

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:22-cv-00259	DATE FILED 7/13/2022	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT ACER Incorporated
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,531,520	12/27/2016	ATLAS GLOBAL TECHNOLOGIES LLC
2 US 9,763,259	9/12/2017	ATLAS GLOBAL TECHNOLOGIES LLC
3 US 9,825,738	11/21/2017	ATLAS GLOBAL TECHNOLOGIES LLC
4 US 9,848,442	12/19/2017	ATLAS GLOBAL TECHNOLOGIES LLC
5 *		* SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Attachment to AO 120 filed 7/13/2022 in Case No. 2:22-cv-00259

Patent Number	Date of Patent	Holder of Patent
US 9,912,513	3/6/2018	Atlas Global Technologies LLC
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Waco Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 6:22-cv-00520	DATE FILED 5/24/2022	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF Atlas Global Technologies LLC		DEFENDANT D-Link Corporation
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,531,520	12/27/2016	ATLAS GLOBAL TECHNOLOGIES LLC
2 9,763,259	9/12/2017	ATLAS GLOBAL TECHNOLOGIES LLC
3 9,825,738	11/21/2017	ATLAS GLOBAL TECHNOLOGIES LLC
4 9,848,442	12/19/2017	ATLAS GLOBAL TECHNOLOGIES LLC
5 *		*SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading		
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Attachment to AO 120 filed 5/24/2022 in Case No. 6:22-cv-00520

Patent Number	Date of Patent	Holder of Patent
US 9,912,513	3/6/2018	Atlas Global Technologies LLC
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

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☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 6:22-cv-00355	DATE FILED 4/4/2022	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT ZYXEL NETWORKS CORPORATION and ZYXEL COMMUNICATIONS CORPORATION
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	ATLAS GLOBAL TECHNOLOGIES LLC
2 US 9,825,738	11/21/2017	ATLAS GLOBAL TECHNOLOGIES LLC
3 US 9,531,520	12/27/2016	ATLAS GLOBAL TECHNOLOGIES LLC
4 US 9,848,442	12/19/2017	ATLAS GLOBAL TECHNOLOGIES LLC
5 *		* SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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Attachment to AO 120 filed 4/4/2022 in Case No. 6:22-cv-00355

Patent Number	Date of Patent	Holder of Patent
US 9,912,513	3/6/2018	Atlas Global Technologies LLC
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

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☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:22-cv-00103	DATE FILED 4/4/2022	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT D-LINK CORPORATION
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,531,520	12/27/2016	ATLAS GLOBAL TECHNOLOGIES LLC
2 9,763,259	9/12/2017	ATLAS GLOBAL TECHNOLOGIES LLC
3 9,825,738	11/21/2017	ATLAS GLOBAL TECHNOLOGIES LLC
4 9,848,442	12/19/2017	ATLAS GLOBAL TECHNOLOGIES LLC
5 *		*SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Attachment to AO 120 filed 4/4/2022 in Case No. 2:22-cv-00103

Patent Number	Date of Patent	Holder of Patent
US 9,912,513	3/6/2018	Atlas Global Technologies LLC
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:21-cv-00304	DATE FILED 8/9/2021	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	Atlas Global Technologies LLC
2 US 9,825,738	11/21/2017	Atlas Global Technologies LLC
3 US 9,848,442	12/19/2017	Atlas Global Technologies LLC
4 US 9,912,513	3/6/2018	Atlas Global Technologies LLC
5 *		*see attached for additional patents

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY	
	☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT All claims asserted by and between all parties as part of the above-captioned case are hereby DISMISSED WITH PREJUDICE with all attorneys' fees, expenses, and costs of court to be borne by the party incurring the same.

CLERK <i>David A. O'Poole</i>	(BY) DEPUTY CLERK nkl	DATE 12/7/21
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Attachment to AO 120 filed 8/25/2021 in Case No. 2:21-cv-00304

Patent Number	Date of Patent	Holder of Patent
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Waco Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 6:21-cv-01217	DATE FILED 11/22/2021	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	ATLAS GLOBAL TECHNOLOGIES LLC
2 US 9,825,738	11/21/2017	ATLAS GLOBAL TECHNOLOGIES LLC
3 US 9,848,442	12/19/2017	ATLAS GLOBAL TECHNOLOGIES LLC
4 US 9,912,513	3/6/2018	ATLAS GLOBAL TECHNOLOGIES LLC
5 *		*SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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	☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
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 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Attachment to AO 120 filed 11/23/2021 in Case No. 6:21-cv-01217

Patent Number	Date of Patent	Holder of Patent
US 9,917,679	3/13/2018	Atlas Global Technologies
US 10,020,919	7/10/2018	Atlas Global Technologies
US 10,153,886	12/11/2018	Atlas Global Technologies
US 10,756,851	8/25/2020	Atlas Global Technologies

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☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2-21-cv-00430	DATE FILED 11/22/2021	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT T-P LINK TECHNOLOGIES CO., LTD., TP-LINK CORPORATION LTD, and TP-LINK INTERNATIONAL LTD.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	Atlas Global Technologies
2 US 9,825,738	11/21/2017	Atlas Global Technologies
3 US 9,912,513	3/6/2018	Atlas Global Technologies
4 US 9,917,679	3/13/2018	Atlas Global Technologies
5 *		*SEE ATTACHED FOR ADDITIONAL PATENTS

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Attachment to AO120 filed 11/23/2021 in Case No. 2-21-cv-00430

Patent Number	Date of Patent	Holder of Patent
US 10,020,919	7/10/2018	Atlas Global Technologies
US 10,756,851	8/25/2020	Atlas Global Technologies
US 9,531,520	12/27/2016	Atlas Global Technologies
US 9,532,187	12/27/2016	Atlas Global Technologies

AO 120 (Rev. 08/10)

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☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:21-cv-00304	DATE FILED 8/9/2021	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	Atlas Global Technologies LLC
2 US 9,825,738	11/21/2017	Atlas Global Technologies LLC
3 US 9,848,442	12/19/2017	Atlas Global Technologies LLC
4 US 9,912,513	3/6/2018	Atlas Global Technologies LLC
5 *		*see attached for additional patents

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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Attachment to AO 120 filed 8/25/2021 in Case No. 2:21-cv-00304

Patent Number	Date of Patent	Holder of Patent
US 9,917,679	3/13/2018	Atlas Global Technologies LLC
US 10,020,919	7/10/2018	Atlas Global Technologies LLC
US 10,153,886	12/11/2018	Atlas Global Technologies LLC
US 10,756,851	8/25/2020	Atlas Global Technologies LLC

AO 120 (Rev. 08/10)

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☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 6:21-cv-00818	DATE FILED 8/9/2021	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF ATLAS GLOBAL TECHNOLOGIES LLC		DEFENDANT SERCOMM CORPORATION
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 9,763,259	9/12/2017	Atlas Global Technologies LLC
2 US 9,825,738	11/21/2017	Atlas Global Technologies LLC
3 US 9,912,513	3/6/2018	Atlas Global Technologies LLC
4 US 9,917,679	3/13/2018	Atlas Global Technologies LLC
5 *		*see attached for additional patents

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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Attachment to AO 120 filed 8/9/2021 in Case No. 6:20-cv-00381

Patent Number	Date of Patent	Holder of Patent
US 10,020,919	7/10/2018	Atlas Global Technologies
US 10,756,851	8/25/2020	Atlas Global Technologies
US 9,531,520	12/27/2016	Atlas Global Technologies



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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE	REQUEST ID
14/931,753	11/03/2015	Yongho SEOK	122247-5022	143527

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 07/15/2021 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

☒ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Thomas J. Lavan/
Name:	Thomas J. Lavan
Registration Number:	58487

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.

**CHANGE OF
CORRESPONDENCE ADDRESS**
*Patent*Address to:
Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patent Number	9917679
Issue Date	2018-03-13
Application Number	14931753
Filing Date	2015-11-03
First Named Inventor	Yongho Seok
Attorney Docket Number	122247-5022

Please change the Correspondence Address for the above-identified patent to:



The address associated with Customer Number:

179786

OR**Firm or
Individual Name****Address****City****State****ZIP****Country****Telephone****Email**

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:



Patentee.



If the Patentee was not the applicant for patent (37 CFR 1.42), then a Statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is enclosed or was filed on _____. See 37 CFR 3.71.



Attorney or agent of record. Registration Number _____.



Patent practitioner acting in a representative capacity whose correspondence address is the correspondence address of record. Notice has been given to the patentee or owner. Registration Number _____.

Signature /Thomas J. Lavan/

Typed or
Printed Name Thomas J. Lavan

Date 2021-06-22

Telephone 303-301-4431

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.



*Total of _____ forms are submitted.

This collection of information is required by 37 CFR 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: Mail Stop Post Issue, 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.

Electronic Acknowledgement Receipt

EFS ID:	43164862
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	157354
Filer:	Thomas John Lavan
Filer Authorized By:	
Attorney Docket Number:	122247-5022
Receipt Date:	02-JUL-2021
Filing Date:	03-NOV-2015
Time Stamp:	17:25:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	373C_9917679_062321.pdf	117931	no	3
			c30f124786613c7c150f6c71cdbfaeдеб4f70be2		

Warnings:

Information:					
2	Change of Address	Change_of_Correspondence_917679_062321.pdf	245832 f6dab77241d260149a7bf8329c3ec0de3630c833	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			363763		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

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: Atlas Global Technologies LLCApplication No./Patent No.: 14/931,753 Filed/Issue Date: 11/03/2015Titled: METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LANAtlas Global Technologies LLC, 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:

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 055517, Frame 0548, 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.

[Page 1 of 2]

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.

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.

/Thomas J. Lavan/

2021-06-22

Signature

Date

Thomas J. Lavan

58487

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:

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.



UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/931,753	11/03/2015	Yongho SEOK	096809-0032

CONFIRMATION NO. 3819

POWER OF ATTORNEY NOTICE



OC000000103172123

31824
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

Date Mailed: 10/19/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/11/2018.

- 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.

/agizaw/



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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/931,753	11/03/2015	Yongho SEOK	122247-5022

CONFIRMATION NO. 3819

POA ACCEPTANCE LETTER



OC000000103172160

157354
Morgan, Lewis & Bockius LLP (OC)
600 Anton Boulevard
Suite 1800
Costa Mesa, CA 92626-7653

Date Mailed: 10/19/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/11/2018.

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.

/agizaw/

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/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	14/931753
Filing Date	November 3, 2015
First Named Inventor	Yongho SEOK
Title	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
Art Unit	2472
Examiner Name	NGUYEN, TOAN D
Attorney Docket Number	122247-5022

SIGNATURE of Applicant or Patent Practitioner

Signature	/Soyeon Pak (Karen) Laub/	Date (Optional)	October 11, 2018
Name	Soyeon Pak (Karen) Laub	Registration Number	39,266
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	NEWRACOM, INC.		

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 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 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.**

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 if 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:

157354

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) 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 patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

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 Customer Number:

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

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

NEWRACOM, 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)

09/13/2018

Name

SoK Kyu Lee

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.

This collection of information is required by 37 CFR 1.131, 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.

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

Electronic Acknowledgement Receipt

EFS ID:	33984386
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Sandy Pham
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	11-OCT-2018
Filing Date:	03-NOV-2015
Time Stamp:	17:03:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	122247-5022_POA.pdf	171271	no	2
			b0ad8b30e073b2ddd491800f4b4db0c7e1ea1e1		

Warnings:

Information:	
Total Files Size (in bytes):	171271
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	03/13/2018	9917679	096809-0032	3819

31824 7590 02/21/2018
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

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 76 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 Data Management (ODM) at (571)-272-4200.

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

Yongho SEOK, Irvine, CA;
NEWRACOM, INC., Irvine, CA;

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.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

31824 7590 02/09/2018
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

EXAMINER

NGUYEN, TOAN D

ART UNIT	PAPER NUMBER
----------	--------------

2472

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

02/09/2018

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):

mweipdocket@mwe.com

<i>Response to Rule 312 Communication</i>	Application No. 14/931,753	Applicant(s) SEOK, YONGHO
	Examiner Hassan Kizou	Art Unit 2472

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

1. ☐ The amendment filed on 30 January 2018 under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

b) ☒ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.

Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/Hassan Kizou/
Supervisory Patent Examiner, Art Unit 2472

Docket No.: 096809-0032

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 31824
Yongho SEOK	:	Confirmation Number: 3819
Application No.: 14/931,753	:	Group Art Unit: 2472
Filed: November 3, 2015	:	Examiner: Toan D. NGUYEN
For: METHOD AND APPARATUS FOR	:	
TRANSMITTING RESPONSE	:	
FRAME BASED ON TYPE IN A	:	
HIGH EFFICIENCY WIRELESS	:	
LAN	:	

Mail Stop – Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. § 1.312

Commissioner:

Prior to the issuance of the above-identified application, please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 5 of this paper.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(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)

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.

31824 7590 10/31/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

TITLE OF INVENTION: METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500 ~~-\$480~~	\$0	\$0	\$500 ~~\$480~~	01/31/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TOAN D	2472	370-329000

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/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form 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.	McDermott Will & Emery LLP 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 has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

NEWRACOM, INC.

IRVINE, CALIFORNIA

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

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 502624 (enclose an extra copy of this form).

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 /SOYEON PAK (KAREN) LAUB/

Date January 30, 2018

Typed or printed name SOYEON PAK (KAREN) LAUB

Registration No. 39,266

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 31824
Yongho SEOK	:	Confirmation Number: 3819
Application No.: 14/931,753	:	Group Art Unit: 2472
Filed: November 3, 2015	:	Examiner: Toan D. NGUYEN
For: METHOD AND APPARATUS FOR	:	
TRANSMITTING RESPONSE	:	
FRAME BASED ON TYPE IN A	:	
HIGH EFFICIENCY WIRELESS	:	
LAN	:	

Mail Stop – Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. § 1.312

Commissioner:

Prior to the issuance of the above-identified application, please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 5 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Previously Presented) A method for transmitting an acknowledgement frame for notifying successful data reception by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

transmitting, to the AP, the acknowledgement frame based on the acknowledgement information at the SIFS time after the downlink frame,

wherein transmitting the acknowledgment frame comprises:

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA, and

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format.

2. (Canceled)

3. (Canceled)

4. (Previously Presented) The method according to claim 1,
wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame.

5. (Previously Presented) The method according to claim 4, wherein a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA.

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Currently Amended) The method according to claim 1, wherein the downlink frame includes downlink data for a plurality of STAs including the STA and the at least one other STA.

10. (Previously Presented) The method according to claim 1, wherein the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA.

11. (Previously Presented) A method for receiving an acknowledgement frame for notifying successful data reception by an access point (AP) from a station (STA) in a wireless local area network, the method comprising:

transmitting, to the STA, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

receiving, from the STA, the acknowledgement frame based on the acknowledgement information at-the SIFS time after the downlink frame,

wherein receiving the acknowledgment frame comprises:

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format, receiving the acknowledgement

frame in the MU format on an allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA, and

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, receiving the acknowledgement frame in SU format.

12. (Canceled)

13. (Canceled)

14. (Previously Presented) The method according to claim 11, wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement frame.

15. (Previously Presented) The method according to claim 14, wherein a same MCS based on the MCS information is applied to the acknowledgement frame by the STA and the at least one other STA.

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Previously Presented) The method according to claim 11, wherein the downlink frame includes downlink data for a plurality of STAs including the STA and the at least one other STA.

20. (Previously Presented) The method according to claim 11, wherein the downlink frame includes block acknowledgement (ACK) requests for a plurality of STAs including the STA and the at least one other STA.

REMARKS

After entry of the foregoing amendments, claims 1, 4, 5, 9-11, 14, 15, 19 and 20 remain pending in the application, of which claims 1 and 11 are the independent claims. Claim 9 is amended herein. Claims 2, 3, 6-8, 12, 13 and 16-18 were previously canceled. The foregoing amendment to claim 9 is made pursuant to 37 C.F.R. § 1.312, and is not believed to affect the allowability of the application. No new matter is believed to have been added by way of the amendments. Accordingly, entry of the amendments set forth herein is respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 502624 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

/Soyeon Pak (Karen) Laub/
Soyeon Pak (Karen) Laub
Registration No. 39,266

4 Park Plaza, Suite 1700
Irvine, CA 92614-2559
Phone: (949) 851-0633 RG:nq
Facsimile: (949) 851-9348
Date: January 30, 2018

**Please recognize our Customer No. 31824 as
our correspondence address.**

Electronic Patent Application Fee Transmittal

Application Number:	14931753			
Filing Date:	03-Nov-2015			
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN			
First Named Inventor/Applicant Name:	Yongho SEOK			
Filer:	Soyeon P. Laub/Nuo Qu			
Attorney Docket Number:	096809-0032			
Filed as Small 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	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				480

Electronic Acknowledgement Receipt

EFS ID:	31644178
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Nuo Qu
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	30-JAN-2018
Filing Date:	03-NOV-2015
Time Stamp:	18:48:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 480
RAM confirmation Number	013118INTEFSW00005608502624
Deposit Account	502624
Authorized User	Nuo Qu

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

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)	096809-0032_IssueFee.pdf	120634	no	1
			f049b522f453a754856d76a91e152af9fd8c6cf2		

Warnings:

Information:

2	Post Allowance Communication - Incoming	096809-0032_312Amendment.pdf	84178	no	5
			74a78be95efa4b7ce27a5c6a6f8b3980b0993834		

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30910	no	2
			fba763ee68567227349bbabd077b896bd38b84b3		

Warnings:

Information:

Total Files Size (in bytes):	235722
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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.



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

31824 7590 10/31/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

EXAMINER

NGUYEN, TOAN D

ART UNIT

PAPER NUMBER

2472

DATE MAILED: 10/31/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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14/931,753

11/03/2015

Yongho SEOK

096809-0032

3819

TITLE OF INVENTION: METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional

SMALL

\$480

\$0

\$0

\$480

01/31/2018

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 and an extra copy of the form should be submitted. 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), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(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)

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.

31824 7590 10/31/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

TITLE OF INVENTION: METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	01/31/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TOAN D	2472	370-329000

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/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form 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, 1 _____
- (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. 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 has been filed for recordation as set forth in 37 CFR 3.11. 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. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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.

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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 _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

31824 7590 10/31/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

EXAMINER

NGUYEN, TOAN D

ART UNIT PAPER NUMBER

2472

DATE MAILED: 10/31/2017

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 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, 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. 14/931,753	Applicant(s) SEOK, YONGHO	
	Examiner TOAN NGUYEN	Art Unit 2472	AIA (First Inventor to File) 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 amendment filed 06/21/2017.
☐ 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 1,4,5,9-11,14,15,19 and 20. 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) | 5. ☐ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>04/13/2017</u> | 6. ☐ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/BRIAN D NGUYEN/
Primary Examiner, Art Unit 2472

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	39	H04L5/0055.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:20
L3	3	H04L1/00.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:21
L4	11	H04L5/0023.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:21
L6	1	H04L5/0028.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user))	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:22
L7	3	H04L5/0037.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:22
L8	6	H04L5/0048.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:23
L9	10	H04L5/0053.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:23
L11	1	H04L5/008.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user))	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:24
L12	3	H04L5/0091.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:24
L16	25	H04W84/12.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:27
L17	14	H04W72/042.cpc. and (acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/09/13 13:28

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L14	3	((acknowledg\$5 or ACK) with (frame or packet) same (MU or (multi\$3 with user)) with format\$4 same (acknowledg\$5 or ACK) with (frame or packet)).clm.	US-PGPUB; USPAT	OR	ON	2017/09/13 13:26
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9/ 13/ 2017 1:28:48 PM

Issue Classification 	Application/Control No. 14931753	Applicant(s)/Patent Under Reexamination SEOK, YONGHO	
	Examiner TOAN NGUYEN	Art Unit 2472	

CPC					
Symbol				Type	Version
H04L	5		0055	F	2013-01-01
H04W	84		12	A	2013-01-01
H04W	72		042	A	2013-01-01
H04L	1		00	I	2013-01-01
H04L	5		0023	A	2013-01-01
H04L	5		0028	I	2013-01-01
H04L	5		0037	I	2013-01-01
H04L	5		0048	A	2013-01-01
H04L	5		0053	I	2013-01-01
H04L	5		008	A	2013-01-01
H04L	5		0091	I	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

/TOAN NGUYEN/ Examiner.Art Unit 2472	9/13/2017	Total Claims Allowed: 10	
(Assistant Examiner)	(Date)		
/BRIAN D NGUYEN/ Primary Examiner.Art Unit 2472	09/13/2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

Issue Classification 	Application/Control No. 14931753	Applicant(s)/Patent Under Reexamination SEOK, YONGHO
	Examiner TOAN NGUYEN	Art Unit 2472

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	—	17												
—	2	—	18												
—	3	9	19												
2	4	10	20												
3	5														
—	6														
—	7														
—	8														
4	9														
5	10														
6	11														
—	12														
—	13														
7	14														
8	15														
—	16														

/TOAN NGUYEN/ Examiner.Art Unit 2472 (Assistant Examiner)	9/13/2017 (Date)	Total Claims Allowed: 10	
/BRIAN D NGUYEN/ Primary Examiner.Art Unit 2472 (Primary Examiner)	09/13/2017 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

Search Notes 	Application/Control No. 14931753	Applicant(s)/Patent Under Reexamination SEOK, YONGHO
	Examiner TOAN NGUYEN	Art Unit 2472

CPC- SEARCHED		
Symbol	Date	Examiner
H04L 5/0055	9/13/2017	TN

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST (US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB) Updated search	9/13/2017	TN
H04L 1/00 (text search only - See search history printout)	9/13/2017	TN
H04L 5/0023, 0028, 0037, 0048, 0053, 008, 0091 (Text search only - see search history printout)	9/13/2017	TN
H04W 72/042 (Text search only - see search history printout)	9/13/2017	TN
H04W 84/12 (Text search only - see search history printout)	9/13/2017	TN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	See Search history printout	9/13/2017	TN

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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.

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	14/931,753-Conf. #3819
				Filing Date	November 3, 2015
				First Named Inventor	Yongho SEOK
				Art Unit	2472
				Examiner Name	T. D. Nguyen
Sheet	1	of	2	Attorney Docket Number	096809-0032

[illegible][illegible]

Examiner Signature	/Toan Nguyen/	Date Considered	09/22/2017
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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. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08b (07-09)

Approved for use through 07/31/2016. 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.

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>		Complete if Known			
		Application Number	14/931,753-Conf. #3819		
		Filing Date	November 3, 2015		
		First Named Inventor	Yongho SEOK		
		Art Unit	2472		
		Examiner Name	T. D. Nguyen		
Sheet	2	of	2	Attorney Docket Number	096809-0032

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
/T.D.N./	C1	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE P802.11ah™/D5.0 Draft Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 2: Sub 1 GHz License Exempt Operation," March 2015	
/T.D.N./	C2	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz," 2013	
/T.D.N./	C3	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," 2012	

Examiner Signature	/TOAN D NGUYEN/	Date Considered	09/13/2017
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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.

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

31824 7590 06/30/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

EXAMINER

NGUYEN, TOAN D

ART UNIT	PAPER NUMBER
----------	--------------

2472

NOTIFICATION DATE	DELIVERY MODE
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06/30/2017

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):

mweipdocket@mwe.com

<i>Applicant-Initiated Interview Summary</i>	Application No. 14/931,753	Applicant(s) SEOK, YONGHO	
	Examiner TOAN NGUYEN	Art Unit 2472	

All participants (applicant, applicant's representative, PTO personnel):

(1) TOAN NGUYEN. (3)_____.

(2) ROLANDO GONZALEZ. (4)_____.

Date of Interview: 16 June 2017.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.

If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others

(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: US 2013/0188627, US 2015/0085836.

Substance of Interview

(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The applicant's representative and examiner discussed proposed claim amendment. The examiner informed the applicant's representative that the proposed claim amendment requires further search and consideration.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/BRIAN D NGUYEN/
Primary Examiner, Art Unit 2472

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/931,753	Filing Date 11/03/2015	☐ To be Mailed
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 ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =	
☐ 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

AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	06/21/2017	CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	* 10	Minus	** 20	= 0	X \$40 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0	X \$210 =	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	
AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
		CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ 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.

** 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 number found in the appropriate box in column 1.

 SLIE
 KIMBERLY D. WILLIAMS

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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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 31824
Yongho SEOK	:	Confirmation Number: 3819
Application No.: 14/931,753	:	Group Art Unit: 2472
Filed: November 3, 2015	:	Examiner: Toan D. NGUYEN
For: METHOD AND APPARATUS FOR	:	
TRANSMITTING RESPONSE	:	
FRAME BASED ON TYPE IN A	:	
HIGH EFFICIENCY WIRELESS	:	
LAN	:	

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

AMENDMENT

Sir:

In response to the Non-Final Office Action dated March 21, 2017, reconsideration and further examination of the above-identified application are respectfully requested based on the following:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

Electronic Acknowledgement Receipt

EFS ID:	29570499
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Amanda Pennington
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	21-JUN-2017
Filing Date:	03-NOV-2015
Time Stamp:	20:23:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		096809-0032_Amendment.pdf	255759	yes	10
			8ddb6fbc0105648121bf3a773fe3dbdea5fc0bd0		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	6	10
	Claims	2	5
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:

Information:

Total Files Size (in bytes):	255759
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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.

REMARKS

After entry of the foregoing amendments, claims 1, 4, 5, 9-11, 14, 15, 19 and 20 are pending examination, of which claims 1 and 11 are the independent claims. Claims 1, 4, 5, 9-11, 14, 15, 19 and 20 are amended herein. Claims 2, 3, 6-8, 12, 13 and 16-18 are canceled herein. These amendments are made without prejudice or disclaimer of subject matter, and Applicant respectfully reserves the right to pursue the original, previously presented, or canceled subject matter in continuing applications. Support for the amendment is found in the original disclosure, including, for example, paragraphs [0262] and [0267], claims 2, 3, 6-8, 12, 13 and 16-18, and figure 19 along with the corresponding description in the specification. No new matter is added herein. Reconsideration and further examination are respectfully requested.

Substance of Interview

Applicant extends its gratitude to Examiner Toan D. NGUYEN for the courtesies extended during the telephonic interview conducted on June 16, 2017, with Applicant's representative, Rolando Gonzalez (Reg. No. 63,191). In the interview, the pending claims and the rejections of the outstanding Office Action were discussed. Although no agreement was reached during the interview, Applicant appreciates the Examiner's time and consideration and respectfully submit that the claims, as presented herein, are allowable over the cited references.

Claim Rejections – 35 U.S.C. § 103

Claims 1-20 are rejected under 35 U.S.C. § 103 over U.S. Patent Publ. No. 2013/0188627 (“*Cheong*”) in view of 2015/0085836 (“*Kang*”). These rejections are respectfully traversed, and reconsideration and withdrawal of these rejections are respectfully requested.

Independent claim 1

Without conceding the correctness of the rejection, independent claim 1, as amended, recites:

A method for transmitting an acknowledgement frame for notifying successful data reception by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user

(SU) format or in a multiple-user (MU) format a Short Inter-Frame Space (SIFS) time after the downlink frame; and

transmitting, to the AP, the acknowledgement frame based on the acknowledgement information the SIFS time after the downlink frame,

wherein transmitting the acknowledgment frame comprises:

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA, and

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format.

The cited portions and proposed combination of the applied references are not understood to disclose or suggest all of the features of independent claim 1, particularly with respect to at least the features of “receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format a Short Inter-Frame Space (SIFS) time after the downlink frame” and “when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA.”

The Office Action contends that *Cheong* teaches the previously-recited features of “receiving, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type.” Office Action at pp. 2, 3.

Cheong discloses that “the STA receives the frame including the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme from the AP.” *Cheong* at para. [0069]. *Cheong* also discloses that “the frame includes the information indicating the group ID assignment when the type of the action is the first type and also includes the group ID, group number information indicating a group number of the STAs corresponding to each group ID table, positional information indicating a spatial stream position of the STAs, and the like.” *Cheong* at para. [0049].

The “group information” of *Cheong*, however, does not disclose or suggest “a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format a Short Inter-Frame Space (SIFS) time after the downlink frame,” as recited in independent claim 1. Nowhere in the cited portions of *Cheong* is seen to disclose or suggest that the “group ID assignment” and/or “group number information” of *Cheong* disclose “acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) format or in a multiple-user (MU) format,” as recited in independent claim 1.

Moreover, the cited portions of *Cheong* are not seen to disclose or suggest that the “transmitting unit” of *Cheong* (e.g., Fig. 7, element 730) disclose “transmitting the acknowledgement frame in the MU format on the allocated resource simultaneously with transmission of at least one acknowledgement frame from at least one other STA” when “the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource,” as recited in independent claim 1.

As for the other applied reference, Applicant respectfully submits that the cited portions of *Kang* do not remedy the above-noted deficiencies of the cited portions of *Cheong*.

Accordingly, the cited portions and proposed combination of the applied references are not understood to disclose or suggest all of the features of independent claim 1, which is believed to be in condition for allowance. Reconsideration and withdrawal of the rejection of independent claim 1 are respectfully requested.

Independent claim 11

For at least some of the reasons described above regarding the applied references, Applicant respectfully submits that the cited portions and proposed combination of the applied references are not understood to disclose or suggest all of the features of independent claim 11, particularly with regard to the features of “transmitting, to the STA, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame in a single-user (SU) or in

a multiple-user (MU) format a Short Inter-Frame Space (SIFS) time after the downlink frame.” Accordingly, it is respectfully submitted that independent claim 11 is in condition for allowance.

Dependent claims

The other claims currently under consideration in the application are dependent from their respective independent claims discussed above and therefore are believed to be allowable for at least similar reasons. Because each dependent claim is deemed to define an additional aspect of the claims, the individual consideration of each on its own merits is respectfully requested. Reconsideration and withdrawal of the rejections of the dependent claims are respectfully requested.

CONCLUSION

Applicant respectfully submits that the entire application is in condition for allowance, and such action is respectfully requested at the Examiner’s earliest convenience. Should the Examiner have any questions, please call the undersigned at the phone number listed below so that any such questions may be promptly resolved.

Any remarks in support of patentability of one claim should not be imputed to any other claim, even if similar terminology is used. Any language or remarks referring to only a portion of a claim should not necessarily be understood to base patentability on solely that portion; rather, patentability rests on each claim taken as a whole.

Applicant respectfully submits that to the extent any disclaimers or statements were made previously during prosecution with respect to the scope of the claimed invention, such disclaimers and statements are hereby rescinded.

Applicant respectfully reserves the right to traverse any of the rejections, assertions and submissions made in connection with the application, even if not discussed herein, including the right to challenge later whether any of the cited references is prior art. The absence of a reply to a specific rejection, issue, or comment does not signify agreement with or concession of that rejection, issue, or comment. In addition, because any arguments made may not be exhaustive, there may be other reasons that have not been expressed for patentability of any or all claims. When amendments are made to any claims, no acquiescence or estoppel is implied thereby; such

amendments are made only to expedite prosecution of the present application and are without prejudice to the presentation or assertion, in the future, of claims directed to subject matter that is same as or similar to that previously presented. Nothing in this paper should be construed as an intent to concede, or actual concession of, any issue with regard to any claim, or to any cited art, except as specifically stated in this paper, and the amendment or cancellation of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment or cancellation.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 50-2624 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

/Soyeon Pak (Karen) Laub/
Soyeon Pak (Karen) Laub
Registration No. 39,266

4 Park Plaza, Suite 1700
Irvine, CA 92614-2559
Phone: (949) 851-0633 RG:adp
Facsimile: (949) 851-9348
Date: June 21, 2017

DM_US 82661430-1.096809.0032

**Please recognize our Customer No. 31824 as
our correspondence address.**

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method for transmitting an ~~uplink~~ acknowledgement frame for notifying successful data reception by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including a quality of service (QoS) control field including acknowledgement information representing whether the STA is requested to transmit the acknowledgement frame ~~related to a type of the uplink frame, the type of the uplink frame including in a single-user (SU) type format or [[and]] in a multiple-user (MU) [[type]] format~~ at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

transmitting, to the AP, the acknowledgement ~~uplink~~ frame ~~having a type determined based on the acknowledgement information at the SIFS time after the downlink frame related to the type of the uplink frame,~~

wherein transmitting the acknowledgement frame comprises: [[,]]

~~when the type of the uplink frame corresponds to the MU type the~~ acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the MU format and the STA is allocated a resource, ~~transmitting the uplink acknowledgement frame in the MU format [[is]] on the allocated resource simultaneously with transmission of at least one acknowledgement frame from transmitted by a plurality of STAs including the STA and at least one other STA, and~~

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, transmitting the acknowledgement frame in SU format.

2. (Canceled)

3. (Canceled)

4. (Currently Amended) The method according to claim 1,
wherein the downlink frame further includes Modulation and Coding Scheme (MCS)
information for the acknowledgement uplink frame.

5. (Currently Amended) The method according to claim 4,
wherein a same MCS based on the MCS information is applied to the acknowledgement
uplink frame by the plurality of STAs STA and the at least one other STA.

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Currently Amended) The method according to claim 1,
wherein the downlink frame includes downlink data ~~[[the]]~~ a plurality of STAs including
the STA and the at least one other STA.

10. (Currently Amended) The method according to claim 1,
wherein the downlink frame includes block acknowledgement (ACK) requests for ~~[[the]]~~
a plurality of STAs including the STA and the at least one other STA.

11. (Currently Amended) A method for receiving an acknowledgement uplink frame
for notifying successful data reception by an access point (AP) from ~~at least one~~ a station (STA)
in a wireless local area network, the method comprising:

transmitting, to the ~~at least one~~ STA, a downlink frame including a quality of service
(QoS) control field including acknowledgement information related to a type of the uplink frame,
the type of the uplink frame including representing whether the STA is requested to transmit the
acknowledgement frame in a single-user (SU) type and format or in a multiple-user (MU)
[[type]] format at a Short Inter-Frame Space (SIFS) time after the downlink frame; and

receiving, from the ~~at least one~~ STA, the acknowledgement ~~uplink~~ frame ~~having a type determined based on the~~ acknowledgement ~~information related to the type of the uplink frame at the SIFS time after the downlink frame,~~

wherein receiving the acknowledgment frame comprises:

when the acknowledgment information represents that the STA is requested to transmit the type of the acknowledgement uplink frame corresponds to in the MU [[type]] format, receiving the acknowledgement uplink frame in the MU format on an allocated resource [[is]] simultaneously with transmission of at least one acknowledgement frame from transmitted by a plurality of STAs including the at least one other STA, and

when the acknowledgment information represents that the STA is requested to transmit the acknowledgement frame in the SU format, receiving the acknowledgement frame in SU format.

12. (Canceled)

13. (Canceled)

14. (Currently Amended) The method according to claim 11,
wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the acknowledgement ~~uplink~~ frame.

15. (Currently Amended) The method according to claim 14,
wherein a same MCS based on the MCS information is applied to the acknowledgement ~~uplink~~ frame by the ~~plurality of STAs~~ STA and the at least one other STA.

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Currently Amended) The method according to claim 11,
wherein the downlink frame includes downlink data for ~~[[the]]~~ a plurality of STAs
including the STA and the at least one other STA.

20. (Currently Amended) The method according to claim 11,
wherein the downlink frame includes block acknowledgement (ACK) requests for ~~[[the]]~~ a
plurality of STAs including the STA and the at least one other STA.

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	14/931,753-Conf. #3819
				Filing Date	November 3, 2015
				First Named Inventor	Yongho SEOK
				Art Unit	2472
				Examiner Name	T. D. Nguyen
				Attorney Docket Number	096809-0032
Sheet	1	of	2		

[illegible][illegible]

Examiner Signature		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. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	14/931,753-Conf. #3819
				Filing Date	November 3, 2015
				First Named Inventor	Yongho SEOK
				Art Unit	2472
				Examiner Name	T. D. Nguyen
Sheet	2	of	2	Attorney Docket Number	096809-0032

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	C1	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE P802.11ah™/D5.0 Draft Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 2: Sub 1 GHz License Exempt Operation," March 2015	
	C2	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz," 2013	
	C3	LAN/MAN Standards Committee of the IEEE Computer Society, "IEEE Standard for Information technology – Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," 2012	

Examiner Signature		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.

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.

Electronic Patent Application Fee Transmittal

Application Number:	14931753			
Filing Date:	03-Nov-2015			
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN			
First Named Inventor/Applicant Name:	Yongho SEOK			
Filer:	Soyeon P. Laub/Sharon Fennessy			
Attorney Docket Number:	096809-0032			
Filed as Small 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:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	90	90
Total in USD (\$)				90

Electronic Acknowledgement Receipt

EFS ID:	28922744
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Sharon Fennessy
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	13-APR-2017
Filing Date:	03-NOV-2015
Time Stamp:	17:52:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$90
RAM confirmation Number	041417INTEFSW00004869502624
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		096809-0032-IDS.pdf	160254	yes	4
			e412be5f08e1bd1b8055149498465cd99b25a4e7		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	4	
Warnings:					
Information:					
2	Non Patent Literature	P802-11ah_D5-0.pdf	5499202	no	632
			6be0e2ecb623ac1df887002e1657f84514252219		
Warnings:					
Information:					
3	Non Patent Literature	802-11ac-2013.pdf	3155574	no	425
			d977522247e217f8951c2241df38835899251510		
Warnings:					
Information:					
4	Non Patent Literature	802-11-2012.pdf	15631843	no	2793
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Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30814	no	2
			62e8cd161d093e8710c6e0bcbd9328d0eacd7a769		
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Information:					
ZYXEL-1002					
Page 081 (of 204)					

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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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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	:	Customer Number: 31824
Yongho SEOK	:	
	:	
Application No.: 14/931,753	:	Confirmation No.: 3819
	:	
Filed: November 3, 2015	:	Art Unit: 2472
	:	
For: METHOD AND APPARATUS FOR	:	Examiner: T. D. Nguyen
TRANSMITTING RESPONSE FRAME BASED	:	
ON TYPE IN A HIGH EFFICIENCY	:	
WIRELESS LAN	:	

INFORMATION DISCLOSURE STATEMENT

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

Pursuant to 37 C.F.R. § 1.56, 1.97, and 1.98, the attention of the United States Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of the above-identified application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

This Information Disclosure Statement is filed more than three months after the filing date of this application, and after the mailing date of a first Office Action on the merits, but before the mailing date of any of a Final Action under 37 C.F.R. § 1.113, a Notice of Allowance under 37 C.F.R. § 1.311 or an action that otherwise closes prosecution in this application (37 C.F.R. § 1.97(c)).

In accordance with 37 C.F.R. § 1.97(g), the filing of this Information Disclosure Statement shall not be construed as a representation that a search has been made. In accordance with 37 C.F.R. § 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that the information cited in this Information Disclosure Statement is, or is considered to be, material to the patentability as defined in 37 C.F.R. § 1.56(b).

Please charge Deposit Account No. 50-2624 in the amount of \$90.00 covering the fee set forth in 37 C.F.R. § 1.17(p).

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith to Deposit Account No. 50-2624.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

/Soyeon Pak (Karen) Laub/
Soyeon Pak (Karen) Laub
Registration No. 39,266

4 Park Plaza
Suite 1700
Irvine, CA 92614-2559
Phone: (949) 757-7112 SL:snf
Facsimile: (949) 851-9348
Date: April 13, 2017

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correspondence address.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/931,753	11/03/2015	Yongho SEOK	096809-0032	3819

31824 7590 03/21/2017
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

EXAMINER

NGUYEN, TOAN D

ART UNIT	PAPER NUMBER
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2472

NOTIFICATION DATE	DELIVERY MODE
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03/21/2017

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):

mweipdocket@mwe.com

Office Action Summary	Application No. 14/931,753	Applicant(s) SEOK, YONGHO	
	Examiner TOAN NGUYEN	Art Unit 2472	AIA (First Inventor to File) 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 11/03/2015.
☐ 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) 1-20 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) 1-20 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 11/03/2015 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) | 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____. | 4) ☐ Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

2. 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.

3. Claims 1-20 are rejected under 35 U.S.C. 103 as being unpatentable over Cheong et al. (US 2013/0188627) in view of Kang et al. (US 2015/0085836).

For claim 1, Cheong et al. discloses a method for transmitting an uplink frame by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type (paragraph [0069], lines 1-4, Cheong et al. teaches in S810 of figure 8, the STA receives the frame including the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme from the AP).

Cheong et al. teaches further in the foregoing frame, in case of a single user (SU), not

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multi users, the membership status 214 and the STA position 216 corresponding to a single user group ID field become 1. That is, the frame includes the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme); and

transmitting, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame (paragraph [0070], lines 3-7, Cheong et al. teaches in S830 of figure 8, the data are transmitted to the AP using the MU-MIMO scheme based on the group information of the STAs).

However, Cheong et al. does not expressly disclose wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA. In an analogous art, Kang et al. discloses wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA (paragraph [0067], lines 13-18, Kang et al. teaches for UL MU-MIMO transmission, packets transmitted by a plurality of devices should be simultaneously received by the AP and at the same frequency).

One skilled in the art would have recognized the wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA, and would have applied Kang et al.'s UL MU-MIMO in Cheong et al.'s MU-MIMO. Therefore, it 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, to use Kang et al.'s uplink signal transmission method and station device, and uplink signal receiving

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method and access point device in Cheong et al.'s apparatus and method for transmitting/receiving data in communication system with the motivation being to provide for UL MU-MIMO transmission, packets transmitted by a plurality of devices should be simultaneously received by the AP and at the same frequency (paragraph [0067], lines 13-18).

For claims 2-5, 8, 10, 12-15, 18, and 20, Cheong et al. does not expressly disclose wherein the downlink frame further includes resource allocation information for the plurality of STAs. In an analogous art, Kang et al. discloses wherein the downlink frame further includes resource allocation information for the plurality of STAs (paragraph [0060], lines 17-21, Kang et al. teaches MU-MIMO for transmitting signals from a single AP to a plurality of terminals using the same time/frequency resource is especially referred to as downlink (DL) MU-MIMO).

Kang et al. teaches wherein the resource allocation information includes information indicating distinguished resources for each of the plurality of STAs (paragraph [0063], lines 5-8, Kang et al. teaches step 2, the BS schedules time, frequency, and spatial resources on which UL transmission is to be performed to each terminal belonging to the terminal group as set forth in claim 3); wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the uplink frame (paragraph [0160], lines 1-4, Kang et al. teaches predetermined coding and modulation for a signal and/or data scheduled to be transmitted to the outside by the processor 11 of figure 12 as set forth in claim 4); wherein a same MCS based on the MCS information is applied to the uplink frame by the plurality of STAs (paragraph

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[0160], lines 1-4, Kang et al. teaches predetermined coding and modulation for a signal and/or data scheduled to be transmitted to the outside by the processor 11 of figure 12 as set forth in claim 5); wherein the immediate response is transmitted a Short Inter-Frame Space (SIFS) time after the downlink frame (paragraph [0138], lines 12-15, Kang et al. teaches AP transmits the CTS after a predetermined time (e.g. a short inter-frame space (SIFS)) upon receiving the RTS from an ATS as set forth in claim 8); wherein the downlink frame includes block acknowledgement (ACK) requests for the plurality of STAs (paragraph [0090], lines 3-14, Kang et al. teaches several STAs may attempt to transmit data (or frames) ... ACK for the transmission frame as set forth in claim 10); wherein the downlink frame further includes resource allocation information for the plurality of STAs (paragraph [0060], lines 17-21, Kang et al. teaches MU-MIMO for transmitting signals from a single AP to a plurality of terminals using the same time/frequency resource is especially referred to as downlink (DL) MU-MIMO as set forth in claim 12); wherein the resource allocation information includes information indicating distinguished resources for each of the plurality of STAs (paragraph [0063], lines 5-8, Kang et al. teaches step 2, the BS schedules time, frequency, and spatial resources on which UL transmission is to be performed to each terminal belonging to the terminal group as set forth in claim 13); wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the uplink frame (paragraph [0160], lines 1-4, Kang et al. teaches predetermined coding and modulation for a signal and/or data scheduled to be transmitted to the outside by the processor 11 of figure 12 as set forth in claim 14); wherein a same MCS based on the MCS information is applied

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to the uplink frame by the plurality of STAs (paragraph [0160], lines 1-4, Kang et al. teaches predetermined coding and modulation for a signal and/or data scheduled to be transmitted to the outside by the processor 11 of figure 12 as set forth in claim 15); wherein the immediate response is transmitted a Short Inter-Frame Space (SIFS) time after the downlink frame (paragraph [0138], lines 12-15, Kang et al. teaches AP transmits the CTS after a predetermined time (e.g. a short inter-frame space (SIFS)) upon receiving the RTS from an ATS as set forth in claim 18); and wherein the downlink frame includes block acknowledgement (ACK) requests for the plurality of STAs (paragraph [0090], lines 3-14, Kang et al. teaches several STAs may attempt to transmit data (or frames) ... ACK for the transmission frame as set forth in claim 20).

One skilled in the art would have recognized the wherein the downlink frame further includes resource allocation information for the plurality of STAs, and would have applied Kang et al.'s MU-MIMO in Cheong et al.'s MU-MIMO. Therefore, it 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, to use Kang et al.'s uplink signal transmission method and station device, and uplink signal receiving method and access point device in Cheong et al.'s apparatus and method for transmitting/receiving data in communication system with the motivation being to provide MU-MIMO for transmitting signals from a single AP to a plurality of terminals using the same time/frequency resource is especially referred to as downlink (DL) MU-MIMO (paragraph [0060], lines 17-21).

For claim 6, Cheong et al. discloses wherein, when the type of the uplink frame corresponds to the SU type, the uplink frame is transmitted only by the STA (paragraph [0033], lines 4-7, Cheong et al. teaches a single user (SU), the membership status 214 and the STA position 216 corresponding to a single user group ID filed become 1).

For claim 7, Cheong et al. discloses wherein the uplink frame is transmitted as an immediate response to the downlink frame (paragraph [0070], lines 3-7, Cheong et al. teaches in S830 of figure 8, the data are transmitted to the AP using the MU-MIMO scheme based on the group information of the STAs).

For claim 9, Cheong et al. discloses wherein the downlink frame includes downlink data for the plurality of STAs (paragraph [0069], lines 1-4, Cheong et al. teaches in S810 of figure 8, the STA receives the frame including the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme from the AP).

For claim 11, Cheong et al. discloses a method for receiving an uplink frame by an access point (AP) from at least one station (STA) in a wireless local area network, the method comprising:

transmitting, to the at least one STA, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type (paragraph [0069], lines 1-4, Cheong et al. teaches in S810 of figure 8, the STA receives the frame including the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme from the AP). Cheong et al. teaches further in the foregoing frame, in case of a single user

(SU), not multi users, the membership status 214 and the STA position 216 corresponding to a single user group ID field become 1. That is, the frame includes the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme); and

receiving, from the at least one STA, the uplink frame having a type determined based on the information related to the type of the uplink frame (paragraph [0070], lines 3-7, Cheong et al. teaches in S830 of figure 8, the data are transmitted to the AP using the MU-MIMO scheme based on the group information of the STAs).

However, Cheong et al. does not expressly disclose wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA. In an analogous art, Kang et al. discloses wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA (paragraph [0067], lines 13-18, Kang et al. teaches for UL MU-MIMO transmission, packets transmitted by a plurality of devices should be simultaneously received by the AP and at the same frequency).

One skilled in the art would have recognized the wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA, and would have applied Kang et al.'s UL MU-MIMO in Cheong et al.'s MU-MIMO. Therefore, it 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, to use Kang et

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al.'s uplink signal transmission method and station device, and uplink signal receiving method and access point device in Cheong et al.'s apparatus and method for transmitting/receiving data in communication system with the motivation being to provide for UL MU-MIMO transmission, packets transmitted by a plurality of devices should be simultaneously received by the AP and at the same frequency (paragraph [0067], lines 13-18).

For claim 16, Cheong et al. discloses wherein, when the type of the uplink frame corresponds to the SU type, the uplink frame is transmitted only by the STA (paragraph [0033], lines 4-7, Cheong et al. teaches a single user (SU), the membership status 214 and the STA position 216 corresponding to a single user group ID filed become 1).

For claim 17, Cheong et al. discloses wherein the uplink frame is transmitted as an immediate response to the downlink frame (paragraph [0070], lines 3-7, Cheong et al. teaches in S830 of figure 8, the data dare transmitted to the AP using the MU-MIMO scheme based on the group information of the STAs).

For claim 19, Cheong et al. discloses wherein the downlink frame includes downlink data for the plurality of STAs (paragraph [0069], lines 1-4, Cheong et al. teaches in S810 of figure 8, the STA receives the frame including the group information of the STAs capable of transmitting/receiving data using the MU-MIMO scheme from the AP).

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TOAN NGUYEN whose telephone number is (571)272-3153. The examiner can normally be reached on M-F (7:00AM-4:30PM).

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, Hassan Kizou can be reached on 571-272-3088. 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 <http://pair-direct.uspto.gov>. 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.

/T. N./

Examiner, Art Unit 2472

/Hassan Kizou/

Supervisory Patent Examiner, Art Unit 2472

Notice of References Cited	Application/Control No. 14/931,753		Applicant(s)/Patent Under Reexamination SEOK, YONGHO	
	Examiner TOAN NGUYEN		Art Unit 2472	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-2013/0188627 A1	07-2013	CHEONG; Minho	H04W4/08	370/338
*	B	US-2015/0085836 A1	03-2015	Kang; Jiwon	H04W74/0808	370/336
*	C	US-2014/0126509 A1	05-2014	You; Hyang Sun	H04B7/04	370/329
*	D	US-2011/0103280 A1	05-2011	Liu; Yong	H04W52/0229	370/311
*	E	US-2012/0106531 A1	05-2012	Seok; Yong Ho	H04B7/0452	370/338
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

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.



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BIB DATA SHEET

CONFIRMATION NO. 3819

SERIAL NUMBER 14/931,753	FILING or 371(c) DATE 11/03/2015 RULE	CLASS 370	GROUP ART UNIT 2472	ATTORNEY DOCKET NO. 096809-0032		
APPLICANTS NEWRACOM, INC., Irvine, CA; INVENTORS Yongho SEOK, Irvine, CA; ** CONTINUING DATA ***** This appln claims benefit of 62/080,026 11/14/2014 and claims benefit of 62/074,514 11/03/2014 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED *** SMALL ENTITY ** 11/13/2015						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/TOAN D NGUYEN/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 23	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 2
ADDRESS MCDERMOTT WILL & EMERY LLP The McDermott Building 500 North Capitol Street, N.W. Washington, DC 20001 UNITED STATES						
TITLE METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN						
FILING FEE RECEIVED 730	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

<i>Index of Claims</i> 	Application/Control No. 14931753	Applicant(s)/Patent Under Reexamination SEOK, YONGHO
	Examiner TOAN NGUYEN	Art Unit 2472

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	03/03/2017							
	1	✓							
	2	✓							
	3	✓							
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	16	✓							
	17	✓							
	18	✓							
	19	✓							
	20	✓							

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	54	H04L5/0055.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:30
L2	146	H04L5/0023.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:30
L3	8	H04L5/0028.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:31
L4	45	H04L5/0037.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:31
L5	97	H04L5/0048.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:31
L6	116	H04L5/0053.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:31
L7	1	H04L5/008.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:32
L8	37	H04L5/0091.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:32
L9	8	H04L1/00.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:32
L10	105	H04W72/042.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU)	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:32
L12	38	H04W84/12.cpc. and frame same ((single with user) or SU) with ((mult\$3 with user) or MU) same uplink	US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 15:34

EAST Search History (Interference)

< This search history is empty >

3/ 4/ 2017 3:34:37 PM

Search Notes 	Application/Control No. 14931753	Applicant(s)/Patent Under Reexamination SEOK, YONGHO
	Examiner TOAN NGUYEN	Art Unit 2472

CPC- SEARCHED		
Symbol	Date	Examiner
H04L 5/0055	3/3/2017	TN

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST (US-PGPUB; USPAT; EPO; DERWENT; IBM_TDB)	3/3/2017	TN
H04L 1/00	3/3/2017	TN
H04L 5/0023, 0028, 0037, 0048, 0053, 008, 0091	3/3/2017	TN
H04W 72/042	3/3/2017	TN
H04W 84/12	3/3/2017	TN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/931,753	11/03/2015	Yongho SEOK	096809-0032

CONFIRMATION NO. 3819

PUBLICATION NOTICE



OC000000082699534

31824
MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001

Title:METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN

Publication No.US-2016-0128057-A1

Publication Date:05/05/2016

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.

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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
14/931,753	11/03/2015	2414	730	096809-0032	20	2

CONFIRMATION NO. 3819

FILING RECEIPT

31824

MCDERMOTT WILL & EMERY LLP
The McDermott Building
500 North Capitol Street, N.W.
Washington, DC 20001



Date Mailed: 11/18/2015

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Inventor(s)

Yongho SEOK, Irvine, CA;

Applicant(s)

NEWRACOM, INC., Irvine, CA;

Power of Attorney: The patent practitioners associated with Customer Number 31824

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/080,026 11/14/2014
and claims benefit of 62/074,514 11/03/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

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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 14/931,753**

Projected Publication Date: 05/05/2016

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A
HIGH EFFICIENCY WIRELESS LAN

Preliminary Class

370

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
14/931,753

APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *	x 210 =	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).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
			TOTAL	730		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	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))							OR		
	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.

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Application Number	Not Yet Assigned		
Filing Date	Concurrently Herewith		
First Named Inventor	Yongho SEOK		
Title	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		
Art Unit	Not Yet Assigned		
Examiner Name	Not Yet Assigned		
Attorney Docket Number	096809-0032		
SIGNATURE of Applicant or Patent Practitioner			
Signature	/Soyeon Pak (Karen) Laub/	Date (Optional)	November 3, 2015
Name	Soyeon Pak (Karen) Laub	Registration Number	39,266
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)		NEWRACOM, INC.	
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☒ *Total of <u>1</u> forms are submitted.			

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Application Number	Filing Date

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NEWRACOM, INC.

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- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
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Name	Jeongwon CHO		
Title	Vice President		

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U.S. PATENT APPLICATION FOR

**METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED
ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN**

Inventor: Yongho SEOK, residing at
33 Canoe, Irvine, CA 92618

Assignee: NEWRACOM, INC.
9008 Research Drive
Irvine, CA 92618

Entity: Small

McDERMOTT WILL & EMERY LLP
4 Park Plaza
Suite 1700
Irvine, California 92614-2559
949.851.0633

METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN

CROSS-REFERECE TO RELATED APPLICATIONS

[0001] This application claims the benefits of U.S. Provisional Application No. 62/074,514, filed on November 3, 2014, and U.S. Provisional Application No. 62/080,026, filed on November 14, 2014, which are hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a Wireless Local Area Network (WLAN), and more particularly, to a method, apparatus, and software for transmitting a response frame according to a type in a High Efficiency WLAN (HEW), and a recording medium that stores the software.

Discussion of the Related Art

[0003] Along with the recent development of information and telecommunication technology, various wireless communication techniques have been developed. Among them, the WLAN enables a user to wirelessly access the Internet based on radio frequency technology in a home, an office, or a specific service area using a portable terminal such as a Personal Digital Assistant (PDA), a laptop computer, a Portable Multimedia Player (PMP), a smartphone, etc.

[0004] To overcome limitations in communication speed that the WLAN faces, the recent technical standards have introduced a system that increases the speed, reliability, and coverage of a wireless network. For example, the Institute of Electrical and Electronics Engineers (IEEE) 802.11n standard has introduced Multiple Input Multiple Output (MIMO) that is implemented using multiple antennas at both a transmitter and a receiver in order to support High Throughput (HT) at a data processing rate of up to 540Mbps, minimize transmission errors, and optimize data rates.

[0005] In recent times, to support increased numbers of devices supporting WLAN, such as smartphones, more Access Points (APs) have been deployed. Despite increase in use of WLAN devices supporting the Institute of Electrical and Electronics Engineers (IEEE) 802.11ac standard, that provide high performance relative to WLAN devices

supporting the legacy IEEE 802.11g/n standard, a WLAN system supporting higher performance is required due to WLAN users' increased use of high volume content such as a ultra high definition video. Although a conventional WLAN system has aimed at increase of bandwidth and improvement of a peak transmission rate, actual users thereof could not feel drastic increase of such performance.

[0006] In a task group called IEEE 802.11ax, High Efficiency WLAN (HEW) standardization is under discussion. The HEW aims at improving performance felt by users demanding high-capacity, high-rate services while supporting simultaneous access of numerous stations in an environment in which a plurality of APs is densely deployed and coverage areas of APs overlap.

[0007] However, there is no specified method for protecting a transmitted frame and no specified method for determining the type of a response frame in a HEW.

SUMMARY OF THE INVENTION

[0008] Objects of the present invention is to provide a method for protecting a transmitted frame and a method for determining the type of a response frame in a High Efficiency WLAN (HEW).

[0009] The objects of the present invention are not limited to the foregoing descriptions, and additional objects will become apparent to those having ordinary skill in the pertinent art to the present invention based upon the following descriptions.

[0010] In an aspect of the present invention, a method for transmitting an uplink frame by a station (STA) to an access point (AP) in a WLAN may be provided. The method may include receiving, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and transmitting, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA..

[0011] In another aspect of the present invention, a method for receiving an uplink frame by an AP from at least one STA in a WLAN may be provided. The method may include transmitting, to the at least one STA, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and receiving, from the at least one STA, the uplink frame having a type determined based on the information related to the type of the

uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the at least one STA.

[0012] In another aspect of the present invention, a STA apparatus for transmitting an uplink frame to an AP in a WLAN may be provided. The STA apparatus may include a baseband processor, a Radio Frequency (RF) transceiver, a memory, etc. The baseband processor may be configured to receive, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and transmit, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA.

[0013] In another aspect of the present invention, an AP apparatus for receiving an uplink frame from at least one STA in a WLAN may be provided. The AP apparatus may include a baseband processor, an RF transceiver, a memory, etc. The baseband processor may be configured to transmit, to the at least one STA, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and receive, from the at least one STA, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the at least one STA.

[0014] In another aspect of the present invention, a software or computer-readable medium having instructions executable for an STA to transmit an uplink frame to an AP in a WLAN may be provided. The executable instructions may cause the STA to receive, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and transmit, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA.

[0015] In another aspect of the present invention, a software or computer-readable medium having instructions executable for an AP to receive an uplink frame from at least

one STA in a WLAN may be provided. The executable instructions may cause the AP to transmit, to the at least one STA, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and receive, from the at least one STA, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the at least one STA.

[0016] It is to be understood that both the foregoing summarized features are exemplary aspects of the following detailed description of the present invention without limiting the scope of the present invention.

[0017] According to the present invention, a method for protecting a transmitted frame and a method for determining the type of a response frame in a HEW can be provided.

[0018] The advantages of the present invention are not limited to the foregoing descriptions, and additional advantages will become apparent to those having ordinary skill in the pertinent art to the present invention based upon the following descriptions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0020] FIG. 1 is a block diagram of a Wireless Local Area Network (WLAN) device;

[0021] FIG. 2 is a schematic block diagram of an exemplary transmitting signal processing unit in a WLAN;

[0022] FIG. 3 is a schematic block diagram of an exemplary receiving signal processing unit in a WLAN;

[0023] FIG. 4 depicts a relationship between InterFrame Spaces (IFSs);

[0024] FIG. 5 is a conceptual diagram illustrating a procedure for transmitting a frame in Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) for avoiding collisions between frames in a channel;

[0025] FIG. 6 depicts an exemplary frame structure in a WLAN system;

[0026] FIG. 7 depicts an exemplary HE PPDU frame format.

[0027] FIG. 8 depicts an exemplary High Efficiency (HE) Physical layer Protocol Data Unit (PPDU) frame format according to the present invention;

[0028] FIG. 9 depicts subchannel allocation in a HE PPDU frame format according to the present invention;

[0029] FIG. 10 depicts a subchannel allocation method according to the present invention;

[0030] FIG. 11 depicts the starting and ending points of an High Efficiency Long Training Field (HE-LTF) field in a HE PPDU frame format according to the present invention;

[0031] FIG. 12 depicts a High Efficiency SIGnal B (HE-SIG-B) field and a High Efficiency SIGnal C (HE-SIG-C) field in the HE PPDU frame format according to the present invention;

[0032] FIG. 13 depicts another example of a HE PPDU frame format according to the present invention;

[0033] FIGS. 14 and 15 depict operating channels in a WLAN system;

[0034] FIG. 16 depicts a Network Allocation Vector (NAV) update operation of an STA according to the present invention;

[0035] FIG. 17 depicts an operation of a third-party STA when a Downlink (DL) Orthogonal Frequency Division Multiple Access (OFDMA) PPDU is transmitted according to the present invention;

[0036] FIG. 18 depicts a NAV update operation of an STA according to the present invention;

[0037] FIG. 19 depicts an exemplary operation for transmitting an ACKnowledgement (ACK) in response to DL Multi-User (MU) transmission in an Uplink (UL) Single User (SU) transmission scheme;

[0038] FIG. 20 depicts an exemplary operation for transmitting an ACK in response to UL MU transmission in a UL MU transmission scheme;

[0039] FIGS. 21 and 22 depict various types of UL responses to DL MU transmission; and

[0040] FIG. 23 depicts an exemplary method according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0041] In the following detailed description, only certain embodiments of the present invention have been shown and described, simply by way of illustration. As those skilled in

the art would realize, the described embodiments may be modified in various different ways, all without departing from the spirit or scope of the present invention. Accordingly, the drawings and description are to be regarded as illustrative in nature and not restrictive. Like reference numerals designate like elements throughout the specification.

[0042] In a Wireless Local Area network (WLAN), a Basic Service Set (BSS) includes a plurality of WLAN devices. A WLAN device may include a Medium Access Control (MAC) layer and a PHYsical (PHY) layer according to Institute of Electrical and Electronics Engineers (IEEE) 802.11 series standards. In the plurality of WLAN devices, at least one the WLAN device may be an Access Point (AP) and the other WLAN devices may be non-AP Stations (non-AP STAs). Alternatively, all of the plurality of WLAN devices may be non-AP STAs in an ad-hoc networking environment. In general, AP STA and non-AP STA may be each referred to as a STA or may be collectively referred to as STAs. However, for ease of description herein, only the non-AP STAs may be referred to herein as the STAs.

[0043] FIG. 1 is a block diagram of a WLAN device.

[0044] Referring to FIG. 1, a WLAN device 1 includes a baseband processor 10, a Radio Frequency (RF) transceiver 20, an antenna unit 30, a memory 40, an input interface unit 50, an output interface unit 60, and a bus 70.

[0045] The baseband processor 10 may be simply referred to as a processor, performs baseband signal processing described in the present specification, and includes a MAC processor (or MAC entity) 11 and a PHY processor (or PHY entity) 15.

[0046] In an embodiment of the present invention, the MAC processor 11 may include a MAC software processing unit 12 and a MAC hardware processing unit 13. The memory 40 may store software (hereinafter referred to as 'MAC software') including at least some functions of the MAC layer. The MAC software processing unit 12 may execute the MAC software to implement some functions of the MAC layer, and the MAC hardware processing unit 13 may implement the remaining functions of the MAC layer in hardware (hereinafter referred to as 'MAC hardware'). However, the MAC processor 11 is not limited to the foregoing implementation examples.

[0047] The PHY processor 15 includes a transmitting (TX) signal processing unit 100 and a receiving (RX) signal processing unit 200.

[0048] The baseband processor 10, the memory 40, the input interface unit 50, and the output interface unit 60 may communicate with one another via the bus 70.

[0049] The RF transceiver 20 includes an RF transmitter 21 and an RF receiver 22.

[0050] The memory 40 may further store an Operating System (OS) and applications. The input interface unit 50 receives information from a user, and the output interface unit 60 outputs information to the user.

[0051] The antenna unit 30 includes one or more antennas. When Multiple input Multiple Output (MIMO) or Multi-User MIMO (MU-MIMO) is used, the antenna unit 30 may include a plurality of antennas.

[0052] FIG. 2 is a schematic block diagram of an exemplary transmission signal processor in a WLAN.

[0053] Referring to FIG. 2, the transmitting signal processing unit 100 may include an encoder 110, an interleaver 120, a mapper 130, an Inverse Fourier Transformer (IFT) 140, and a Guard Interval (GI) inserter 150.

[0054] The encoder 110 encodes input data. For example, the encoder 110 may be a Forward Error Correction (FEC) encoder. The FEC encoder may include a Binary Convolutional Code (BCC) encoder followed by a puncturing device, or the FEC encoder may include a Low-Density Parity-Check (LDPC) encoder.

[0055] The transmitting signal processing unit 100 may further include a scrambler for scrambling the input data before encoding to reduce the probability of long sequences of 0s or 1s. If BCC encoding is used in the encoder 110, the transmitting signal processing unit 100 may further include an encoder parser for demultiplexing the scrambled bits among a plurality of BCC encoders. If LDPC encoding is used in the encoder 110, the transmitting signal processing unit 100 may not use the encoder parser.

[0056] The interleaver 120 interleaves the bits of each stream output from the encoder 110 to change the order of bits. Interleaving may be applied only when BCC encoding is used in the encoder 110. The mapper 130 maps the sequence of bits output from the interleaver 120 to constellation points. If LDPC encoding is used in the encoder 110, the mapper 130 may further perform LDPC tone mapping in addition to constellation mapping.

[0057] When MIMO or MU-MIMO is used, the transmitting signal processing unit 100 may use a plurality of interleavers 120 and a plurality of mappers 130 corresponding to the number of spatial streams, N_{SS} . In this case, the transmitting signal processing unit 100 may further include a stream parser for dividing outputs of the BCC encoders or output of the LDPC encoder into blocks that are sent to different interleavers 120 or mappers 130. The transmitting signal processing unit 100 may further include a Space-Time Block Code (STBC) encoder for spreading the constellation points from the N_{SS} spatial streams into N_{STS} space-time streams and a spatial mapper for mapping the space-time streams to

transmit chains. The spatial mapper may use direct mapping, spatial expansion, or beamforming.

[0058] The IFT 140 converts a block of constellation points output from the mapper 130 or the spatial mapper to a time-domain block (i.e., a symbol) by using Inverse Discrete Fourier Transform (IDFT) or Inverse Fast Fourier Transform (IFFT). If the STBC encoder and the spatial mapper are used, the IFT 140 may be provided for each transmit chain.

[0059] When MIMO or MU-MIMO is used, the transmitting signal processing unit 100 may insert Cyclic Shift Diversities (CSDs) to prevent unintentional beamforming. The CSD insertion may occur before or after IFT. The CSD may be specified per transmit chain or may be specified per space-time stream. Alternatively, the CSD may be applied as a part of the spatial mapper.

[0060] When MU-MIMO is used, some blocks before the spatial mapper may be provided for each user.

[0061] The GI inserter 150 prepends a GI to the symbol. The transmitting signal processing unit 100 may optionally perform windowing to smooth edges of each symbol after inserting the GI. The RF transmitter 21 converts the symbols into an RF signal and transmits the RF signal via the antenna unit 30. When MIMO or MU-MIMO is used, the GI inserter 150 and the RF transmitter 21 may be provided for each transmit chain.

[0062] FIG. 3 is a schematic block diagram of an exemplary a receiving signal processor in a WLAN.

[0063] Referring to FIG. 3, the receiving signal processing unit 200 includes a GI remover 220, a Fourier Transformer (FT) 230, a demapper 240, a deinterleaver 250, and a decoder 260.

[0064] An RF receiver 22 receives an RF signal via the antenna unit 30 and converts the RF signal into symbols. The GI remover 220 removes the GI from the symbol. When MIMO or MU-MIMO is used, the RF receiver 22 and the GI remover 220 may be provided for each receive chain.

[0065] The FT 230 converts the symbol (i.e., the time-domain block) into a block of constellation points by using a Discrete Fourier Transform (DFT) or a Fast Fourier Transform (FFT). The FT 230 may be provided for each receive chain.

[0066] When MIMO or MU-MIMO is used, the receiving signal processing unit 200 may include a spatial demapper for converting Fourier Transformed receiver chains to constellation points of the space-time streams, and an STBC decoder for despreading the constellation points from the space-time streams into the spatial streams.

[0067] The demapper 240 demaps the constellation points output from the FT 230 or the STBC decoder to bit streams. If LDPC encoding is applied to the received signal, the demapper 240 may further perform LDPC tone demapping before constellation demapping. The deinterleaver 250 deinterleaves the bits of each stream output from the demapper 240. Deinterleaving may be applied only when a BCC encoding scheme is applied to the received signal.

[0068] When MIMO or MU-MIMO is used, the receiving signal processing unit 200 may use a plurality of demappers 240 and a plurality of deinterleavers 250 corresponding to the number of spatial streams. In this case, the receiving signal processing unit 200 may further include a stream deparser for combining streams output from the deinterleavers 250.

[0069] The decoder 260 decodes the streams output from the deinterleaver 250 or the stream deparser. For example, the decoder 100 may be an FEC decoder. The FEC decoder may include a BCC decoder or an LDPC decoder. The receiving signal processing unit 200 may further include a descrambler for descrambling the decoded data. If BCC decoding is used in the decoder 260, the receiving signal processing unit 200 may further include an encoder deparser for multiplexing the data decoded by a plurality of BCC decoders. If LDPC decoding is used in the decoder 260, the receiving signal processing unit 200 may not use the encoder deparser.

[0070] In a WLAN system, Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) is a basic MAC access mechanism. The CSMA/CA mechanism is referred to as Distributed Coordination Function (DCF) of IEEE 802.11 MAC, shortly as a ‘listen before talk’ access mechanism. According to the CSMA/CA mechanism, an AP and/or a STA may sense a medium or a channel for a predetermined time before starting transmission, that is, may perform Clear Channel Assessment (CCA). If the AP or the STA determines that the medium or channel is idle, it may start to transmit a frame on the medium or channel. On the other hand, if the AP and/or the STA determines that the medium or channel is occupied or busy, it may set a delay period (e.g., a random backoff period), wait for the delay period without starting transmission, and then attempt to transmit a frame. By applying a random backoff period, a plurality of STAs are expected to attempt frame transmission after waiting for different time periods, resulting in minimizing collisions.

[0071] FIG. 4 depicts a relationship between InterFrame Spaces (IFSs).

[0072] WLAN devices may exchange data frames, control frames, and management frames with each other.

[0073] A data frame is used for transmission of data forwarded to a higher layer. The WLAN device transmits the data frame after performing backoff if a Distributed Coordination Function IFS (DIFS) has elapsed from a time when the medium has been idle. A management frame is used for exchanging management information which is not forwarded to the higher layer. The WLAN device transmits the management frame after performing backoff if an IFS such as the DIFS or a Point Coordination Function IFS (PIFS) has elapsed. Subtype frames of the management frame include a beacon frame, an association request/response frame, a probe request/response frame, and an authentication request/response frame. A control frame is used for controlling access to the medium. Subtype frames of the control frame include a Request-To-Send (RTS) frame, a Clear-To-Send (CTS) frame, and an ACKnowledgement (ACK) frame. In the case that the control frame is not a response frame to another frame, the WLAN device transmits the control frame after performing backoff if the DIFS has elapsed. In case that the control frame is a response frame to another frame, the WLAN device transmits the control frame without performing backoff if a Short IFS (SIFS) has elapsed. The type and subtype of a frame may be identified by a type field and a subtype field in a Frame Control (FC) field.

[0074] On the other hand, a Quality of Service (QoS) STA transmits a frame after performing backoff if an Arbitration IFS (AIFS) for an associated Access Category (AC), i.e., AIFS[i] (i is determined based on AC) has elapsed. In this case, the AIFS[i] may be used for a data frame, a management frame, or a control frame that is not a response frame.

[0075] In the example illustrated in FIG. 4, upon generation of a frame to be transmitted, a STA may transmit the frame immediately, if it determines that the medium is idle for the DIFS or AIFS[i] or longer. The medium is busy for a time period during which the STA transmits the frame. During the time period, upon generation of a frame to be transmitted, another STA may defer access by confirming that the medium is busy. If the medium gets idle, the STA that intends to transmit the frame may perform a backoff operation after a predetermined IFS in order to minimize collision with any other STA. Specifically, the STA that intends to transmit the frame selects a random backoff count, waits for a slot time corresponding to the selected random backoff count, and then attempt transmission. The random backoff count is determined based on a Contention Window (CW) parameter and the medium is monitored continuously during count-down of backoff slots (i.e. decrement a backoff count-down) according to the determined backoff count. If

the STA monitors the medium as busy, the STA discontinues the count-down and waits, and then, if the medium gets idle, the STA resumes the count-down. If the backoff slot count reaches 0, the STA may transmit the next frame.

[0076] FIG. 5 is a conceptual diagram illustrating a CSMA/CA-based frame transmission procedure for avoiding collisions between frames in a channel.

[0077] Referring FIG. 5, a first STA (STA1) is a transmit WLAN device for transmitting data, a second STA (STA2) is a receive WLAN device for receiving the data from STA1, and a third STA (STA3) is a WLAN device which may be located in an area where a frame transmitted from STA1 and/or a frame transmitted from STA2 can be received by STA3.

[0078] STA1 may determine whether the channel is busy by carrier sensing. The STA1 may determine the channel occupation based on an energy level on the channel or correlation of signals in the channel, or may determine the channel occupation by using a Network Allocation Vector (NAV) timer.

[0079] After determining that the channel is not being used by other devices during DIFS (that is, the channel is idle), STA1 may transmit an RTS frame to STA2 after performing backoff. Upon receiving the RTS frame, STA2 may transmit a CTS frame as a response to the CTS frame after SIFS.

[0080] When STA3 receives the RTS frame, STA3 may set the NAV timer for a transmission duration of subsequently transmitted frame by using duration information included in the RTS frame. For example, the NAV timer may be set for a duration of SIFS + CTS frame duration + SIFS + data frame duration + SIFS + ACK frame duration. When STA3 receives the CTS frame, it may set the NAV timer for a transmission duration of subsequently transmitted frames by using duration information included in the CTS frame. For example, the NAV timer may be set for a duration of SIFS + a data frame duration + SIFS + an ACK frame duration. Upon receiving a new frame before the NAV timer expires, STA3 may update the NAV timer by using duration information included in the new frame. STA3 does not attempt to access the channel until the NAV timer expires.

[0081] When STA1 receives the CTS frame from STA2, it may transmit a data frame to STA2 after SIFS elapsed from the CTS frame has been completely received. Upon successfully receiving the data frame, STA2 may transmit an ACK frame as a response to the data frame after SIFS elapsed.

[0082] When the NAV timer expires, STA3 may determine whether the channel is busy through the use of carrier sensing. Upon determining that the channel is not in use by

other devices during DIFS and after the NAV timer has expired, STA3 may attempt channel access after a contention window after a random backoff has elapsed.

[0083] FIG. 6 depicts an exemplary frame structure in a WLAN system.

[0084] PHY layer may prepare a transmission MAC PDU (MPDU) in response to an instruction (or a primitive, which is a set of instructions or a set of parameters) by the MAC layer. For example, upon receipt of an instruction requesting transmission start from the MAC layer, the PHY layer may switch to a transmission mode, construct a frame with information (e.g., data) received from the MAC layer, and transmit the frame.

[0085] Upon detection of a valid preamble in a received frame, the PHY layer monitors a header of the preamble and transmits an instruction indicating reception start of the PHY layer to the MAC layer.

[0086] Information is transmitted and received in frames in the WLAN system. For this purpose, a Physical layer Protocol Data Unit (PPDU) frame format is defined.

[0087] A PPDU frame may include a Short Training Field (STF) field, a Long Training Field (LTF) field, a SIGNAL (SIG) field, and a Data field. The most basic (e.g., a non-High Throughput (non-HT)) PPDU frame may include only a Legacy-STF (L-STF) field, a Legacy-LTF (L-LTF) field, a SIG field, and a Data field. Additional (or other types of) STF, LTF, and SIG fields may be included between the SIG field and the Data field according to the type of a PPDU frame format (e.g., an HT-mixed format PPDU, an HT-greenfield format PPDU, a Very High Throughput (VHT) PPDU, etc.).

[0088] The STF is used for signal detection, Automatic Gain Control (AGC), diversity selection, fine time synchronization, etc. The LTF field is used for channel estimation, frequency error estimation, etc. The STF and the LTF fields may be referred to as signals for OFDM PHY layer synchronization and channel estimation.

[0089] The SIG field may include a RATE field and a LENGTH field. The RATE field may include information about a modulation scheme and coding rate of data. The LENGTH field may include information about the length of the data. The SIG field may further include parity bits, SIG TAIL bits, etc.

[0090] The Data field may include a SERVICE field, a Physical layer Service Data Unit (PSDU), and PPDU TAIL bits. When needed, the Data field may further include padding bits. A part of the bits of the SERVICE field may be used for synchronization at a descrambler of a receiver. The PSDU corresponds to a MAC PDU defined at the MAC layer and may include data generated/used in a higher layer. The PPDU TAIL bits may be

used to return an encoder to a zero state. The padding bits may be used to match the length of the Data field in predetermined units.

[0091] A MAC PDU is defined according to various MAC frame formats. A basic MAC frame includes a MAC header, a frame body, and a Frame Check Sequence (FCS). The MAC frame includes a MAC PDU and may be transmitted and received in the PSDU of the data part in the PPDU frame format.

[0092] The MAC header includes a Frame Control field, a Duration/Identifier (ID) field, an Address field, etc. The Frame Control field may include control information required for frame transmission/reception. The Duration/ID field may be set to a time for transmitting the frame. For details of Sequence Control, QoS Control, and HT Control subfields of the MAC header, refer to the IEEE 802.11-2012 technical specification.

[0093] The Frame Control field of the MAC header may include Protocol Version, Type, Subtype, To DS, From DS, More Fragment, Retry, Power Management, More Data, Protected Frame, and Order subfields. For the contents of each subfield in the Frame Control field, refer to the IEEE 802.11-2012 technical specification.

[0094] A Null-Data Packet (NDP) frame format is a frame format that does not include a data packet. In other words, the NDP frame format includes only a Physical Layer Convergence Protocol (PLCP) header part (i.e., the STF, LTF, and SIG fields) of the general PPDU frame format, without the remaining part (i.e., the Data field) of the general PPDU frame format. The NDP frame format may be referred to as a short frame format.

[0095] The IEEE 802.11ax task group is discussing a WLAN system, called a High Efficiency WLAN (HEW) system, that operates in 2.4GHz or 5GHz and supports a channel bandwidth (or channel width) of 20MHz, 40MHz, 80MHz, or 160MHz. The present invention defines a new PPDU frame format for the IEEE 802.11ax HEW system. The new PPDU frame format may support MU-MIMO or OFDMA. A PPDU of the new format may be referred to as a 'HEW PPDU' or 'HE PPDU' (similarly, HEW xyz may be referred to as 'HE xyz' or 'HE-xyz' in the following descriptions).

[0096] In present specification, the term 'MU-MIMO or OFDMA mode' includes MU-MIMO without using OFDMA, or OFDMA mode without using MU-MIMO in an orthogonal frequency resource, or OFDMA mode using MU-MIMO in an orthogonal frequency resource.

[0097] FIG. 7 depicts an exemplary HE PPDU frame format.

[0098] A transmitting STA may generate a PPDU frame according to the HE PPDU frame format as illustrated in FIG. 7 and transmit the PPDU frame to a receiving STA. The receiving STA may detect a PPDU and then process the PPDU.

[0099] The HE PPDU frame format may broadly include two parts: the first part including an L-STF field, an L-LTF field, an L-SIG field, an RL-SIG field, a HE-SIG-A field, and a HE-SIG-B field and the second part including a HE-STF field, a HE-LTF field, and a HE-DATA field. 64-FFT based on a channel bandwidth of 20MHz may be applied to the first part and a basic subcarrier spacing of 312.5kHz and a basic DFT period of $3.2 \mu\text{s}$ may be included in the first part. 256-FFT based on a channel bandwidth of 20MHz may be applied to the second part and a basic subcarrier spacing of 75.125kHz and a basic DFT period of $12.8 \mu\text{s}$ may be included in the second part.

[00100] The HE-SIG-A field may include N_{HESIGA} symbols, the HE-SIG-B field may include N_{HESIGB} symbols, the HE-LTF field may include N_{HELTF} symbols, and the HE-DATA field may include N_{DATA} symbols.

[00101] A detailed description of the fields included in the HE PPDU frame format is given in Table 1.

[00102] [Table 1]

Element	definition	duration	DFT period	GI	Subcarrier spacing	Description
Legacy(L)-STF	Non-high throughput(HT) Short Training field	8 μ s	-	-	equivalent to 1,250 kHz	• L-STF of a non-trigger-based PPDU has a periodicity of 0.8 μs with 10 periods.
L-LTF	Non-HT Long Training field	8 μ s	3.2 μ s	1.6 μ s	312.5 kHz	
L-SIG	Non-HT SIGNAL field	4 μ s	3.2 μ s	0.8 μ s	312.5 kHz	
RL-SIG	Repeated Non-HT SIGNAL field	4 μ s	3.2 μ s	0.8 μ s	312.5 kHz	
HE-SIG-A	HE SIGNAL A field	$N_{\text{HE-SIG-A}} * 4 \mu$ s	3.2 μ s	0.8 μ s	312.5 kHz	• HE-SIG-A is duplicated on each 20 MHz segment after the legacy preamble to indicate common control information. • $N_{\text{HE-SIG-A}}$ means the number of OFDM symbols of the HE-SIG-A field and is equal to 2 or 4.
HE-SIG-B	HE SIGNAL B field	$N_{\text{HE-SIG-B}} * 4 \mu$ s	3.2 μ s	0.8 μ s	312.5 kHz	• $N_{\text{HE-SIG-B}}$ means the number of OFDM symbols of the HE-SIG-B field and is variable. • DL MU packet contains HE-SIG-B. • SU packets and UL Trigger based packets do not contain HE-SIG-B.
HE-STF	HE Short Training field	4 or 8 μ s	-	-	• non-trigger-based PPDU: (equivalent to) 1,250 kHz; • trigger-based PPDU: (equivalent to) 625 kHz	• HE-STF of a non-trigger-based PPDU has a periodicity of 0.8 μs with 5 periods. A non-trigger-based PPDU is not sent in response to a trigger frame. • The HE-STF of a trigger-based PPDU has a periodicity of 1.6 μs with 5 periods. A trigger-based PPDU is an UL PPDU sent in response to a trigger frame.
HE-LTF	HE Long Training field	$N_{\text{HE-LTF}} * (\text{DFT period} + \text{GI}) \mu$ s	• 2xLTF: 6.4 μs • 4xLTF: 12.8 μs	supports 0.8, 1.6, 3.2 μ s	• 2xLTF: (equivalent to) 156.25 kHz; • 4xLTF: 78.125 kHz	• HE PPDU shall support 2xLTF mode and 4xLTF mode. • In the 2xLTF mode, HE-LTF symbol excluding GI is equivalent to modulating every other tone in an OFDM symbol of 12.8 μs excluding GI, and then removing the second half of the OFDM symbol in time domain. • $N_{\text{HE-LTF}}$ means the number of HE-LTF symbols and is equal to 1, 2, 4, 6, 8.
HE-DATA	HE DATA field	$N_{\text{DATA}} * (\text{DFT period} + \text{GI}) \mu$ s	12.8 μ s	supports 0.8, 1.6, 3.2 μ s	78.125 kHz	• N_{DATA} means the number of HE data symbols.

[00103] L-STF is a non-HT Short Training field and may have a duration of 8 μ s and a subcarrier spacing equivalent to 1250kHz. L-STF of a PPDU which is not based on a trigger may have a periodicity of 0.8 μ s with 10 periods. Herein, the trigger corresponds to scheduling information for UL transmission.

[00104] L-LTF is a non-HT Long Training field and may have a duration of $8\ \mu\text{s}$, a DFT period of $3.2\ \mu\text{s}$, a Guard Interval (GI) of $1.6\ \mu\text{s}$, and a subcarrier spacing of 312.5kHz.

[00105] L-SIG is a non-HT SIGNAL field and may have a duration of $4\ \mu\text{s}$, a DFT period of $3.2\ \mu\text{s}$, a GI of $0.8\ \mu\text{s}$, and a subcarrier spacing of 312.5kHz.

[00106] RL-SIG is a Repeated Non-HT SIGNAL field and may have a duration of $4\ \mu\text{s}$, a DFT period of $3.2\ \mu\text{s}$, a GI of $0.8\ \mu\text{s}$, and a subcarrier spacing of 312.5kHz.

[00107] L-STF, L-LTF, L-SIG, and RL-SIG may be called legacy preambles.

[00108] HE-SIG-A is a HE SIGNAL A field and may have a duration of $N_{\text{HESIGA}} * 4\ \mu\text{s}$, a DFT period of $3.2\ \mu\text{s}$, a GI of $0.8\ \mu\text{s}$, and a subcarrier spacing of 312.5kHz. HE-SIG-A may be duplicated on each 20MHz segment after the legacy preambles to indicate common control information. N_{HESIGA} represents the number of OFDM symbols of the HE-SIG-A field and may have a value of 2 or 4.

[00109] HE-SIG-B is a HE SIGNAL B field and may have a duration of $N_{\text{HESIGB}} * 4\ \mu\text{s}$, a DFT period of $3.2\ \mu\text{s}$, a GI of $0.8\ \mu\text{s}$, and a subcarrier spacing of 312.5kHz. N_{HESIGB} represents the number of OFDM symbols of the HE-SIG-B field and may have a variable value. In addition, although a DL Multi-User (MU) packet may include the HE-SIG-B field, a Single-User (SU) packet and a UL trigger based packet may not include the HE-SIG-B field.

[00110] HE-STF is a HE Short Training field and may have a duration of 4 or $8\ \mu\text{s}$. A non-trigger based PPDU may have a subcarrier spacing equivalent to 1250kHz and a trigger based PPDU may have a subcarrier spacing equivalent to 625kHz. HE-STF of the non-triggered PPDU may have a periodicity of $0.8\ \mu\text{s}$ with 4 periods. The non-triggered PPDU is not transmitted in response to a trigger field. HE-STF of the trigger based PPDU may have a periodicity of $1.6\ \mu\text{s}$ with 5 periods. The trigger based PPDU is a UL PPDU transmitted in response to the trigger frame.

[00111] HE-LTF is a HE Long Training field and may have a duration of $N_{\text{HELTF}} * (\text{DFT period} + \text{GI})\ \mu\text{s}$. N_{HELTF} represents the number of HE-LTF symbols and may have a value of 1, 2, 4, 6, or 8. A HE PPDU may support a 2xLTF mode and a 4xLTF mode. In the 2xLTF mode, a HE-LTF symbol except for a GI is equivalent to a symbol obtained by modulating every other tone in an OFDM symbol of $12.8\ \mu\text{s}$ excluding a GI and then eliminating the first half or the second half of the OFDM symbol in the time domain. In the 4xLTF mode, a HE-LTF symbol excluding a GI are equivalent to a symbol obtained by

modulating every fourth tone in an OFDM symbol of $12.8 \mu\text{s}$ excluding a GI and then eliminating the first three-fourths or the last three-fourths of the OFDM symbol in the time domain. 2xLTF may have a DFT period of $6.4 \mu\text{s}$ and 4xLTF may have a DFT period of $12.8 \mu\text{s}$. A GI of HE-LTF may support $0.8 \mu\text{s}$, $1.6 \mu\text{s}$, and $3.2 \mu\text{s}$. 2xLTF may have a subcarrier spacing equivalent to 156.25kHz and 4xLTF may have a subcarrier spacing of 78.125kHz .

[00112] HE-DATA is a HE DATA field and may have a duration of, $N_{\text{DATA}} * (\text{DFT period} + \text{GI}) \mu\text{s}$. N_{DATA} represents the number of HE-DATA symbols. HE-DATA may have a DFT period of $12.8 \mu\text{s}$. A GI of HE-DATA may support $0.8 \mu\text{s}$, $1.6 \mu\text{s}$, and $3.2 \mu\text{s}$. HE-DATA may have a subcarrier spacing of 78.125kHz .

[00113] The above description of the fields included in the HE PPDU frame format may be combined with exemplary HE PPDU frame formats described below. For example, characteristics of fields exemplarily described below may be applied while a transmission order of the fields of the HE PPDU frame format of FIG. 7 is maintained.

[00114] FIG. 8 depicts an exemplary HE PPDU frame format according to the present invention.

[00115] Referring to FIG. 8, the vertical axis represents frequency and the horizontal axis represents time. It is assumed that frequency and time increase in the upward direction and the right direction, respectively.

[00116] In the example of FIG. 8, one channel includes four subchannels. An L-STF, an L-LTF, an L-SIG, and an HE-SIG-A may be transmitted per channel (e.g., 20MHz), a HE-STF and a HE-LTF may be transmitted on each subchannel being a basic subchannel unit (e.g., 5MHz), and a HE-SIG-B and a PSDU may be transmitted on each of subchannels allocated to a STA. A subchannel allocated to a STA may have a size required for PSDU transmission to the STA. The size of the subchannel allocated to the STA may be N ($N=1, 2, 3, \dots$) times as large as the size of basic subchannel unit (i.e., a subchannel having a minimum size). In the example of FIG. 8, the size of a subchannel allocated to each STA is equal to the size of the basic subchannel unit. For example, a first subchannel may be allocated for PSDU transmission from an AP to STA1 and STA2, a second subchannel may be allocated for PSDU transmission from the AP to STA3 and STA4, a third subchannel may be allocated for PSDU transmission from the AP to STA5, and a fourth subchannel may be allocated for PSDU transmission from the AP to STA6.

[00117] While the term subchannel is used in the present disclosure, the term subchannel may be referred to as Resource Unit (RU) or subband. In particular, the terms like OFDMA subchannel, OFDMA RU, OFDMA subband can be used in embodiments for OFDMA in the present disclosure. Terms like a bandwidth of a subchannel, a number of tones (or subcarriers) allocated to a subchannel, a number of data tones (or data subcarriers) allocated to a subchannel can be used to express a size of a subchannel. A subchannel refers to a frequency band allocated to a STA and a basic subchannel unit refers to a basic unit used to represent the size of a subchannel. While the size of the basic subchannel unit is 5MHz in the above example, this is purely exemplary. Thus, the basic subchannel unit may have a size of 2.5MHz.

[00118] In FIG. 8, a plurality of HE-LTF elements are distinguished in the time and frequency domains. One HE-LTF element may correspond to one OFDM symbol in time domain and one subchannel unit (i.e., a subchannel bandwidth allocated to a STA) in frequency domain. The HE-LTF elements are logical units, and the PHY layer does not necessarily operate in units of an HE-LTF element. In the following description, a HE-LTF element may be referred to shortly as a HE-LTF.

[00119] A HE-LTF symbol may correspond to a set of HE-LTF elements in one OFDM symbol in time domain and in one channel unit (e.g., 20MHz) in frequency domain.

[00120] A HE-LTF section may correspond to a set of HE-LTF elements in one or more OFDM symbols in time domain and in one subchannel unit (i.e., a subchannel bandwidth allocated to a STA) in frequency domain.

[00121] A HE-LTF field may be a set of HE-LTF elements, HE-LTF symbols, or HE-LTF sections for a plurality of stations.

[00122] The L-STF field is used for frequency offset estimation and phase offset estimation, for preamble decoding at a legacy STA (i.e., a STA operating in a system such as IEEE 802.11a/b/g/n/ac). The L-LTF field is used for channel estimation, for the preamble decoding at the legacy STA. The L-SIG field is used for the preamble decoding at the legacy STA and provides a protection function for PPDU transmission of a third-party STA (e.g., a third-party STA is not allowed to transmit during a certain period based on the value of a LENGTH field included in the L-SIG field).

[00123] HE-SIG-A (or HEW SIG-A) represents High Efficiency Signal A (or High Efficiency WLAN Signal A), and includes HE PPDU (or HEW PPDU) modulation parameters, etc. for HE preamble (or HEW preamble) decoding at a HE STA (or HEW STA). The parameters set included in the HEW SIG-A field may include one or more of

Very High Throughput (VHT) PPDU modulation parameters transmitted by IEEE 802.11ac stations, as listed in [Table 2] below, to ensure backward compatibility with legacy STAs (e.g., IEEE 802.11ac stations).

[00124] [Table 2]

Two parts of VHT-SIG-A	Bit	Field	Number of bits	Description
VHT-SIG-A1	B0-B1	BW	2	Set to 0 for 20 MHz, 1 for 40 MHz, 2 for 80 MHz, and 3 for 160 MHz and 80+80 MHz
	B2	Reserved	1	Reserved. Set to 1.
	B3	STBC	1	For a VHT SU PPDU: Set to 1 if space time block coding is used and set to 0 otherwise. For a VHT MU PPDU: Set to 0.
	B4-B9	Group ID	6	Set to the value of the TXVECTOR parameter GROUP_ID. A value of 0 or 63 indicates a VHT SU PPDU; otherwise, indicates a VHT MU PPDU.
	B10-B21	NSTS/Partial AID	12	For a VHT MU PPDU: NSTS is divided into 4 user positions of 3 bits each. User position p , where $0 \leq p \leq 3$, uses bits $B(10 + 3p)$ to $B(12 + 3p)$. The number of space-time streams for user u are indicated at user position $p = \text{USER_POSITION}[u]$ where $u = 0, 1, \dots, \text{NUM_USERS} - 1$ and the notation $A[b]$ denotes the value of array A at index b . Zero space-time streams are indicated at positions not listed in the USER_POSITION array. Each user position is set as follows: Set to 0 for 0 space-time streams Set to 1 for 1 space-time stream Set to 2 for 2 space-time streams Set to 3 for 3 space-time streams Set to 4 for 4 space-time streams Values 5-7 are reserved For a VHT SU PPDU: B10-B12 Set to 0 for 1 space-time stream Set to 1 for 2 space-time streams Set to 2 for 3 space-time streams Set to 3 for 4 space-time streams Set to 4 for 5 space-time streams Set to 5 for 6 space-time streams Set to 6 for 7 space-time streams Set to 7 for 8 space-time streams B13-B21 Partial AID: Set to the value of the TXVECTOR parameter PARTIAL_AID. Partial AID provides an abbreviated indication of the intended recipient(s) of the PSDU (see 9.17a).
	B22	TXOP_PS_NOT_ALLO WED	1	Set to 0 by VHT AP if it allows non-AP VHT STAs in TXOP power save mode to enter Doze state during a TXOP. Set to 1 otherwise. The bit is reserved and set to 1 in VHT PPDU transmitted by a non-AP VHT STA.
	B23	Reserved	1	Set to 1

Two parts of VHT-SIG-A	Bit	Field	Number of bits	Description
VHT-SIG-A2	B0	Short GI	1	Set to 0 if short guard interval is not used in the Data field. Set to 1 if short guard interval is used in the Data field.
	B1	Short GI N_{SYM} Disambiguation	1	Set to 1 if short guard interval is used and $N_{SYM} \bmod 10 = 9$; otherwise, set to 0. N_{SYM} is defined in 22.4.3.
	B2	SU/MU[0] Coding	1	For a VHT SU PPDU, B2 is set to 0 for BCC, 1 for LDPC. For a VHT MU PPDU, if the MU[0] NSTS field is nonzero, then B2 indicates the coding used for user u with $USER_POSITION[u] = 0$; set to 0 for BCC and 1 for LDPC. If the MU[0] NSTS field is 0, then this field is reserved and set to 1.
	B3	LDPC Extra OFDM Symbol	1	Set to 1 if the LDPC PPDU encoding process (if an SU PPDU), or at least one LDPC user's PPDU encoding process (if a VHT MU PPDU), results in an extra OFDM symbol (or symbols) as described in 22.3.10.5.4 and 22.3.10.5.5. Set to 0 otherwise.
	B4-B7	SU VHT-MCS/MU[1-3] Coding	4	For a VHT SU PPDU: VHT-MCS index For a VHT MU PPDU: If the MU[1] NSTS field is nonzero, then B4 indicates coding for user u with $USER_POSITION[u] = 1$; set to 0 for BCC, 1 for LDPC. If the MU[1] NSTS field is 0, then B4 is reserved and set to 1. If the MU[2] NSTS field is nonzero, then B5 indicates coding for user u with $USER_POSITION[u] = 2$; set to 0 for BCC, 1 for LDPC. If the MU[2] NSTS field is 0, then B5 is reserved and set to 1. If the MU[3] NSTS field is nonzero, then B6 indicates coding for user u with $USER_POSITION[u] = 3$; set to 0 for BCC, 1 for LDPC. If the MU[3] NSTS field is 0, then B6 is reserved and set to 1. B7 is reserved and set to 1
	B8	Beamformed	1	For a VHT SU PPDU: Set to 1 if a Beamforming steering matrix is applied to the waveform in an SU transmission as described in 20.3.11.11.2, set to 0 otherwise. For a VHT MU PPDU: Reserved and set to 1 NOTE—If equal to 1 smoothing is not recommended.
	B9	Reserved	1	Reserved and set to 1
	B10-B17	CRC	8	CRC calculated as in 20.3.9.4.4 with c_7 in B10. Bits 0-23 of HT-SIG1 and bits 0-9 of HT-SIG2 are replaced by bits 0-23 of VHT-SIG-A1 and bits 0-9 of VHT-SIG-A2, respectively.
	B18-B23	Tail	6	Used to terminate the trellis of the convolutional decoder. Set to 0.

[00125] [Table 2] illustrates fields, bit positions, numbers of bits, and descriptions included in each of two parts, VHT-SIG-A1 and VHT-SIG-A2, of the VHT-SIG-A field defined by the IEEE 802.11ac standard. For example, a BW (BandWidth) field occupies two Least Significant Bits (LSBs), B0 and B1 of the VHT-SIG-A1 field and has a size of 2 bits. If the 2 bits are set to 0, 1, 2, or 3, the BW field indicates 20MHz, 40MHz, 80MHz, or 160 and 80+80MHz. For details of the fields included in the VHT-SIG-A field, refer to the IEEE 802.11ac-2013 technical specification. In the HE PPDU frame format of the present invention, the HE-SIG-A field may include one or more of the fields included in the VHT-SIG-A field, and it may provide backward compatibility with IEEE 802.11ac stations.

[00126] FIG. 9 depicts subchannel allocation in the HE PPDU frame format according to the present invention.

[00127] In FIG. 9, it is assumed that information indicating subchannels allocated to STAs in HE PPDU indicates that 0MHz subchannel is allocated to STA1 (i.e., no subchannel is allocated), a 5-MHz subchannel is allocated to each of STA2 and STA3, and a 10-MHz subchannel is allocated to STA4.

[00128] In the example of FIG. 9, an L-STF, an L-LTF, an L-SIG, and a HE-SIG-A may be transmitted per channel (e.g., 20MHz), a HE-STF and a HE-LTF may be transmitted on each of subchannels being basic subchannel units (e.g., 5MHz), and a HE-SIG-B and a PSDU may be transmitted on each of subchannels allocated to STAs. A subchannel allocated to a STA has a size required for PSDU transmission to the STA. The size of the subchannel allocated to the STA may be an N ($N=1, 2, 3, \dots$) multiple of the size of the basic subchannel unit (i.e., a minimum-size subchannel unit). In the example of FIG. 9, the size of a subchannel allocated to STA2 is equal to that of the basic subchannel unit, the size of a subchannel allocated to STA3 is equal to that of the basic subchannel unit, and the size of a subchannel allocated to STA4 is twice larger than that of the basic subchannel unit.

[00129] FIG. 9 illustrates a plurality of HE-LTF elements and a plurality of HE-LTF subelements which are distinguished in the time and frequency domains. One HE-LTF element may correspond to one OFDM symbol in the time domain and one subchannel unit (i.e., the bandwidth of a subchannel allocated to a STA) in the frequency domain. One HE-LTF subelement may correspond to one OFDM symbol in the time domain and one basic subchannel unit (e.g. 5MHz) in the frequency domain. In the example of FIG. 9, one HE-LTF element includes one HE-LTF subelement in the 5-MHz subchannel allocated to STA2 or STA3. On the other hand, one HE-LTF element includes two HE-LTF subelements in the third subchannel, i.e., 10-MHz subchannel, allocated to STA4. A HE-LTF element and a HE-LTF subelement are logical units and the PHY layer does not always operate in units of a HE-LTF element or HE-LTF subelement.

[00130] A HE-LTF symbol may correspond to a set of HE-LTF elements in one OFDM symbol in the time domain and one channel unit (e.g. 20MHz) in the frequency domain. That is, one HE-LTF symbol may be divided into HE-LTF elements by a subchannel width allocated to a STA and into HE-LTF subelements by the width of the basic subchannel unit in the frequency domain.

[00131] A HE-LTF section may correspond to a set of HE-LTF elements in one or more OFDM symbols in the time domain and one subchannel unit (i.e. the bandwidth of a subchannel allocated to a STA) in the frequency domain. A HE-LTF subsection may correspond to a set of HE-LTF elements in one or more OFDM symbols in the time domain and one basic subchannel unit (e.g., 5MHz) in the frequency domain. In the example of FIG. 9, one HE-LTF section includes one HE-LTF subsection in the 5-MHz subchannel allocated to STA2 or STA3. On the other hand, one HE-LTF section includes two HE-LTF subsections in the third subchannel, i.e., 10-MHz subchannel, allocated to STA4.

[00132] A HE-LTF field may correspond to a set of HE-LTF elements (or subelements), HE-LTF symbols, or HE-LTF sections (or subsections) for a plurality of stations.

[00133] For the afore-described HE PPDU transmission, subchannels allocated to a plurality of HE STAs may be contiguous in the frequency domain. In other words, for HE PPDU transmission, the subchannels allocated to the HE STAs may be sequential and any intermediate one of the subchannels of one channel (e.g., 20MHz) may not be allowed to be unallocated or empty. Referring to FIG. 8, if one channel includes four subchannels, it may not be allowed to keep the third subchannel unallocated and empty, while the first, second, and fourth subchannels are allocated to STAs. However, the present invention does not exclude non-allocation of an intermediate subchannel of one channel to a STA.

[00134] FIG. 10 depicts a subchannel allocation method according to the present invention.

[00135] In the example of FIG. 10, a plurality of contiguous channels (e.g., 20-MHz-bandwidth channels) and boundaries of the plurality of contiguous channels are shown. In FIG. 10, a preamble may correspond to an L-STF, an L-LTF, an L-SIG, and a HE-SIG-A as illustrated in the examples of FIGS. 8 and 9.

[00136] A subchannel for each HE STA may be allocated only within one channel, and may not be allocated with partially overlapping between a plurality of channels. That is, if there are two contiguous 20-MHz channels CH1 and CH2, subchannels for STAs paired for MU-MIMO-mode or OFDMA-mode transmission may be allocated either within CH1 or within CH2, and it may be prohibited that one part of a subchannel exists in CH1 and another part of the subchannel exists in CH2. This means that one subchannel may not be allocated with crossing a channel boundary. From the perspective of RUs supporting the MU-MIMO or OFDMA mode, a bandwidth of 20MHz may be divided into one or more RUs, and a bandwidth of 40MHz may be divided into one or more RUs in each of two

contiguous 20-MHz bandwidths, and no RU is allocated with crossing the boundary between two contiguous 20-MHz bandwidths.

[00137] As described above, it is not allowed that one subchannel belongs to two or more 20-MHz channels. Particularly, a 2.4-GHz OFDMA mode may support a 20-MHz OFDMA mode and a 40-MHz OFDMA mode. In the 2.4-GHz OFDMA mode, it may not be allowed that one subchannel belongs to two or more 20-MHz channels.

[00138] FIG. 10 is based on the assumption that subchannels each having the size of a basic subchannel unit (e.g., 5MHz) in CH1 and CH2 are allocated to STA1 to STA7, and subchannels each having double the size (e.g., 10MHz) of the basic subchannel unit in CH4 and CH5 are allocated to STA8, STA9, and STA10.

[00139] As illustrated in the lower part of FIG. 9, although a subchannel allocated to STA1, STA2, STA3, STA5, STA6, or STA7 is fully overlapped only with one channel (i.e., without crossing the channel boundary, or belonging only to one channel), a subchannel allocated to STA4 is partially overlapped with the two channels (i.e., crossing the channel boundary, or belonging to the two channels). In the forgoing example of the present invention, the subchannel allocation to STA4 is not allowed.

[00140] As illustrated in the upper part of FIG. 9, although a subchannel allocated to STA8 or STA10 is fully overlapped only with one channel (i.e., crossing the channel boundary, or belonging only to one channel), a subchannel allocated to STA9 is partially overlapped with two channels (i.e., crossing the channel boundary, or belonging to the two channels). In the forgoing example of the present invention, the subchannel allocation to STA9 is not allowed.

[00141] On the other hand, it may be allowed to allocate a subchannel partially overlapped between a plurality of channels (i.e., crossing the channel boundary, or belonging to two channels). For example, in SU-MIMO mode transmission, a plurality of contiguous channels may be allocated to a STA and any of one or more subchannels allocated to the STA may cross the boundary between two contiguous channels.

[00142] While the following description is given with an assumption that one subchannel has a channel bandwidth of 5MHz in one channel having a channel bandwidth of 20MHz, this is provided to simplify the description of the principle of the present invention and thus should not be construed as limiting the present invention. For example, the bandwidths of a channel and a subchannel may be defined or allocated as values other than the above examples. In addition, a plurality of subchannels in one channel may have the same or different channel widths.

[00143] FIG. 11 depicts the starting and ending points of a HE-LTF field in the HE PPDU frame format according to the present invention.

[00144] To support the MU-MIMO mode and the OFDMA mode, the HE PPDU frame format according to the present invention may include, in the HE-SIG-A field, information about the number of spatial streams to be transmitted to a HE STA allocated to each subchannel.

[00145] If MU-MIMO-mode or OFDMA-mode transmission is performed to a plurality of HE STAs on one subchannel, the number of spatial streams to be transmitted to each of the HE STAs may be provided in the HE-SIG-A or HE-SIG-B field, which will be described later in detail.

[00146] FIG. 11 is based on the assumption that a first 5-MHz subchannel is allocated to STA1 and STA2 and two spatial streams are transmitted to each STA in a DL MU-MIMO or OFDMA mode (i.e., a total of four spatial streams are transmitted on one subchannel). For this purpose, a HE-STF, a HE-LTF, a HE-LTF, a HE-LTF, a HE-LTF, and a HE-SIG-B follow the HE-SIG-A field on the subchannel. The HE-STF is used for frequency offset estimation and phase offset estimation for the 5-MHz subchannel. The HE-LTFs are used for channel estimation for the 5-MHz subchannel. Since the subchannel carries four spatial streams, as many HE-LTFs (i.e., HE-LTF symbols or HE-LTF elements in a HE-LTF section) as the number of the spatial streams, that is, four HE-LTFs are required to support MU-MIMO transmission.

[00147] According to an example of the present invention, relationship between a total number of spatial streams transmitted on one subchannel and a number of HE-LTFs is listed in [Table 3].

[00148] [Table 3]

Total number of spatial streams transmitted on one subchannel	Number of HE-LTFs
1	1
2	2
3	4
4	4
5	6
6	6
7	8
8	8

[00149] Referring to [Table 3], if one spatial stream is transmitted on one subchannel, at least one HE-LTF needs to be transmitted on the subchannel. If an even number of spatial streams are transmitted on one subchannel, at least as many HE-LTFs as the number of the

spatial streams need to be transmitted. If an odd number of spatial streams greater than one are transmitted on one subchannel, at least as many HE-LTFs as a number of adding 1 to the number of the spatial streams need to be transmitted.

[00150] Referring to FIG. 11 again, it is assumed that the second 5-MHz subchannel is allocated to STA3 and STA4 and one spatial streams per STA is transmitted in the DL MU-MIMO or OFDMA mode (i.e., a total of two spatial streams are transmitted on one subchannel). In this case, two HE-LTFs need to be transmitted on the second subchannel, however, in the example of FIG. 11, a HE-STF, a HE-LTF, a HE-LTF, a HE-LTF, a HE-LTF, and a HE-SIG-B follow the HE-SIG-A field on the subchannel (i.e., four HE-LTFs are transmitted). This is for setting the same starting time of PSDU transmission for subchannels allocated to other STAs paired with STA3 and STA4 for MU-MIMO transmission. If only two HE-LTFs are transmitted on the second subchannel, PSDUs are transmitted at different time points on the first and second subchannels. PSDU transmission on each subchannel at a different time point results in discrepancy between OFDM symbol timings of subchannels, thereby no orthogonality is maintained. To overcome this problem, an additional constraint need to be imposed for HE-LTF transmission.

[00151] Basically, transmission of as many HE-LTFs as required is sufficient in an SU-MIMO or non-OFDMA mode. However, timing synchronization (or alignment) with fields transmitted on subchannels for other paired STAs is required in the MU-MIMO or OFDMA mode. Accordingly, the numbers of HE-LTFs may be determined for all other subchannels based on a subchannel having the maximum number of streams in MU-MIMO-mode or OFDMA-mode transmission.

[00152] Specifically, the numbers of HE-LTFs may be determined for all subchannels according to the maximum of the numbers of HE-LTFs (HE-LTF symbols or HE-LTF elements in a HE-LTF section) required according to the total numbers of spatial streams transmitted on each subchannel, for a set of HE STAs allocated to each subchannel. A “set of HE STAs allocated to each subchannel” is one HE STA in the SU-MIMO mode, and a set of HE STAs paired across a plurality of subchannels in the MU-MIMO mode. The ‘number of spatial streams transmitted on each subchannel’ is the number of spatial streams transmitted to one HE STA in the SU-MIMO mode, and the number of spatial streams transmitted to a plurality of HE STAs paired on the subchannel in the MU-MIMO mode.

[00153] That is, it may be said that a HE-LTF field starts at the same time point and ends at the same time point in a HE PPDU for all users (i.e. HE STAs) in MU-MIMO-mode or OFDMA-mode transmission. Or it may be said that the lengths of HE-LTF sections are

equal on a plurality of subchannels for all users (i.e. HE STAs) in MU-MIMO-mode or OFDMA-mode transmission. Or it may be said that the number of HE-LTF elements included in each HE-LTF section is equal on a plurality of subchannels for all users (i.e. HE STAs) in MU-MIMO-mode or OFDMA-mode transmission. Accordingly, PSDU transmission timings may be synchronized among a plurality of subchannels for all HE STAs in MU-MIMO-mode or OFDMA-mode transmission.

[00154] As described above, the number of HE-LTF symbols (refer to FIG. 8) may be 1, 2, 4, 6, or 8 in HE PPDU transmission in the MU-MIMO or OFDMA mode, determined according to the maximum of the numbers of spatial streams on each of a plurality of subchannels. A different number of spatial streams may be allocated to each of a plurality of subchannels, and the number of spatial streams allocated to one subchannel is the number of total spatial streams for all users allocated to the subchannel. That is, the number of HE-LTF symbols may be determined according to the number of spatial streams allocated to a subchannel having a maximum number of spatial streams by comparing the number of total spatial streams for all users allocated to one of a plurality of subchannels with the number of total spatial streams for all users allocated to another subchannel.

[00155] Specifically, in HE PPDU transmission in the OFDMA mode, the number of HE-LTF symbols may be 1, 2, 4, 6, or 8, determined based on the number of spatial streams transmitted in a subchannel having a maximum number of spatial streams across a plurality of subchannels. Further, in HE PPDU transmission in the OFDMA mode, the number of HE-LTF symbols may be determined based on whether the number of spatial streams transmitted in a subchannel having a maximum number of spatial streams across a plurality of subchannels is odd or even (refer to [Table 3]). That is, in HE PPDU transmission in the OFDMA mode, when the number (e.g., K) of spatial streams transmitted in a subchannel having a maximum number of spatial streams across a plurality of subchannels is an even number, the number of HE-LTF symbols may be equal to K . In HE PPDU transmission in the OFDMA mode, when the number, K , of spatial streams transmitted in a subchannel having a maximum number of spatial streams across a plurality of subchannels is an odd number greater than one, the number of HE-LTF symbols may be equal to $K+1$.

[00156] When only one STA is allocated to one subchannel in OFDMA mode (i.e., OFDMA mode without using MU-MIMO), a subchannel having a maximum number of spatial streams across a plurality of subchannels may be determined by the number of spatial streams for a STA allocated to each subchannel. When more than one STA is allocated to one subchannel in OFDMA mode (i.e., OFDMA mode using MU-MIMO), a

subchannel having a maximum number of spatial streams across a plurality of subchannels may be determined by the number of STAs allocated to each subchannel and the number of spatial streams for each STA allocated to each subchannel (e.g., if STA1 and STA2 are allocated to one subchannel, sum of the number of spatial streams for STA1 and the number of spatial streams for STA2).

[00157] When transmitting a HE PPDU frame in the MU-MIMO or OFDMA mode, a transmitter may generate P (P is an integer equal to or larger than 1) HE-LTF symbols (refer to FIG. 8) and transmit a HE PPDU frame including at least the P HE-LTF symbols and a Data field to a receiver. The HE PPDU frame may be divided into Q subchannels in the frequency domain (Q is an integer equal to or larger than 2). Each of the P HE-LTF symbols may be divided into Q HE-LTF elements corresponding to the Q subchannels in the frequency domain. That is, the HE PPDU may include P HE-LTF elements on one subchannel (herein, the P HE-LTF elements may belong to one HE-LTF section on the subchannel).

[00158] As described above, the number of HE-LTF elements (i.e., P) in one of the Q subchannels may be equal to the number of HE-LTF elements (i.e., P) of another subchannel. Also, the number of HE-LTF elements (i.e., P) included in a HE-LTF section in one of the Q subchannels may be equal to the number of HE-LTF elements (i.e., P) included in a HE-LTF section in another subchannel. The HE-LTF section of one of the Q subchannels may start and end at the same time points as the HE-LTF section of another subchannel. Also, the HE-LTF sections may start and end at the same time points across the Q subchannels (i.e., across all users or stations).

[00159] Referring to FIG. 11 again, the third 5-MHz subchannel is allocated to STA5 and one spatial stream is transmitted on the subchannel in SU-MIMO (considering all subchannels, a plurality of spatial streams are transmitted to STA1 to STA6 in MU-MIMO or OFDMA mode). In this case, although transmission of one HE-LTF is sufficient for the subchannel, as many HE-LTFs as the maximum of the numbers of HE-LTFs on the other subchannels, that is, four HE-LTFs are transmitted on the subchannel in order to align the starting points and ending points of the HE-LTF fields of the subchannels.

[00160] The fourth 5-MHz subchannel is allocated to STA6 and one spatial stream is transmitted on the subchannel in SU-MIMO (considering all other subchannels, a plurality of spatial streams are transmitted to STA1 to STA6 in MU-MIMO or OFDMA mode). In this case, although transmission of one HE-LTF is sufficient for the subchannel, as many HE-LTFs as the maximum of the numbers of HE-LTFs on the other subchannels, that is,

four HE-LTFs are transmitted on the subchannel in order to align the starting points and ending points of the HE-LTF fields of the subchannels.

[00161] In the example of FIG. 11, the remaining two HE-LTFs except two HE-LTFs required for channel estimation of STA3 and STA4 on the second subchannel, the remaining three HE-LTFs except one HE-LTF required for channel estimation of STA5 on the third subchannel, and the remaining three HE-LTFs except one HE-LTF required for channel estimation of STA6 on the fourth subchannel may be said to be placeholders that are actually not used for channel estimation at the STAs.

[00162] FIG. 12 depicts a HE-SIG-B field and a HE-SIG-C field in the HE PPDU frame format according to the present invention.

[00163] To effectively support MU-MIMO-mode or OFDMA-mode transmission in the HE PPDU frame format according to the present invention, independent signaling information may be transmitted on each subchannel. Specifically, a different number of spatial streams may be transmitted to each of a plurality of HE STAs that receive an MU-MIMO-mode or OFDMA-mode transmission simultaneously. Therefore, information about the number of spatial streams to be transmitted should be indicated to each HE STA.

[00164] Information about the number of spatial streams on one channel may be included in, for example, a HE-SIG-A field. A HE-SIG-B field may include spatial stream allocation information about one subchannel. Also, a HE-SIG-C field may be transmitted after transmission of HE-LTFs, including Modulation and Coding Scheme (MCS) information about a PSDU and information about the length of the PSDU, etc.

[00165] With reference to the foregoing examples of the present invention, mainly the features of a HE PPDU frame structure applicable to a DL MU-MIMO-mode or OFDMA-mode transmission that an AP transmits simultaneously to a plurality of STAs have been described. Now, a description will be given of the features of a HE PPDU frame structure applicable to a UL MU-MIMO-mode or OFDMA-mode transmission that a plurality of STAs transmits simultaneously to an AP.

[00166] The above-described various examples of structures of the HE PPDU frame format supporting MU-MIMO-mode or OFDMA-mode transmission should not be understood as applicable only to DL without applicable UL. Rather, the examples should be understood as also applicable to UL. For example, the above-described exemplary HE PPDU frame formats may also be used for a UL HE PPDU transmission that a plurality of STAs simultaneously transmits to a single AP.

[00167] However, in the case of a DL MU-MIMO-mode or OFDMA-mode HE PPDU transmission that an AP simultaneously transmits to a plurality of STAs, the transmission entity, AP has knowledge of the number of spatial streams transmitted to a HE STA allocated to each of a plurality of subchannels. Therefore, the AP may include, in a HE-SIG-A field or a HE-SIG-B field, information about the total number of spatial streams transmitted across a channel, a maximum number of spatial streams (i.e., information being a basis of the number of HE-LTF elements (or the starting point and ending point of a HE-LTF section) on each subchannel), and the number of spatial streams transmitted on each subchannel. In contrast, in the case of a UL MU-MIMO-mode or OFDMA-mode HE PPDU transmission that a plurality of STAs simultaneously transmits to an AP, each STA being a transmission entity may be aware only of the number of spatial streams in a HE PSDU that it will transmit, without knowledge of the number of spatial streams in a HE PSDU transmitted by another STA paired with the STA. Accordingly, the STA may determine neither the total number of spatial streams transmitted across a channel nor a maximum number of spatial streams.

[00168] To solve this problem, a common parameter (i.e., a parameter applied commonly to STAs) and an individual parameter (a separate parameter applied to an individual STA) may be configured as follows in relation to a UL HE PPDU transmission.

[00169] For simultaneous UL HE PPDU transmissions from a plurality of STAs to an AP, a protocol may be designed in such a manner that the AP sets a common parameter or individual parameters (common/individual parameters) for the STAs for the UL HE PPDU transmissions and each STA operates according to the common/individual parameters. For example, the AP may transmit a trigger frame (or polling frame) for a UL MU-MIMO-mode or OFDMA-mode transmission to a plurality of STAs. The trigger frame may include a common parameter (e.g., the number of spatial streams across a channel or a maximum number of spatial streams) and individual parameters (e.g., the number of spatial streams allocated to each subchannel), for the UL MU-MIMO-mode or OFDMA-mode transmission. As a consequence, a HE PPDU frame format applicable to a UL MU-MIMO or OFDMA mode may be configured without a modification to an exemplary HE PPDU frame format applied to a DL MU-MIMO or OFDMA mode. For example, each STA may configure a HE PPDU frame format by including information about the number of spatial streams across a channel in a HE-SIG-A field, determining the number of HE-LTF elements (or the starting point and ending point of a HE-LTE section) on each subchannel according

to the maximum number of spatial streams, and including information about the number of spatial streams for the individual STA in a HE-SIG-B field.

[00170] Alternatively, if the STAs operate always according to the common/individual parameters received in the trigger frame from the AP, each STA does not need to indicate the common/individual parameters to the AP during a HE PPDU transmission. Therefore, this information may not be included in a HE PPDU. For example, each STA may have only to determine the total number of spatial streams, the maximum number of spatial streams, and the number of spatial streams allocated to individual STA, as indicated by the AP, and configure a HE PPDU according to the determined numbers, without including information about the total number of spatial streams or the number of spatial streams allocated to the STA in the HE PPDU.

[00171] On the other hand, if the AP does not provide common/individual parameters in a trigger frame, for a UL MIMO-mode or OFDMA-mode HE PPDU transmission, the following operation may be performed.

[00172] Common transmission parameters (e.g., channel BandWidth (BW) information, etc.) for simultaneously transmitted HE PSDUs may be included in HE-SIG-A field, but parameters that may be different for individual STAs (e.g., the number of spatial streams, an MCS, and whether STBC is used or not, for each individual STA) may not be included in HE-SIG-A field. Although the individual parameters may be included in HE-SIG-B field, information about the number of spatial streams and information indicating whether STBC is used or not, need to be transmitted before a HE-LTF field because the number of spatial streams and the information indicating whether STBC is used or not are significant to determination of configuration information about a preamble and a PSDU in a HE PPDU frame format (e.g., the number of HE-LTF elements is determined according to a combination of the number of spatial streams and the information indicating whether STBC is used or not). For this purpose, a HE PPDU frame format as illustrated in FIG. 13 may be used for a UL HE PPDU transmission.

[00173] FIG. 13 depicts another exemplary HE PPDU frame format according to the present invention. The HE PPDU frame format illustrated in FIG. 13 is characterized in that a structure of HE-SIG-A, HE-SIG-B, and HE-SIG-C fields similar to in FIG. 12 is used for a UL PPDU transmission.

[00174] As described before, if a UL MU-MIMO-mode or OFDMA-mode transmission is performed by triggering of an AP (according to common/individual parameters provided by the AP), an individual STA may not need to report an individual

parameter to the AP. In this case, one or more of a HE-SIG-B field, a HE-SIG-C field, and a first HE-LTF element (i.e., a HE-LTF between a HE-STF field and a HE-SIG-B field) illustrated in FIG. 13 may not exist. In this case, a description of each field given below may be applied only in the presence of the field.

[00175] In the example of FIG. 13, a HE-SIG-A field is transmitted per channel (i.e., per 20-MHz channel) and may include transmission parameters common to simultaneously transmitted HE PSDUs. Since the same information is transmitted in up to HE-SIG-A fields in UL PPDU transmitted by HE STAs allocated to subchannels, the AP may receive the same signals from the plurality of STAs successfully.

[00176] A HE-SIG-B field is transmitted per subchannel in one channel. The HE-SIG-B field may have an independent parameter value according to the transmission characteristics of a HE PSDU transmitted on each subchannel. The HE-SIG-B field may include spatial stream allocation information and information indicating whether STBC is used or not, for each subchannel. If MU-MIMO is applied to a subchannel (i.e., if a plurality of STAs perform transmission on a subchannel), the HE-SIG-B field may include a common parameter for the plurality of STAs paired on the subchannel.

[00177] A HE-SIG-C field is transmitted on the same subchannel as the HE-SIG-B field and may include information about an MCS and a packet length. If MU-MIMO is applied to a subchannel (i.e., if a plurality of STAs perform transmission on a subchannel), the HE-SIG-C field may include respective individual parameters for each of the plurality of STAs paired on the subchannel.

[00178] Similarly to DL MU-MIMO-mode or OFDMA-mode HE PPDU transmission, transmissions of PSDUs may start at different time points on subchannels in UL MU-MIMO-mode or OFDMA-mode HE PPDU transmission, and if OFDM symbols are not aligned accordingly, then the implementation complexity of an AP that receives a plurality of PSDUs increased. To solve this problem, ‘the number of HE-LTFs may be determined for all subchannels according to the maximum of the numbers of HE LTFs required according to the total numbers of spatial streams transmitted on each subchannel for a set of HE STAs allocated to each of subchannels’ as described with reference to the example of FIG. 11.

[00179] This feature may mean that the HE-LTF field start at the same time point and end at the same time point across all users (i.e., HE STAs) in UL MU-MIMO-mode or OFDMA-mode transmission. Or it may be said that the HE-LTF sections of a plurality of subchannels have the same length across all HE STAs in UL MU-MIMO-mode or

OFDMA-mode transmission. Or it may be said that each of the HE-LTF sections of a plurality of subchannels includes the same number of HE-LTF elements across all HE STAs in UL MU-MIMO-mode or OFDMA-mode transmission. Therefore, PSDU transmission timings are synchronized between a plurality of subchannels across all HE STAs in UL MU-MIMO-mode or OFDMA-mode transmission.

[00180] As described before, a plurality of STAs may simultaneously transmit PSDUs in a HE PPDU frame format on their allocated subchannels or on their allocated spatial streams to an AP (i.e., referred to as UL MU-MIMO or OFDMA transmission or “UL MU transmission”) and may simultaneously receive PSDUs in the HE PPDU frame format on their allocated subchannels on their allocated spatial streams from the AP (i.e., referred to as DL MU-MIMO or OFDMA transmission or “DL MU transmission”).

[00181] FIGS. 14 and 15 depict operating channels in a WLAN system.

[00182] Basically, the WLAN system may support a single channel having a bandwidth of 20MHz as a BSS operating channel. The WLAN system may also support a BSS operating channel having a bandwidth of 40MHz, 80MHz, or 160MHz by bonding a plurality of contiguous 20-MHz channels (refer to FIG. 14). Further, the WLAN system may support a BSS operating channel having a bandwidth of 160MHz including non-contiguous 80-MHz channels (called a bandwidth of 80+80MHz) (refer to FIG. 15).

[00183] As illustrated in FIG. 14, one 40-MHz channel may include a primary 20-MHz channel and a secondary 20-MHz channel which are contiguous. One 80-MHz channel may include a primary 40-MHz channel and a secondary 40-MHz channel which are contiguous. One 160-MHz channel may include a primary 80-MHz channel and a secondary 80-MHz channel which are contiguous. As illustrated in FIG. 15, one 80+80-MHz channel may include a primary 80-MHz channel and a secondary 80-MHz channel which are non-contiguous.

[00184] A primary channel is defined as a common channel for all STAs within a BSS. The primary channel may be used for transmission of a basic signal such as a beacon. The primary channel may also be a basic channel used for transmission of a data unit (e.g., a PPDU). If an STA uses a channel width larger than the channel width of the primary channel, for data transmission, the STA may use another channel within a corresponding channel, in addition to the primary channel. This additional channel is referred to as a secondary channel.

[00185] A STA according to an Enhanced Distributed Channel Access (EDCA) scheme may determine a transmission bandwidth (or a transmission channel width) as follows.

[00186] Upon generation of a transmission frame, an STA (e.g., an AP or a non-AP STA) may perform a back-off procedure on a primary channel in order to acquire a Transmission Opportunity (TXOP). For this purpose, the STA may sense the primary channel during a DIFS or AIFS[i]. If the primary channel is idle, the STA may attempt to transmit the frame. The STA may select a random back-off count, wait for a slot time corresponding to the selected random back-off count, and then attempt to transmit the frame. The random back-off count may be determined to be a value ranging from 0 to CW (CW is a value of a contention window parameter).

[00187] When the random back-off procedure starts, the STA may activate a back-off timer according to the determined back-off count and decrement the back-off count by 1 each time. If the medium of the corresponding channel is monitored as busy, the STA discontinues the count-down and waits. If the medium is idle, the STA resumes the count-down. If the back-off timer reaches 0, the STA may determine a transmission bandwidth by checking whether the secondary channel is idle or busy at the corresponding time point.

[00188] For example, the STA may monitor a channel-idle state during a predetermined IFS (e.g., DIFS or AIFS[i]) on the primary channel and determine a transmission start timing on the primary channel by the random back-off procedure. If the secondary channel is idle during a PIFS shortly before the determined transmission start timing of the primary channel, the STA may transmit a frame on the primary channel and the secondary channel.

[00189] As described above, when the back-off timer reaches 0 for the primary channel, the STA may transmit an X-MHz mask PPDU (e.g., X is 20, 40, 80, or 160) on channels including an idle secondary channel(s) according to the CCA result of the secondary channel(s).

[00190] The X-MHz mask PPDU is a PPDU for which a TXVECTOR parameter, CH_BANDWIDTH is set to CBW X. That is, if the X-MHz mask PPDU can be transmitted, this means that a PPDU satisfying a spectrum mask for X-MHz transmission can be transmitted. The X-MHz mask PPDU may include a PPDU transmitted in a bandwidth equal to or smaller than X MHz.

[00191] For example, if an 80-MHz mask PPDU can be transmitted, this means that a PPDU having a channel width of 80MHz or a PPDU having a channel width smaller than

80MHz (e.g., 40MHz, 20MHz, etc.) can be transmitted within a Power Spectral Density (PSD) limit of a spectrum mask for 80-MHz transmission.

[00192] As described before, if a STA is allowed to start a TXOP and has at least one MAC Service Data Unit (MSDU) to be transmitted under the Access Category (AC) of the TXOP allowed for the STA, the STA may perform one of the following a), b), c), d), or e) (in the following description, FIGS. 14 and 15 may be referred to for a primary channel (i.e., a primary 20-MHz channel) a secondary channel (i.e., a secondary 20-MHz channel), a secondary 40-MHz channel, and a secondary 80-MHz channel).

[00193] a) If the secondary channel, the secondary 40-MHz channel, and the secondary 80-MHz channel are idle during a PIFS shortly before the start of the TXOP, a 160-MHz or 80+80-MHz mask PPDU may be transmitted.

[00194] b) If both the secondary channel and the secondary 40-MHz channel are idle during the PIFS shortly before the start of the TXOP, an 80-MHz mask PPDU may be transmitted on a primary 80-MHz channel.

[00195] c) If the secondary channel is idle during the PIFS shortly before the start of the TXOP, a 40-MHz mask PPDU may be transmitted on a primary 40-MHz channel.

[00196] d) A 20-MHz mask PPDU may be transmitted on the primary 20-MHz channel.

[00197] e) A channel access attempt may be resumed by performing a back-off procedure as in the case where the medium is indicated as busy on the primary channel by one of physical carrier sensing and virtual carrier sensing and a back-off timer has a value of 0.

[00198] Now, a description will be given of a method for performing UL SU PPDU transmission or UL MU PPDU transmission according to the type of a response to DL MU transmission and a method for protecting a DL/UL HE PPDU in a WLAN system supporting DL/UL MU transmission.

[00199] The method for protecting a DL/UL HE PPDU will first be described below.

[00200] Transmission of a HE PPDU may be protected by preventing another STA (e.g., a third-party STA) from accessing a wireless channel during transmission of the HE PPDU. For this purpose, a specific field included in the HE PPDU may be used.

[00201] That is, the third-party STA may regard the channel as busy during a corresponding time period based on duration information included in a PHY header (e.g., an L-SIG, a HE-SIG-A, a HE-SIG-B, etc.) of the HE PPDU.

[00202] For example, the third-party STA (e.g., including a legacy STA that is not

capable of decoding a HE preamble and a data part of the HE PPDU and a HE STA capable of decoding the HE PPDU) may not perform transmission during the corresponding time period based on a duration (i.e., an L-SIG duration) determined according to a parameter (e.g., a L_LENGTH subfield or an L_DATARATE subfield) included in the L-SIG field of the HE PPDU. As a consequence, since the third-party STA does not attempt to access the channel during the time period determined based on the L-SIG duration even though the channel is physically idle, the HE PPDU transmission may be protected.

[00203] For example, the parameter, L_LENGTH or L_DATARATE included in the L-SIG field may be set as follows by [Equation 1].

[00204] [Equation 1]

$$L_LENGTH = \left\lceil \frac{((TXTIME - \text{Signal Extension}) - (aPreambleLength + aPHYHeaderLength))}{aSymbolLength} \right\rceil \\ \times N_{OPS} - \left\lfloor \frac{aPHYServiceLength + aPHYConvolutionalTailLength}{8} \right\rfloor$$

[00205] In [Equation 1], $\lceil \cdot \rceil$ represents a ceiling operation and $\lfloor x \rfloor$ represents the least integer equal to or larger than x.

[00206] If a TXVECTOR parameter, NO_SIG_EXTN is set to True, SignalExtension may have a value of 0μs. On the other hand, if the TXVECTOR parameter, NO_SIG_EXTN is set to False, SignalExtension may have a value corresponding to a duration defined by an aSignalExtension parameter (6μs in 2.4GHz and 0μs in 5GHz).

[00207] aSymbolLength may have a value corresponding to a symbol duration (in μs). In general, aSymbolLength may have a fixed value of 4.

[00208] (aPreambleLength + aPHYHeaderLength) may have a value corresponding to the durations of a non-HT PHY preamble and an L-SIG (in μs), and may follow what is defined in a PLME-CHARACTERISTICS.confirm primitive.

[00209] If a rate specified by L_DATARATE is used, N_{OPS} may have a value corresponding to the number of octets transmitted during a time period indicated by aSymbolLength. In general, L_DATARATE may have a fixed value of 6Mbps. In this case, N_{OPS} may have a fixed value of 4.

[00210] aPHYServiceLength may have a value corresponding to the number of bits of a PHY SERVICE field.

[00211] aPHYConvolutionalTailLength may have a value corresponding to the number of bits of a convolutional code tail bit sequence.

[00212] In the case of a HE PPDU, if $(aPreambleLength + aPHYHeaderLength)=20$, $aSymbolLength=4$, $N_{OPS}=3$, and $24 \leq (aPHYServiceLength + aPHYConvolutionalTailLength) < 32$ in the above [Equation 1], the value of the L_LENGTH subfield may be expressed as [Equation 2].

[00213] [Equation 2]

$$L_LENGTH = \left\lfloor \frac{((TXTIME - \text{Signal Extension}) - 20)}{4} \right\rfloor \times 3 - 3$$

[00214] In [Equation 2], TXTIME represents the duration of the HE PPDU, defined by [Equation 3].

[00215] [Equation 3]

$$TXTIME = T_{L-STF} + T_{L-LTF} + T_{L-SIG} + T_{HE-SIG-A} + \left\lfloor \frac{T_{HE-STF} + N_{HE-LTF} \times T_{HE-LTF} + T_{HE-SIG-B} + N_{SYM} \times T_{SYMD}}{T_{SYML}} \right\rfloor \times T_{SYML}$$

[00216] In [Equation 3], T_{L-STF} may have a value corresponding to the duration of a Non-HT STF field (e.g., 8μs).

[00217] T_{L-LTF} may have a value corresponding to the duration of a Non-HT LTF field (e.g., 8μs).

[00218] T_{L-SIG} may have a value corresponding to the duration of a Non-HT SIGNAL field (e.g., 4μs).

[00219] $T_{HE-SIG-A}$ may have a value corresponding to the duration of a HE-SIG-A field (e.g., 8μs or 12μs). Or $T_{HE-SIG-A}$ may have a value based on a duration of $N_{HE-SIG-A} \times 4\mu s$ and a GI of 0.8μs, as illustrated in [Table 1].

[00220] If a HE-SIG-B field is not included in the HE PPDU, $T_{HE-SIG-B}$ may have a value of 0, and if the HE-SIG-B field is included in the HE PPDU, $T_{HE-SIG-B}$ may have a value corresponding to the duration of the HE-SIG-B field (e.g., 16μs or 15.6μs). Or $T_{HE-SIG-B}$ may have a value based on a duration of $N_{HE-SIG-B} \times 4\mu s$ and a GI of 0.8μs, as illustrated in [Table 1].

[00221] T_{HE-STF} may have a value corresponding to the duration of a HE-STF field (e.g., 16μs or 15.6μs). Or T_{HE-STF} may have a value of 4μs or 8μs, as illustrated in [Table 1].

[00222] $T_{HEW-LTF}$ may have a value corresponding to the duration of a HE-LTF field (e.g., 16μs or 15.6μs). Or $T_{HEW-LTF}$ may have a value of $N_{HE-LTF} \times (DFT \text{ interval} + GI)\mu s$, as illustrated in [Table 1].

[00223] N_{HE-LTF} may have a value corresponding to the number of HE-LTF symbols.

[00224] T_{SYMD} may have a value corresponding to a double GI symbol interval (e.g.,

16 μ s or 15.6 μ s).

[00225] T_{SYML} may have a value corresponding to a long GI symbol interval (e.g., 4 μ s).

[00226] N_{SYM} may have a value corresponding to the number of symbols of a DATA (or HE-DATA) field.

[00227] As illustrated in [Equation 3], since the HE-STF, HE-LTF, HE-SIG-B, and DATA (or HE-DATA) fields have variable durations (e.g. in view of an included variable GI) in the HE PPDU, a ceiling operation may be applied in consideration that division of the durations by the number of OFDM symbols results in a remainder.

[00228] Further, $T_{\text{RL-SIG}}$ having a value corresponding to the duration of an RL-SIG field of the HE PPDU may be added to TXTIME depicted in [Equation 3].

[00229] In another example of protecting transmission of a HE PPDU using a specific field included in the HE PPDU from a third-party STA, a Duration/ID field (or a Duration field) included in the MAC header of a data unit (e.g., a PSDU field, a DATA field, or a HE-DATA field) in the HE PPDU may be used. As a third-party STA (e.g., a HE STA capable of decoding the HE PPDU) sets a NAV, the Duration field of the MAC header may induce the third-party STA to regard a channel as busy for a corresponding time period. Therefore, even though the channel is physically idle during a time period to which the NAV is set, the third-party STA may not attempt to access the channel, thereby protecting the HE PPDU transmission.

[00230] FIG. 16 depicts a NAV update operation of an STA according to the present invention.

[00231] Upon detection of a PPDU (S1610), the STA may determine the type of the PPDU (S1620). According to an embodiment, the PPDU may have a first type or a second type. Specifically, the first type may be a non-OFDMA PPDU type or an SU type, and the second type may be an OFDMA PPDU type or an MU type.

[00232] If the types allowed for a PPDU include the non-OFDMA PPDU type as the first type and the OFDMA PPDU type as the second type, the STA may perform NAV update depending on whether the received PPDU is an OFDMA PPDU. The STA may determine whether the received PPDU is an OFDMA PPDU by checking whether a transmission channel bandwidth of the (HE) PPDU is equal to a transmission channel bandwidth of a PSDU. A NAV may be updated in different manners in the cases of reception of an OFDMA PPDU and reception of a non-OFDMA PPDU.

[00233] If the PPDU is of the first type, particularly the non-OFDMA PPDU type, the

STA performs a NAV update operation for a first-type PPDU (non-OFDMA PPDU) (S1630). When the PPDU is of the first type, the STA performs NAV update based on the Duration/ID field of a frame received on a primary channel. If the transmission channel bandwidth of a (HE) PPDU is equal to the transmission channel bandwidth of a PSDU, a (HE) STA receiving the (HE) PPDU may set a NAV as defined as follows: If a Receiver Address (RA) matching to the MAC address of the (HE) STA is not included in any frame received in a 20-MHz (HE) PPDU on a primary 20-MHz channel, in a 40-MHz (HE) PPDU on a primary 40-MHz channel, in a 80-MHz (HE) PPDU on a primary 80-MHz channel, or in a 160-MHz or 80+80-MHz (HE) PPDU, a NAV of the (HE) STA is updated using the Duration/ID field (or the Duration field) of the frame. Specifically, if the STA receives a frame that belongs to a secondary channel (a secondary 20-MHz channel, a secondary 40-MHz channel, or a secondary 80-MHz channel) but does not belong to a primary channel (a primary 20-MHz channel, a primary 40-MHz channel, or a primary 80-MHz channel), the STA does not perform the NAV update.

[00234] On the other hand, if the PPDU is of the second type, particularly the OFDMA PPDU type, the STA performs a NAV update operation for a second-type PPDU (OFDMA PPDU) (S1640). If the PPDU is of the second type, the STA may perform NAV update based on the Duration/ID field of a frame received on a subchannel, irrespective of a channel to which the received subchannel belongs (i.e., without considering whether the received subchannel carrying the PPDU belongs to a primary channel or a secondary channel). In the case of a HE PPDU supporting DL/UL OFDMA transmission, the channel bandwidth of a PSDU for a specific HE STA may be smaller than the channel bandwidth of the HE PPDU. In the example of FIG. 13, a HE PPDU has a transmission channel bandwidth of 20MHz, and a PSDU for STA1 has a transmission channel bandwidth (i.e., a subchannel bandwidth) of 5MHz. If a PSDU has a smaller transmission channel bandwidth than a HE PPDU as in the example, a HE STA receiving the HE PPDU may set a NAV as defined as follows. If an RA matching to the MAC address of the HE STA is not included in any frame received on any subchannel of a 20-MHz HE PPDU (or a 20-MHz OFDMA PPDU) on a primary 20-MHz channel, any subchannel of a 40-MHz HE PPDU (or a 40-MHz OFDMA PPDU) on a primary 40-MHz channel, any subchannel of a 80-MHz HE PPDU (or a 80-MHz OFDMA PPDU) on a primary 80-MHz channel, or any subchannel of a 160-MHz or 80+80-MHz HE PPDU (or a 160-MHz or 80+80-MHz OFDMA PPDU), the HE STA updates its NAV using the Duration/ID field (or the Duration field) of the frame.

[00235] Specifically, if a HE STA receives a frame including an RA that does not

match to the MAC address of the HE STA on any subchannel, the HE STA updates its NAV using the Duration/ID field (or the Duration field) of the frame, irrespective of whether the subchannel belongs to the primary 20-MHz channel, the secondary 20-MHz channel, the secondary 40-MHz channel, or the secondary 80-MHz channel.

[00236] More specifically, if the RA matching to the MAC address of the HE STA is not included in any frame received on any subchannel of a 40-MHz HE PPDU (or a 40-MHz OFDMA PPDU) on the primary 40-MHz channel, the HE STA updates its NAV using the Duration/ID field (or the Duration field) of the frame, irrespective of whether the subchannel belongs to the primary 20-MHz channel or the secondary 20-MHz channel. If the RA matching to the MAC address of the HE STA is not included in any frame received on any subchannel of a 80-MHz HE PPDU (or a 80-MHz OFDMA PPDU) on the primary 80-MHz channel, the HE STA updates its NAV using the Duration/ID field (or the Duration field) of the frame, irrespective of whether the subchannel belongs to the primary 20-MHz channel, the secondary 20-MHz channel, or the secondary 40-MHz channel. If the RA matching to the MAC address of the HE STA is not included in any frame received on any subchannel of a 160-MHz HE PPDU (or a 160-MHz OFDMA PPDU) or a 80+80-MHz HE PPDU (or a 80+80-MHz OFDMA PPDU) on a 160-MHz or 80+80-MHz channel, the HE STA updates its NAV using the Duration/ID field (or the Duration field) of the frame, irrespective of whether the subchannel belongs to the primary 20-MHz channel, the secondary 20-MHz channel, the secondary 40-MHz channel, or the secondary 80-MHz channel.

[00237] The HE PPDU may also include a resource unit having a channel bandwidth equal to or smaller than the channel bandwidth of the HE PPDU. HE PPDU protection may be implemented in the case where a HE PPDU is received on a secondary channel as well as in the case where a HE PPDU is received on a primary channel. Accordingly, NAV setting of a HE STA receiving a HE PPDU may be defined as follows. If an RA matching to the MAC address of the HE STA is not included in any frame received in any 20-MHz or less resource unit of a 20-MHz HE PPDU (or 20-MHz OFDMA PPDU) on the primary or secondary 20-MHz channel, in any 40-MHz or less resource unit of a 40-MHz HE PPDU (or 40-MHz OFDMA PPDU) on the primary or secondary 40-MHz channel, in any 80-MHz or less resource unit of a 80-MHz HE PPDU (or 80-MHz OFDMA PPDU) on the primary or secondary 80-MHz channel, in any 160-MHz or less resource unit of a 160-MHz or 80+80-MHz HE PPDU (or 160-MHz or 80+80-MHz OFDMA PPDU), the NAV of the HE STA is updated using the Duration/ID field (or the Duration field) of the frame.

[00238] FIG. 17 depicts an operation of a third-party STA, when a DL OFDMA

PPDU is transmitted according to the present invention.

[00239] While FIG. 17 illustrates an exemplary case where the transmission times of PSDUs are different on subchannels (i.e., the lengths of HE-LTF sections are different on the subchannels) in a DL HE PPDU format transmitted on each of a plurality of channels, a HE PPDU format in which the transmission times of PSDUs are identical on subchannels (i.e., the lengths of HE-LTF sections are equal on the subchannels) as illustrated in the examples of FIGS. 11, 12, and 13, and a UL HE PPDU format are also applicable.

[00240] FIG. 17 illustrates an operation of a third-party HE STA, STA21, when a DL OFDMA PPDU is transmitted to STA1, STA2, STA3, STA4, STA5, STA6, STA7, STA8, STA9, STA10, STA11, and STA12.

[00241] A HE preamble of the HE PPDU may include resource allocation information. For example, a plurality of destination STAs may acquire information about subchannels allocated to the STAs from the HE preamble (e.g., a HE-SIG (HE-SIG-A or HE-SIG-B) field) of the DL OFDMA PPDU. That is, the HE preamble of the HE PPDU may include STA identification information identifying an STA(s) allocated to a specific subchannel (or resource unit).

[00242] Because the size (e.g., the number of available bits) of information that can be included in the HE preamble is limited, STA identification information for a specific subchannel (or resource unit) may not specify only one STA. For example, the Association ID (AID) of an STA may be defined in 16 bits. If STA identification information identifying an STA allocated to a specific resource unit includes a partial AID (e.g., X (X<16) Least Significant Bits (LSBs) of an AID), one piece of STA identification information may identify a plurality of STAs. Or if an STA belonging to a BSS (OBSS) overlapping with a BSS of an AP receives a DL OFDMA PPDU, STAs of the different BSSs may correspond to one piece of STA identification information.

[00243] In this case, although an STA receiving the DL OFDMA PPDU may determine that it is a destination STA of the DL OFDMA PPDU based on the resource allocation information (e.g., STA identification information for a specific subchannel (or resource unit)) included in the HE preamble, the STA may not be an STA to which the AP has actually allocated resources. That is, although resources are not actually allocated to the STA, the STA may consider that resources are allocated to it based on the resource allocation information of the DL OFDMA PPDU.

[00244] The example of FIG. 17 illustrates a case in which subchannel allocation information is shared between STA11 and STA21. That is, although STA21 may consider

that a subchannel is allocated to STA21 based on information of a HE preamble, STA11 and STA12 may not actually be serviced simultaneously in a DL OFDMA PPDU.

[00245] Specifically, although resources of a third 5-MHz subchannel of a second 20-MHz channel (an upper 20-MHz channel in FIG. 17) are actually allocated to STA11, STA21 may determine that the subchannel resources are allocated to STA21 from the HE preamble (e.g., HE-SIG-A) of the DL OFDMA PPDU in the example of FIG. 17. Therefore, after receiving the HE-SIG-A field, STA21 may move to its allocated subchannel and start to receive a HE-STF, a HE-LTF, a HE-SIG-B, and a PSDU. However, STA21 may be aware from the RA field of the MAC header of the PSDU that the actual destination STA of the PSDU is STA11. In this case, STA21 may perform the afore-described NAV update operation. That is, since the value of the RA field of a frame received on any subchannel of a 40-MHz OFDMA PPDU on a primary 40-MHz channel does not match to the MAC address of STA21, STA21 may set a NAV value based on the value of the Duration field of the MAC header of the PSDU.

[00246] As described above, if a third-party STA receiving a HE PPDU supporting DL/UL OFDMA determines that the third-party STA is not an actual destination STA of a frame received even on a part (e.g., a subchannel) of a transmission channel bandwidth of the HE PPDU (e.g., the RA value of the received frame does not match to the address of the third-party STA), the third-party STA may perform NAV update based on the Duration field of the MAC header of the frame.

[00247] Even though the HE PPDU supporting DL/UL OFDMA received at the third-party STA has been transmitted on a secondary 20-MHz, 40-MHz, or 80-MHz channel, not on a primary 20-MHz, 40-MHz, or 80-MHz channel, if the third-party STA determines that the third-party STA is not an actual destination of the received frame (e.g., the RA value of the received frame does not match to the address of the third-party STA), the third-party STA may perform NAV update based on the Duration field of the MAC header of the frame.

[00248] In the example of FIG. 17, if resource allocation information for the other third-party STA(s) except for STA21 is not included in the received PPDU, the other third-party STA(s) may determine that the other third-party STA(s) is not a destination STA of the HE PPDU. In this case, the other STA(s) may not perform transmission during a time period determined based on duration information included in a PHY header (e.g., L-SIG, HE-SIG-A, HE-SIG-B) and may not process a data unit (e.g. a PSDU) following the PHY header. Meanwhile, although resource allocation information for STA21 is included in the received PPDU and thus STA21 determines that it is a destination STA of the HE PPDU, STA21 may

finally determine that it is not a destination STA by checking the RA field of the MAC header of the received frame and thus may perform NAV update using the Duration field of the MAC header in the example of FIG. 17.

[00249] FIG. 18 depicts a NAV update operation of an STA according to the present invention.

[00250] Upon detection of reception of a HE PPDU in step S1810, an STA may determine whether the detected HE PPDU is of the first type (e.g., the non-OFDMA PPDU type) or of the second type (e.g., the OFDMA PPDU type) in step S1820.

[00251] If the type of the PPDU is the first type, particularly the non-OFDMA PPDU type, the STA may determine whether the value of the RA field of the MAC header of a data unit in the non-OFDMA PPDU matches to an address of the STA in step S1830.

[00252] If the STA determines that the value of the RA field of the MAC header of the data unit matches to the address of the STA, the STA may process (e.g., decode) the data unit in step S1840.

[00253] On the contrary, if the STA determines that the value of the RA field of the MAC header of the data unit does not match to the address of the STA, the STA may perform NAV update according to a NAV update operation for an STA receiving a non-OFDMA PPDU in step S1850. Specifically, the STA performs NAV update based on the Duration/ID field of a frame received on a primary channel. If the STA receives a frame that belongs to a secondary channel, not the primary channel, the STA does not perform NAV update. The examples described in relation to step S1630 of FIG. 16 are also applicable to step S1850 of FIG. 18.

[00254] If the type of the PPDU is the second type, particularly the OFDMA PPDU type, the STA may determine whether it is a destination STA of the PPDU in step S1860. The STA may determine whether it is a destination STA of the PPDU based on information included in the PHY header (e.g., HE-SIG-A or HE-SIG-B) of the detected PPDU. For example, upon detection of the HE PPDU, if resource allocation information included in the HE-SIG-A or HE-SIG-B field of the HE PPDU indicates the presence of a resource unit allocated to the STA, the STA may determine that it is a destination STA of the HE PPDU, and otherwise, the STA may determine that it is not a destination STA of the HE PPDU.

[00255] If the STA determines that it is not a destination STA of the HE PPDU in step S1860, the STA may not process a data unit (e.g., a PSDU) following the PHY header in step S1865. In addition, the STA may not perform transmission during a time period determined based on duration information included in the PHY header (e.g., L-SIG, HE-SIG-A, or HE-

SIG-B).

[00256] If the STA determines that it is a destination STA of the HE PPDU in step S1860, the STA may determine whether the value of the RA field of the MAC header of a data unit in the OFDMA PPDU (i.e., a data unit received in a resource unit indicated by the resource allocation information of the HE preamble of the OFDMA PPDU) matches to the address of the STA in step S1870.

[00257] If the value of the RA field of the MAC header of the data unit received in the resource unit allocated to the STA matches to the address of the STA, the STA may process (e.g., decode) the data unit received in the resource unit allocated to the STA in step S1880.

[00258] On the contrary, if the value of the RA field of the MAC header of the data unit received in the resource unit allocated to the STA does not match to the address of the STA, the STA may perform NAV update according to a NAV update operation for an STA receiving an OFDMA PPDU in step S1890. That is, if the type of the PPDU is the second type, the STA may perform NAV update based on the Duration/ID field of a frame received on a subchannel irrespective of a channel to which the received subchannel belongs (i.e., without considering whether the subchannel carrying the PPDU belongs to a primary channel or a secondary channel). The examples described in relation to step S1640 of FIG. 16 is also applicable to step S1890 of FIG. 18.

[00259] Now, a description will be given of a method for performing UL SU PPDU transmission or UL MU PPDU transmission according to the type of a response to DL MU transmission. For example, while UL SU transmission of a response to DL MU transmission is basically supported, if responses to DL MU transmission can be transmitted in UL MU transmission, system performance such as DL throughput may be significantly increased.

[00260] UL MU-MIMO transmission is taken as an example of UL MU transmission in the following examples of the present invention. However, the examples of the present invention are also applicable in the same manner to UL OFDMA transmission in which one transmission channel is divided into a plurality of subchannels and each STA performs simultaneous UL transmission on an allocated subchannel. Similarly, DL MU-MIMO transmission is taken as an example of DL MU transmission in the following examples of the present invention. However, the examples of the present invention are also applicable in the same manner to DL OFDMA transmission in which one transmission channel is divided into a plurality of subchannels and simultaneous DL transmission is performed on respective subchannels allocated to STAs. That is, UL MU transmission includes UL MU-

MIMO transmission or UL OFDMA transmission, and DL MU transmission includes DL MU-MIMO transmission or DL OFDMA transmission, in the following description.

[00261] FIG. 19 depicts an exemplary UL SU transmission-based ACK procedure in response to DL MU transmission.

[00262] In a DL MU transmission operation, an AP may transmit a DL MU PPDU to destination STAs of the DL MU transmission after exchanging an RTS frame and a CTS frame with one of the STAs of the DL MU transmission. The QoS Control fields of the MAC headers of a plurality of data units (e.g., PSDUs) in the DL MU PPDU may include ACK Policy subfields. While the ACK Policies of the destination STAs of the DL MU PPDU may be set to Block ACK, the ACK Policy of one of the destination STAs may be set to Implicit Block ACK Request. Thus, the STA for which the ACK Policy is set to Implicit Block ACK Request may transmit a block ACK frame to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU PPDU, without receiving a block ACK request frame. On the other hand, an STA(s) for which the ACK Policy is set to Block ACK may transmit a block ACK frame to the AP a predetermined IFS (e.g., an SIFS) after receiving a block ACK request frame from the AP.

[00263] The DL MU PPDU may include information requesting one STA to transmit an immediate response to the DL MU PPDU (e.g., a UL response transmitted a predetermined IFS (e.g., an SIFS) after receiving the DL MU PPDU), that is, information triggering UL SU transmission (or a UL SU transmission trigger frame).

[00264] If the ACK Policy is set to Implicit Block ACK Request for two or more of the destination STAs of the DL MU transmission, the plurality of STAs may transmit block ACK frames simultaneously (i.e., a predetermined IFS (e.g., an SIFS) after reception of the DL MU PPDU), thereby causing collision between them. Therefore, the ACK Policy for the DL MU PPDU should be set to Implicit Block ACK Request only for one STA, and otherwise, Implicit Block ACK Request may not be used.

[00265] In the example of FIG. 19, before transmitting a DL MU PPDU to a plurality of STAs (e.g., STA1, STA2, STA3, and STA4) on a 40-MHz channel, the AP may transmit an RTS frame to one (e.g., STA1) of the plurality of STAs in duplicated PPDU's on a primary 20-MHz channel (i.e., a lower-frequency 20-MHz channel) and a secondary 20-MHz channel (i.e., a higher-frequency 20-MHz channel). STA1 may transmit a CTS frame to the AP in duplicated PPDU's on the primary 20-MHz channel and the secondary 20-MHz channel in response to the received RTS frame.

[00266] The DL MU DATA PPDU transmitted by the AP may include PSDUs

directed to STA1, STA2, STA3, and STA4. The ACK Policy of a PSDU may be set to Implicit Block ACK Request for STA1, and to Block ACK for STA2, STA3, and STA4. Therefore, STA1 may determine from the PSDU of the DL MU DATA PPDU that the ACK Policy is Implicit Block ACK Request and transmit a block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU. To receive block ACK PPDU from STA2, STA3, and STA4, the AP may transmit block ACK request PPDU sequentially STA2, STA3, and STA4.

[00267] FIG. 20 depicts an exemplary UL MU transmission-based ACK procedure in response to DL MU transmission.

[00268] To improve the performance of a procedure for performing DL MU transmission and transmitting an ACK in response to the DL MU transmission, block ACKs may be transmitted in UL MU transmission. For example, if all of the destination STAs of a DL MU DATA PPDU support UL MU transmission, a procedure for receiving block ACK PPDU from the STAs may be simplified and thus the use efficiency of a wireless channel may be increased.

[00269] As illustrated in the example of FIG. 20, after the AP and STA1 exchange an RTS frame and a CTS frame on a 40-MHz channel, the AP may transmit a DL MU DATA PPDU to STA1, STA2, STA3, and STA4 on the 40-MHz channel. If all of STA1, STA2, STA3, and STA4 support UL MU transmission, STA1, STA2, STA3, and STA4 may simultaneously transmit a UL MU block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU.

[00270] For example, STA1, STA2, STA3, and STA4 may be allocated distinguishable streams and simultaneously transmit block ACK frames in a UL PPDU having a transmission channel bandwidth of 40MHz to the AP in UL MU-MIMO transmission. Or STA1, STA2, STA3, and STA4 may all be allocated subchannels each having a bandwidth less than 40MHz in a 40-MHz UL PPDU and transmit block ACK frames simultaneously to the AP in UL OFDMA.

[00271] To enable STA2, STA3, and STA4 to simultaneously transmit a UL MU block ACK PPDU, the ACK Policy may be set to Implicit Block ACK Request for STA1, STA2, STA3, and STA4 in the DL MU DATA PPDU.

[00272] As described above, information eliciting a plurality of STAs to transmit immediate responses (e.g., UL responses transmitted a predetermined IFS (e.g., an SIFS) after reception of a DL MU PPDU) to the DL MU PPDU, that is, information triggering UL MU transmission (or a UL MU transmission trigger frame) may be included in the DL MU

PPDU.

[00273] As described with reference to the examples of FIGS. 19 and 20, an immediate response to a DL MU PPDU may be of a UL SU transmission type or a UL MU transmission type. The type of the immediate response may be indicated by information included in the DL MU PPDU (e.g., a block ACK request). That is, information indicating the type of the immediate response to the DL MU PPDU (e.g., a response frame transmitted in UL SU transmission or a response frame transmitted in UL MU transmission) may be included in the DL MU PPDU (e.g., a block ACK request included in the DL MU PPDU). Also, the DL MU PPDU may include a block ACK request PPDU for the plurality of STAs.

[00274] FIGS. 21 and 22 depict various types of UL responses to DL MU transmission.

[00275] All destination STAs of a DL MU DATA PPDU may not be assumed to support UL MU transmission. Therefore, the destination STAs of the DL MU DATA PPDU may be classified into UL MU transmission supported STAs and UL MU transmission non-supported STAs, and a UL transmission scheme may be determined for the DL MU DATA PPDU accordingly.

[00276] The AP may request a UL MU transmission supported STA to transmit a UL MU block ACK PPDU (i.e., the AP may provide a response request (or trigger) indicating the UL MU transmission-based response type). Meanwhile, the AP may request a UL MU transmission non-supported STA to transmit a UL SU block ACK PPDU (e.g., a legacy block ACK PPDU) (i.e., the AP may provide a response request (or trigger) indicating the UL SU transmission-based response type).

[00277] Such different types of UL responses may not be transmitted simultaneously. Therefore, a UL response request (or trigger) may be provided such that different types of UL responses to a DL MU DATA PPDU may be transmitted at different time points. For example, to receive block ACK PPDU from a plurality of STAs including UL MU transmission supported STAs and a UL MU transmission non-supported STA(s), the AP may include an implicit block ACK request in the DL MU PPDU or an explicit block request in a separate block ACK request PPDU, and transmit the DL MU PPDU sequentially to the UL MU transmission supported STAs and the UL MU transmission non-supported STA(s).

[00278] In the examples of FIGS. 21 and 22, it is assumed that STA1, STA2, and STA3 are UL MU transmission supported STAs and STA4 is a UL MU transmission non-supported STA. If the destination STAs of a DL MU DATA PPDU include both a UL MU transmission supported STA and a UL MU transmission non-supported STA, the ACK Policy

may be set to Implicit Block ACK Request for one or more STAs supporting one (a first type) of different UL immediate response types and to Block ACK for one or more STAs supporting the other type (a second type). Herein, the first type may be the UL MU transmission-based response type and the second type may be the UL SU transmission-based response type. Or the first type may be the UL SU transmission-based response type and the second type may be the UL MU transmission-based response type.

[00279] In the example of FIG. 21, the ACK Policy is set to Implicit Block ACK Request for STA1, STA2, and STA3 supporting UL MU transmission (i.e., supporting the UL MU transmission-based response type) in a DL MU DATA PPDU. In this case, STA1, STA2, and STA3 may transmit a UL MU Block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU. That is, the UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type), STA1, STA2, and STA3 may simultaneously transmit block ACK frames in UL MU transmission. Since different channel estimation sequences (e.g., HE-STF and HE-LTF sequences) are used for the plurality of STAs participating in the UL MU transmission, the AP may receive the block ACK frames from the plurality of STAs without collision.

[00280] Since a UL MU transmission non-supported STA (i.e., an STA supporting only the UL SU transmission-based response type) is not allowed to transmit a block ACK frame simultaneously with other STAs, the ACK Policy may not be set to Implicit Block ACK Request for the UL MU transmission non-supported STA except for the case where the ACK Policy is set to Implicit Block ACK Request for only one STA in a DL MU DATA PPDU.

[00281] In the example of FIG. 21, since the ACK Policy is set to Implicit Block ACK Request for STA1, STA2, and STA3, the ACK Policy may be set to not Implicit Block ACK Request but Block ACK for STA4 that does not support UL MU transmission (i.e., supporting only the UL SU transmission-based response type). In this case, STA4 may transmit a legacy block ACK PPDU (or a UL SU block ACK PPDU) a predetermined IFS (e.g., an SIFS) after receiving a block ACK request PPDU from the AP.

[00282] Meanwhile, in the example of FIG. 22, the ACK Policy is set to Block ACK for STA1, STA2, and STA3 supporting UL MU transmission (i.e., supporting the UL MU transmission-based response type) and to Implicit Block ACK Request for STA4 that does not support UL MU transmission (i.e., supporting only the UL SU transmission-based response type) in a DL MU DATA PPDU. In this case, STA4 may transmit a block ACK PPDU (e.g., a legacy block ACK PPDU or a UL SU block ACK PPDU) a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU from the AP. STA1, STA2, and

STA3 may transmit a UL MU block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving a block ACK request PPDU from the AP. That is, the UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type), STA1, STA2, and STA3 may simultaneously transmit block ACK frames in UL MU transmission. Since different channel estimation sequences (e.g., different scrambling codes used in generation of HE-STFs and HE-LTFs) are used for the plurality of STAs participating in the UL MU transmission, the AP may receive the block ACK frames from the plurality of STAs without collision.

[00283] As described above with reference to the examples of FIGS. 21 and 22, the PPDU type of an immediate response to a DL MU PPDU (i.e., a UL response transmitted a predetermined IFS (e.g., an SIFS) after reception of a DL MU PPDU) may be of the UL SU transmission type (e.g. a legacy PPDU type) or the UL MU transmission type (e.g., a UL MU PPDU type), and the type of the immediate response to the DL MU PPDU may be determined based on information (e.g., information triggering UL transmission) included in the DL MU PPDU.

[00284] If the immediate response to the DL MU PPDU is of the UL MU transmission type, identification information about different channel estimation sequences (e.g., HE-STF and HE-LTF sequences) to be used in UL MU PPDU transmission by a plurality of STAs may be included in the DL MU PPDU. The identification information about the channel estimation sequences may be defined as information indicating one element of a set including a plurality of elements corresponding to a plurality of channel estimation sequences (or scrambling codes for generation of the channel estimation sequences). That is, the identification information about the channel estimation sequences corresponds to information that allocates resources (e.g., sequence resources or code resources) distinguishable for a plurality of STAs in UL MU transmission of the STAs.

[00285] Further, the identification information about the channel estimation sequences for the UL MU transmission may be included in a frame (e.g., a DL MU PPDU) eliciting the UL MU transmission. For example, the identification information about the channel estimation sequences for the UL MU transmission may be included in a UL MU transmission trigger frame (i.e., a frame including information triggering a UL MU transmission-based response) in the DL MU PPDU. Or the identification information about the channel estimation sequences for the UL MU transmission may be included in each of a plurality of PSDUs of the DL MU PPDU. More specifically, a UL MU Sequence ID subfield of the QoS Control field of the MAC header in the DL MU DATA PPDU may indicate a channel

estimation sequence for the UL MU transmission. Or the identification information (e.g., the UL MU Sequence ID subfield) about the channel estimation sequences for the UL MU transmission may be included in a VHT Control field, a HE Control field, a Service field, etc.

[00286] If the identification information (e.g., the UL MU Sequence ID subfield) about the channel estimation sequences for the UL MU transmission has a specific value (e.g., 0), it may indicate that a UL immediate response PPDU transmitted a predetermined IFS (e.g., an SIFS) after reception of the DL MU PPDU is of the UL SU PPDU type (or the legacy PPDU type). On the other hand, if the identification information (e.g., the UL MU Sequence ID subfield) about the channel estimation sequences for the UL MU transmission has a value other than the specific value (e.g., 0), it may indicate that the UL immediate response PPDU transmitted a predetermined IFS (e.g., an SIFS) after reception of the DL MU PPDU is of the UL MU PPDU type. In this case, one channel estimation sequence (or one scrambling code for generation of the channel estimation sequence) may be determined from a set of a plurality of channel estimation sequences (or scrambling codes for generation of the channel estimation sequences) based on the identification information (e.g., the UL MU Sequence ID subfield) about the channel estimation sequences for the UL MU transmission.

[00287] Referring to FIG. 21 again, the ACK Policy is set to Implicit Block ACK Request commonly for the UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type), STA1, STA2, and STA3, and the values of UL MU Sequence ID subfields are 1, 2, and 3, respectively for STA1, STA2, and STA3. When STA1, STA2, and STA3 transmit the UL MU block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU, STA1, STA2, and STA3 may perform the UL MU transmission using different channel estimation sequences corresponding to the values of the UL MU Sequence ID subfields, 1, 2, and 3. On the other hand, the value of the UL MU Sequence ID subfield is set to 0 for the UL MU transmission non-supported STA (i.e., the STA supporting only the UL SU transmission-based response type), STA4, and STA4 may transmit a legacy block ACK PPDU (or a UL SU block ACK PPDU) to the AP a predetermined IFS (e.g., an SIFS) after receiving a block ACK request PPDU from the AP.

[00288] Referring to FIG. 22 again, the ACK Policy is set to Implicit Block ACK Request for the UL MU transmission non-supported STA (i.e., the STA supporting only the UL SU transmission-based response type), STA4, and the value of the UL MU Sequence ID subfield is set to 0 for STA4. STA4 may transmit a legacy block ACK PPDU (or a UL SU block ACK PPDU) to the AP a predetermined IFS (e.g., an SIFS) after receiving the DL MU DATA PPDU from the AP. On the other hand, the ACK Policy is set to Implicit Block ACK

Request commonly for the UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type), STA1, STA2, and STA3, and the values of UL MU Sequence ID subfields are 1, 2, and 3, respectively for STA1, STA2, and STA3. When STA1, STA2, and STA3 transmit a UL MU block ACK PPDU to the AP a predetermined IFS (e.g., an SIFS) after receiving a block ACK request PPDU, STA1, STA2, and STA3 may perform the UL MU transmission using different channel estimation sequences corresponding to the values of the UL MU Sequence ID subfields, 1, 2, and 3.

[00289] Like the afore-described DL MU PPDU, the block ACK request PPDU that the AP transmits to the plurality of STAs (e.g., STA1, STA2, and STA3) may include information indicating the type of a UL transmission PPDU (e.g., a UL MU transmission-based PPDU type) as an immediate response to the block ACK request PPDU, and channel estimation sequence identification information (e.g., a UL MU Sequence ID subfield) for UL MU transmission for each STA participating in the UL MU transmission.

[00290] Additionally, if the UL MU transmission supported STAs (i.e., the STAs supporting the UL MU transmission-based response type) simultaneously transmit block ACK frames in a UL MU PPDU to the AP, the transmission times of the block ACK frames transmitted by the plurality of STAs may be identical. If the transmission times of the block ACK frames transmitted simultaneously by the plurality of STAs are different, the load of processing the block ACK frames at the AP increases. To prevent the increase of the load, the transmission times of the block ACK frames transmitted by the plurality of STAs may be made identical (e.g., the block ACK frames may be made start at the same time and end at the same time). The same transmission time of the block ACK frames transmitted by the plurality of STAs may mean the same transmission MCS of the block ACK frames transmitted by the plurality of STAs.

[00291] In the example of FIG. 21, to make the transmission times of the UL MU block ACK PPDU transmitted by STA1, STA2, and STA3 supporting UL MU transmission (i.e., the UL MU transmission-based response type) identical, MCS information may be included in the DL MU DATA PPDU. That is, the plurality of STAs participating in UL MU transmission may use an MCS value indicated by the MCS information for the UL MU transmission, included in the DL MU DATA PPDU, for transmission of the UL MU PPDU including the block ACK frames. Specifically, a UL MU MCS subfield of the QoS Control field of the MAC header in the DL MU DATA PPDU may indicate an MCS value for the UL MU transmission. Or the MCS information for the UL MU transmission (e.g., the UL MU MCS subfield) may be included in a VHT Control field, a HE Control field, a Service field,

etc.

[00292] In the example of FIG. 22, to make the transmission times of the UL MU block ACK PPDU transmitted by STA1, STA2, and STA3 supporting UL MU transmission (i.e., the UL MU transmission-based response type) identical, MCS information for the UL MU transmission may be included in the block ACK request PPDU.

[00293] As described before, a frame eliciting UL MU transmission may include information based on which at least one of the type of a UL MU PPDU, resources for use in the UL MU transmission, and an MCS of the UL MU transmission. That is, a frame (e.g., a DL MU DATA PPDU or a block ACK request PPDU for a plurality of STAs) eliciting UL MU transmission (e.g., a UL immediate response) may include at least one of information based on which a UL MU PPDU type (i.e., the UL MU transmission-based PPDU type or the UL SU transmission-based PPDU type) is determined, information based on which distinguishable resources for use in the UL MU transmission (e.g., sequence resources or code resources) are determined, information based on which a UL MU transmission time is determined, and information based on which an MCS applied to the UL MU transmission is determined.

[00294] If UL MU transmission supported STAs (i.e., STAs supporting the UL MU transmission-based response type) simultaneously transmit block ACK frames in a UL MU PPDU, the Duration fields of the block ACK frames may have the same value. The value of the Duration fields included in the UL MU PPDU may be set to a value calculated by subtracting a transmission time of the UL MU transmission and a predetermined IFS (e.g., an SIFS) from the value of the Duration field included in the frame eliciting the transmission of the UL MU PPDU (e.g., the DL MU DATA PPDU, or the block ACK request PPDU for a plurality of STAs). In this case, if a third-party STA receiving the UL MU PPDU determines that it is not a destination STA of the received frame even in a part of the transmission channel bandwidth of the UL MU PPDU (e.g., a subchannel) (e.g., if the RA value of the received frame does not match to the address of the third-party STA), the third-party STA may perform NAV update based on the value of the Duration field set in the above manner.

[00295] FIG. 23 depicts an exemplary method according to the present invention.

[00296] In step S2310, an AP may transmit a DL frame to an STA group including one or more STAs. The DL frame may correspond to a DL MU DATA PPDU or a block ACK request PPDU described in the foregoing examples. The DL frame may include information about the type of a UL frame transmitted as an immediate response (i.e., transmitted a predetermined IFS (e.g., an SIFS) after reception of the DL frame). The UL

frame may correspond to a block ACK PPDU described in the foregoing examples. The type of the UL frame may be an SU type or an MU type. If the information about the type of a UL frame, included in the DL frame is the MU type, the DL frame may further include resource allocation information, transmission time information, and MCS information for a plurality of STAs, for transmission of UL frames (i.e., a UL MU frame).

[00297] In step S2320, each STA of the STA group may determine the type of the UL frame elicited by the DL frame based on the information (e.g., the information about the type of a UL frame) included in the received DL frame. If the type of the UL frame is the MU type, the STA may determine UL MU transmission parameters (e.g., a resource index for the STA, for transmission of the UL MU frame, a transmission time of the UL MU frame, and an MCS to be applied to the UL MU frame) based on the information included in the DL frame (e.g., the resource allocation information, the transmission time information, and the MCS information). Therefore, a plurality of STAs may simultaneously transmit a UL MU frame to the AP in step S2340.

[00298] If the type of the UL frame is determined to be the SU type in step S2320, one STA may transmit a UL SU frame to the AP in step S2350.

[00299] While the afore-described exemplary methods of present invention have been described as a series of operations for simplicity of description, this does not limit the sequence of steps. When needed, steps may be performed at the same time or in a different sequence. All of the exemplary steps are not always necessary to implement the method proposed by the present invention.

[00300] The foregoing embodiments of the present invention may be implemented separately or combinations of two or more of the embodiments may be implemented simultaneously, for the afore-described exemplary methods of present invention.

[00301] The present invention includes an apparatus for processing or performing the method of the present invention (e.g., the wireless device and its components described with reference to FIGS. 1, 2, and 3).

[00302] The present invention includes software (an operating system (OS), an application, firmware, a program, etc.) for executing the method of the present invention in a device or a computer, and a medium storing the software that can be executed in a device or a computer.

[00303] While various embodiments of the present invention have been described in the context of an IEEE 802.11 system, they are applicable to various mobile communication systems.

WHAT IS CLAIMED IS:

1. A method for transmitting an uplink frame by a station (STA) to an access point (AP) in a wireless local area network, the method comprising:

receiving, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and

transmitting, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame,

wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA.

2. The method according to claim 1,

wherein the downlink frame further includes resource allocation information for the plurality of STAs.

3. The method according to claim 2,

wherein the resource allocation information includes information indicating distinguished resources for each of the plurality of STAs.

4. The method according to claim 1,

wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the uplink frame.

5. The method according to claim 4,

wherein a same MCS based on the MCS information is applied to the uplink frame by the plurality of STAs.

6. The method according to claim 1,

wherein, when the type of the uplink frame corresponds to the SU type, the uplink frame is transmitted only by the STA.

7. The method according to claim 1,

wherein the uplink frame is transmitted as an immediate response to the downlink frame.

8. The method according to claim 7,
wherein the immediate response is transmitted a Short Inter-Frame Space (SIFS) time after the downlink frame.

9. The method according to claim 1,
wherein the downlink frame includes downlink data for the plurality of STAs.

10. The method according to claim 1,
wherein the downlink frame includes block acknowledgement (ACK) requests for the plurality of STAs.

11. A method for receiving an uplink frame by an access point (AP) from at least one station (STA) in a wireless local area network, the method comprising:

transmitting, to the at least one STA, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and

receiving, from the at least one STA, the uplink frame having a type determined based on the information related to the type of the uplink frame,

wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the at least one STA.

12. The method according to claim 11,
wherein the downlink frame further includes resource allocation information for the plurality of STAs.

13. The method according to claim 12,
wherein the resource allocation information includes information indicating distinguished resources for each of the plurality of STAs.

14. The method according to claim 11,

wherein the downlink frame further includes Modulation and Coding Scheme (MCS) information for the uplink frame.

15. The method according to claim 14,
wherein a same MCS based on the MCS information is applied to the uplink frame by the plurality of STAs.

16. The method according to claim 11,
wherein, when the type of the uplink frame corresponds to the SU type, the uplink frame is transmitted only by a STA.

17. The method according to claim 11,
wherein the uplink frame is received as an immediate response to the downlink frame.

18. The method according to claim 17,
wherein the immediate response is received a Short Inter-Frame Space (SIFS) time after the downlink frame.

19. The method according to claim 11,
wherein the downlink frame includes downlink data for the plurality of STAs.

20. The method according to claim 11,
wherein the downlink frame includes block acknowledgement (ACK) requests for the plurality of STAs.

ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a method and apparatus for transmitting a response frame based on a type in a High Efficiency Wireless Local Area Network (WLAN) (HEW). According to an aspect, a method for transmitting an uplink frame by a station (STA) to an access point (AP) in a WLAN may be provided. The method may include receiving, from the AP, a downlink frame including information related to a type of the uplink frame, the type of the uplink frame including a single-user (SU) type and a multiple-user (MU) type; and transmitting, to the AP, the uplink frame having a type determined based on the information related to the type of the uplink frame, wherein, when the type of the uplink frame corresponds to the MU type, the uplink frame is simultaneously transmitted by a plurality of STAs including the STA and at least one other STA.

FIG. 1

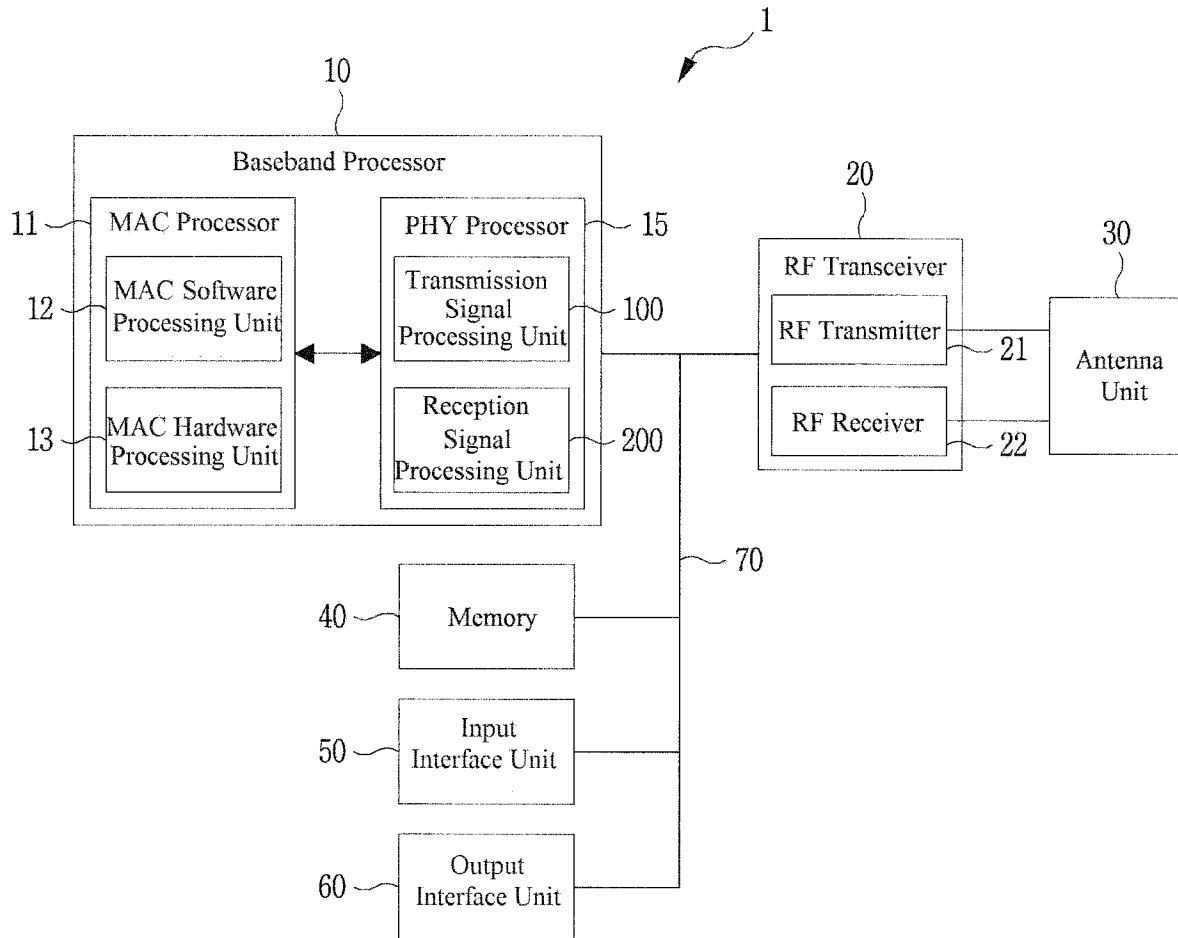


FIG. 2

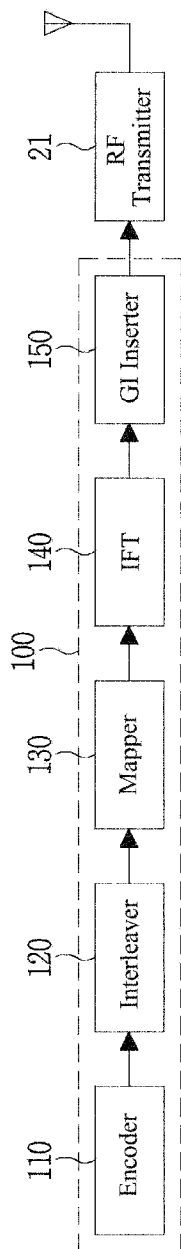


FIG. 3

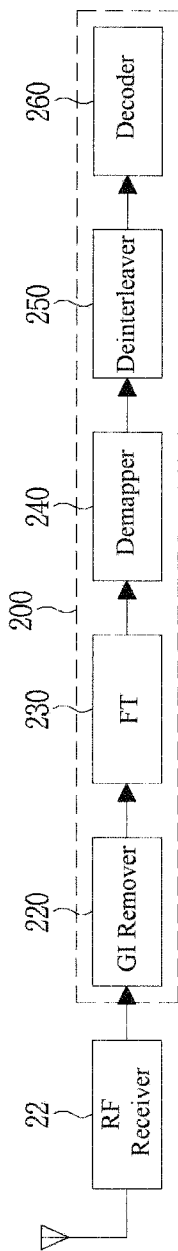


FIG. 4

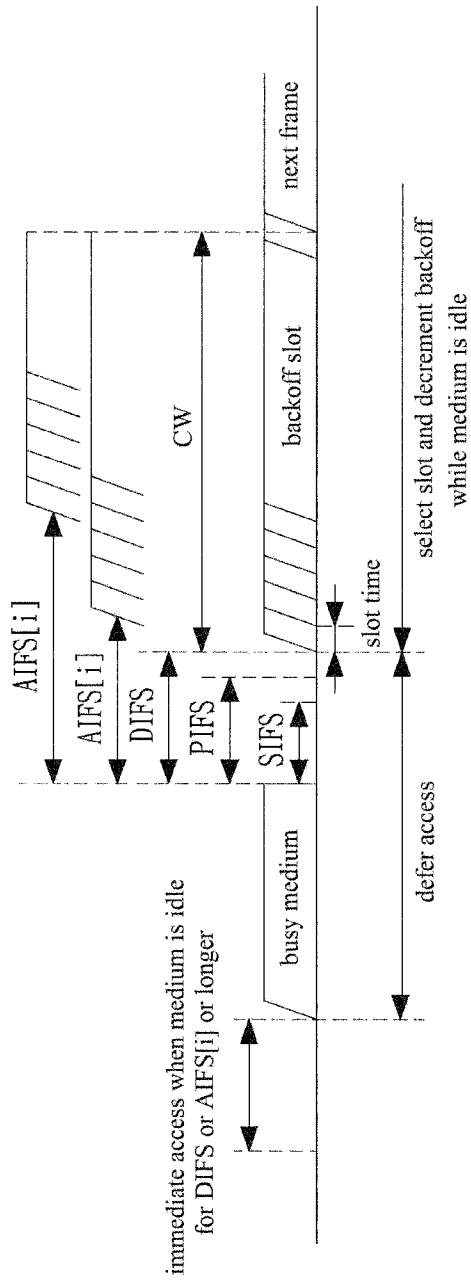


FIG. 5

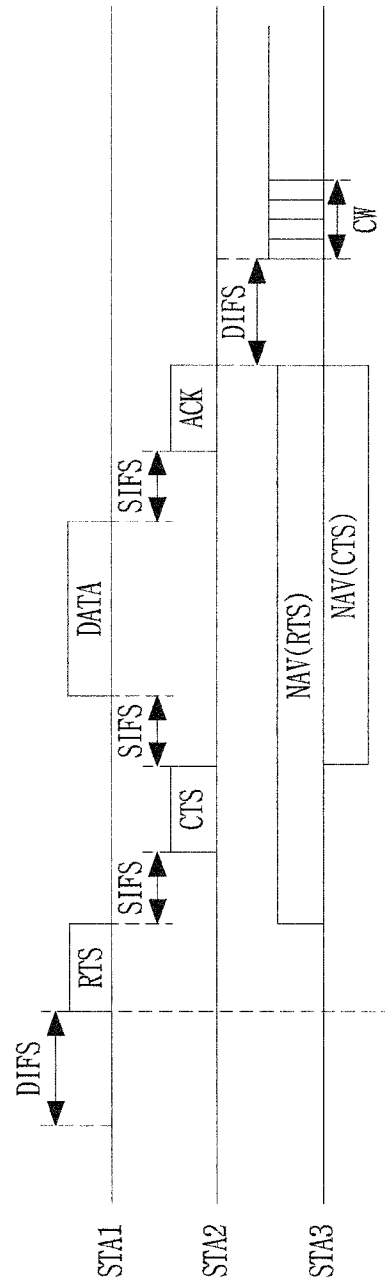


FIG. 6

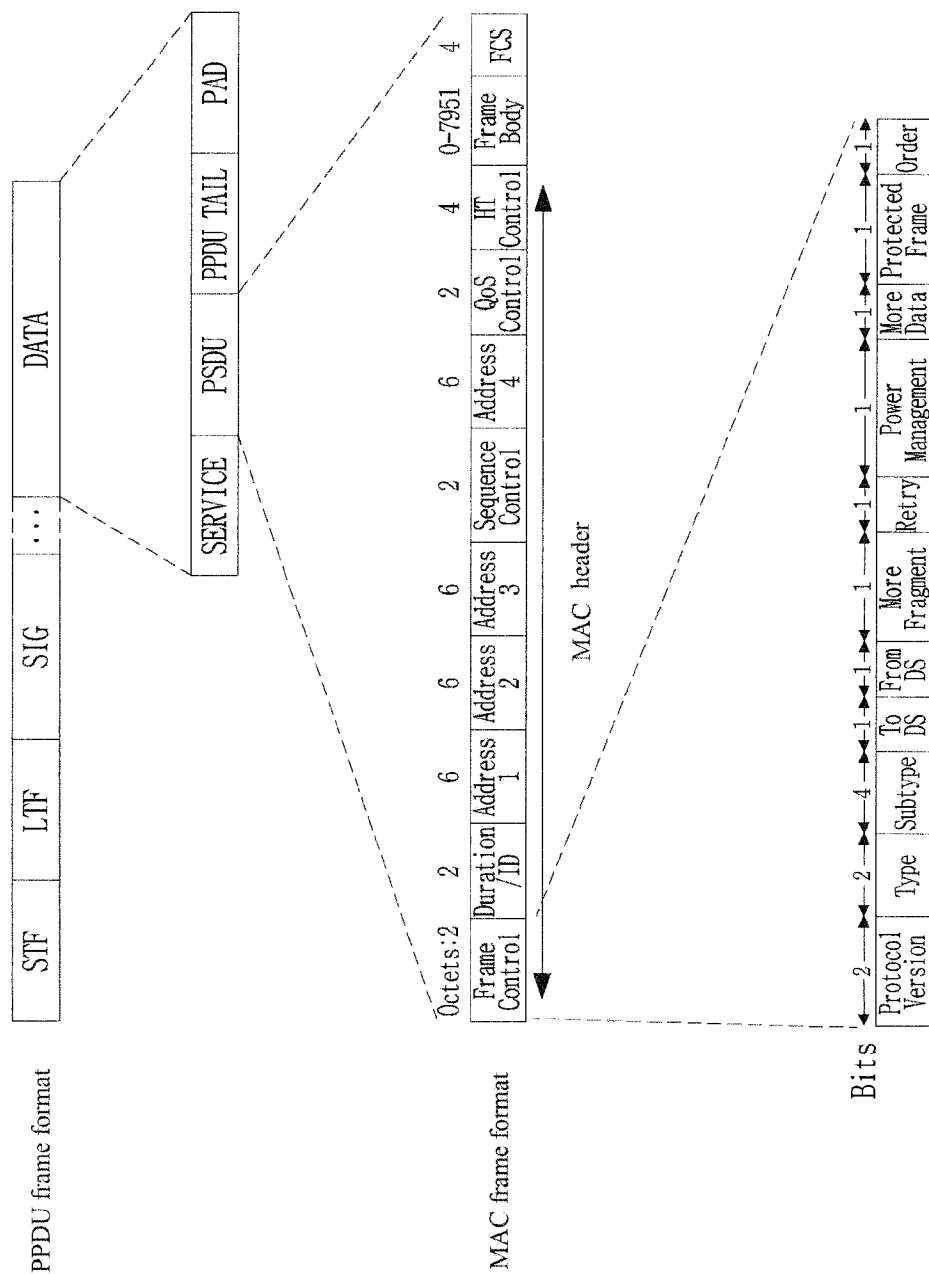


FIG. 7

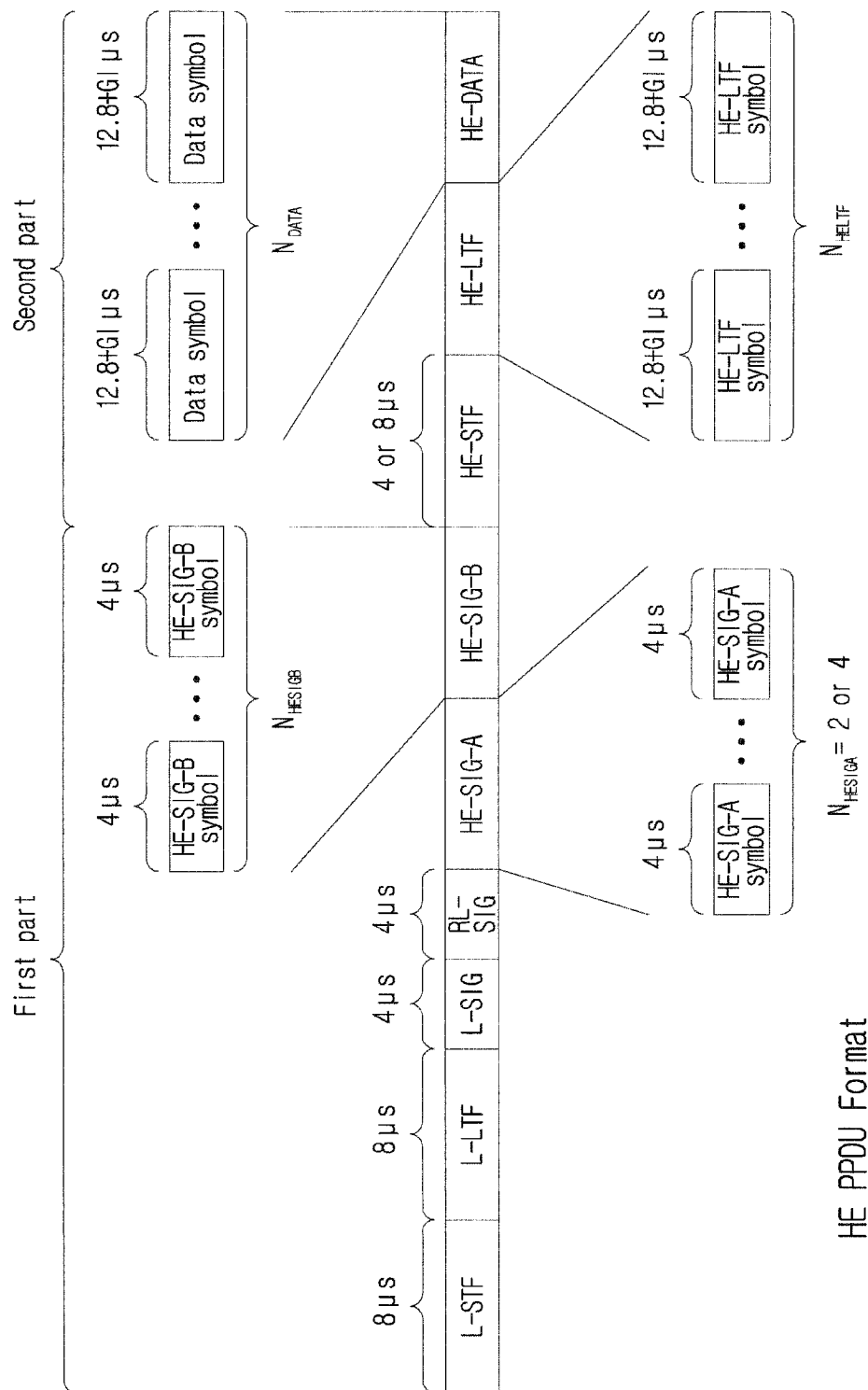


FIG. 8

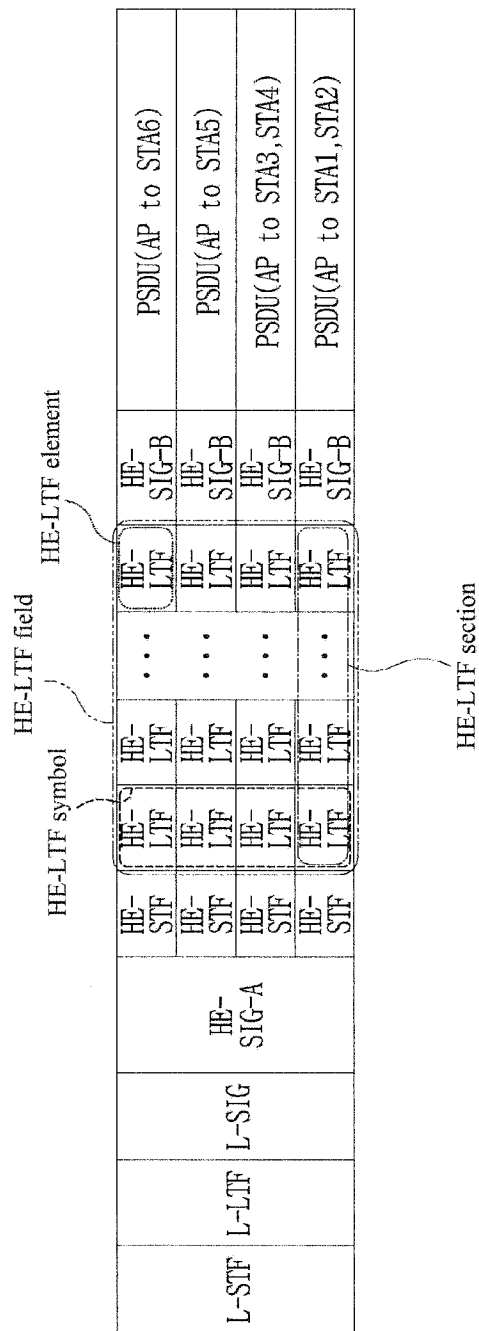


FIG. 9

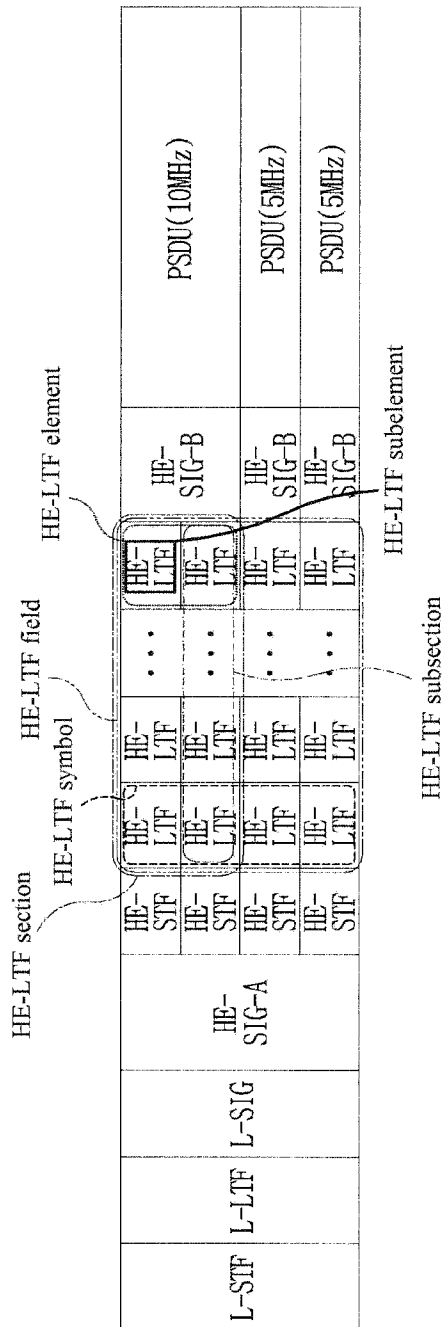


FIG. 10

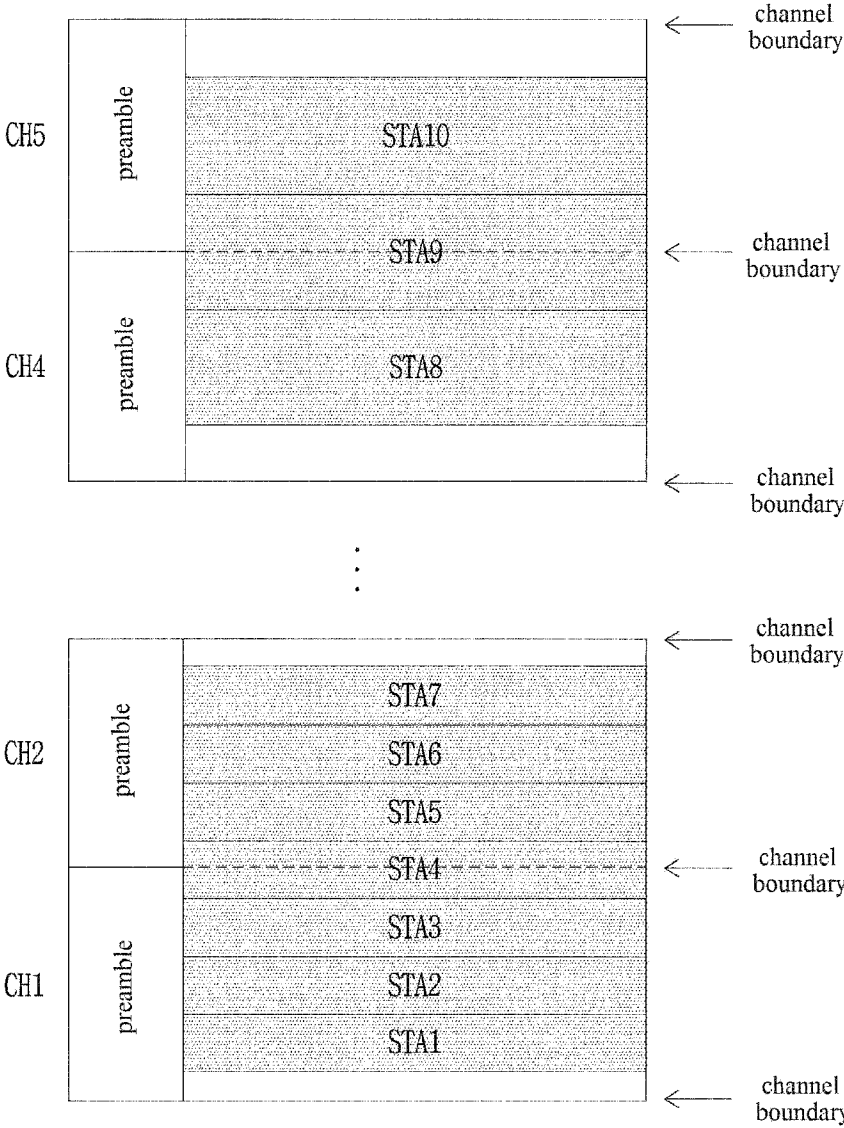


FIG. 11

L-STF	L-LTF	L-SIG	HE-SIG-A	HE-STF	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-B	PSDU(AP to STA6)
				HE-STF	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-B	PSDU(AP to STA5)
				HE-STF	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-B	PSDU(AP to STA3, STA4)
				HE-STF	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-B	PSDU(AP to STA1, STA2)

FIG. 12

L-STF	L-LTF	L-SIG	HE-SIG-A	HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(AP to STA6)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(AP to STA5)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(AP to STA3, STA4)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(AP to STA1, STA2)

FIG. 13

L-STF	L-LTF	L-SIG	HE-SIG-A	HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(STA4 to AP)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(STA3 to AP)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(STA2 to AP)
				HE-STF	HE-LTF	HE-SIG-B	HE-LTF	HE-LTF	HE-LTF	HE-LTF	HE-SIG-C	PSDU(STA1 to AP)

FIG. 14

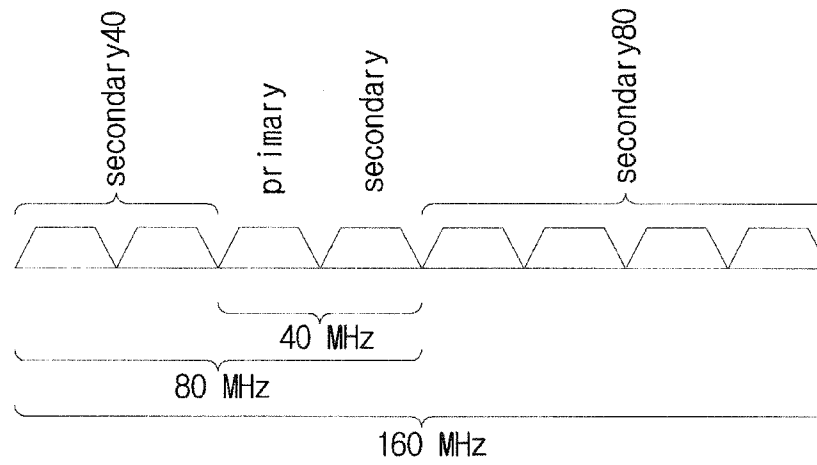


FIG. 15

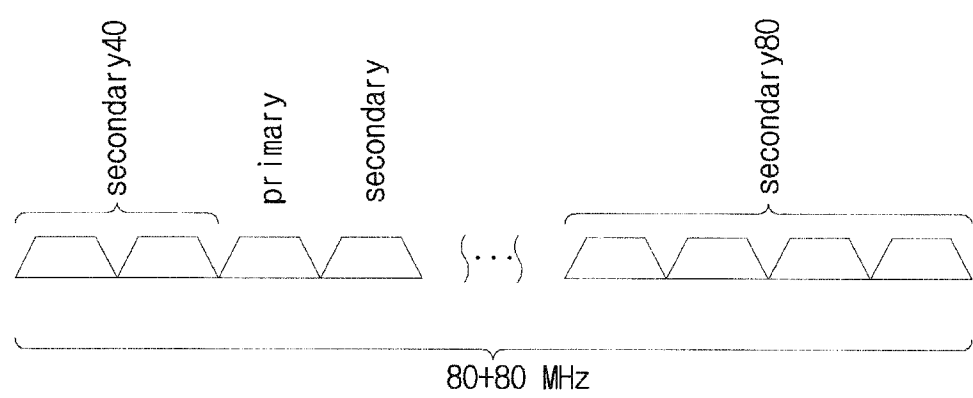


FIG. 16

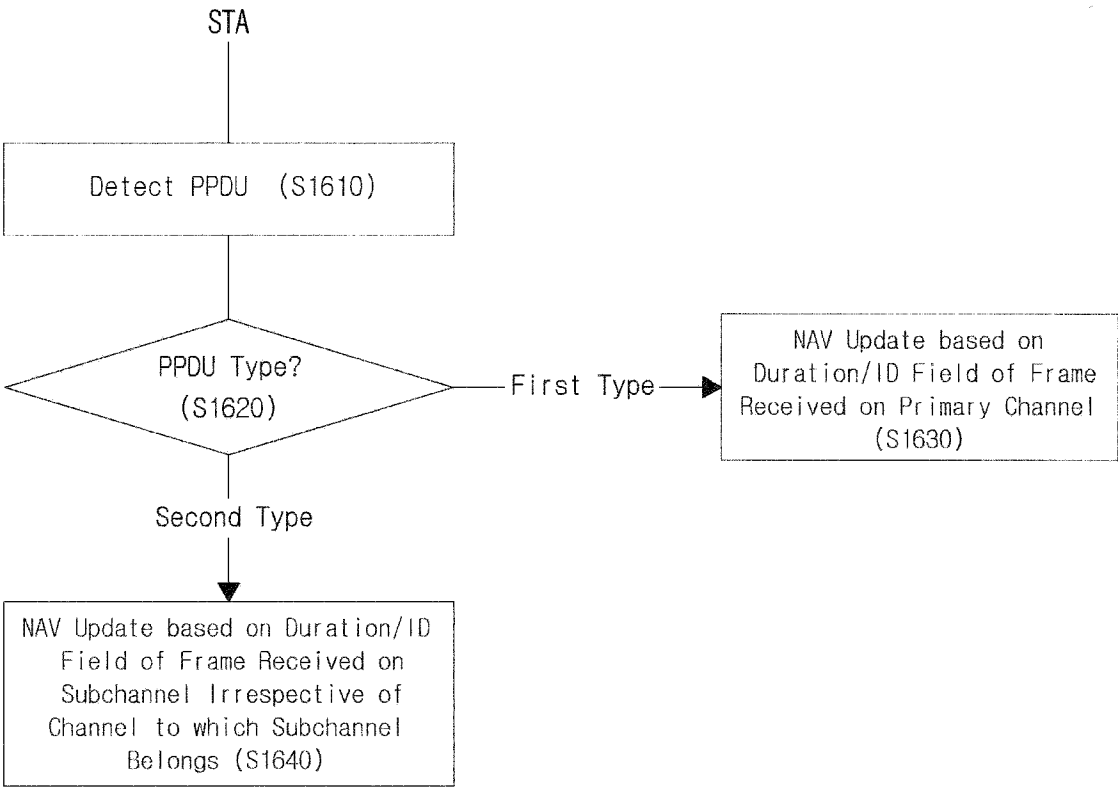


FIG. 17

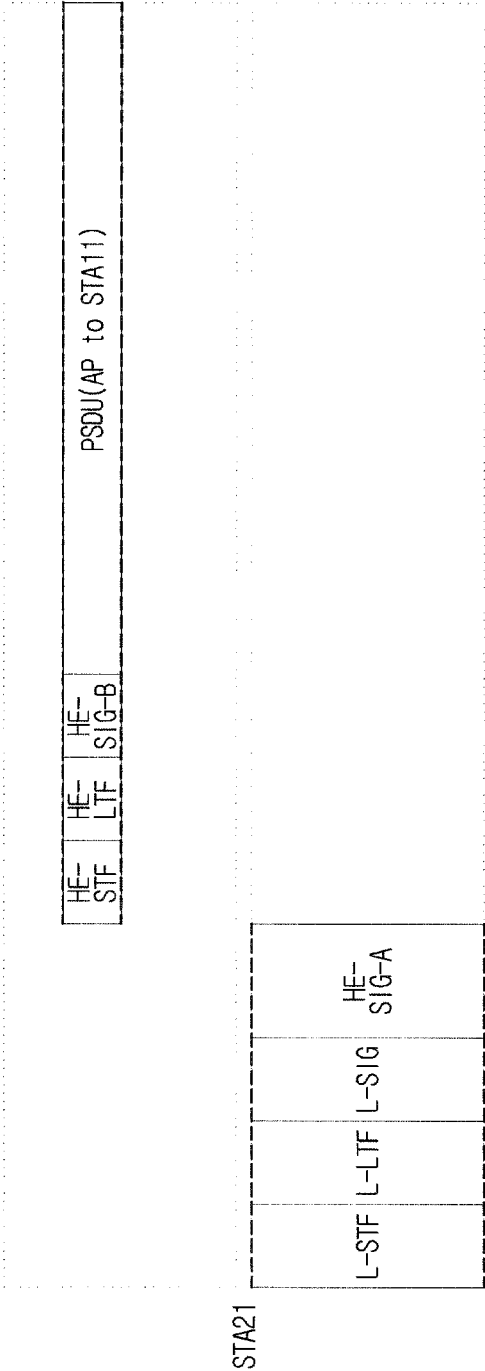
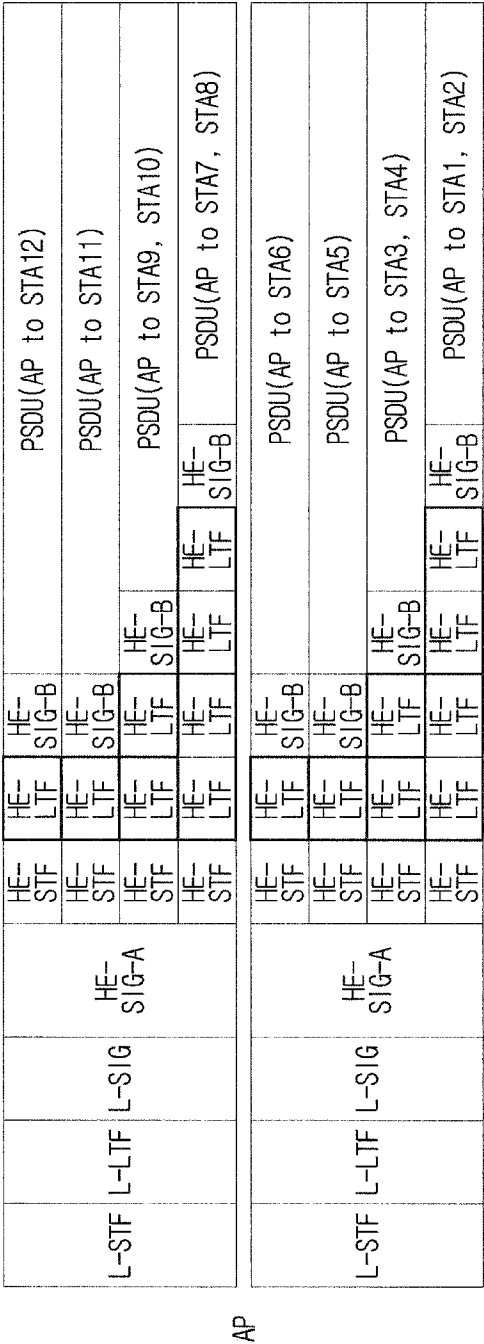


FIG. 18

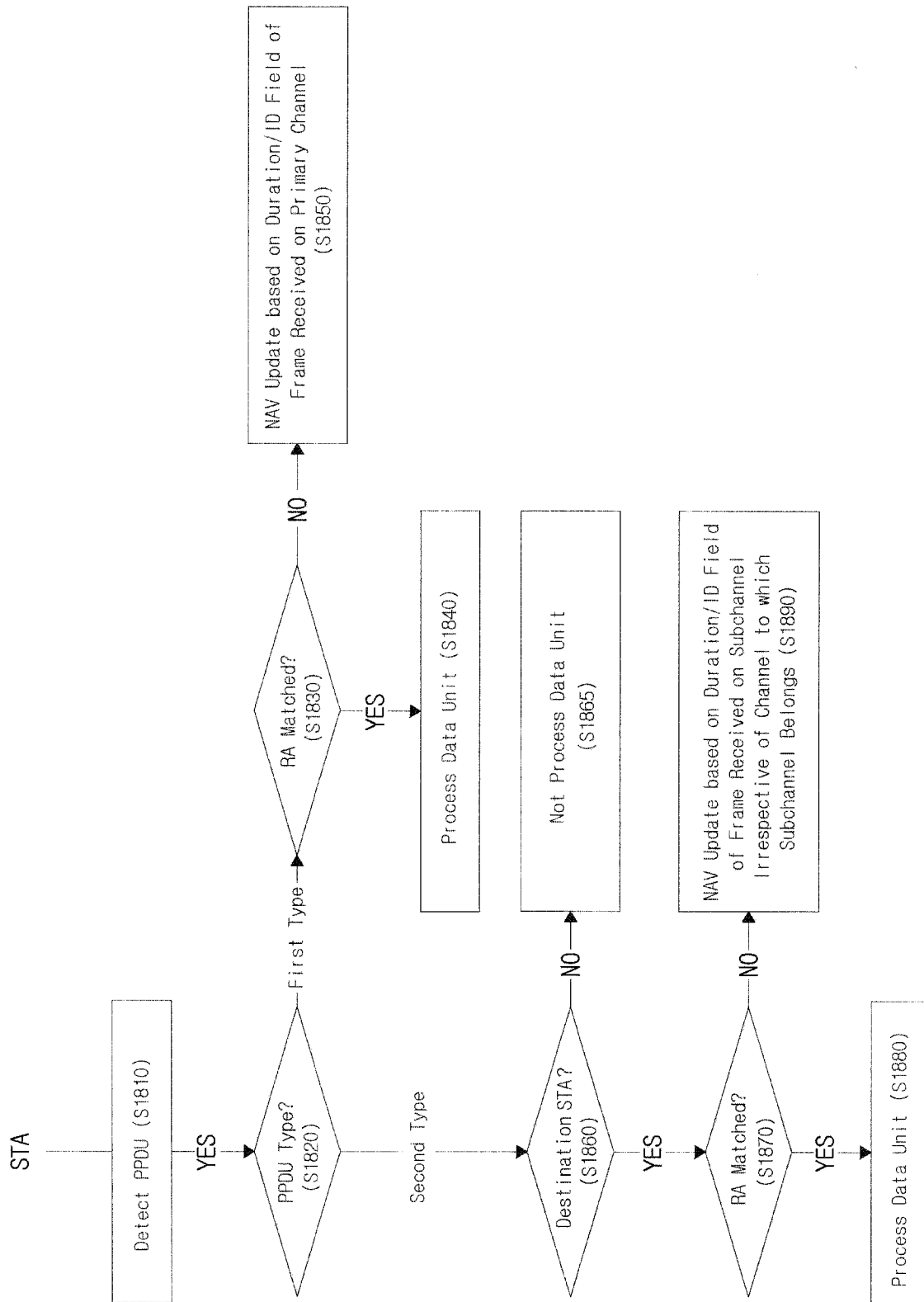


FIG. 19

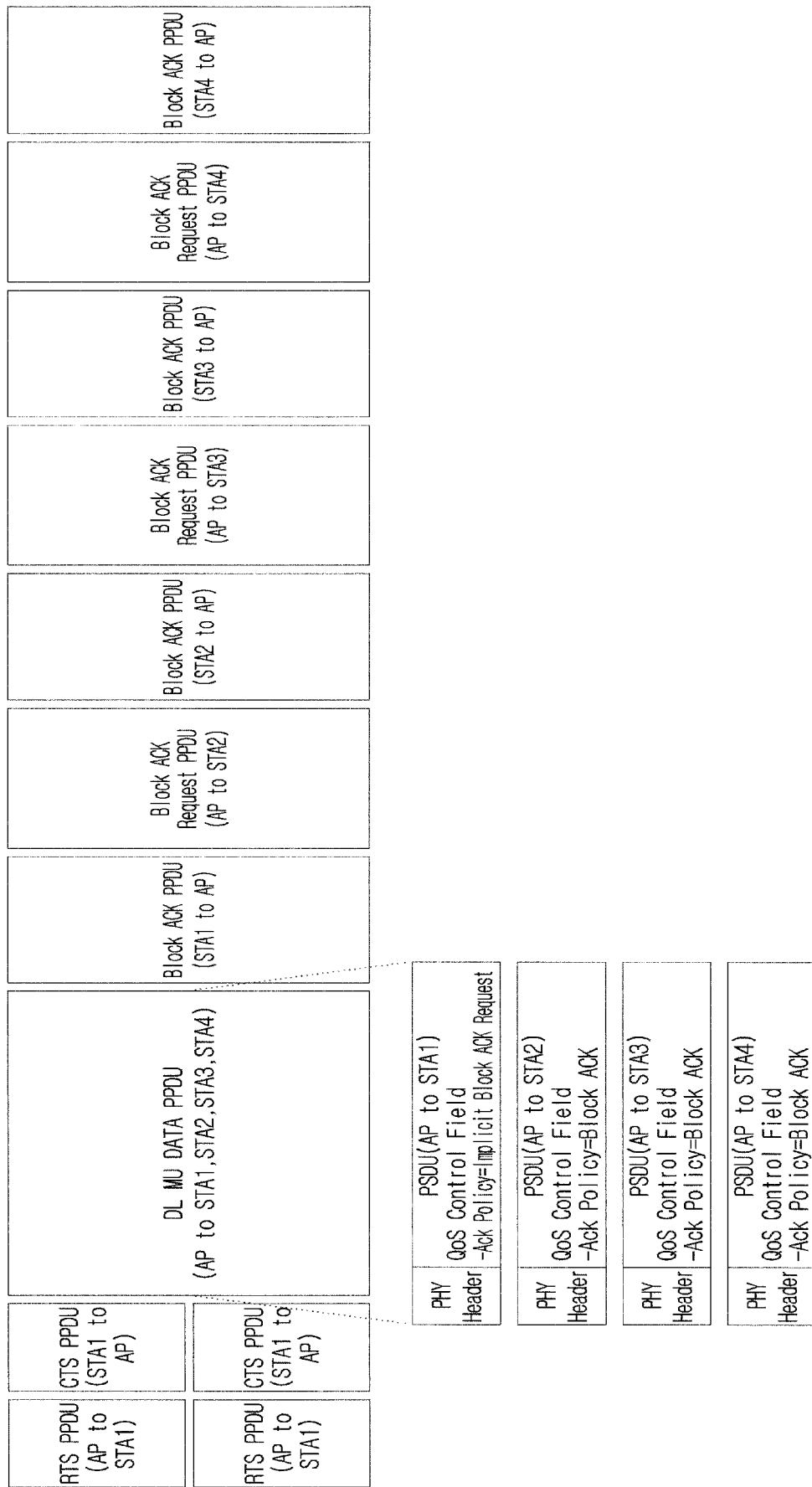


FIG. 20

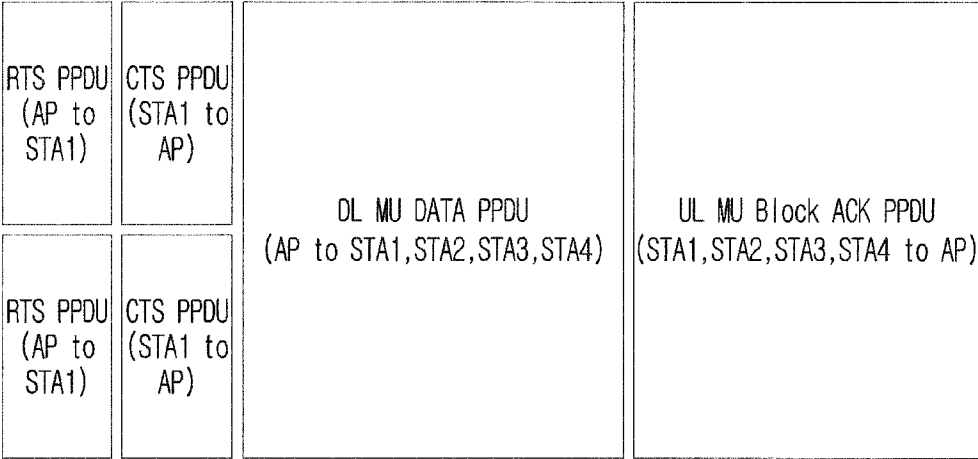


FIG. 21

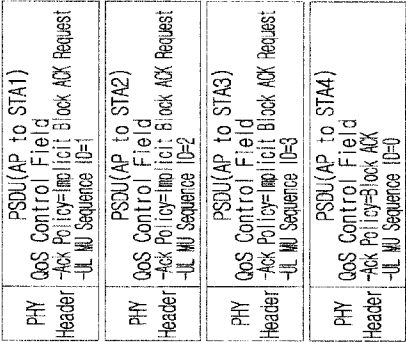
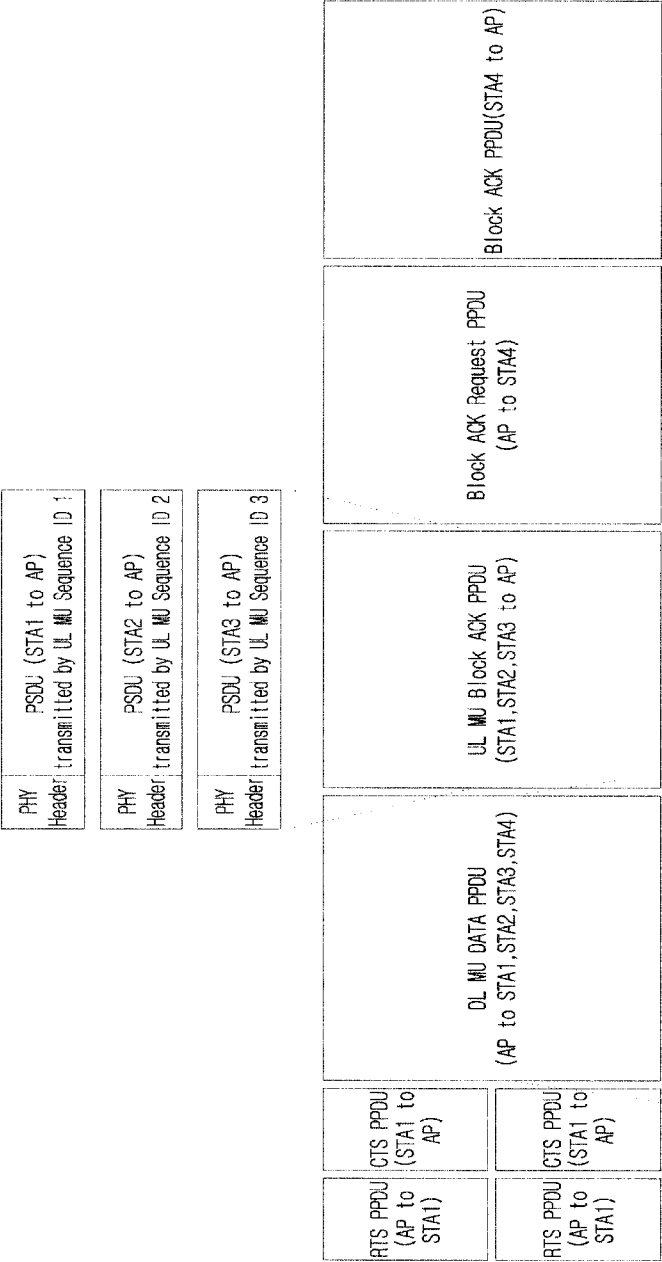


FIG. 22

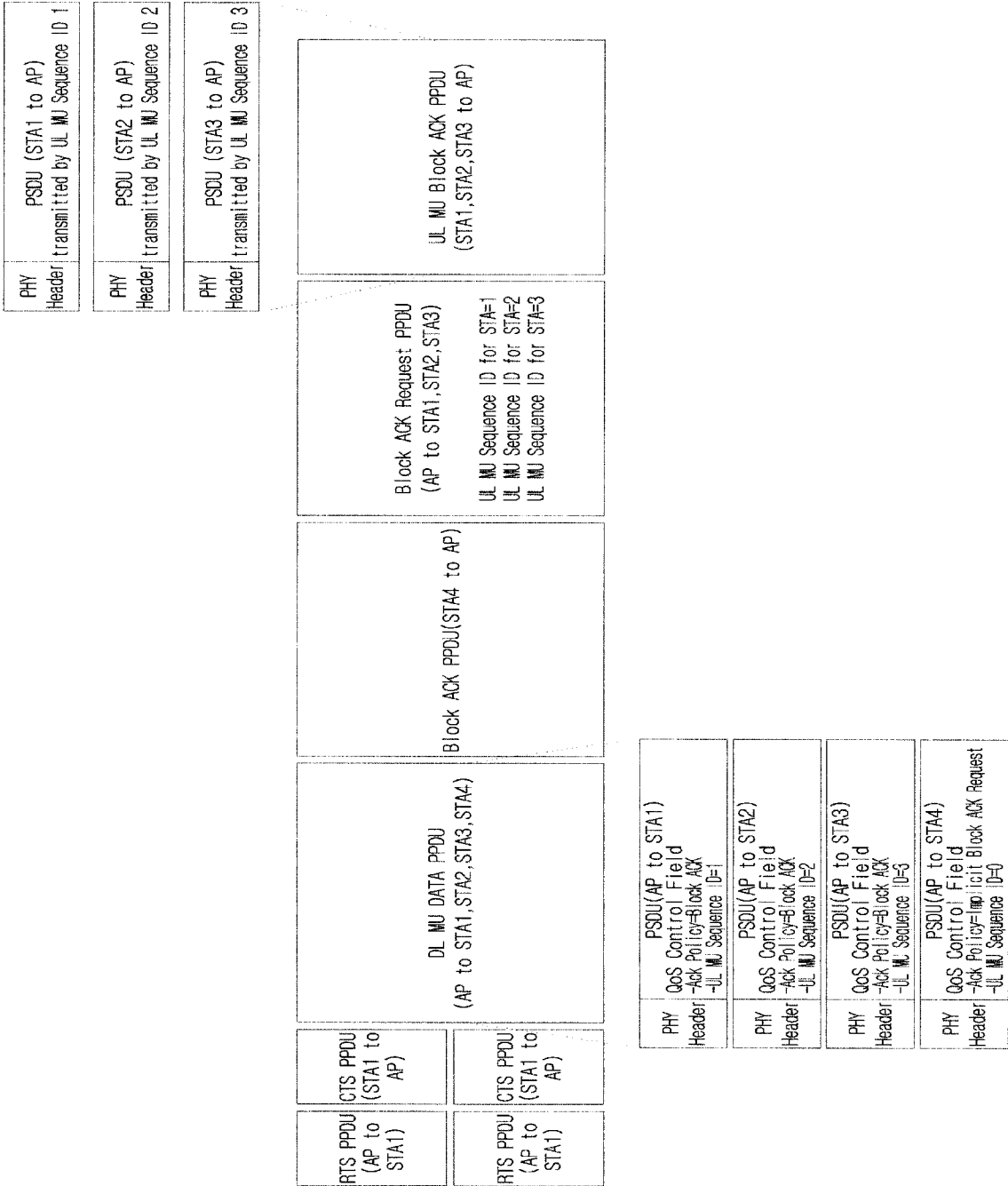
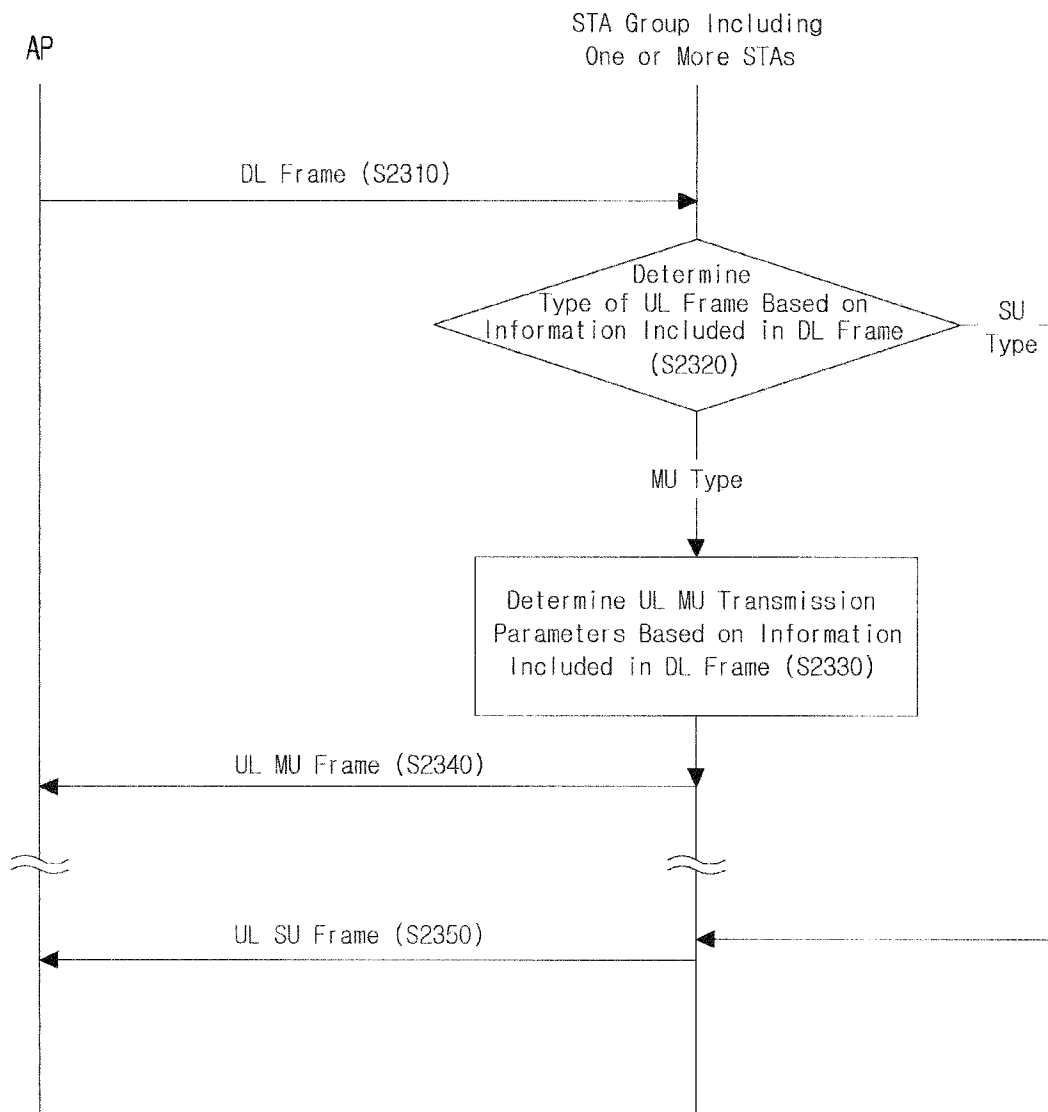


FIG. 23



Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN			
First Named Inventor/Applicant Name:	Yongho SEOK			
Filer:	Soyeon P. Laub/Lori Tillman			
Attorney Docket Number:	096809-0032			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	70	70
Utility Search Fee	2111	1	300	300
Utility Examination Fee	2311	1	360	360
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				730

Electronic Acknowledgement Receipt

EFS ID:	23978928
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Lori Tillman
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	03-NOV-2015
Filing Date:	
Time Stamp:	20:06:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$730
RAM confirmation Number	5464
Deposit Account	502624
Authorized User	LAUB, SOYEON P. KAREN

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	096809-0032_ADS.pdf	1818609	no	7
			cc205a62360bcb52c6b750ebdf3577c5c1d5531b		
Warnings:					
Information:					
2	Oath or Declaration filed	096809-0032_Declaration.pdf	89546	no	1
			0993d67f5f0785ed448db8f554f0c3c5614835aa		
Warnings:					
Information:					
3	Power of Attorney	096809-0032_PoA.pdf	151844	no	2
			4fb686b1042b148cf68f5dbf16d847c817eb9078		
Warnings:					
Information:					
4		096809-0032_Application.pdf	549735	yes	57
			436ed3146e6f54a0cfb419570f6a835e99c6c122		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	53	
	Claims		54	56	
	Abstract		57	57	
Warnings:					
Information:					
5	Drawings-only black and white line drawings	096809-0032_Drawings.pdf	876920	no	23
			19d8e7a8ac032b9e14d50a5fd335bf8044e06e9c		
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	35457	no	2
			431793f7b7a36a2643fa9af1d0cf84670d53338		

Warnings:	
Information:	
Total Files Size (in bytes):	3522111
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.	

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		
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		
	Yongho		SEOK			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Irvine	State/Province	CA	Country of Residence i	US	
Mailing Address of Inventor:						
Address 1		33 Canoe				
Address 2						
City	Irvine	State/Province	CA			
Postal Code	92618	Country i	US			
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	31824		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		
Attorney Docket Number	096809-0032	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	23	Suggested Figure for Publication (if any)	

Filing By Reference :

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		

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	31824		

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 this 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 blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Claims benefit of provisional	62080026	2014-11-14
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Claims benefit of provisional	62074514	2014-11-03

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

[Add](#) ZYY EL-1002
Page 195 (of 204)

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		

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) 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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^j (if applicable)

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.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		

If 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 World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

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			Remove
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	NEWRACOM, INC.		
Mailing Address Information For Applicant:			
Address 1	9008 Research Drive		
Address 2			
City	Irvine	State/Province	CA
Country ⁱ	US	Postal Code	92618
Phone Number		Fax Number	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			Add

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.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
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.				Add

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.				
Signature	/Soyeon Pak (Karen) Laub/		Date (YYYY-MM-DD)	2015-11-03
First Name	Soyeon Pak (Karen)	Last Name	Laub	Registration Number
				39266
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	096809-0032
		Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN		

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 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 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.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

**Title of
Invention**

**METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE
IN A HIGH EFFICIENCY WIRELESS LAN**

As the below named inventor, I hereby declare that:

This declaration ☒ The attached application, or
is directed to:

☐ 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.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be
material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which
became available between the filing date of the prior application and the national or PCT International filing date of the
continuation-in-part application.

I authorize and request the practitioners of McDermott Will & Emery LLP to insert the filing date and application number of
the application, when known, and/or check the appropriate box.

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

Inventor: Yongho SEOK

Date (Optional): 11/02/2015

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or
must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

Electronic Acknowledgement Receipt

EFS ID:	23978928
Application Number:	14931753
International Application Number:	
Confirmation Number:	3819
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING RESPONSE FRAME BASED ON TYPE IN A HIGH EFFICIENCY WIRELESS LAN
First Named Inventor/Applicant Name:	Yongho SEOK
Customer Number:	31824
Filer:	Soyeon P. Laub/Lori Tillman
Filer Authorized By:	Soyeon P. Laub
Attorney Docket Number:	096809-0032
Receipt Date:	03-NOV-2015
Filing Date:	
Time Stamp:	20:06:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$730
RAM confirmation Number	5464
Deposit Account	502624
Authorized User	LAUB, SOYEON P. KAREN

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	096809-0032_ADS.pdf	1818609	no	7
			cc205a62360bcb52c6b750ebdf3577c5c1d5531b		
Warnings:					
Information:					
2	Oath or Declaration filed	096809-0032_Declaration.pdf	89546	no	1
			0993d67f5f0785ed448db8f554f0c3c5614835aa		
Warnings:					
Information:					
3	Power of Attorney	096809-0032_PoA.pdf	151844	no	2
			4fb686b1042b148cf68f5dbf16d847c817eb9078		
Warnings:					
Information:					
4		096809-0032_Application.pdf	549735	yes	57
			436ed3146e6f54a0cfb419570f6a835e99c6c122		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	53	
	Claims		54	56	
	Abstract		57	57	
Warnings:					
Information:					
5	Drawings-only black and white line drawings	096809-0032_Drawings.pdf	876920	no	23
			19d8e7a8ac032b9e14d50a5fd335bf8044e06e9c		
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	35457	no	2
			431793f7b7a36a2643fa9af1d0cf84670d533338		

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