one of the HE-SIG-B content channels is transmitted may be variable. In this case, the receiver should be able to variably set the decoding channel for receiving the HE-SIG-B content channel. In the embodiment of FIG. 34, it is

assumed that the HE-SIG-B content channel 1 is transmitted through the P20 channel and the channel through which the HE-SIG-B content channel 2 is transmitted may vary.

According to the embodiment of FIG. 34, the bandwidth field of the HE-SIG-A indicates location information X of the HE-SIG-B content channel and size information Y of the common block field of the HE-SIG-B. FIG. 34 illustrates a combination of (X, Y) that can be indicated by the bandwidth field.

First, the location information X of the HE-SIG-B content channel may indicate a channel through which the HE-SIG-B content channel 2 is transmitted within the P80 channel. When the location information consists of 2 bits, it may indicate a total of four channels, that is, P20, S20, S40A and S40B. When the location information consists of 1 bit, it may indicate a total of two channels, that is, S20 and S40B. In the latter case, even when only the P20 channel is assigned to a user, it can be signaled that the HE-SIG-B content channel is transmitted through the S20 channel. However, since no signal is actually transmitted through the S20 channel and the receiver would fail to decode the HE-SIG-B content channel on the S20 channel, there is no problem in a PPDU transmission configured only on the P20 channel.

Next, the size information Y of the common block field may be different depending on the number of RA fields to be carried. When the size information consists of 2 bits, the number of RA fields included in the common block field may be indicated as one, two, three, or four. When the size information consists of 1 bit, the number of RA fields included in the common block field may be indicated as 2 or 4. In the latter case, an unnecessary RA field may be additionally transmitted. However, it is possible to prevent additional signaling overhead by causing the unnecessary RA field to indicate the unassigned RU described in the embodiment of FIG. 27.

The receiver may determine a channel to receive the HE-SIG-B content

channel based on the location information X of the HE-SIG-B content channel. In addition, the receiver decodes the common block field of the HE-SIG-B based on the size information of the common block field. The additional unassigned channel information of the transmitted PPDU may be indicated via the RA field of the common block field. According to an embodiment of the present invention, a resource unit indication field representing which channel each of a plurality of RA fields indicates within a bandwidth up to 160 MHz may be used. In this case, the resource unit indication field may indicate, via a bitmap representing eight 20 MHz channels in a bandwidth up to 160 MHz, channels in which the subsequent RA fields sequentially indicate information.

FIGS. 35 to 37 illustrate embodiments of a resource unit filtering according to additional embodiments of the present invention. Referring to FIG. 20, several embodiments for transmitting a non-contiguous PPDU have been described. FIGS. 35 to 37 illustrate embodiments in which additional resource units are filtered in the non-contiguous PPDU transmission process described above with reference to FIG. 20. In the embodiment of the present invention, a filtered resource unit (or channel) may refer to an unassigned resource unit (or channel).

FIG. 35 illustrates a situation in which a terminal equipped with one RF module attempts to transmit a PPDU through a bandwidth of 160 MHz but an S40 channel 640 is busy as a result of CCA. The terminal transmits a non-contiguous PPDU through a 140 MHz band including the P40 channel (i.e., P20 channels + S20 channels) and the S80 channel. In this case, the non-contiguous PPDU is transmitted using a 160 MHz spectral mask 610. Furthermore, in the S40 channel 640 determined to be busy, filtering is performed and no data is transmitted. However, since a 40 MHz spectral mask is not applied to the signal transmitted through the P40 channel, signals of some

resource units adjacent to the boundary of the S40 channel may interfere with OBSS signal transmitted through the S40 channel.

Therefore, according to the embodiment of the present invention, in the non-contiguous PPDU transmission situations, the resource unit adjacent to the unassigned S40 channel 640 may be additionally filtered and be set as the unassigned resource unit. Depending on the location of the S40 channel 640 within the entire bandwidth, a maximum of two adjacent resource units, including a center 26-tone RU 650, on either side of the S40 channel 640 may exist. According to the embodiment of the present invention, when a 40 MHz bandwidth channel is set to an unassigned channel, additional filtering may be performed on a resource unit adjacent to that channel, e.g., the center 26-tone RU 650. Moreover, if there is a possibility that some resource units in a transmission channel (i.e., P20 channel) adjacent to the unassigned S40 channel 640 may interfere with OBSS signal in the unassigned S40 channel 640, additional filtering may be performed on the some resource units. Whether to perform such an additional filtering of resource units may be determined based on information of a transmission power of a transmitter, the maximum transmission power per frequency band, the strength of the received OBSS signal, and the like.

According to an embodiment of the present invention, whether to filter the center 26-tone RU 650 (i.e., to set as an unassigned resource unit) may be determined as below according to a CCA result of the unassigned S40 channel 640. First, if a legacy PPDU using 64 FFT / 20 MHz is detected in the unassigned S40 channel 640, filtering of the center 26-tone RU 650 may be performed. Second, if an HE PPDU using 256 FFT / 20 MHz is detected in the unassigned S40 channel 640, whether to filter the center 26-tone RU 650 may be determined based on a band occupied by the HE PPDU. When the band occupied by the HE PPDU is more than a predetermined frequency

interval away from the center 26-tone RU 650, the center 26-tone RU 650 may not be filtered. However, when the band occupied by the HE PPDU is less than the predetermined frequency interval from the center 26-tone RU 650, filtering of the center 26-tone RU 650 may be performed. Third, if a legacy PPDU or HE PPDU is not detected and an arbitrary radio signal is detected in the unassigned S40 channel 640, whether to filter the center 26-tone RU 650 may be determined based on a band occupied by the signal. When the edge of the band occupied by the signal is more than a predetermined frequency interval away from the center 26-tone RU 650, the center 26-tone RU 650 may not be filtered.

Next, FIG. 36 illustrates a situation in which a terminal equipped with one RF module attempts to transmit a PPDU through a bandwidth of 80 MHz but an S20 channel 642 is busy as a result of CCA. The terminal transmits a non-contiguous PPDU through a 60 MHz band including the P20 channel and the S40 channel. In this case, the non-contiguous PPDU is transmitted using an 80 MHz spectral mask 612. Furthermore, in the S20 channel 642 determined to be busy, filtering is performed and no data is transmitted. However, since a 20 MHz spectral mask is not applied to the signal transmitted through the P20 channel, signals of some resource units adjacent to the boundary of the S20 channel may interfere with OBSS signal transmitted through the S20 channel.

Likewise in the embodiment of FIG. 36, whether to filter the center 26-tone RU 652 and/or the adjacent resource units may be determined according to the method described in the embodiment of FIG. 35. Moreover, if there is a possibility that some resource units in a transmission channel (i.e., P20 channel) adjacent to the unassigned S20 channel 642 may interfere with OBSS signal in the unassigned S20 channel 642, additional filtering may be performed on the some resource units. According to an

embodiment of the present invention, the transmitter may minimize resource waste by allocating resource units of a narrow bandwidth to a band adjacent to the unassigned channel in the transmission channel.

Next, FIG. 37 illustrates a situation in which a terminal equipped with two RF modules attempts to transmit a PPDU through a bandwidth of 80+80 MHz but an S40 channel 644 is busy as a result of CCA. The terminal transmits a non-contiguous PPDU through the P40 channel (i.e., P20 channel + S20 channel) and the S80 channel, respectively, using the two RF modules. The terminal transmits, by using the first RF module, the PPDU to which a 40 MHz spectral mask 614 is applied through the P40 channel. In addition, the terminal transmits, by using the second RF module, the PPDU to which an 80 MHz spectral mask 616 is applied through the S80 channel. Therefore, in the embodiment of FIG. 37, no additional filtering of some resource units included in the transmission channel (i.e., P20 channel) adjacent to the unassigned S40 channel 644 is required. However, at least a half of a center 26-tone RU 654 adjacent to the unassigned S40 channel 644 should be filtered. Thus, according to the embodiment of the present invention, the center 26-tone RU 654 may be set as an unassigned resource unit.

FIGS. 38 to 42 illustrate methods of signaling an HE MU PPDU according to additional embodiments of the present invention. In the embodiments of FIGS. 38 to 42, channel A to channel D refer to respective 20 MHz channels through which an 80 MHz PPDU is transmitted. In this case, it is designated that channel A is a P20 channel, channel B is an S20 channel, and channel C and channel D are an S40 channel. In addition, HE-SIG-B content channel 1 is transmitted through at least one of channel A and channel C, and HE-SIG-B content channel 2 is transmitted through at least one of channel B and channel D.

FIG. 38 illustrates an embodiment of a method of signaling allocation information of a center 26-tone RU in an HE MU PPDU. FIG. 38(a) illustrates resource units constituting a PPDU in a total bandwidth of 80 MHz, and FIG. 38(b) illustrates a configuration of HE-SIG-B content channel 1 and HE-SIG-B content channel 2 carried via the PPDU. The specific method in which the RA field and the user field are carried in each HE-SIG-B content channel is as described in the previous embodiments.

When a PPDU is transmitted in a total bandwidth of 80 MHz or more, a center 26-tone RU 502 as shown in FIG. 38(a) may additionally be used. As described above, the common block field of the HE-SIG-B may further include a C26 field (not illustrated) indicating whether a user is allocated to the center 26-tone RU 502. The C26 field may consist of a 1-bit indicator located before or after the RA field in the common block field. According to the embodiment of the present invention, the C26 field may be carried in both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2. When the C26 field indicates assignment of the center 26-tone RU 502, a user field 422 corresponding to the center 26-tone RU 502 should be carried in the HE-SIG-B.

When a PPDU is transmitted in a total bandwidth of 80 MHz, both of a C26 field carried in the HE-SIG-B content channel 1 and a C26 field carried in the HE-SIG-B content channel 2 indicate whether a user is allocated to the center 26-tone RU 502 in the total bandwidth of 80 MHz. In this case, when the C26 field indicates the assignment of the center 26-tone RU 502, the user field 422 corresponding to the center 26-tone RU 502 may be carried in the user specific field of the HE-SIG-B content channel 1. However, when the C26 field indicates non-assignment of the center 26-tone RU 502, the user field 422 corresponding to the center 26-tone RU 502 is not carried.

On the other hand, when a PPDU is transmitted in a total bandwidth of 160 MHz or 80+80 MHz, the total bandwidth may consist of the first 80 MHz bandwidth

and the second 80 MHz bandwidth. In this case, the first 80 MHz bandwidth may be a frequency band lower than the second 80 MHz bandwidth. A center 26-tone RU may be present in each 80 MHz bandwidth. In this case, the first C26 field carried in the HE-SIG-B content channel 1 may indicate whether a user is allocated to the first center 26-tone RU of the first 80 MHz bandwidth. In addition, the second C26 field carried in HE-SIG-B content channel 2 may indicate whether a user is allocated to the second center 26-tone RU of the second 80 MHz bandwidth. When the first C26 field indicates the assignment of the first center 26-tone RU, a user field corresponding to the first center 26-tone RU may be carried in the user specific field of the HE-SIG-B content channel 1. Also, when the second C26 field indicates the assignment of the second center 26-tone RU, a user field corresponding to the second center 26-tone RU may be carried in the user specific field of the HE-SIG-B content channel 2. However, when the first C26 field and/or the second C26 field indicate non-assignment of the center 26-tone RU, the corresponding user field is not carried.

FIG. 39 illustrates a method of signaling HE-SIG-B in an HE MU PPDU transmitted through a full bandwidth MU-MIMO. When the full bandwidth MU-MIMO transmission is performed as shown in FIG. 39(a), the RA field of the HE-SIG-B need not be transmitted. Thus, the SIG-B compression field of the HE-SIG-A may indicate the compression mode of the HE-SIG-B field. Meanwhile, the user fields are carried as split to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2. The receiver decodes both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 to identify whether the user field corresponding to the corresponding terminal is transmitted.

FIG. 39(b) illustrates an embodiment in which a specific subfield of the HE-SIG-A indicates information on the number of MU-MIMO users when a full bandwidth

MU-MIMO transmission is performed (i.e., the SIG-B compression field indicates the compression mode of the HE-SIG-B field). According to an embodiment of the present invention, when the full bandwidth MU-MIMO transmission is performed, the SIG-B dual MCS field of the HE-SIG-A may indicate information on the number of MU-MIMO users. It is because the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 do not need to distribute the amount of information through different MCSs when the full bandwidth MU-MIMO transmission is performed. According to another embodiment of the present invention, when the full bandwidth MU-MIMO transmission is performed, the number of HE-SIG-B symbols field in the HE-SIG-A may indicate information on the number of MU-MIMO user. It is because, when full-bandwidth MU-MIMO transmission is performed, it is easier to transmit the information on the number of MU-MIMO users and the MCS information than to transmit the number of HE-SIG-B symbols and MCS information for the decoding of the receiver.

FIG. 39(c) illustrates the detailed configuration of the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 when the full bandwidth MU-MIMO transmission is performed. When the full-bandwidth MU-MIMO is performed, the RA field is not present in the HE-SIG-B. Therefore, when an MU-MIMO transmission is performed through a bandwidth greater than 20 MHz, the number of users to be allocated to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively, should be separately determined.

According to the embodiment of the present invention, when the MU-MIMO transmission is performed through a bandwidth greater than 20 MHz, user fields may be split equitably between the two content channels for load balancing. That is, the number of user fields transmitted in each SIG-B content channel is determined as a round up or down value of a half the total number of users. For example, when the total number of

user fields is n, the first to m-th (where m is ceil (n/2)) user fields may be transmitted through the HE-SIG-B content channel 1, and the m+1-th to the n-th user fields may be transmitted through the HE-SIG-B content channel 2. If n is an odd number, the number of user fields included in the HE-SIG-B content channel 1 may be one more than the number of user fields included in the HE-SIG-B content channel 2. A total of n user fields are allocated in order of each user field of the HE-SIG-B content channel 1, and then each user field of the HE-SIG-B content channel 2.

FIG. 40 illustrates an embodiment of signaling a non-assignment of a specific resource unit in a non-contiguous PPDU. As described in the embodiments of FIGS. 35 to 37, in the non-contiguous PPDU transmission process, additional filtering may be performed on some resource units 506 of the transmission channel adjacent to the unassigned channel. Referring to FIG. 40(a), additional filtering may be performed on the resource unit 506 of the transmission channel (i.e., channel A) adjacent to the unassigned channel, that is, channel B.

FIG. 40(b) illustrates a configuration of the HE-SIG-B indicating the non-assignment of the specific resource unit 506 in a non-contiguous PPDU. Referring to FIG. 40(b), the RA field of the HE-SIG-B indicates resource unit allocation information of the transmission channel (i.e., channel A). Each resource unit of channel A is assigned to STA A1 to STA An. A user specific field of the HE-SIG-B carries a user field corresponding to each resource unit. In this case, a null STA ID may be contained in a user field 426 corresponding to the resource unit 506 to be filtered. The specific embodiment of the null STA ID is as described above in the embodiments of the previous figures.

FIG. 41 illustrates another embodiment of signaling allocation information of the center 26-tone RU 502 in a non-contiguous PPDU. As described above, the RA field

may indicate a specific channel that is not assigned to a user through a predetermined index. That is, the RA field may indicate nulling of a bandwidth of a multiple of a 20 MHz channel, i.e., 242-tone, 484-tone or 996-tone resource unit. As above, when the bandwidth information of the unassigned channel is indicated via the RA field, whether the center 26-tone RU 502 is assigned may be implicitly identified.

First, FIG. 41(a) illustrates a situation in which the S40A channel (i.e., channel C) is busy in a total bandwidth of 80 MHz. The terminal transmits a PPDU in a 60 MHz band including the P40 channel and the S40B channel (i.e., channel D). In this case, the RA field corresponding to channel C indicates nulling of 242-tone RU. FIG. 41(b) illustrates a configuration of the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 of the PPDU transmitted according to the embodiment of FIG. 41(a). Since the nulling of 242-tone RU is indicated by the RA field of the HE-SIG-B content channel 1, the receiver may identify that a user can be allocated to the center 26-tone RU 502. Thus, the HE-SIG-B content channel 1 carries a user field 422 corresponding to the center 26-tone RU 502.

On the other hand, FIG. 41(c) illustrates a situation in which the S40 channel is busy in the total bandwidth of 80 MHz. The terminal transmits a PPDU through the P40 channel. In this case, the RA fields corresponding to channel C and channel D indicate nulling of 484-tone RU. FIG. 41(d) illustrates a configuration of the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 of the PPDU transmitted according to the embodiment of FIG. 41(c). Since the nulling of 484-tone RU is indicated by the RA fields of the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, the receiver may identify that the center 26-tone RU 502 is not assigned to a user. That is, since the entire S40 channel is not assigned to a user, the center 26-tone RU 502 may also be set as an unassigned resource unit. Thus, the HE-

SIG-B content channel 1 may not carry the user field 422 corresponding to the center 26-tone RU 502.

FIG. 42 illustrates a method of transmitting a preamble and data when a non-contiguous PPDU is transmitted according to the embodiment of the present invention. In each embodiment of FIGS. 42(a) to 42(c), it is assumed that the S40B channel (i.e., channel D) is busy in the total bandwidth of 80 MHz. The terminal transmits a PPDU in a 60 MHz band including the P40 channel and the S40A channel (i.e., channel C).

First, according to the embodiment of FIG. 42(a), when transmitting the non-contiguous PPDU, the terminal may not transmit the preamble in addition to the data through the unassigned channel. In this case, the terminal does not transmit both the legacy preamble and the non-legacy preamble through the unassigned channel. In such a case, there is an advantage that no interference may occur to OBSS signal already transmitted through the corresponding channel. In addition, if a transmission is not performed through a specific channel, the dispersion amount of the transmission power is reduced in spite of the transmission of the wideband PPDU, and the reception ratio of the PPDU is increased. However, this method has a disadvantage in that the signaling of the HE-SIG-B becomes complicated when the S20 channel is busy. In addition, while the HE-STF has a repetitive pattern on the time axis when the PPDU is transmitted through a total bandwidth of 80 MHz, it is difficult to have a repetitive pattern on the time axis when the HE-STF is not transmitted on some channels.

Therefore, according to the embodiment of FIG. 42(b), when transmitting a non-contiguous PPDU, the terminal may not transmit data but may transmit the preamble through the unassigned channel. In this case, the terminal may transmit both the legacy preamble and the non-legacy preamble through the unassigned channel. In such a case, an interference may occur to OBSS signal already transmitted through the

corresponding channel. However, since the transmission power may be dispersed to the entire band in the case of the wideband PPDU transmission, there may be no significant damage to the OBSS signal.

According to yet another embodiment of the present invention, the terminal may transmit only HE-STF and HE-LTF (or only HE-STF) through the unassigned channel as shown in FIG. 42(c). That is, a transmission of the legacy preamble, the HE-SIG-A and the HE-SIG-B, of which reception through the entire band is not required, may be restricted and only a transmission of the HE-STF and the HE-LTF, of which reception through the entire band is required, may be performed, thereby minimizing interference to the OBSS signal.

FIGS. 43 to 44 illustrate embodiments in which a transmission using an HE MU PPDU is performed between a single STA and an AP. As described above, the HE MU PPDU may be used not only for a DL-MU transmission but also for an uplink transmission.

FIG. 43 illustrates an embodiment in which an HE MU PPDU is used in an uplink transmission of a single STA. According to the embodiment of the present invention, a STA may perform a transmission using a resource unit of 20 MHz bandwidth or less (i.e., a narrowband) as shown in FIG. 43(a). The STA may increase a transmission distance of data by concentrating the transmission power on a specific resource unit. FIGS. 43(b) to 43(d) illustrate embodiments for signaling such a narrowband transmission.

According to an embodiment of the present invention, the narrowband transmission may be signaled via a null STA ID contained in a user field of the HE-SIG-B, as shown in FIG. 43(b). More specifically, the RA field of the HE-SIG-A may indicate information on resource unit partition type in a specific channel. For example,

if a bandwidth of 20 MHz is partitioned into nine resource units based on OFDMA, the RA field may signal "00000000" as shown in FIG. 15(c). In this case, an AID of a receiver or a transmitter may be contained in a user field corresponding to a resource unit used for an uplink data transmission among the nine partitioned resource units. On the other hand, a null STA ID may be contained in user fields corresponding to the remaining resource units through which data transmission is not performed.

For example, when data is transmitted only through the third 26-tone RU among the nine resource units, a null STA ID may be contained in the first to second user fields and the fourth to ninth user fields. However, if the signaling structure of the HE-SIG-B, which is designed based on the DL-MU transmission, is directly used in the uplink narrowband transmission, the signaling overhead may be increased. Thus, other signaling methods may be used to reduce the signaling overhead. According to another embodiment of the present invention, user fields after a user field in which the AID of the receiver or transmitter is contained may be excluded from the signaling. That is, in the above embodiment, the null STA ID is contained in the first to second user fields, and the AID of the receiver or transmitter may be contained in the third user field. However, the fourth to ninth user fields may not be transmitted. It is because the AP receiving the PPDU does not need to receive additional user fields after obtaining information of the transmitting STA in the third user field.

According to another embodiment of the present invention, index values for the uplink resource unit allocation may be newly defined in the RA field of the HE-SIG-B for the narrowband transmission as shown in FIG. 43(c). More specifically, the RA field of the HE-SIG-B may index a specific 26-tone RU, 52-tone RU and/or 106-tone RU through which an uplink transmission is performed. In this case, since only one user field corresponding to a resource unit indicated by the RA field is carried, the signaling

overhead may be greatly reduced. According to an embodiment, index values for the uplink resource unit allocation may be used among unassigned (i.e., TBD) indices of the RA field configuration for the DL-MU transmission. According to another embodiment, the index values for the uplink resource unit allocation may be newly defined in the RA field.

According to yet another embodiment of the present invention, the narrowband transmission may be signaled by recycling unnecessary fields of the HE-SIG-A. For example, if the HE MU PPDU is used in the uplink transmission, the number of HE-LTF symbols field and the number of HE-SIG-B symbols field in the HE-SIG-A may be used for other purposes. Since the number of HE-LTF symbols field has a function redundant with the NSTS field of the user specific field of the HE-SIG-B, no separate signaling is required. Also, in a signaling of a single STA, since the amount of signaling information is fixed and the number of symbols can be fixed according to the design, it is not necessary to indicate the number of symbols separately through the number of HE-SIG-B symbols field. Accordingly, it is possible to perform signaling of the uplink HE MU PPDU using at least one of the above fields. For example, in the resource unit allocation indicated by the RA field, the location of the resource unit through which the STA transmits the uplink data may be indicated using at least one of the above fields. In this case, the RA field of the HE-SIG-B is set to be the same as the conventional one, and the signaling overhead can be reduced since only one user field is carried.

Meanwhile, according to still another embodiment of the present invention, the uplink transmission using the HE MU PPDU may be performed not only through the narrowband but also through the entire bandwidth of 20 MHz, 40 MHz, 80 MHz, or 160 MHz (80+80 MHz). In this case, the bandwidth field of the HE-SIG-A may indicate

the total bandwidth of the PPDU, and the SIG-B compression field may indicate the compression mode of the HE-SIG-B field. Therefore, the RA field of the HE-SIG-B may be omitted in an uplink HE MU PPDU. On the other hand, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field in a downlink HE MU PPDU, MU-MIMO based user specific information could be indicated. However, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field in an uplink HE MU PPDU, OFDMA-based user specific information may be indicated as shown in FIG. 43(c).

FIG. 44 illustrates a method of configuring the HE-SIG-B when a single STA transmits a non-contiguous PPDU to an AP. In the embodiment of FIG. 44, the S20 channel is busy in a total bandwidth of 80 MHz. Therefore, the STA transmits a PPDU in a 60 MHz band including the P20 channel and the S40 channel.

The bandwidth field of the HE-SIG-A defined in the existing HE SU PPDU format is not suitable for signaling a non-contiguous PPDU. Therefore, the STA may perform the transmission of the non-contiguous PPDU using the HE MU PPDU format. In this case, the bandwidth field of the HE-SIG-A indicates puncturing of the S20 channel in the total bandwidth of 80 MHz. The HE-SIG-B carries information of the single STA (i.e., SU Info) through the P20 channel and the S40 channel.

Meanwhile, since the configuration information of the non-contiguous PPDU is signaled via the bandwidth field, the common block field of the HE-SIG-B may be omitted. Therefore, the SIG-B compression field may indicate the compression mode of the HE-SIG-B field. In addition, the user specific field of the HE-SIG-B may carry only one user field. In this case, an AID of a transmitter, not an AID of a receiver, is contained in the user field. When the HE MU PPDU is used for the uplink transmission, it is obvious that the receiver of the corresponding PPDU is an AP. When the UL/DL

field of the HE MU PPDU indicates an uplink transmission, the AP may interpret the AID contained in the user field as the AID of the transmitter.

FIGS. 45 to 46 illustrate methods of a non-contiguous channel allocation and a signaling thereof according to additional embodiments of the present invention. As described above, according to an embodiment of the present invention, a wideband PPDU may be transmitted according to a non-contiguous, limited flexible channel extension method.

FIG. 45 illustrates a method of signaling the HE-SIG-A and the HE-SIG-B when a PPDU is transmitted according to a non-contiguous, limited flexible channel extension method. As described above with reference to FIG. 19(e), the flexible channel extension method refers to a channel extension method in which a band occupied by a transmitted PPDU always includes predetermined core channels including the P20 channel. In the embodiment of FIG. 45, the P40 channel including the P20 channel and the S20 channel is set as the core channels. However, the core channels are selected bandwidths to reduce the signaling burden of the HE-SIG-B, and if the signaling burden of the HE-SIG-B is not increased, the core channels can be changed according to the embodiment.

First, FIG. 45(a) illustrates a situation in which the S40B channel and the S80 channel are busy in a total bandwidth of 160 MHz. The terminal transmits a non-contiguous PPDU through a 60 MHz band including the P40 channel and the S40A channel. In this case, the bandwidth field of the HE-SIG-A of the transmitted PPDU may indicate 160 MHz. The HE-SIG-B content channel 1 carries allocation information of channel A and channel C (i.e., A, C, 996-null, 996-null) and is transmitted through channel A and channel C. The HE-SIG-B content channel 2 carries allocation information of CH B (i.e., B, 242-Null, 996-null, 996-null) and is transmitted through

channel B.

Next, FIG. 45(b) illustrates a situation in which the S40A channel and the S80 channel are busy in a total bandwidth of 160 MHz. The terminal transmits a non-contiguous PPDU through a 60 MHz band including the P40 channel and the S40B channel. In this case, the bandwidth field of the HE-SIG-A of the transmitted PPDU may indicate 160 MHz. The HE-SIG-B content channel 1 carries allocation information of channel A (i.e., A, 242-Null, 996-null, 996-null) and is transmitted through channel A. HE-SIG-B content channel 2 carries allocation information of channel B and channel D (i.e., B, D, 996-null, 996-null) and is transmitted through channel B and channel D.

Next, FIG. 45(c) illustrates a situation in which a PPDU is transmitted only through the P20 channel in a total bandwidth of 160 MHz. In this case, the bandwidth field of the HE-SIG-A of the transmitted PPDU indicates 160 MHz, and the HE-SIG-B content channel 1 carries allocation information of channel A (i.e., A, 242-Null, 996-null, 996-null). In this case, since the signaling burden of the HE-SIG-B is not increased, it is possible to transmit a PPDU not occupying at least a part of the core channels.

Finally, FIG. 45(d) illustrates a situation in which the S40B channel, the S80A channel, the S80C channel and the S80D channel are busy in a total bandwidth of 160 MHz. The terminal transmits a non-contiguous PPDU through an 80 MHz band including the P40 channel, the S40A channel, and the S80B channel. In this case, the bandwidth field of the HE-SIG-A of the transmitted PPDU may indicate 160 MHz. The HE-SIG-B content channel 1 carries allocation information of channel A and channel C (i.e., A, C, 242-null, 484-null) and is transmitted through channel A and channel C. The HE-SIG-B content channel 2 carries allocation information of channel B and channel F (i.e., B, 242-Null, F, 484 -Null) and is transmitted through channel B and channel F.

In the channel allocation information (i.e., A1, A2, A3 and A4) described with

reference to the respective drawings, the A1, A2, A3 and A4 denote the first RA field, the second RA field, the third RA field and the fourth RA field which are carried in the HE-SIG-B content channel, respectively. As above, according to the embodiment of the present invention, various non-contiguous PPDUs may be signaled via a combination of the HE-SIG-A and the HE-SIG-B.

FIG. 46 illustrates a channel allocation method when a PPDU is transmitted according to a non-contiguous, limited flexible channel extension method. FIG. 46(a) illustrates options of non-contiguous channel allocation in a total bandwidth of 80 MHz, and FIG. 46(b) illustrates options of non-contiguous channel allocation in a total bandwidth of 160 MHz. In FIG. 46(b), the P80 channel may consist of any one of the channels shown in FIG. 46(a).

The non-assignment information of the S80 channel shown in FIG. 46(b) may be indicated via the RA field of the HE-SIG-B or indicated by the null STA ID of the user field, as described above. In addition, whether the center 26-tone RU shown in FIGS. 46(a) and 46(b) is assigned may be indicated via the C26 field of the HE-SIG-B.

Although the present invention is described by using the wireless LAN communication as an example, the present invention is not limited thereto and the present invention may be similarly applied even to other communication systems such as cellular communication, and the like. Further, the method, the apparatus, and the system of the present invention are described in association with the specific embodiments, but some or all of the components and operations of the present invention may be implemented by using a computer system having universal hardware architecture.

The detailed described embodiments of the present invention may be implemented by various means. For example, the embodiments of the present invention

may be implemented by a hardware, a firmware, a software, or a combination thereof.

In case of the hardware implementation, the method according to the embodiments of the present invention may be implemented by one or more of Application Specific Integrated Circuits (ASICSs), Digital Signal Processors (DSPs), Digital Signal Processing Devices (DSPDs), Programmable Logic Devices (PLDs), Field Programmable Gate Arrays (FPGAs), processors, controllers, micro-controllers, micro-processors, and the like.

In case of the firmware implementation or the software implementation, the method according to the embodiments of the present invention may be implemented by a module, a procedure, a function, or the like which performs the operations described above. Software codes may be stored in a memory and operated by a processor. The processor may be equipped with the memory internally or externally and the memory may exchange data with the processor by various publicly known means.

The description of the present invention is used for exemplification and those skilled in the art will be able to understand that the present invention can be easily modified to other detailed forms without changing the technical idea or an essential feature thereof. Thus, it is to be appreciated that the embodiments described above are intended to be illustrative in every sense, and not restrictive. For example, each component described as a single type may be implemented to be distributed and similarly, components described to be distributed may also be implemented in an associated form.

The scope of the present invention is represented by the claims to be described below rather than the detailed description, and it is to be interpreted that the meaning and scope of the claims and all the changes or modified forms derived from the equivalents thereof come within the scope of the present invention.

[Industrial Applicability]

Various exemplary embodiments of the present invention have been described with reference to an IEEE 802.11 system, but the present invention is not limited thereto and the present invention can be applied to various types of mobile communication apparatus, mobile communication system, and the like.

[CLAIMS]

1. A wireless communication terminal, the terminal comprising:

a processor; and

a communication unit,

wherein the processor is configured to:

receive a wireless packet through the communication unit,

obtain total bandwidth information indicated via a bandwidth field of HE-SIG-A of the received packet,

obtain information of an unassigned resource unit via at least one of the bandwidth field of the HE-SIG-A and a subfield of HE-SIG-B of the received packet, and

decode the received packet based on the total bandwidth information and the information of the unassigned resource unit.

2. The wireless communication terminal of claim 1,

wherein the information of the unassigned resource unit is indicated via a resource unit allocation field of the HE-SIG-B, and

wherein the resource unit allocation field indicates a specific resource unit not assigned to a user through a predetermined index.

3. The wireless communication terminal of claim 2, wherein the specific resource unit not assigned to a user is at least one of a 242-tone resource unit, a 484-tone resource unit, and a 996-tone resource unit.

4. The wireless communication terminal of claim 1, wherein the information

of the unassigned resource unit is obtained through resource unit arrangement information indicated by a resource unit allocation field of the HE-SIG-B and a Null STA ID contained in a user field corresponding to a specific resource unit in the resource unit arrangement.

5. The wireless communication terminal of claim 4, wherein the specific resource unit is at least one of a 26-tone resource unit, a 52-tone resource unit, and a 106-tone resource unit.

6. The wireless communication terminal of claim 1, wherein the information of the unassigned resource unit is indicated via a combination of the bandwidth field of the HE-SIG-A and a resource unit allocation field of the HE-SIG-B.

7. The wireless communication terminal of claim 6,

wherein the bandwidth field indicates channel information to be punctured within the total bandwidth, and

wherein the resource unit allocation field indicates additional puncturing information within the total bandwidth.

8. The wireless communication terminal of claim 7, wherein when the bandwidth field indicates puncturing of one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 80 MHz or puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field indicates which 20 MHz channel in the secondary 40 MHz channel is punctured.

9. The wireless communication terminal of claim 7, wherein when the bandwidth field indicates puncturing of a secondary 20 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz or puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field indicates additional puncturing in a secondary 80 MHz channel.

10. A wireless communication method of a wireless communication terminal, the method comprising:

receiving a wireless packet;

obtaining total bandwidth information indicated via a bandwidth field of HE-SIG-A of the received packet;

obtaining information of an unassigned resource unit via at least one of the bandwidth field of the HE-SIG-A and a subfield of HE-SIG-B of the received packet; and

decoding the received packet based on the total bandwidth information and the information of the unassigned resource unit.

11. The wireless communication method of claim 10,

wherein the information of the unassigned resource unit is indicated via a resource unit allocation field of the HE-SIG-B, and

wherein the resource unit allocation field indicates a specific resource unit not assigned to a user through a predetermined index.

12. The wireless communication method of claim 11, wherein the specific resource unit not assigned to a user is at least one of a 242-tone resource unit, a 484-tone resource unit, and a 996-tone resource unit.

13. The wireless communication method of claim 10, wherein the information of the unassigned resource unit is obtained through resource unit arrangement information indicated by a resource unit allocation field of the HE-SIG-B and a Null STA ID contained in a user field corresponding to a specific resource unit in the resource unit arrangement.

14. The wireless communication method of claim 13, wherein the specific resource unit is at least one of a 26-tone resource unit, a 52-tone resource unit, and a 106-tone resource unit.

15. The wireless communication method of claim 10, wherein the information of the unassigned resource unit is indicated via a combination of the bandwidth field of the HE-SIG-A and a resource unit allocation field of the HE-SIG-B.

16. The wireless communication method of claim 15,

wherein the bandwidth field indicates channel information to be punctured within the total bandwidth, and

wherein the resource unit allocation field indicates additional puncturing information within the total bandwidth.

17. The wireless communication method of claim 16, wherein when the

bandwidth field indicates puncturing of one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 80 MHz or puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field indicates which 20 MHz channel in the secondary 40 MHz channel is punctured.

18. The wireless communication method of claim 16, wherein when the bandwidth field indicates puncturing of a secondary 20 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz or puncturing of at least one of two 20 MHz channels in a secondary 40 MHz channel in a total bandwidth of 160 MHz or 80+80 MHz, the resource unit allocation field indicates additional puncturing in a secondary 80 MHz channel.

[ABSTRACT]

The present invention relates to a wireless communication method and a wireless communication terminal using a non-contiguous channel. To this end, provided are a wireless communication terminal including a processor and a transceiver, wherein the processor receives a wireless packet through the communication unit, obtains total bandwidth information indicated via a bandwidth field of HE-SIG-A of the received packet, obtains information of an unassigned resource unit via at least one of the bandwidth field of the HE-SIG-A and a subfield of HE-SIG-B of the received packet, and decodes the received packet based on the total bandwidth information and the information of the unassigned resource unit and a wireless communication method using the same.

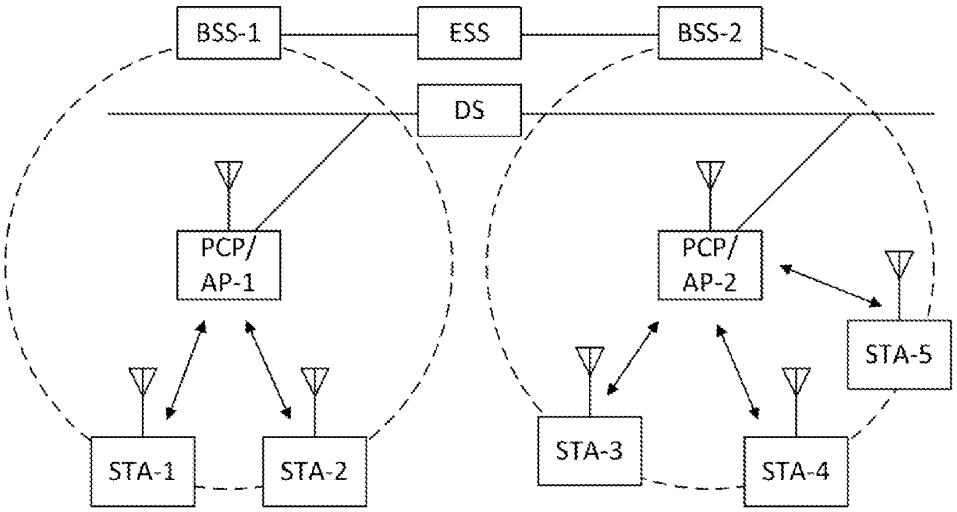

BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

*FIG. 1*

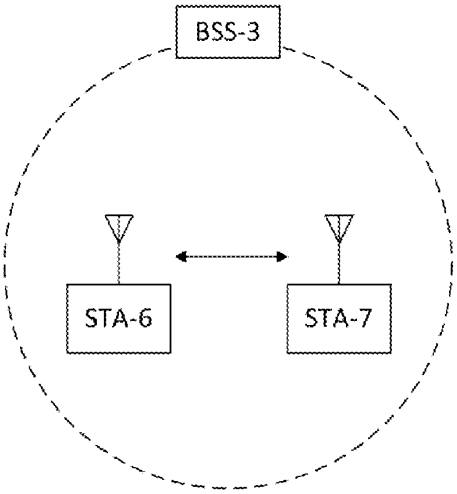

BSS-3
STA-6
STA-7

*FIG. 2*

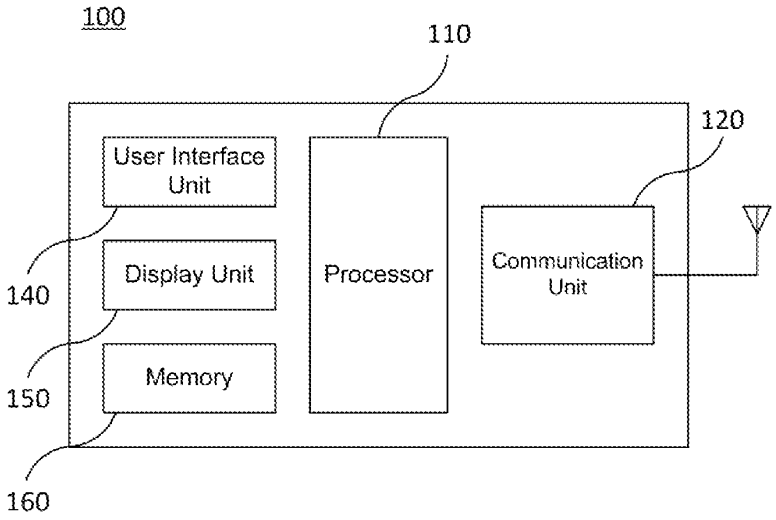

100
110
120
User Interface Unit
Display Unit
Memory
Processor
Communication Unit
140
150
160

*FIG. 3*

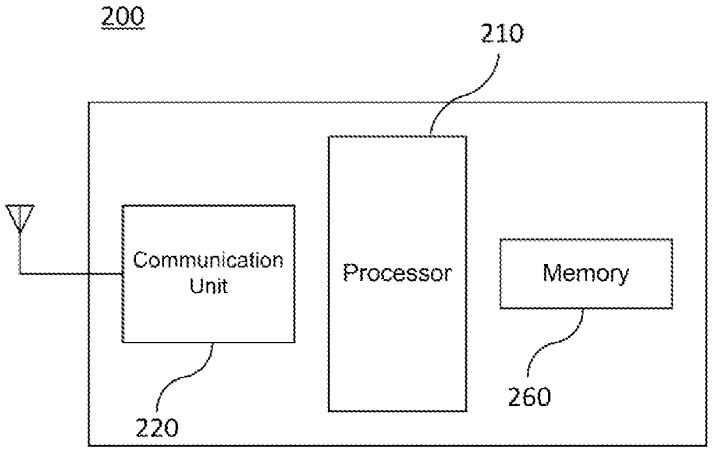

200
210
Communication Unit
Processor
Memory
220
260

*FIG. 4*

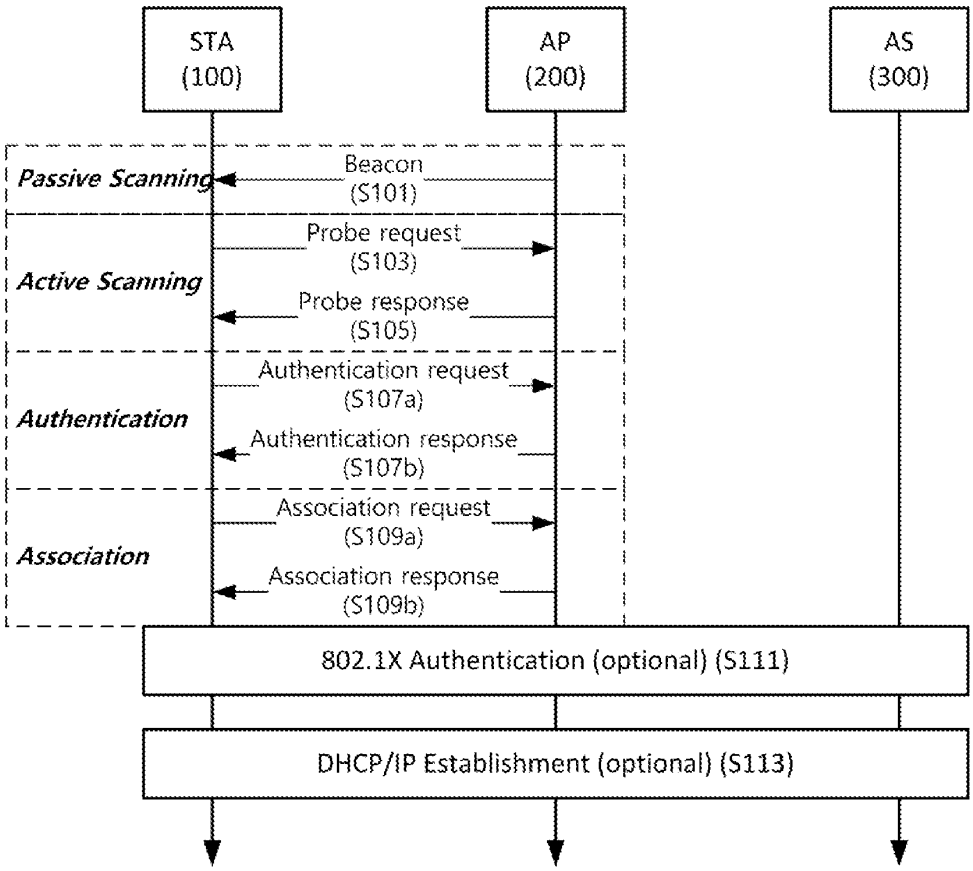

STA
(100)
AP
(200)
AS
(300)
Passive Scanning
Beacon
(S101)
Active Scanning
Probe request
(S103)
Probe response
(S105)
Authentication
Authentication request
(S107a)
Authentication response
(S107b)
Association
Association request
(S109a)
Association response
(S109b)
802.1X Authentication (optional) (S111)
DHCP/IP Establishment (optional) (S113)

*FIG. 5*

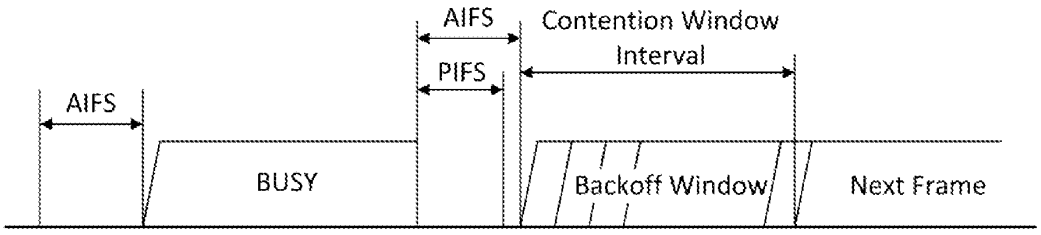

AIFS
AIFS
PIFS
Contention Window
Interval
BUSY
Backoff Window
Next Frame

*FIG. 6*

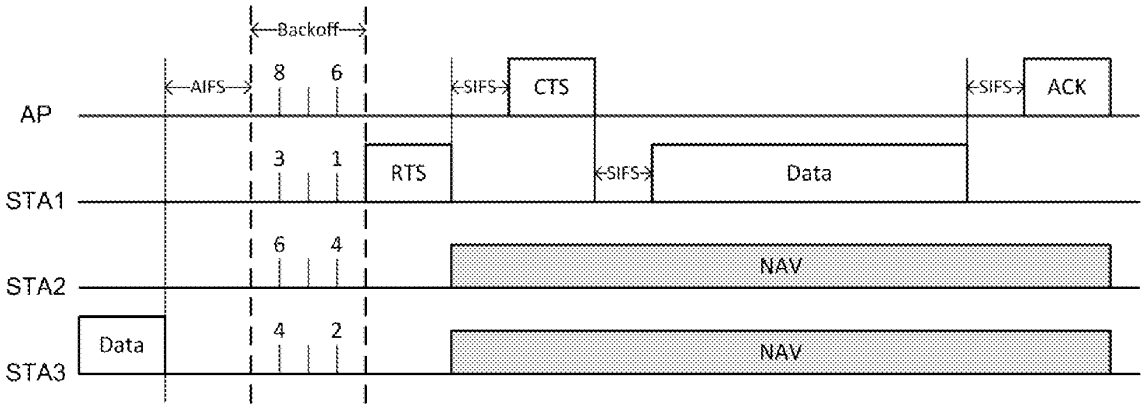

Backoff
AIFS
8
6
SIFS
CTS
SIFS
ACK
AP
3
1
RTS
SIFS
Data
STA1
6
4
NAV
STA2
Data
4
2
NAV
STA3

*FIG. 7*

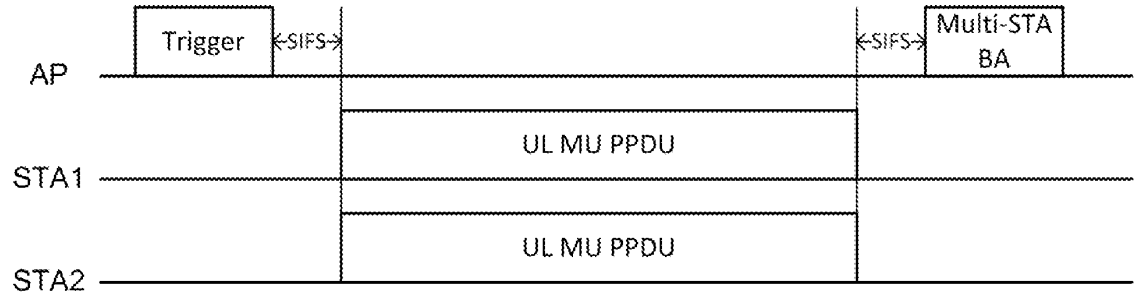

Trigger
SIFS
SIFS
Multi-STA
BA
AP
UL MU PPDU
STA1
UL MU PPDU
STA2

*FIG. 8*

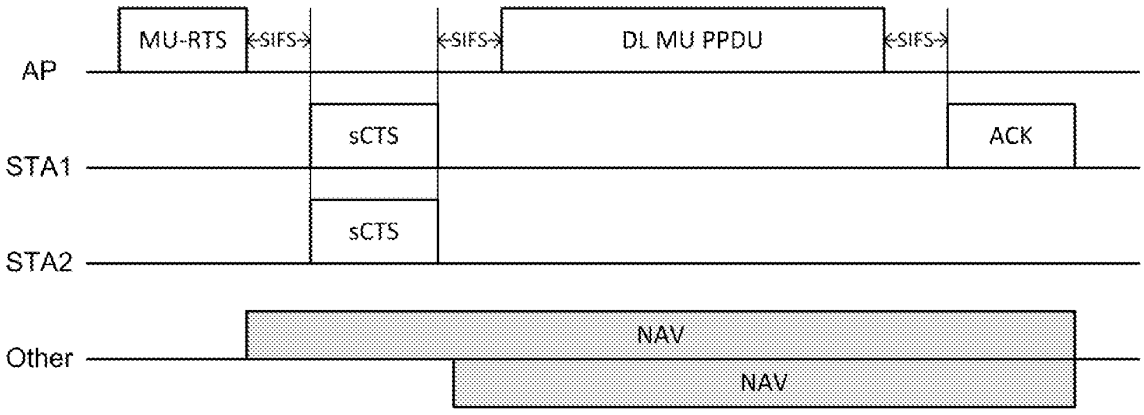

AP
MU-RTS
SIFS
SIFS
DL MU PPDU
SIFS
STA1
sCTS
ACK
STA2
sCTS
Other
NAV
NAV

*FIG. 9*

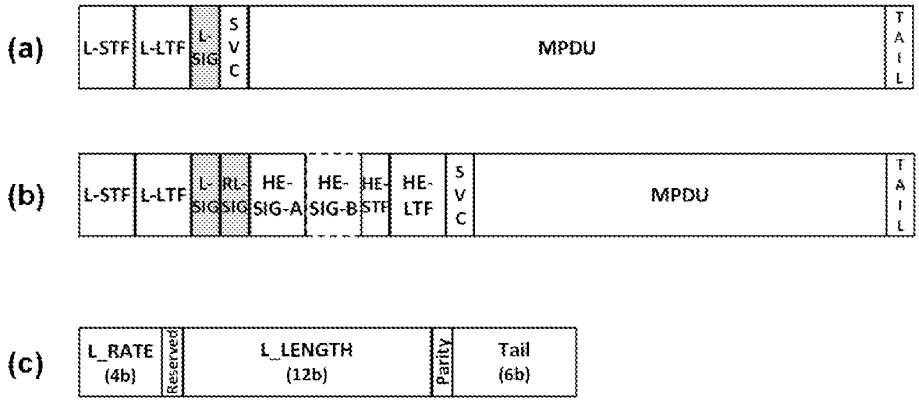

(a)
L-STF
L-LTF
L-SIG
SVC
MPDU
TAIL
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
(c)
L_RATE (4b)
Reserved
L_LENGTH (12b)
Parity
Tail (6b)

*FIG. 10*

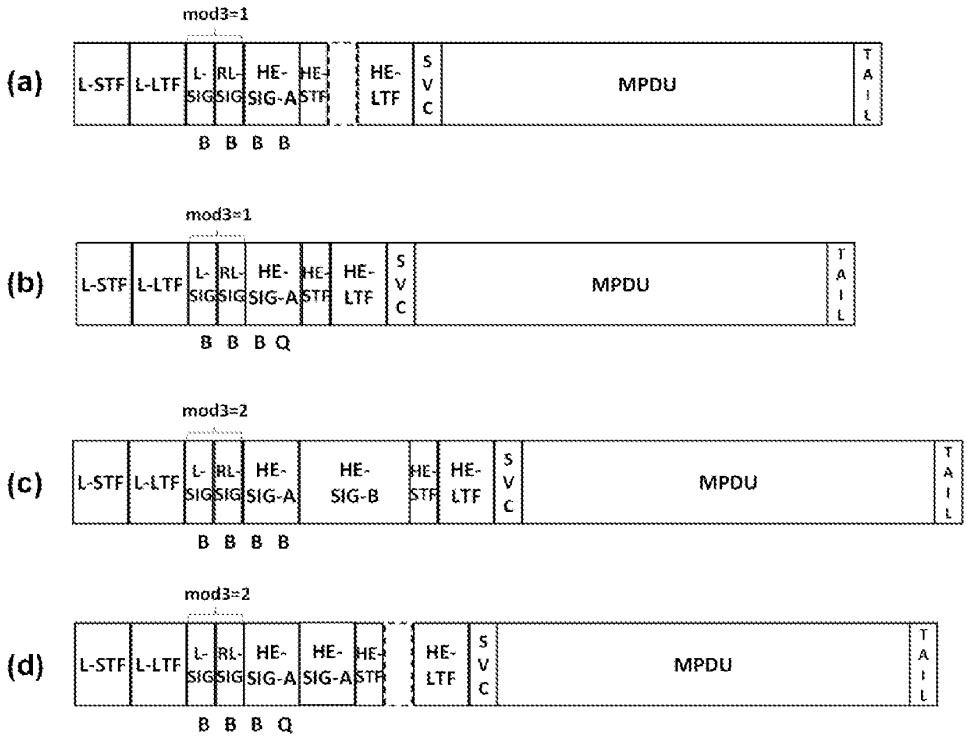

mod3=1
(a)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=1
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q
mod3=2
(c)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=2
(d)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q

*FIG. 11*

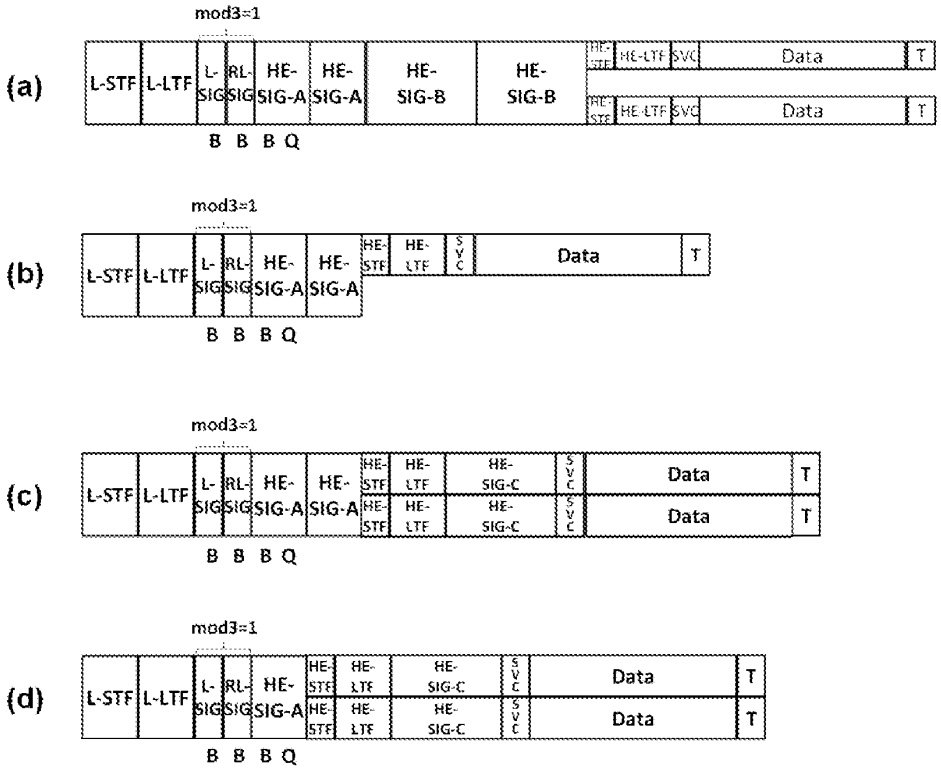

mod3=1
(a)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-SIG-B
HE-SIG-B
HE-STF
HE-LTF
SVC
Data
T
B B B Q
mod3=1
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
SVC
Data
T
B B B Q
mod3=1
(c)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
HE-SIG-C
SVC
Data
T
B B B Q
mod3=1
(d)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
HE-SIG-C
SVC
Data
T
B B B Q

*FIG. 12*

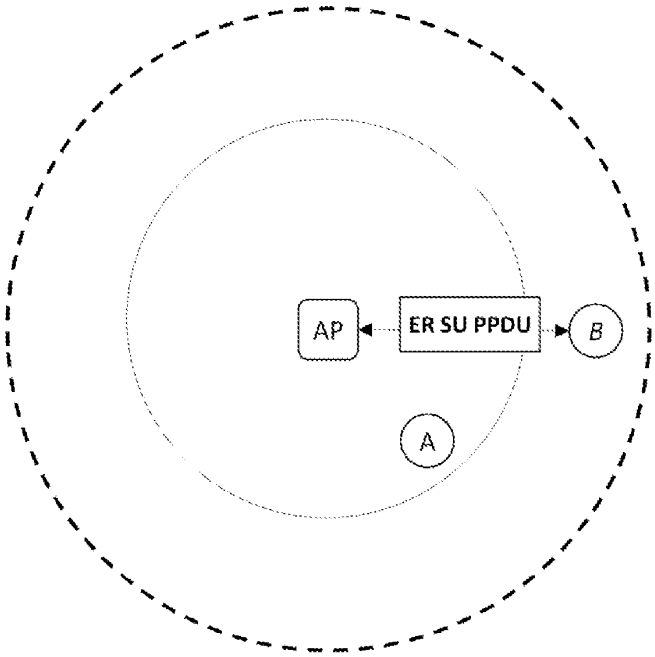
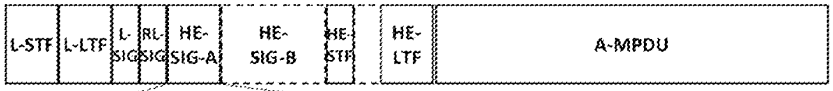



*FIG. 13*




| Field | Bit | Descriptions |
|---|---|---|
| UL/DL | 1 | |
| Format | 1 | SU(o)/Trigger(x) |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse | 4 | |
| TXOP Duration | 7 | |
| Bandwidth | 2 | 20/40/80/160 |
| MCS | 4 | |
| CP+LTF Size | 3 | 1x_LTF+0.8us_CP<br>2x_LTF+0.8us_CP<br>2x_LTF+1.6us_CP<br>4x_LTF+3.2us_CP<br>TBD |
| Coding | 2 | BCC/LDPC, LDPC Extra SYM |
| NSTS | 3 | 1~8 |
| STBC | 1 | on/off |
| TxBF | 1 | on/off |
| DCM | 1 | Dual carrier modulation |
| Packet Extension | 3 | 'a'-factor, PE dis-ambiguity |
| Beam Change | 1 | |
| Doppler | 1 | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 52 | |

(a)

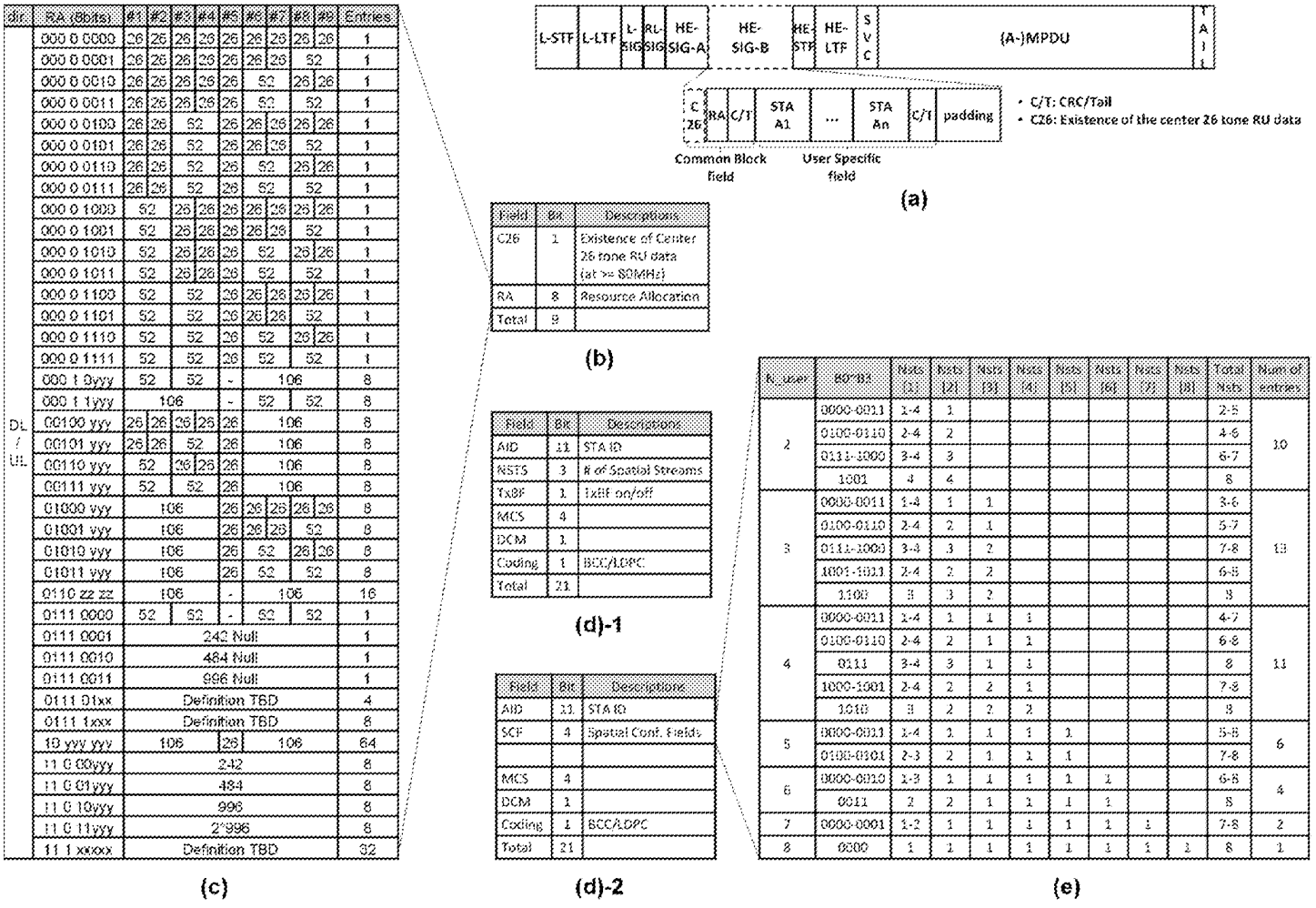
| Field | Bit | Descriptions |
|---|---|---|
| UL/DL | 1 | UL |
| | | |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse | 4 | |
| TXOP Duration | 7 | |
| Bandwidth | 3 | 20/40/80/160/non-contiguous |
| SIG-B MCS | 3 | MCS0~MCS5 |
| CP+LTF Size | 3 | 4x_LTF+0.8us_CP<br>2x_LTF+0.8us_CP<br>2x_LTF+1.6us_CP<br>4x_LTF+3.2us_CP |
| LDPC Extra SYM | 1 | |
| Number of HE-LTF symbols | 3 | 1, 2, 4, 6, 8 |
| SIG-B Compression | 1 | |
| | | |
| SIG-B DCM | 1 | Dual carrier modulation |
| Packet Extension | 3 | 'a'-factor, PE dis-ambiguity |
| Number of HE-SIG-B symbols | 4 | |
| Doppler | 1 | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 52 | |

(b)

| Field | Bit | Descriptions |
|---|---|---|
| | | |
| Format | 1 | SU(x)/Trigger(o) |
| BSS Color | 6 | BSS identification information |
| Spatial Reuse (1~4) | 16 | Per 20 MHz |
| TXOP Duration | 7 | |
| Bandwidth | 2 | 20/40/80/160 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Reserved | 1 | |
| CRC | 4 | |
| Tail | 6 | |
| Total | 43 | |

(c)

*FIG. 14*




| dir. | RA (8bits) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | Entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DL / UL | 000 0 0000 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 0001 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 0010 | 26 | 26 | 26 | 26 | 26 | 52 | | 26 | 26 | 1 |
| | 000 0 0011 | 26 | 26 | 26 | 26 | 26 | 52 | | 52 | | 1 |
| | 000 0 0100 | 26 | 26 | 52 | | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 0101 | 26 | 26 | 52 | | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 0110 | 26 | 26 | 52 | | 26 | 52 | | 26 | 26 | 1 |
| | 000 0 0111 | 26 | 26 | 52 | | 26 | 52 | | 52 | | 1 |
| | 000 0 1000 | 52 | | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 1001 | 52 | | 26 | 26 | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 1010 | 52 | | 26 | 26 | 26 | 52 | | 26 | 26 | 1 |
| | 000 0 1011 | 52 | | 26 | 26 | 26 | 52 | | 52 | | 1 |
| | 000 0 1100 | 52 | | 52 | | 26 | 26 | 26 | 26 | 26 | 1 |
| | 000 0 1101 | 52 | | 52 | | 26 | 26 | 26 | 52 | | 1 |
| | 000 0 1110 | 52 | | 52 | | 26 | 52 | | 26 | 26 | 1 |
| | 000 0 1111 | 52 | | 52 | | 26 | 52 | | 52 | | 1 |
| | 000 1 0yyy | 52 | | 52 | | - | 106 | | | | 8 |
| | 000 1 1yyy | 106 | | | | - | 52 | | 52 | | 8 |
| | 00100 yyy | 26 | 26 | 26 | 26 | 26 | 106 | | | | 8 |
| | 00101 yyy | 26 | 26 | 52 | | 26 | 106 | | | | 8 |
| | 00110 yyy | 52 | | 26 | 26 | 26 | 106 | | | | 8 |
| | 00111 yyy | 52 | | 52 | | 26 | 106 | | | | 8 |
| | 01000 yyy | 106 | | | | 26 | 26 | 26 | 26 | 26 | 8 |
| | 01001 yyy | 106 | | | | 26 | 26 | 26 | 52 | | 8 |
| | 01010 yyy | 106 | | | | 26 | 52 | | 26 | 26 | 8 |
| | 01011 yyy | 106 | | | | 26 | 52 | | 52 | | 8 |
| | 0110 zz zzz | 106 | | | | - | 106 | | | | 16 |
| | 0111 0000 | 52 | | 52 | | - | 52 | | 52 | | 1 |
| | 0111 0001 | 242 Null | | | | | | | | | 1 |
| | 0111 0010 | 484 Null | | | | | | | | | 1 |
| | 0111 0011 | 996 Null | | | | | | | | | 1 |
| | 0111 01xx | Definition TBD | | | | | | | | | 4 |
| | 0111 1xxx | Definition TBD | | | | | | | | | 8 |
| | 10 yyy yyy | 106 | | | | 26 | 106 | | | | 64 |
| | 11 0 00yyy | 242 | | | | | | | | | 8 |
| | 11 0 01yyy | 484 | | | | | | | | | 8 |
| | 11 0 10yyy | 996 | | | | | | | | | 8 |
| | 11 0 11yyy | 2*996 | | | | | | | | | 8 |
| | 11 1 xxxxx | Definition TBD | | | | | | | | | 32 |

(c)

| Field | Bit | Descriptions |
|---|---|---|
| CZ6 | 1 | Existence of Center 26 tone RU data (at >= 80MHz) |
| RA | 8 | Resource Allocation |
| Total | 9 | |

(b)

| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| NSTS | 3 | # of Spatial Streams |
| TxBF | 1 | TxBF on/off |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

(d)-1

| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| SCF | 4 | Spatial Conf. Fields |
| | | |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

(d)-2

| N_user | B0~B3 | Nsts [1] | Nsts [2] | Nsts [3] | Nsts [4] | Nsts [5] | Nsts [6] | Nsts [7] | Nsts [8] | Total Nsts | Num of entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0000-0011 | 1-4 | 1 | | | | | | | 2-5 | 10 |
| | 0100-0110 | 2-4 | 2 | | | | | | | 4-6 | |
| | 0111-1000 | 3-4 | 3 | | | | | | | 6-7 | |
| | 1001 | 4 | 4 | | | | | | | 8 | |
| 3 | 0000-0011 | 1-4 | 1 | 1 | | | | | | 3-6 | 13 |
| | 0100-0110 | 2-4 | 2 | 1 | | | | | | 5-7 | |
| | 0111-1000 | 3-4 | 3 | 2 | | | | | | 7-8 | |
| | 1001-1011 | 2-4 | 2 | 2 | | | | | | 6-8 | |
| | 1100 | 3 | 3 | 2 | | | | | | 8 | |
| 4 | 0000-0011 | 1-4 | 1 | 1 | 1 | | | | | 4-7 | 11 |
| | 0100-0110 | 2-4 | 2 | 1 | 1 | | | | | 6-8 | |
| | 0111 | 3-4 | 3 | 1 | 1 | | | | | 8 | |
| | 1000-1001 | 2-4 | 2 | 2 | 1 | | | | | 7-8 | |
| | 1010 | 3 | 2 | 2 | 2 | | | | | 8 | |
| 5 | 0000-0011 | 1-4 | 1 | 1 | 1 | 1 | | | | 5-8 | 6 |
| | 0100-0101 | 2-3 | 2 | 1 | 1 | 1 | | | | 7-8 | |
| 6 | 0000-0010 | 1-3 | 1 | 1 | 1 | 1 | 1 | | | 6-8 | 4 |
| | 0011 | 2 | 2 | 1 | 1 | 1 | 1 | | | 8 | |
| 7 | 0000-0001 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | | 7-8 | 2 |
| 8 | 0000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | 1 |

(e)

*FIG. 15*

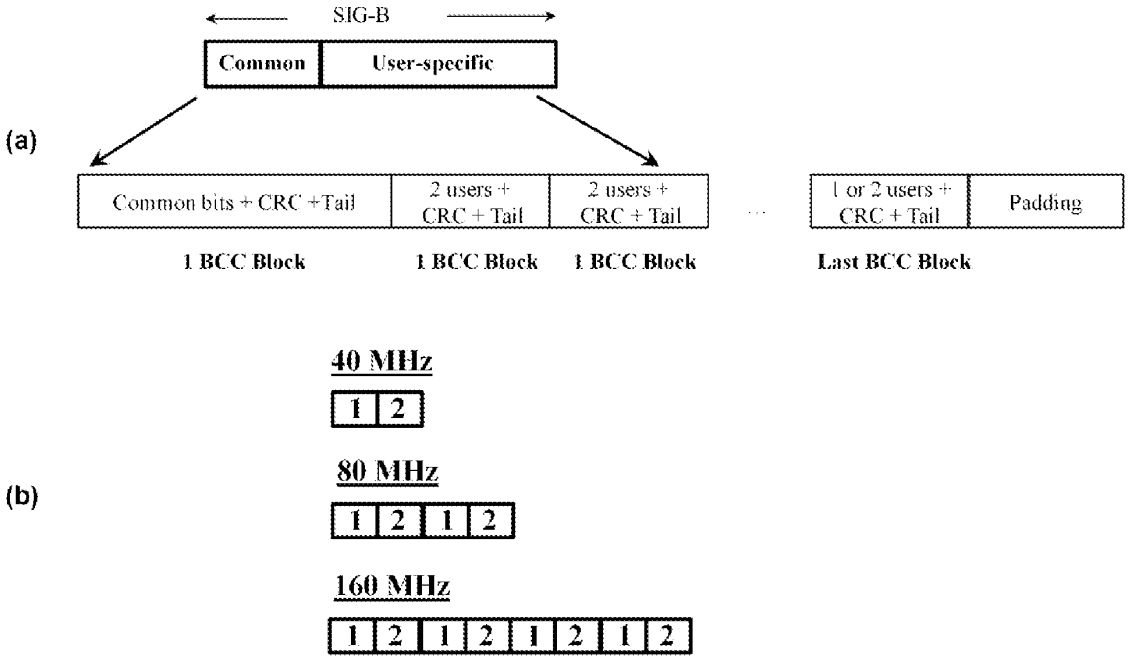

(a)
SIG-B
Common
User-specific
Common bits + CRC +Tail
2 users + CRC + Tail
2 users + CRC + Tail
1 or 2 users + CRC + Tail
Padding
1 BCC Block
1 BCC Block
1 BCC Block
Last BCC Block
(b)
40 MHz
1 2
80 MHz
1 2 1 2
160 MHz
1 2 1 2 1 2 1 2

*FIG. 16*

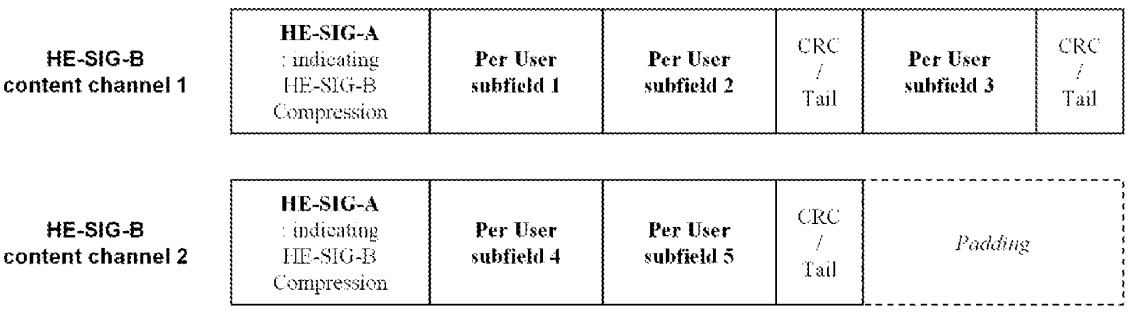

HE-SIG-B content channel 1
HE-SIG-A : indicating HE-SIG-B Compression
Per User subfield 1
Per User subfield 2
CRC / Tail
Per User subfield 3
CRC / Tail
HE-SIG-B content channel 2
HE-SIG-A : indicating HE-SIG-B Compression
Per User subfield 4
Per User subfield 5
CRC / Tail
Padding

*FIG. 17*

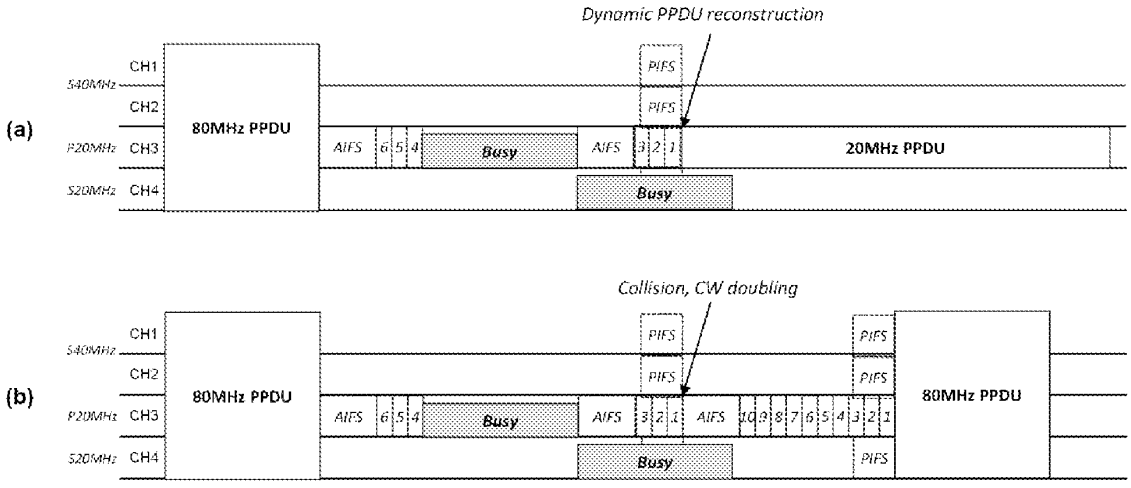

(a)
Dynamic PPDU reconstruction
CH1
CH2
CH3
CH4
540MHz
P20MHz
S20MHz
80MHz PPDU
PIFS
AIFS
Busy
20MHz PPDU
(b)
Collision, CW doubling
80MHz PPDU

*FIG. 18*

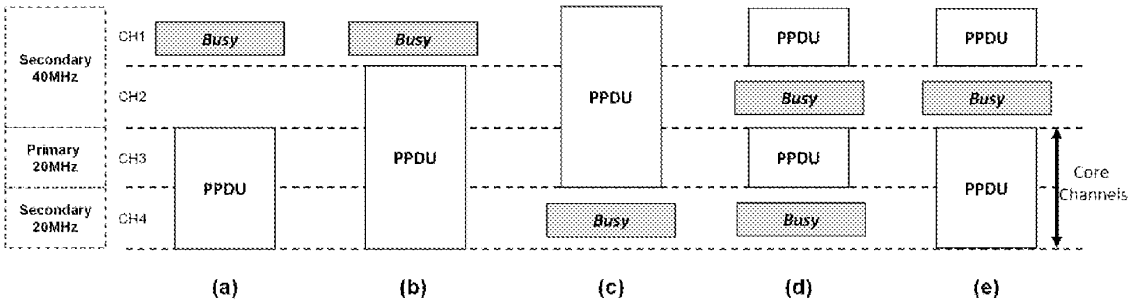

Secondary 40MHz
Primary 20MHz
Secondary 20MHz
CH1
CH2
CH3
CH4
Busy
PPDU
Core Channels
(a)
(b)
(c)
(d)
(e)

*FIG. 19*

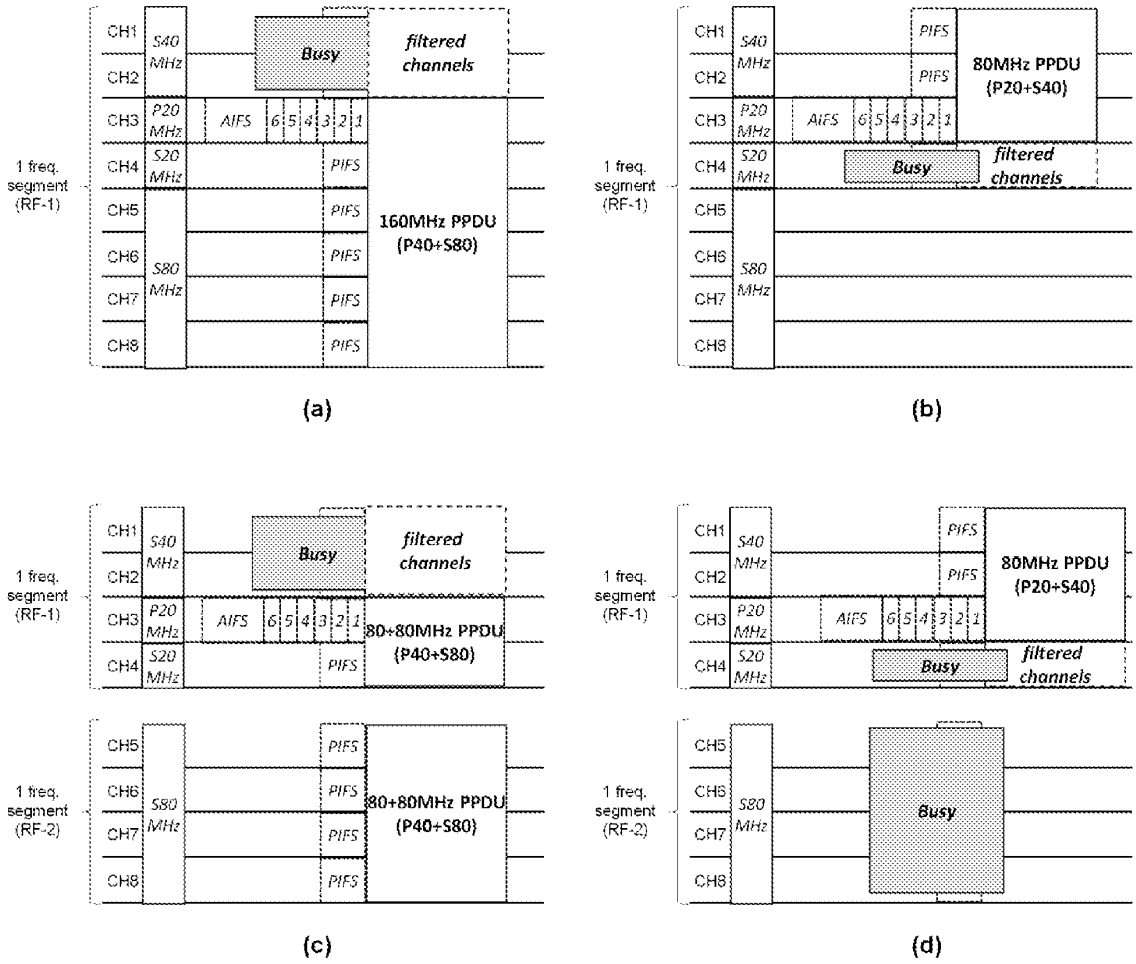
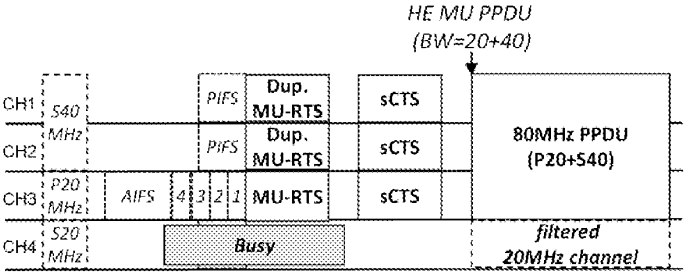
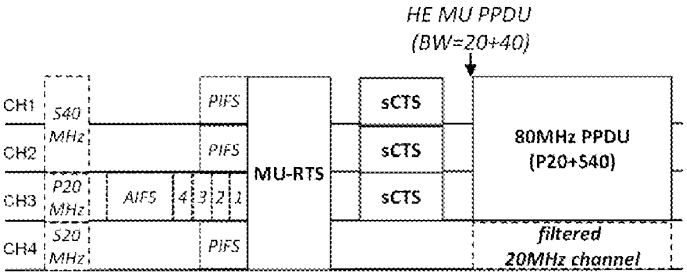

1 freq. segment (RF-1)
CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH8
S40 MHz
P20 MHz
S20 MHz
S80 MHz
Busy
filtered channels
AIFS
6 5 4 3 2 1
PIFS
160MHz PPDU (P40+S80)
80MHz PPDU (P20+S40)
80+80MHz PPDU (P40+S80)
1 freq. segment (RF-2)
(a)
(b)
(c)
(d)

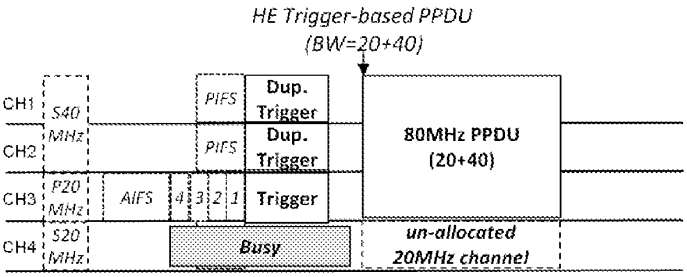
*FIG. 20*


HE MU PPDU
(BW=20+40)
CH1
S40 MHz
PIFS
Dup. MU-RTS
sCTS
CH2
S40 MHz
PIFS
Dup. MU-RTS
sCTS
80MHz PPDU
(P20+S40)
CH3
P20 MHz
AIFS
4
3
2
1
MU-RTS
sCTS
CH4
S20 MHz
Busy
filtered 20MHz channel

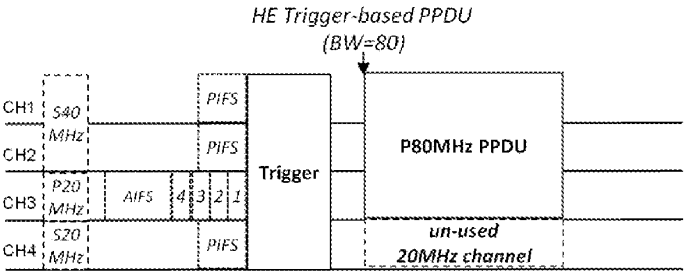
(a)


HE MU PPDU
(BW=20+40)
CH1
S40 MHz
PIFS
sCTS
CH2
S40 MHz
PIFS
MU-RTS
sCTS
80MHz PPDU
(P20+S40)
CH3
P20 MHz
AIFS
4
3
2
1
sCTS
CH4
S20 MHz
PIFS
filtered 20MHz channel

(b)

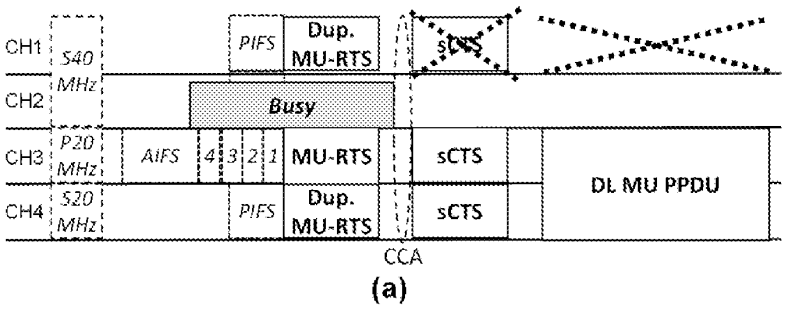

HE Trigger-based PPDU
(BW=20+40)
CH1
S40 MHz
PIFS
Dup. Trigger
80MHz PPDU
(20+40)
CH2
S40 MHz
PIFS
Dup. Trigger
CH3
P20 MHz
AIFS
4
3
2
1
Trigger
CH4
S20 MHz
Busy
un-allocated 20MHz channel

(c)

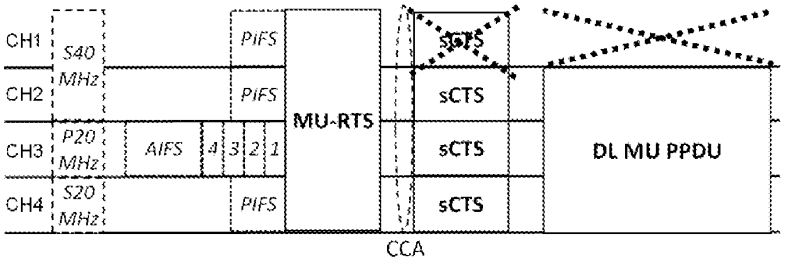

HE Trigger-based PPDU
(BW=80)
CH1
S40 MHz
PIFS
Trigger
P80MHz PPDU
CH2
S40 MHz
PIFS
CH3
P20 MHz
AIFS
4
3
2
1
CH4
S20 MHz
PIFS
un-used 20MHz channel

(d)

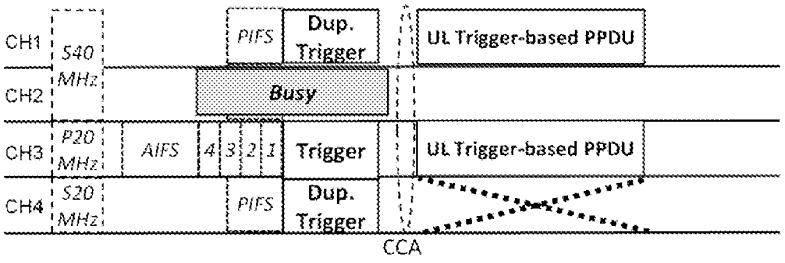
***FIG. 21***


CH1
S40 MHz
PIFS
Dup. MU-RTS
sCTS
CH2
Busy
CH3
P20 MHz
AIFS
4
3
2
1
MU-RTS
sCTS
DL MU PPDU
CH4
S20 MHz
PIFS
Dup. MU-RTS
sCTS
CCA

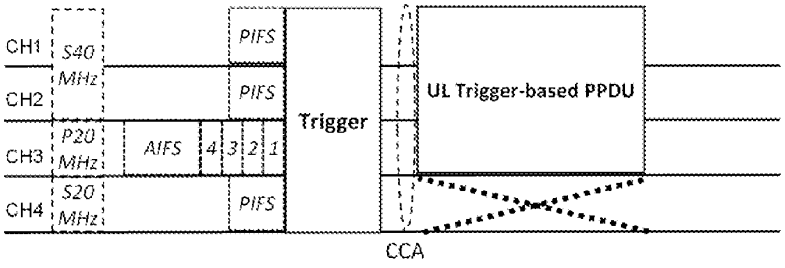
(a)


CH1
S40 MHz
PIFS
MU-RTS
sCTS
CH2
PIFS
sCTS
CH3
P20 MHz
AIFS
4
3
2
1
sCTS
DL MU PPDU
CH4
S20 MHz
PIFS
sCTS
CCA

(b)

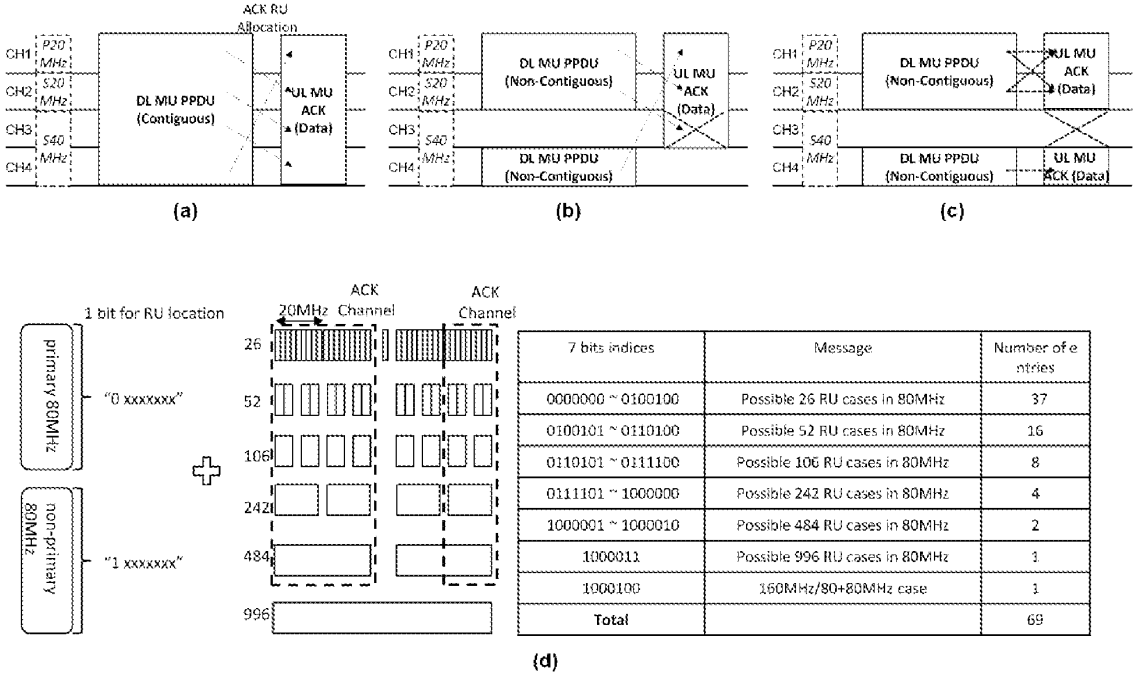

CH1
S40 MHz
PIFS
Dup. Trigger
UL Trigger-based PPDU
CH2
Busy
CH3
P20 MHz
AIFS
4
3
2
1
Trigger
UL Trigger-based PPDU
CH4
S20 MHz
PIFS
Dup. Trigger
CCA

(c)


CH1
S40 MHz
PIFS
CH2
PIFS
Trigger
UL Trigger-based PPDU
CH3
P20 MHz
AIFS
4
3
2
1
CH4
S20 MHz
PIFS
CCA

(d)

*FIG. 22*




| 7 bits indices | Message | Number of entries |
|---|---|---|
| 0000000 ~ 0100100 | Possible 26 RU cases in 80MHz | 37 |
| 0100101 ~ 0110100 | Possible 52 RU cases in 80MHz | 16 |
| 0110101 ~ 0111100 | Possible 106 RU cases in 80MHz | 8 |
| 0111101 ~ 1000000 | Possible 242 RU cases in 80MHz | 4 |
| 1000001 ~ 1000010 | Possible 484 RU cases in 80MHz | 2 |
| 1000011 | Possible 996 RU cases in 80MHz | 1 |
| 1000100 | 160MHz/80+80MHz case | 1 |
| Total | | 69 |

*FIG. 23*

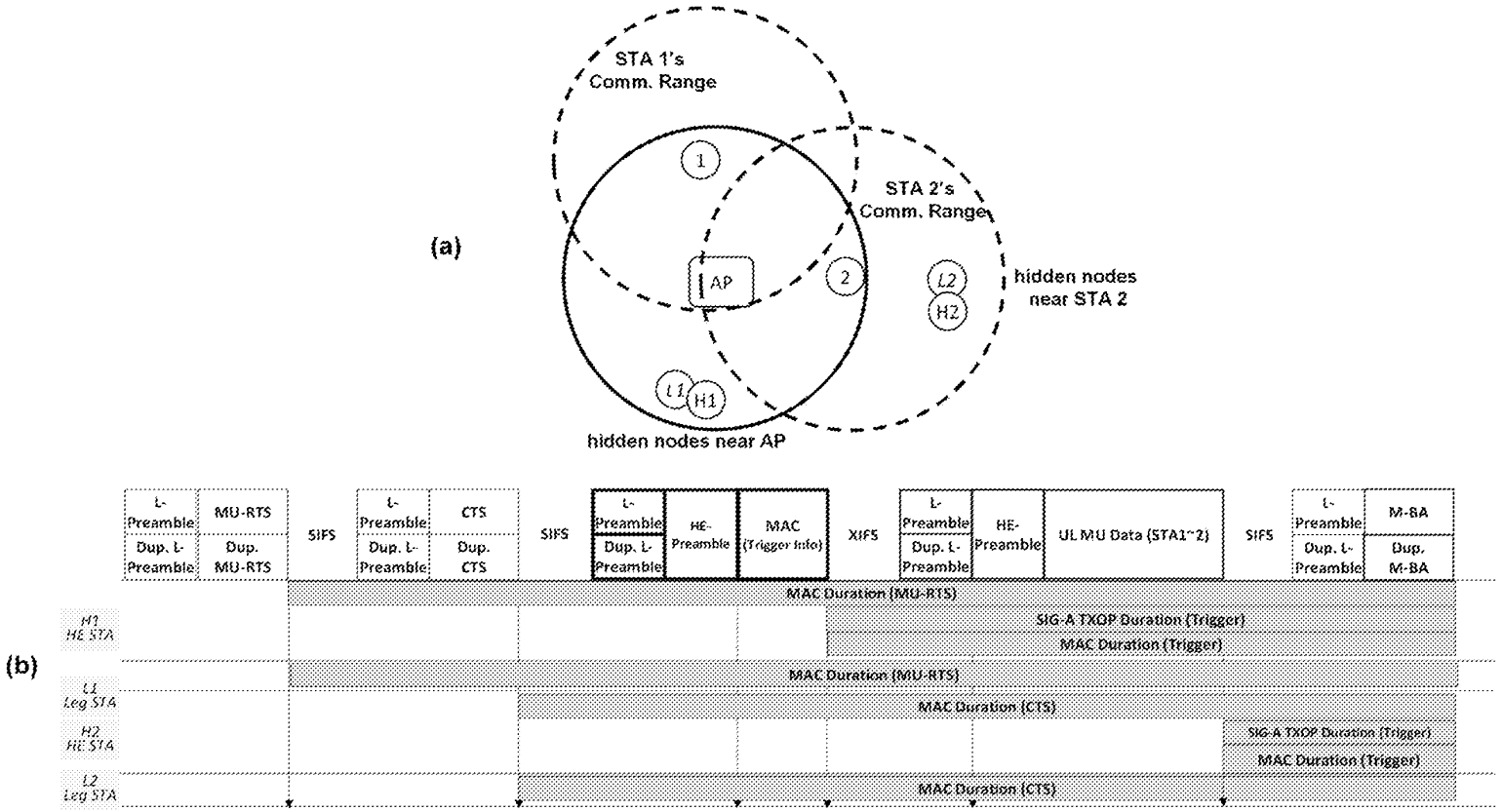

(a)
STA 1's Comm. Range
STA 2's Comm. Range
AP
1
2
L1
H1
L2
H2
hidden nodes near AP
hidden nodes near STA 2
(b)
L-Preamble
MU-RTS
Dup. L-Preamble
Dup. MU-RTS
SIFS
CTS
Dup. CTS
HE-Preamble
MAC (Trigger Info)
XIFS
UL MU Data (STA1~2)
M-BA
Dup. M-BA
MAC Duration (MU-RTS)
SIG-A TXOP Duration (Trigger)
MAC Duration (Trigger)
MAC Duration (CTS)
H1 HE STA
L1 Leg STA
H2 HE STA
L2 Leg STA

*FIG. 24*

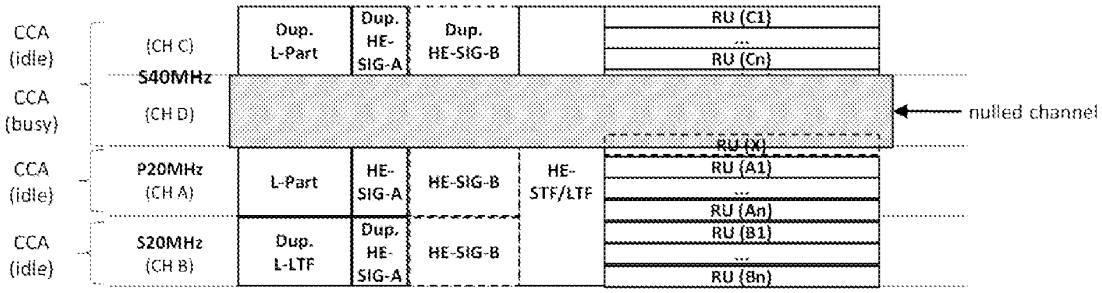

CCA (idle)
(CH C)
Dup. L-Part
Dup. HE-SIG-A
Dup. HE-SIG-B
RU (C1)
...
RU (Cn)
S40MHz
CCA (busy)
(CH D)
nulled channel
RU (X)
P20MHz
CCA (idle)
(CH A)
L-Part
HE-SIG-A
HE-SIG-B
HE-STF/LTF
RU (A1)
...
RU (An)
S20MHz
CCA (idle)
(CH B)
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-B
RU (B1)
...
RU (Bn)

*FIG. 25*

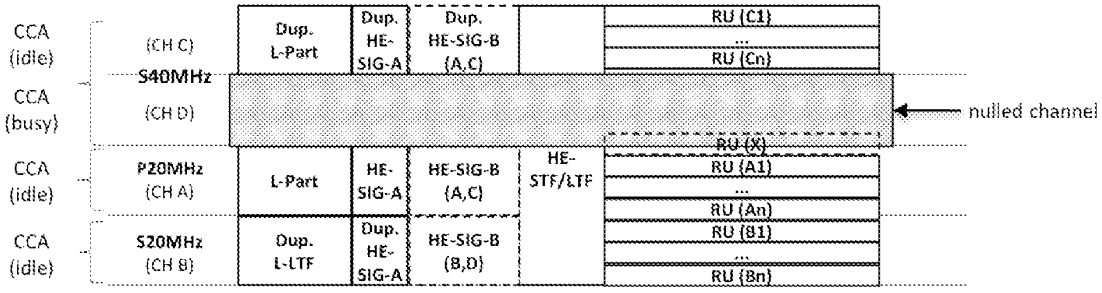
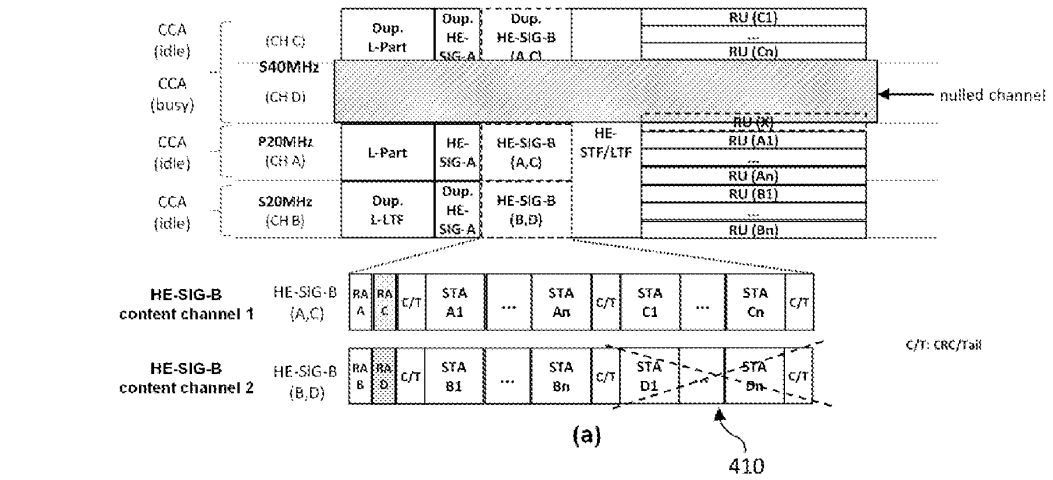

CCA (idle)
(CH C)
Dup. L-Part
Dup. HE-SIG-A
Dup. HE-SIG-B (A,C)
RU (C1)
...
RU (Cn)
S40MHz
CCA (busy)
(CH D)
nulled channel
RU (X)
P20MHz
CCA (idle)
(CH A)
L-Part
HE-SIG-A
HE-SIG-B (A,C)
HE-STF/LTF
RU (A1)
...
RU (An)
S20MHz
CCA (idle)
(CH B)
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-B (B,D)
RU (B1)
...
RU (Bn)

*FIG. 26*




| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ... |
| 11000yyy | 242 | | | | | | | | | 8 |
| TBD | 242 Null | | | | | | | | | 1 |
| TBD | 484 Null | | | | | | | | | 1 |
| TBD | 996 Null | | | | | | | | | 1 |
| | ... | | | | | | | | | |

(b)

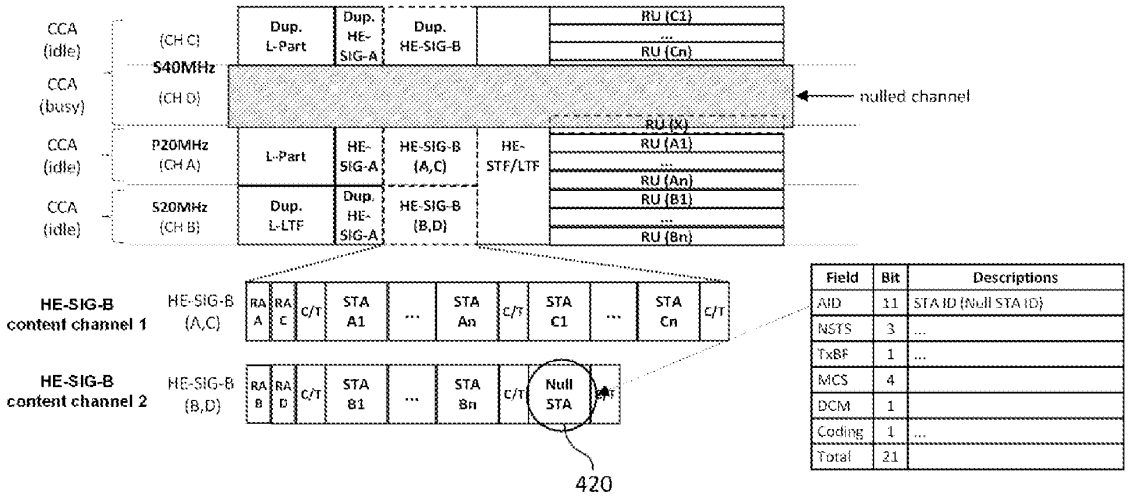
| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ... |
| 11000yyy | 242 | | | | | | | | | 8 |
| TBD | 484 Null | | | | | | | | | 1 |
| TBD | 996 Null | | | | | | | | | 1 |
| | ... | | | | | | | | | |

(c)

| indices | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | # of Entries |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ... |
| 11000yyy | 242 | | | | | | | | | 8 |
| TBD | Null | | | | | | | | | 1 |
| | ... | | | | | | | | | |

(d)

*FIG. 27*




| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID (Null STA ID) |
| NSTS | 3 | ... |
| TxBF | 1 | ... |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | ... |
| Total | 21 | |

*FIG. 28*

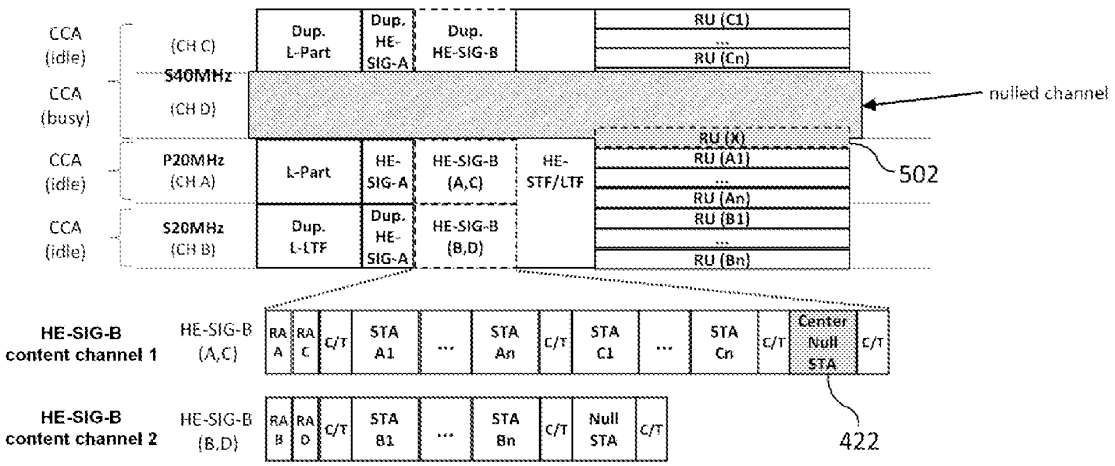

CCA (idle)
(CH C)
Dup. L-Part
Dup. HE-SIG-A
Dup. HE-SIG-B
RU (C1)
...
RU (Cn)
CCA (busy)
S40MHz
(CH D)
nulled channel
RU (X)
CCA (idle)
P20MHz (CH A)
L-Part
HE-SIG-A
HE-SIG-B (A,C)
HE-STF/LTF
RU (A1)
...
RU (An)
502
CCA (idle)
S20MHz (CH B)
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-B (B,D)
RU (B1)
...
RU (Bn)
HE-SIG-B content channel 1
HE-SIG-B (A,C)
RA A
RA C
C/T
STA A1
...
STA An
C/T
STA C1
...
STA Cn
C/T
Center Null STA
C/T
422
HE-SIG-B content channel 2
HE-SIG-B (B,D)
RA B
RA D
C/T
STA B1
...
STA Bn
C/T
Null STA
C/T

*FIG. 29*

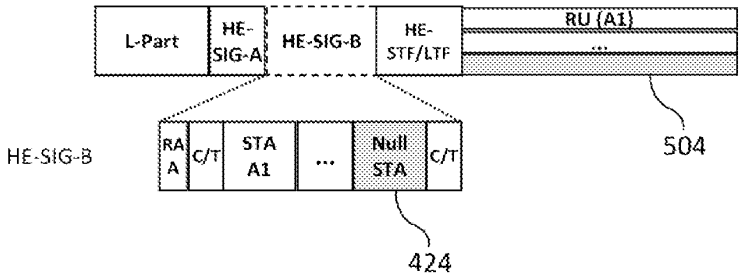

L-Part
HE-SIG-A
HE-SIG-B
HE-STF/LTF
RU (A1)
...
504
HE-SIG-B
RA A
C/T
STA A1
...
Null STA
C/T
424

*FIG. 30*

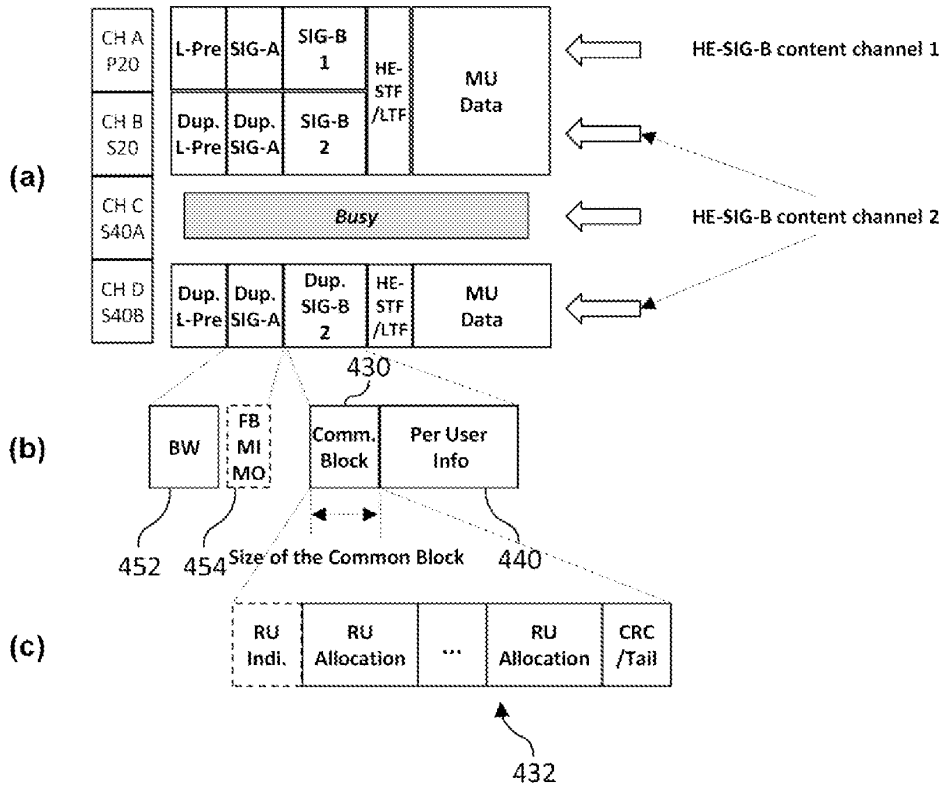

(a)
CH A P20
CH B S20
CH C S40A
CH D S40B
L-Pre
SIG-A
SIG-B 1
HE-STF /LTF
MU Data
Dup. L-Pre
Dup. SIG-A
SIG-B 2
Busy
HE-SIG-B content channel 1
HE-SIG-B content channel 2
430
(b)
BW
FB MI MO
Comm. Block
Per User Info
452
454
Size of the Common Block
440
(c)
RU Indi.
RU Allocation
...
CRC /Tail
432

*FIG. 31*

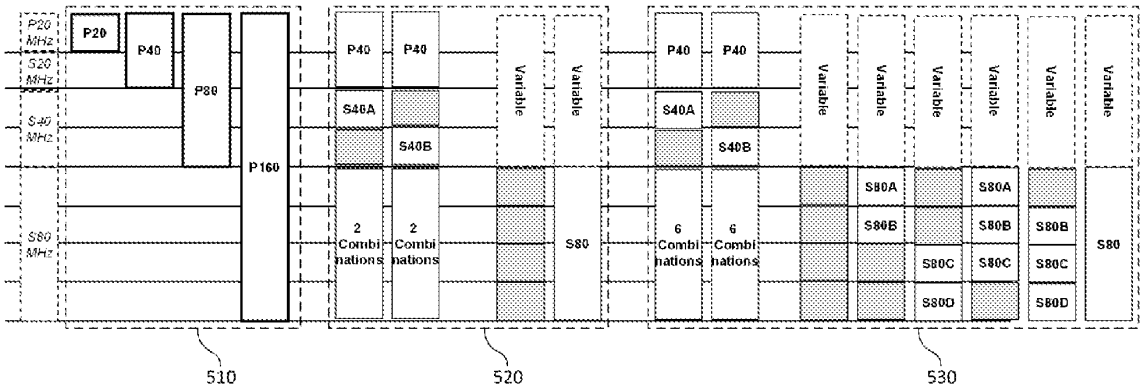

P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
P80
P160
S40A
S40B
2 Combinations
6 Combinations
Variable
S80
S80A
S80B
S80C
S80D
510
520
530

*FIG. 32*

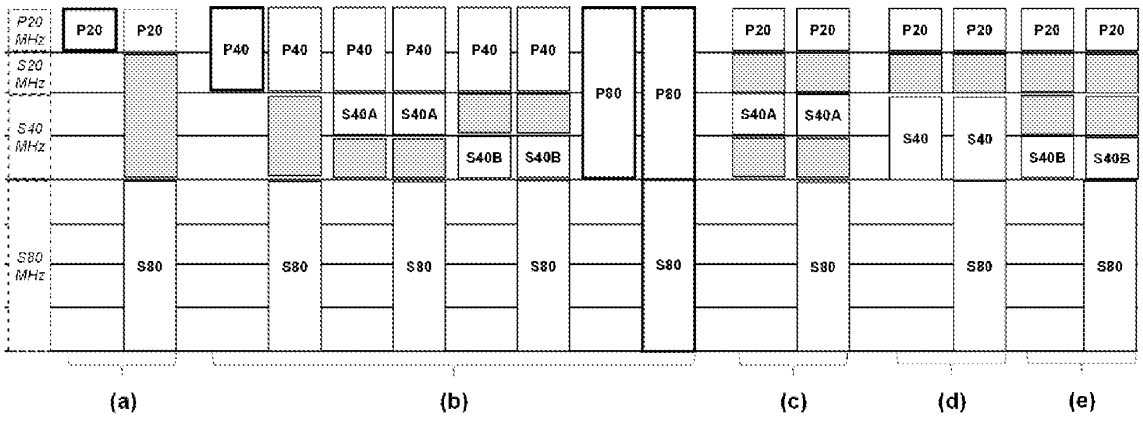

P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
S40A
S40B
P80
S40
S80
(a)
(b)
(c)
(d)
(e)

*FIG. 33*

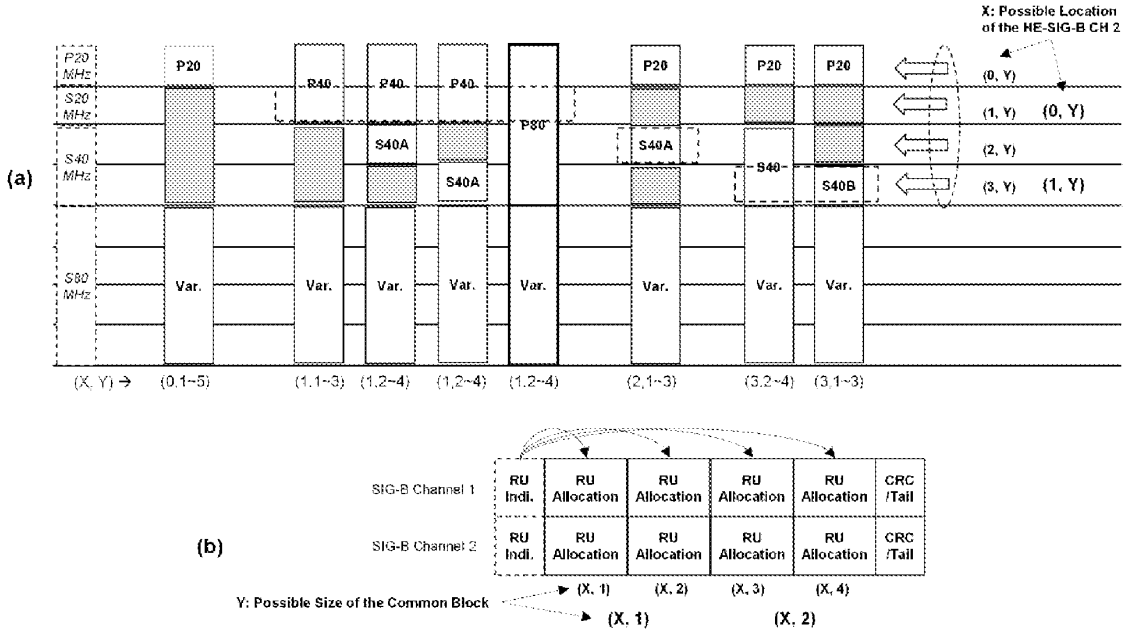

X: Possible Location of the HE-SIG-B CH 2
(a)
P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
S40A
S40B
P80
Var.
(0, Y)
(1, Y)
(2, Y)
(3, Y)
(X, Y) →
(0,1~5)
(1,1~3)
(1,2~4)
(1,2~4)
(1,2~4)
(2,1~3)
(3,2~4)
(3,1~3)
(b)
SIG-B Channel 1
SIG-B Channel 2
RU Indi.
RU Allocation
CRC /Tail
Y: Possible Size of the Common Block
(X, 1)
(X, 2)
(X, 3)
(X, 4)

*FIG. 34*

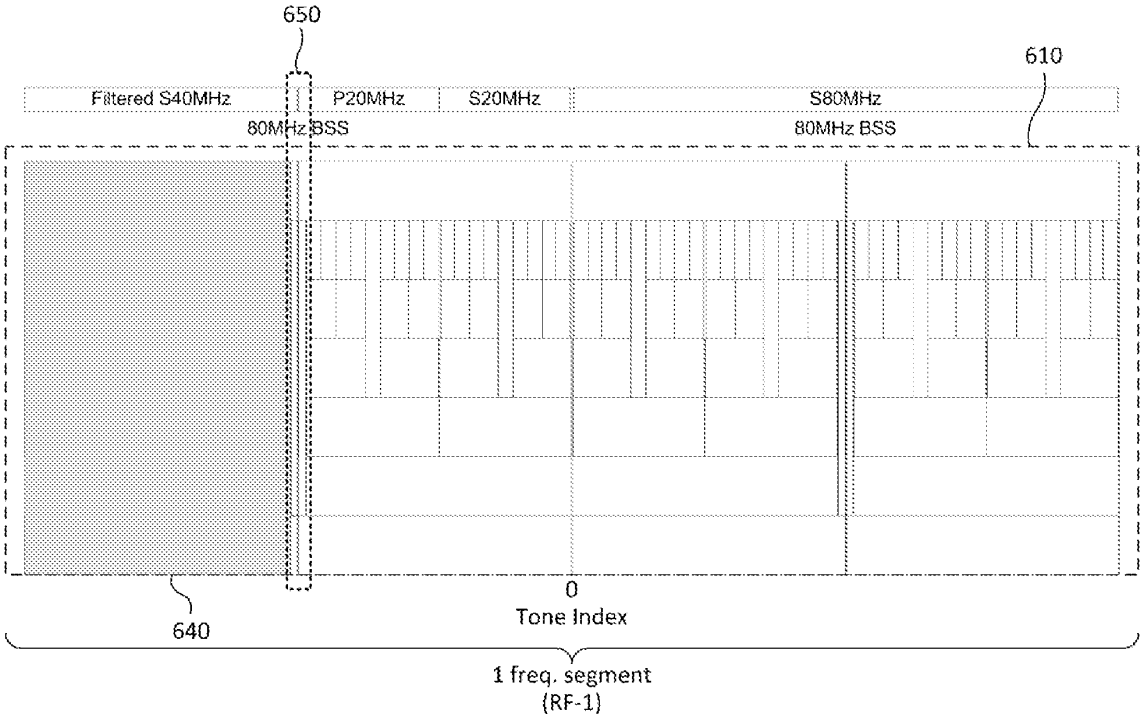

650
610
Filtered S40MHz
P20MHz
S20MHz
S80MHz
80MHz BSS
80MHz BSS
640
0
Tone Index
1 freq. segment
(RF-1)

*FIG. 35*

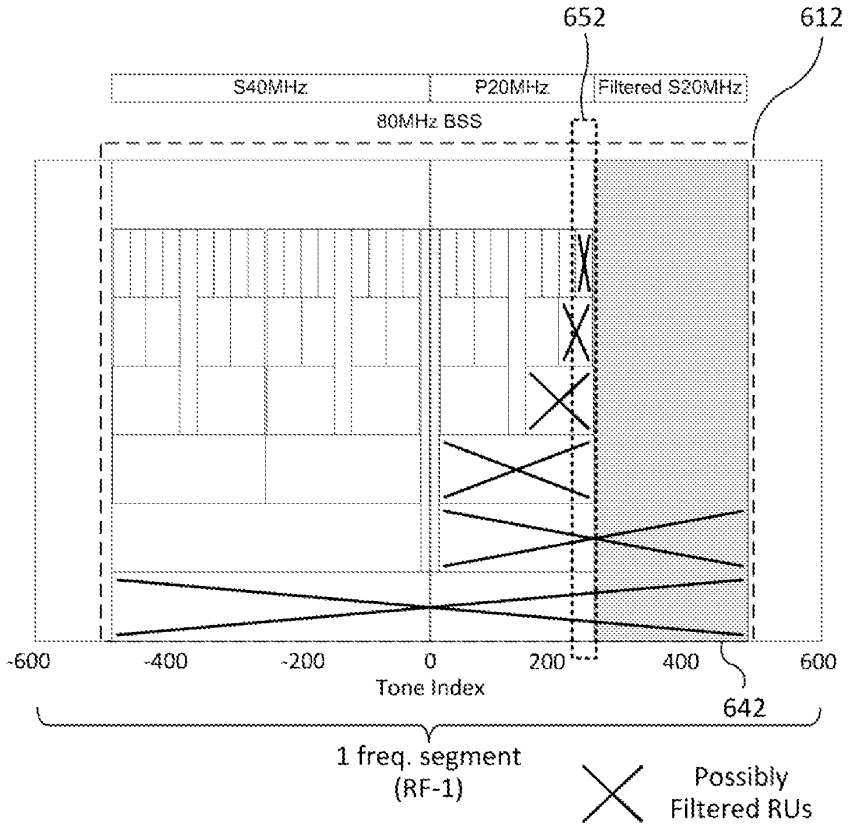

652
612
S40MHz
P20MHz
Filtered S20MHz
80MHz BSS
-600
-400
-200
0
200
400
600
Tone Index
642
1 freq. segment
(RF-1)
Possibly
Filtered RUs

*FIG. 36*

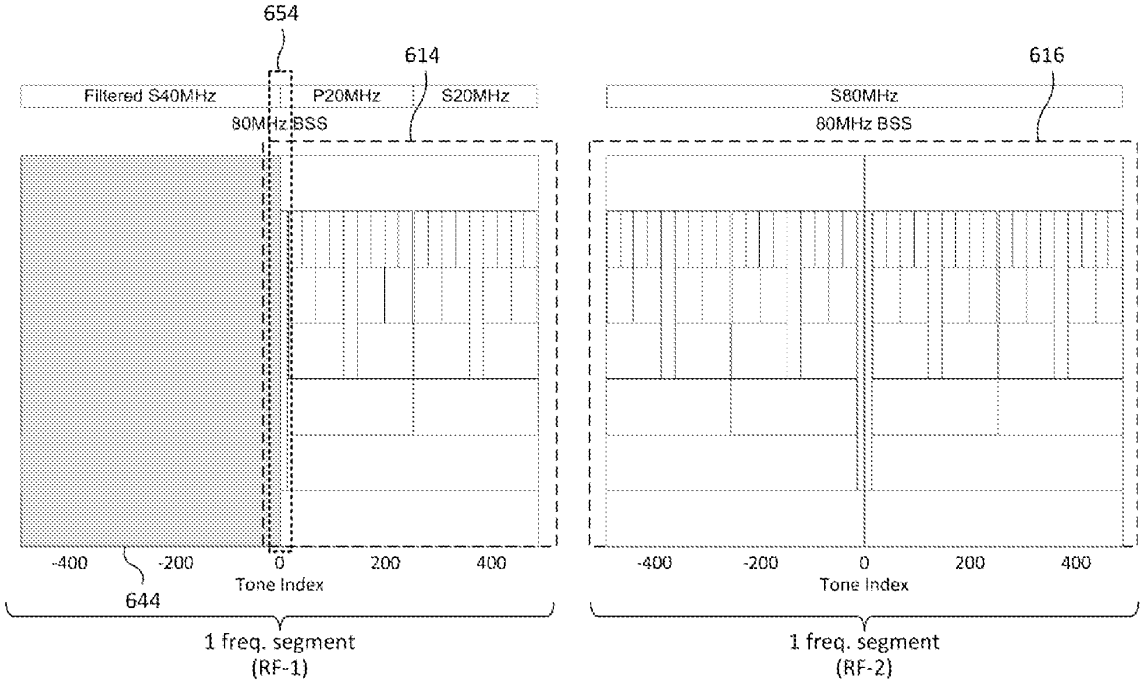

654
614
616
Filtered S40MHz
P20MHz
S20MHz
80MHz BSS
S80MHz
80MHz BSS
-400
-200
0
200
400
Tone Index
644
1 freq. segment
(RF-1)
1 freq. segment
(RF-2)

*FIG. 37*

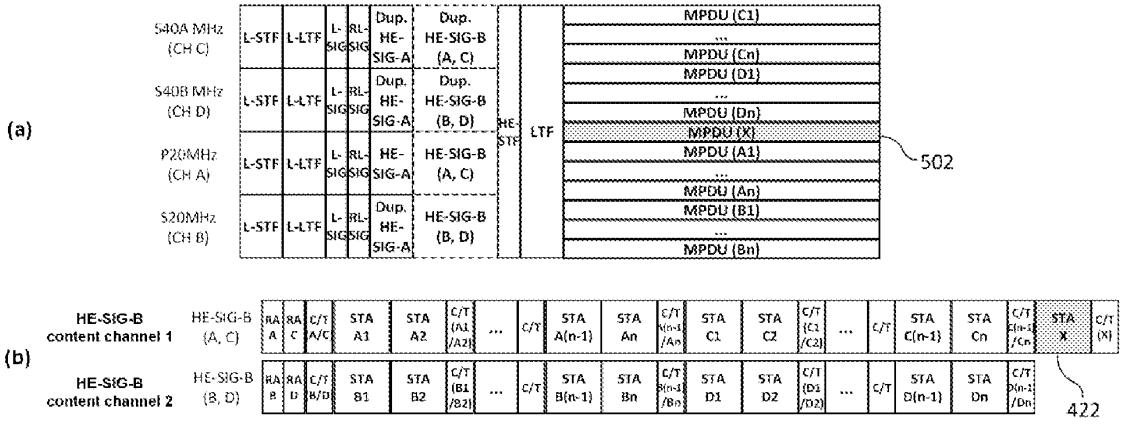

(a)
S40A MHz (CH C)
S40B MHz (CH D)
P20MHz (CH A)
S20MHz (CH B)
L-STF
L-LTF
L-SIG
RL-SIG
Dup. HE-SIG-A
HE-SIG-A
Dup. HE-SIG-B (A, C)
Dup. HE-SIG-B (B, D)
HE-SIG-B (A, C)
HE-SIG-B (B, D)
HE-STF
LTF
MPDU (C1)
MPDU (Cn)
MPDU (D1)
MPDU (Dn)
MPDU (X)
MPDU (A1)
MPDU (An)
MPDU (B1)
MPDU (Bn)
502
(b)
HE-SIG-B content channel 1
HE-SIG-B (A, C)
HE-SIG-B content channel 2
HE-SIG-B (B, D)
RA A
RA C
C/T A/C
STA A1
STA A2
C/T (A1 /A2)
STA A(n-1)
STA An
C/T A(n-1) /An
STA C1
STA C2
C/T (C1 /C2)
STA C(n-1)
STA Cn
C/T C(n-1) /Cn
STA X
C/T (X)
RA B
RA D
C/T B/D
STA B1
STA B2
C/T (B1 /B2)
STA B(n-1)
STA Bn
C/T B(n-1) /Bn
STA D1
STA D2
C/T (D1 /D2)
STA D(n-1)
STA Dn
C/T D(n-1) /Dn
422

*FIG. 38*

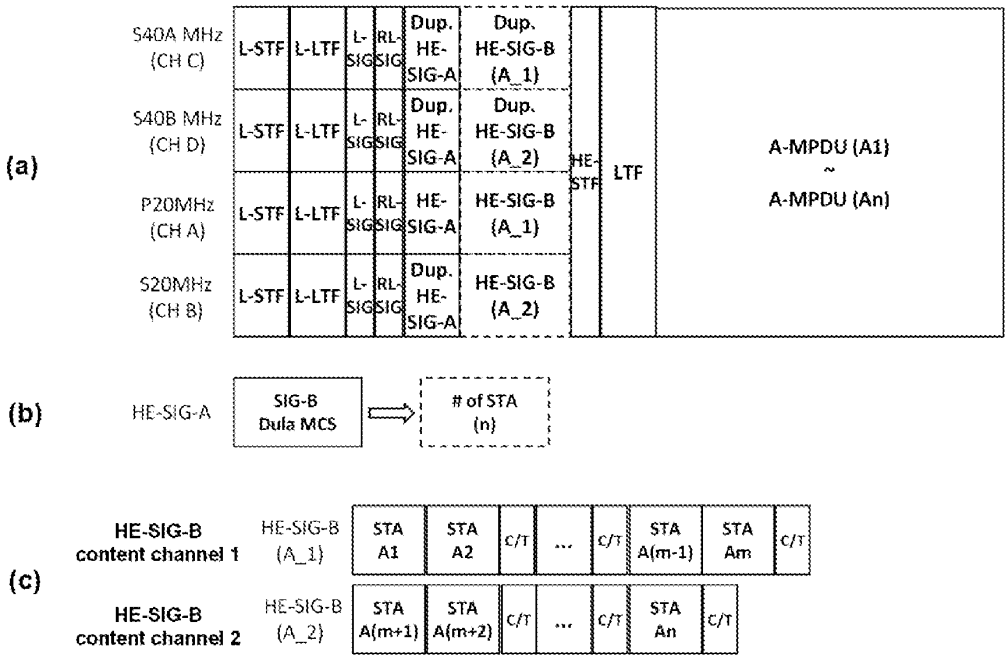
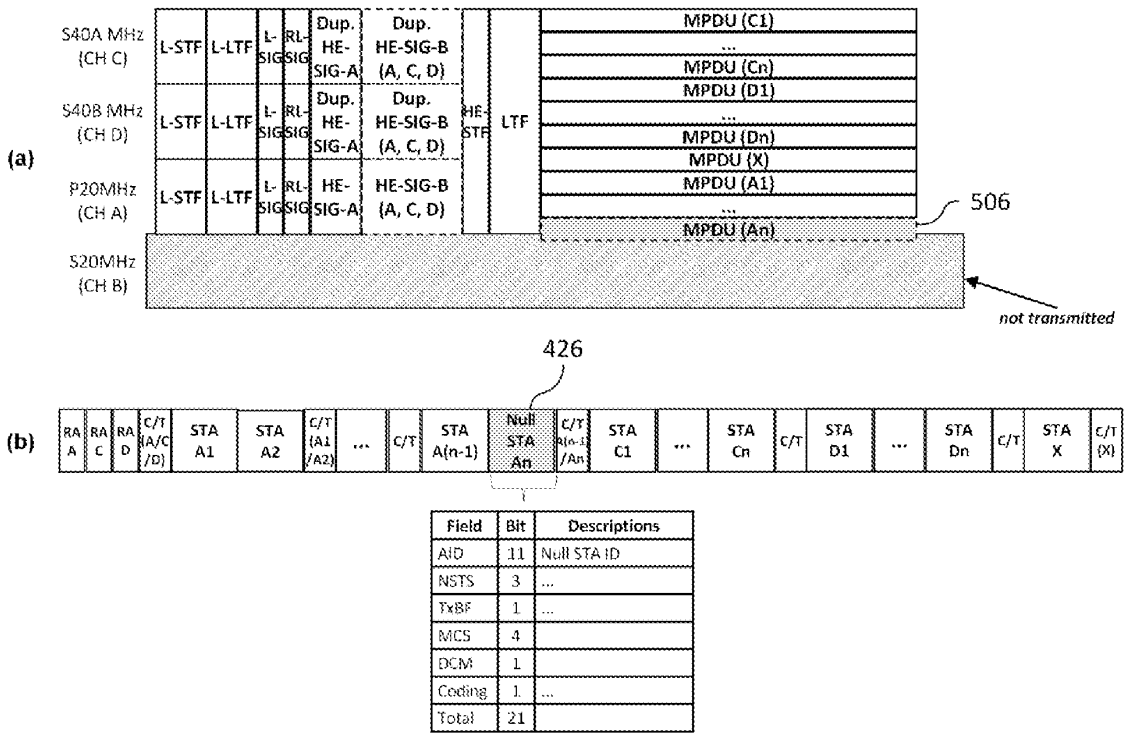

(a)
S40A MHz (CH C)
S40B MHz (CH D)
P20MHz (CH A)
S20MHz (CH B)
L-STF
L-LTF
L-SIG
RL-SIG
Dup. HE-SIG-A
HE-SIG-A
Dup. HE-SIG-B (A_1)
Dup. HE-SIG-B (A_2)
HE-SIG-B (A_1)
HE-SIG-B (A_2)
HE-STF
LTF
A-MPDU (A1) ~ A-MPDU (An)
(b)
HE-SIG-A
SIG-B Dula MCS
# of STA (n)
(c)
HE-SIG-B content channel 1
HE-SIG-B (A_1)
HE-SIG-B content channel 2
HE-SIG-B (A_2)
STA A1
STA A2
C/T
...
STA A(m-1)
STA Am
STA A(m+1)
STA A(m+2)
STA An

*FIG. 39*




| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | Null STA ID |
| NSTS | 3 | ... |
| TxBF | 1 | ... |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | ... |
| Total | 21 | |

*FIG. 40*

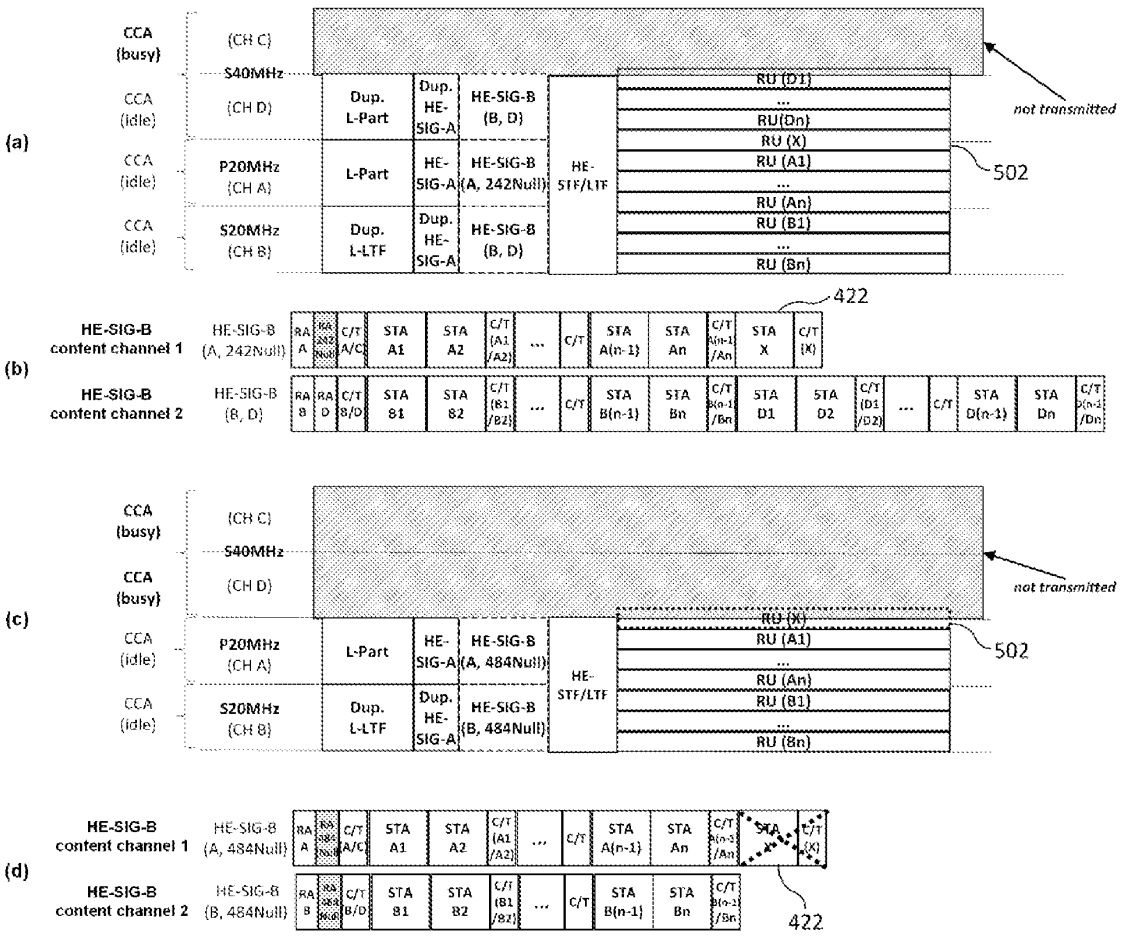

(a)
CCA (busy)
(CH C)
S40MHz
CCA (idle)
(CH D)
P20MHz (CH A)
S20MHz (CH B)
Dup. L-Part
L-Part
Dup. L-LTF
HE-SIG-A
HE-SIG-B (B, D)
HE-SIG-B (A, 242Null)
HE-STF/LTF
RU (D1)
RU(Dn)
RU (X)
RU (A1)
RU (An)
RU (B1)
RU (Bn)
not transmitted
502
(b)
422
HE-SIG-B content channel 1
HE-SIG-B (A, 242Null)
HE-SIG-B content channel 2
HE-SIG-B (B, D)
RA A
RA B
RA D
C/T A/C
C/T B/D
STA A1
STA A2
STA B1
STA B2
STA An
STA Bn
STA X
STA D1
STA D2
STA Dn
(c)
HE-SIG-B (A, 484Null)
HE-SIG-B (B, 484Null)
(d)

*FIG. 41*

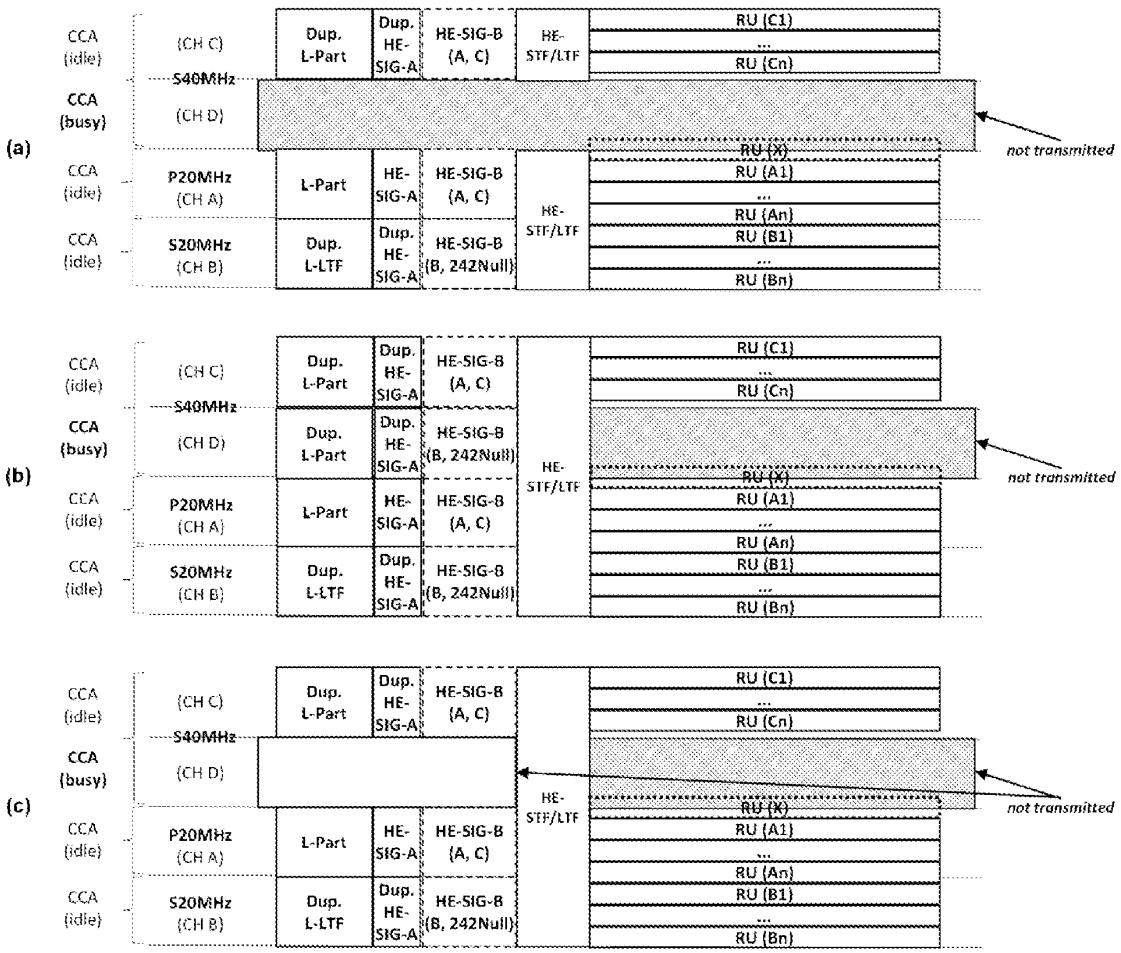
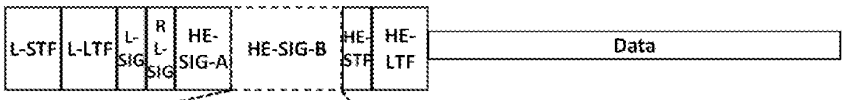
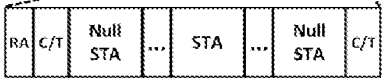

(a)
CCA (idle)
(CH C)
Dup. L-Part
Dup. HE-SIG-A
HE-SIG-B (A, C)
HE-STF/LTF
RU (C1)
...
RU (Cn)
S40MHz
CCA (busy)
(CH D)
RU (X)
not transmitted
CCA (idle)
P20MHz (CH A)
L-Part
HE-SIG-A
HE-SIG-B (A, C)
RU (A1)
...
RU (An)
CCA (idle)
S20MHz (CH B)
Dup. L-LTF
Dup. HE-SIG-A
HE-SIG-B (B, 242Null)
RU (B1)
...
RU (Bn)
(b)
HE-SIG-B (B, 242Null)
(c)

*FIG. 42*

(a)




(b)



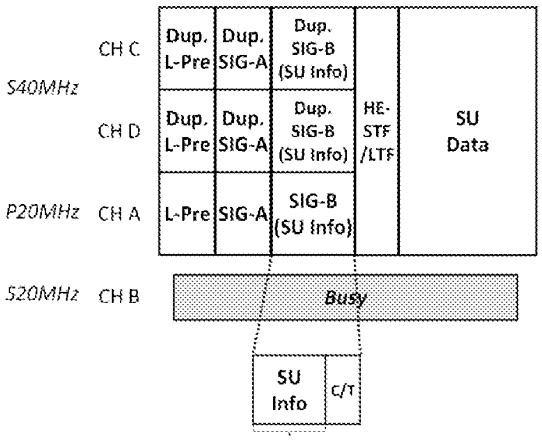

(c)

| direction | RA (8bits) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | Entries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DL | others | X | X | X | X | X | X | X | X | X | X |
| UL | TBD | 26 | - | - | - | - | - | - | - | - | 1 |
| | TBD | - | 26 | - | - | - | - | - | - | - | 1 |
| | TBD | - | - | 26 | - | - | - | - | - | - | 1 |
| | TBD | - | - | - | 26 | - | - | - | - | - | 1 |
| | TBD | - | - | - | - | 26 | - | - | - | - | 1 |
| | TBD | - | - | - | - | - | 26 | - | - | - | 1 |
| | TBD | - | - | - | - | - | - | 26 | - | - | 1 |
| | TBD | - | - | - | - | - | - | - | 26 | - | 1 |
| | TBD | - | - | - | - | - | - | - | - | 26 | 1 |
| | TBD | 52 | | - | | - | - | | - | | 1 |
| | TBD | - | | 52 | | - | - | | - | | 1 |
| | TBD | - | | - | | - | 52 | | - | | 1 |
| | TBD | - | | - | | - | - | | 52 | | 1 |
| | TBD | 106 | | | | - | - | | | | 1 |
| | TBD | - | | | | - | 106 | | | | 1 |

(d)

| Field | Bit | Descriptions |
|---|---|---|
| | | |
| SIG-B Compression | 1 | DL HE MU PPDU case<br>- "0" refer RA field in SIG-B<br>- "1" MU-MIMO user specific info<br><br>UL HE MU PPDU case<br>- "0" refer RA field in SIG-B<br>- "1" OFDMA user specific info |
| | | |

*FIG. 43*




| Field | Bit | Descriptions |
|---|---|---|
| AID | 11 | STA ID |
| NSTS | 3 | # of Spatial Streams |
| TxBF | 1 | TxBF on/off |
| MCS | 4 | |
| DCM | 1 | |
| Coding | 1 | BCC/LDPC |
| Total | 21 | |

user specific information

*FIG. 44*

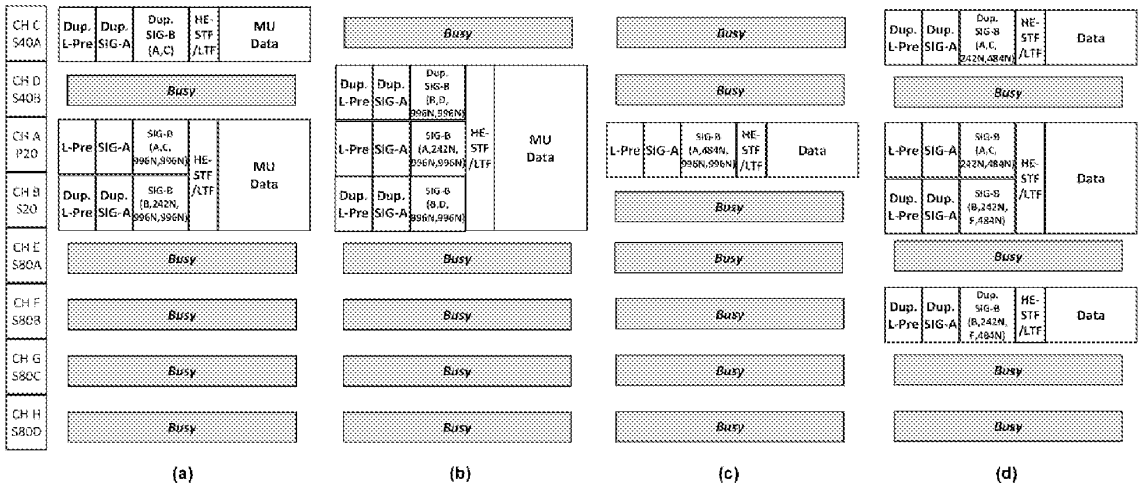



*FIG. 45*

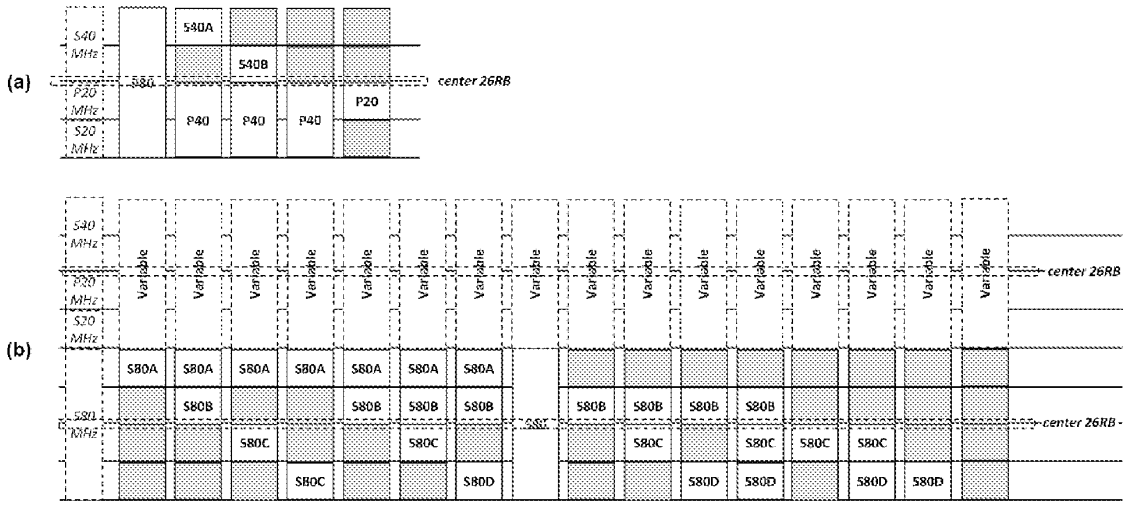

(a)
S40 MHz
P20 MHz
S20 MHz
S80
S40A
S40B
P40
P40
P40
P20
center 26RB
(b)
S40 MHz
P20 MHz
S20 MHz
S80 MHz
Variable
S80A
S80B
S80C
S80D
center 26RB
center 26RB

*FIG. 46*

**NOTE: 37 CFR 1.63(c) states, "A person may not execute an oath or declaration unless the person has reviewed and understands the contents of the application, including the claims and is aware of the duty to disclose to the Office all information known to be material to patentability as defined in § 1.56."**

## DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| | |
|---|---|
| **Title of Invention** | WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL |

As the below named inventor, I hereby declare that:

This declaration is directed to:

☒ The attached application, or

☐ United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

### WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR (1)

Inventor: Juhyung SON Date (Optional): June 20 2011

Signature: _____

LEGAL NAME OF INVENTOR (2)

Inventor: Jinsam KWAK Date (Optional): June 11 2011

Signature: _____

LEGAL NAME OF INVENTOR (3)

Inventor: Geonjung KO Date (Optional): Jun 20 2018

Signature: [signature]

LEGAL NAME OF INVENTOR (4)

Inventor: Woojin AHN Date (Optional): June. 20. 2018

Signature: [signature]

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

PTO/SB/80 (11-08)
Approved for use through 11/30/2020. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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# POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

*OR*

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

| Name | Registration Number | Name | Registration Number |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

*OR*

| | | | |
|---|---|---|---|
| ☐ Firm or Individual Name | | | |
| Address | | | |
| City | | State | Zip |
| Country | | | |
| Telephone | | Email | |

Assignee Name and Address:

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.
5F 216 Hwangsaeul-ro Bundang-gu
Seongnam-si, Gyeonggi-do, 13595 Republic of Korea

**A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.**

**SIGNATURE of Assignee of Record**

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

| | | | |
|---|---|---|---|
| Signature | | Date | Nov. 22, 2019 |
| Name | JIN SAM KWAK | Telephone | 82-10-8623 |
| Title | CEO | | |

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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# POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

*OR*

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

| Name | Registration Number | Name | Registration Number |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

*OR*

| | | | |
|---|---|---|---|
| ☐ Firm or Individual Name | | | |
| Address | | | |
| City | | State | Zip |
| Country | | | |
| Telephone | | Email | |

Assignee Name and Address:

SK TELECOM CO., LTD.
65, Eulji-ro, Jung-gu
Seoul 04539 Republic of Korea

**A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.**

**SIGNATURE of Assignee of Record**

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

| | | | |
|---|---|---|---|
| Signature | [signature] | Date | Nov. 21, 2019 |
| Name | Bum Soo Shin | Telephone | 82-2-6100-7465 |
| Title | Director of IPR | | |

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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# STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., a INSTITUTE

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   SK TELECOM CO., LTD.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 046185, Frame 0366, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.



This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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## STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

| | |
|---|---|
| /Young Seok Koo 76,255/ | May 5, 2020 |
| Signature | Date |
| YOUNG SEOK KOO | 76,255 |
| Printed or Typed Name | Title or Registration Number |

[Page 2 of 2]

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/96 (08-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

# STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL

SK TELECOM CO., LTD., a CORPORATION

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 046185, Frame 0366, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.



This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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## STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

| | |
|---|---|
| /Young Seok Koo 76,255/ | May 5, 2020 |
| Signature | Date |
| YOUNG SEOK KOO | 76,255 |
| Printed or Typed Name | Title or Registration Number |

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD. | Examiner: Not Yet Assigned |
| Serial No.: Not Yet Assigned | Art Unit: N/A |
| Filing or 371 (c) Date: Concurrently Herewith | Conf. No.: N/A |
| For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL, WHICH USE DISCONTINUOUS CHANNEL" | Our Ref: B-9493CON1 632642-0 |
| Date: May 5, 2020 | Re: ***Information Disclosure Statement*** |

**INFORMATION DISCLOSURE STATEMENT**

**Mail Stop Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

*Timing and Fees*

This IDS is being filed:

[x] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[ ] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

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[ ] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

  [ ] accompanied by the fee set forth in § 1.17(p), or

  [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

  [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

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[ ] After the periods described above, and is accompanied by the fee set forth in § 1.17(p), and is

  [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

  [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

*Items Disclosed*

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

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[x] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

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*Additional Information*

[x] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[x] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

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[ ] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on _____ and therefore are not submitted in this IDS.

[ ] Other:

Respectfully submitted,

/ Young Seok Koo 76,255 /

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