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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	10/26/2021	11159210	B-10010CON2 632450-9	3714

158747 7590 10/06/2021

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

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 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):

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

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PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

158747 7590 06/25/2021
LADAS & PARRY
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SUITE 240
LOS ANGELES, CA 90010

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Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	09/27/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
TAYONG, HELENE E	2631	375-262000

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 03-09 or more recent) attached. **Use of a Customer Number is required.**

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

1 Ladas & Parry, LLP
2
3

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

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

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature /Young Seok Koo 76,255/ Date September 24, 2021

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

Electronic Patent Application Fee Transmittal

Application Number:	16731031
Filing Date:	31-Dec-2019
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Filer:	Young Seok Koo/Lianne Herbert
Attorney Docket Number:	B-10010CON2 632450-9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

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

Electronic Acknowledgement Receipt	
EFS ID:	43858215
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Lianne Herbert
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	24-SEP-2021
Filing Date:	31-DEC-2019
Time Stamp:	13:17:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	632450-IssueFee-Transmittal.pdf	103779 3c71e6712e20c0211aae471e1473cd2af8cd69e2	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38111 2be3608c54db0c6dc1ed8709915f2b793d4281b0	no	2
Warnings:					
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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.

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158747 7590 09/17/2021

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SUITE 240
LOS ANGELES, CA 90010

EXAMINER	
TAYONG, HELENE E	

ART UNIT	PAPER NUMBER
2631	

NOTIFICATION DATE	DELIVERY MODE
09/17/2021	ELECTRONIC

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

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

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

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

Corrected ***Notice of Allowability***	**Application No.** 16/731,031	**Applicant(s)** Son et al.	
	Examiner HELENE E TAYONG	**Art Unit** 2631	**AIA (FITF) Status** Yes

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

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

1. ☑ This communication is responsive to 08/14/2021.
   ☐ 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 21,24-27 and 30-33 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

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

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

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

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

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631

Notice of Pre-AIA or AIA Status

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

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on **08/12/21** was filed after the mailing date of **the Notice of Allowance on 06/25/21**. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

3. Claims 21, 24-27 and 30-33 are allowed.

4. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

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

6. **The following is a statement of reasons for allowance:**

Regarding claims 21 and 27, the prior art of record, specifically **Lim Dongguk et al (WO2016208830 A1)(see IDS)** teaches a wireless communication terminal (see

fig. 30, and claim 1, receiving a signal from a station(STA) in a wireless LAN system) , the terminal comprising: a communication unit {copper line); and

a processor (see claim 12, — And a processor)) configured to process signals transmitted and received through the communication unit (for processing the preferences sent over the copper line) wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12, in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A field jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field), and decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B), see [142]-[143], fig.23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted

over 20 MHz, 40 MHz, or 180 MHz bandwidths. Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, HE-SIG-A and HE-SIG-B are set in Ix symbol It can be set in symbol (12.8us) units. Also see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)). Is a wireless mobile terminal that specifies. However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, Lim Dongguk et al discloses that the 'STA' is a SIG-A and SIG-B field. The MU frame containing the information obtained from the SIG-A field, see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)) and see [199], The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can use information obtained from the SIG-A field, e.g., information on multiple MCS levels) for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS) teaches *in section 26.3.3.7.4 An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A full bandwidth MU Ml MO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If*

the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users fieid(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1,...., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-SIG-B content channel 2. (#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams fora designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding. When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA

IDs. The user position is indicated by the block index. From a multiplexing information lookup table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.

However, none of the prior arts cited alone or in combination provides the motivation to teach decode the received HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A, wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation as recited in **claims 21 and 27**.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
September 14, 2021

August 11, 2021

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

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

FOREIGN PATENT DOCUMENTS

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

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	1.	Office Action dated July 8, 2021 for Korean Patent Application No. 10-2021-7015929 and its English translation provided by Applicant's foreign counsel

EXAMINER	*DATE CONSIDERED*
/HELENE E TAYONG/	09/14/2021

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
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EXAMINER	*DATE CONSIDERED*

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

Electronic Patent Application Fee Transmittal					
Application Number:	16731031				
Filing Date:	31-Dec-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET				
First Named Inventor/Applicant Name:	Juhyung Son				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-10010CON2 632450-9				
Filed as Large Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt	
EFS ID:	43489354
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	12-AUG-2021
Filing Date:	31-DEC-2019
Time Stamp:	16:00:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E20218BG00464795
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021-08-11_632450_IDS.pdf	152322 15188af75add20b08182b4c1f1e17fbaadf57ead	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	Ref_KR10-2021-7015929_OA_7-8-2021.pdf	167473 6b9da4fcf94910575891655ff2c2a77457166d28	no	6
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	38317 2b088b0a4458af3bb5948e674d90907defeb01b7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	358112		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	Examiner: Tayong, Helene E
Serial No.: 16/731,031	Art Unit: 2631
Filing or 371 (c) Date: December 31, 2019	Conf. No.: 3714
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	Our Ref: B-10010CON2 632450-9
Date: August 11, 2021	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

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

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

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

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

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

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

Items Disclosed

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

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

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

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

Additional Information

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

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

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

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

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[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on December 31, 2019 and therefore are not submitted in this IDS.

[ ] Other:

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

August 11, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
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LADAS & PARRY LLP
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

158747 7590 08/09/2021

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LOS ANGELES, CA 90010

EXAMINER	
TAYONG, HELENE E	

ART UNIT	PAPER NUMBER
2631	

NOTIFICATION DATE	DELIVERY MODE
08/09/2021	ELECTRONIC

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

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

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

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

PTOL-90A (Rev. 04/07)

Corrected ***Notice of Allowability***	**Application No.** 16/731,031	**Applicant(s)** Son et al.	
	Examiner HELENE E TAYONG	**Art Unit** 2631	**AIA (FITF) Status** Yes

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

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

1. ☑ This communication is responsive to 07/12/21.
   ☐ 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 21,24-27 and 30-33 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

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

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

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

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

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631

Notice of Pre-AIA or AIA Status

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

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on **07/01/21** was filed after the mailing date of **the Notice of Allowance on 06/25/21**. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

3. Claims 21, 24-27 and 30-33 are allowed.

4. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

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

6. **The following is a statement of reasons for allowance:**

Regarding claims 21 and 27, the prior art of record, specifically **Lim Dongguk et al (WO2016208830 A1)(see IDS)** teaches a wireless communication terminal (see

fig. 30, and claim 1, receiving a signal from a station(STA) in a wireless LAN system) , the terminal comprising: a communication unit {copper line); and

a processor (see claim 12, — And a processor)) configured to process signals transmitted and received through the communication unit (for processing the preferences sent over the copper line) wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12, in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A field jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field), and decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B), see [142]-[143], fig.23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted

over 20 MHz, 40 MHz, or 180 MHz bandwidths. Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, HE-SIG-A and HE-SIG-B are set in Ix symbol It can be set in symbol (12.8us) units. Also see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)). Is a wireless mobile terminal that specifies. However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, Lim Dongguk et al discloses that the 'STA' is a SIG-A and SIG-B field. The MU frame containing the information obtained from the SIG-A field, see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)) and see [199], The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can use information obtained from the SIG-A field, e.g., information on multiple MCS levels) for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS) teaches *in section 26.3.3.7.4 An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A full bandwidth MU Ml MO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If*

the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users fieid(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1,...., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-SIG-B content channel 2. (#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams fora designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding. When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA

IDs. The user position is indicated by the block index. From a multiplexing information lookup table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.

However, none of the prior arts cited alone or in combination provides the motivation to teach decode the received HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A, wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation as recited in **claims 21 and 27**.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
August 4, 2021

July 1, 2021

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

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

FOREIGN PATENT DOCUMENTS

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

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	1.	Office Action dated May 11, 2021 for European Patent Application No. 18 736 375.9

EXAMINER	*DATE CONSIDERED*
/HELENE E TAYONG/	08/04/2021

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
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EXAMINER	*DATE CONSIDERED*

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	Examiner: Tayong, Helene E
Serial No.: 16/731,031	Art Unit: 2631
Filing or 371 (c) Date: December 31, 2019	Conf. No.: 3714
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	Our Ref: B-10010CON2 632450-9
Date: July 1, 2021	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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---

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

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

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

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

Items Disclosed

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

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

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

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

Additional Information

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

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

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

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

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

[ ] Other:

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

July 1, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
Attorney for Applicant
Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

Electronic Patent Application Fee Transmittal					
Application Number:	16731031				
Filing Date:	31-Dec-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET				
First Named Inventor/Applicant Name:	Juhyung Son				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-10010CON2 632450-9				
Filed as Large Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt	
EFS ID:	43155881
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	01-JUL-2021
Filing Date:	31-DEC-2019
Time Stamp:	23:20:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E202171N20544250
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Other Reference-Patent/App/Search documents	Ref_EP187363759_OA_5-11-21.pdf	296176 3797f672d03b73776118b1db1cc15f95478f1a42	no	5
Warnings:					
Information:					
2		2021-07-01_632450_IDS.pdf	151765 20da088fef9b8bd32ac297b887ccfa2e41f9d7ba	yes	4

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

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30795 b6385c9a7db10fc3e221fc38fbf8498490d31199	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	478736		

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
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

158747 7590 06/25/2021

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

EXAMINER
TAYONG, HELENE E

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 06/25/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	09/27/2021

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), by mail or fax, or via EFS-Web.

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

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

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

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

158747 7590 06/25/2021
LADAS & PARRY
E-MAIL
4525 WILSHIRE BOULEVARD
SUITE 240
LOS ANGELES, CA 90010

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	09/27/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
TAYONG, HELENE E	2631	375-262000

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 03-09 or more recent) attached. **Use of a Customer Number is required.**

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

1_____
2_____
3_____

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

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

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

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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 _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

158747 7590 06/25/2021

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

EXAMINER	
TAYONG, HELENE E	
ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 06/25/2021

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/731,031	Applicant(s) Son et al.	
	Examiner HELENE E TAYONG	Art Unit 2631	AIA (FITF) Status Yes

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

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

1. ☑ This communication is responsive to 05/25/21.
   ☐ 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 21,24-27 and 30-33 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

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

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

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

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

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631

Notice of Pre-AIA or AIA Status

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

Request for Continued Examination Under 37 CFR 1.114 2.

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on **05/25/21** has been entered. Accordingly, claims 21,25,27,31 are amended. Claims 1-20, 22-23,28-29 are cancelled. No new claims are added. As a result, claims 21,24-27 and 30-33 are now pending.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on **05/25/21** was filed after the mailing date of **the Notice of Allowance on 04/20/21**. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

4. Claims 21, 24-27,30-33 are allowed.

5. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

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

7. **The following is a statement of reasons for allowance:**

Regarding claims 21 and 27, the prior art of record, specifically **Lim Dongguk et al (WO2016208830 A1)(see IDS)** teaches a wireless communication terminal (see fig. 30, and claim 1, receiving a signal from a station(STA) in a wireless LAN system) , the terminal comprising: a communication unit {copper line); and
a processor (see claim 12, — And a processor)) configured to process signals transmitted and received through the communication unit (for processing the preferences sent over the copper line) wherein the processor is configured to:
receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12, in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A fieid jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit

blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field), and decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B), see [142]-[143], fig.23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted over 20 MHz, 40 MHz, or 180 MHz bandwidths. Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, HE-SIG-A and HE-SIG-B are set in Ix symbol It can be set in symbol (12.8us) units. Also see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)). Is a wireless mobile terminal that specifies. However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, Lim Dongguk et al discloses that the ‘STA’ is a SIG-A and SIG-B field. The MU frame containing the information obtained from the SIG-A field, see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz

bandwidth based on orthogonal frequency division multiple access (OFDMA)) and see [199], The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can use information obtained from the SIG-A field, e.g., information on multiple MCS levels) for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS) teaches *in section 26.3.3.7.4 An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A full bandwidth MU Ml MO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users fieid(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1,...., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-*

SIG-B content channel 2. (#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams fora designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding. When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA IDs. The user position is indicated by the block index. From a multiplexing information lookup table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.

However, none of the prior arts cited alone or in combination provides the motivation to teach decode the received HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a

format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A, wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation as recited in **claims 21 and 27**.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-

my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
June 19, 2021

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	**Art Unit**
	HELENE E TAYONG	2631

CPC							
Symbol						**Type**	**Version**
H04B	/	7	/	0452		F	2013-01-01
H04B	/	7	/	028		I	2013-01-01
H04L	/	5	/	0023		I	2013-01-01
H04L	/	5	/	0048		I	2013-01-01

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	19 June 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210619

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	**Art Unit**
	HELENE E TAYONG	2631

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	5	/	12

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
375	262

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	19 June 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210619

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	**Art Unit**
	HELENE E TAYONG	2631

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12	1	21	7	30								
	4		13		22	8	31								
	5		14		23	9	32								
	6		15	2	24	5	33								
	7		16	3	25										
	8		17	4	26										
	9		18	6	27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	19 June 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210619

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	**Art Unit**
	HELENE E TAYONG	2631

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

CLAIMS

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

CLAIM		DATE								
Final	Original	06/20/2020	01/01/2021	04/10/2021	06/19/2021					
	1	-	-	-	-					
	2	-	-	-	-					
	3	-	-	-	-					
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	20	-	-	-	-					
1	21	✓	✓	=	=					
	22	O	-	-	-					
	23	✓	O	-	-					
2	24	✓	O	=	=					
3	25	✓	O	=	=					
4	26	✓	✓	=	=					
6	27	✓	✓	=	=					
	28	O	-	-	-					
	29	✓	O	-	-					
7	30	✓	O	=	=					
8	31	✓	O	=	=					
9	32	✓	✓	=	=					
5	33		✓	=	=					

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04B7/0452 , H04B7/028 , H04L5/0023 , H04L5/0048	06/20/2020	HT

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

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
375	262	06/20/2020	HT

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

Search Notes		
Search Notes	**Date**	**Examiner**
EAST: USPAT,USPG PUB,EPO,JPO, and DERWENT	06/20/2020	HT
NPL: Google	06/20/2020	HT
INVENTORS and Assignee NAME SEARCH on palm and East	06/20/2020	HT
Search for parent and/or provisional Application	01/01/2021	HT
Updated search	01/01/2021	HT
updated search (EAST)	04/10/2021	HT
Updated search (EAST)	06/19/2021	HT

/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
same as above	same as above	04/10/2021	HT
same as above	same as above	06/19/2021	HT

/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	

May 25, 2021

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2016/0315681	Oct. 27, 2016	MOON et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	2.	2016/178795	Nov. 10, 2016	WO			

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	3.	Office Action dated November 2, 2020 for Korean Patent Application No. 10-2020-7005005 and its English translation provided by Applicant's foreign counsel
	4.	Notce of Allowance dated February 25, 2021 for Korean Patent Application No. 10-2020-7005005 and its English translation provided by Applicant's foreign counsel
	5.	Office Action dated March 22, 2021 for Japanese Patent Application No. 2019-537309 and its English translation provided by Applicant's foreign counsel

EXAMINER	*DATE CONSIDERED*
/HELENE E TAYONG/	06/19/2021

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	WO-2016208830-$.did.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/06/19 15:43

EAST Search History (Interference)

<This search history is empty>

6/19/2021 3:43:46 PM
C:\Users\htayong\Documents\EAST\Workspaces\16731031-processor receives high efficiency multi-user PHY protocol data unit and He-SIG-A and HE-SIG-B field..wsp

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

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	4.	Notce of Allowance dated February 25, 2021 for Korean Patent Application No. 10-2020-7005005 and its English translation provided by Applicant's foreign counsel
	5.	Office Action dated March 22, 2021 for Japanese Patent Application No. 2019-537309 and its English translation provided by Applicant's foreign counsel

EXAMINER	*DATE CONSIDERED*

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

Electronic Patent Application Fee Transmittal					
Application Number:	16731031				
Filing Date:	31-Dec-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET				
First Named Inventor/Applicant Name:	Juhyung Son				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-10010CON2 632450-9				
Filed as Large Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

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

Electronic Acknowledgement Receipt	
EFS ID:	42820147
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	25-MAY-2021
Filing Date:	31-DEC-2019
Time Stamp:	23:32:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1360
RAM confirmation Number	E20215ON32240636
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	632450_RCE_Transmittal.pdf	202651 d8b2d07804bd234833270f3225ecddc5ca63f433	no	2
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		2021-05-25_632450_IDS.pdf	243814 cf72b1d3e144e808ec3fdc2541fda46a2a999051	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Ref1_KR10-2020-7005005_OA_11-2-2020.pdf	186651 2269edd3db7571584f6b78dadf5f9fdc48935b29	no	8
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	Ref2_KR10-2020-7005005_NOA_2-25-21.pdf	347622 89208ff22ed1bdfd2b806a53f563f2c99cd7b747	no	8
Warnings:					
Information:					
5	Foreign Reference	Ref4_WO2016-178795A1.pdf	5864557 8768057950dc9c3e485434202ee55ca064a591c1	no	80
Warnings:					

Information:					
6	Other Reference-Patent/App/Search documents	Ref5_JP2019-537309_3-22-2021.pdf	325546 6e4482aa31de895ce0a2786a7e9989da5a243e49	no	10
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Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	30792 d75ec2dcf1d2f12c503989de4b5f7a3eaa382878	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7201633		

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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

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

Request for Continued Examination (RCE) Transmittal

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

Application Number	16/731,031
Filing Date	December 31, 2019
First Named Inventor	Juhyung SON
Art Unit	2631
Examiner Name	Tayong, Helene E
Attorney Docket Number	B-10010CON2 632450-9

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

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

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

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

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☐ Amendment/Reply

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

      iii. ☑ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

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

   b. ☐ Other _____

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

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

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

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

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

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

   d. ■ Payment by EFS-Web

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

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Young Seok Koo 76255/	Date	May 25, 2021
Name (Print/Type)	Young Seok Koo	Registration No.	76255

CERTIFICATE OF MAILING OR TRANSMISSION

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

Signature	/Azatuhi Chinaryan/		
Name (Print/Type)	Azatuhi Chinaryan	Date	May 25, 2021

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

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

Privacy Act Statement

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

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

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	Examiner: Tayong, Helene E
Serial No.: 16/731,031	Art Unit: 2631
Filing or 371 (c) Date: December 31, 2019	Conf. No.: 3714
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	Our Ref: B-10010CON2 632450-9
Date: May 25, 2021	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

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

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

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

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

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

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

Items Disclosed

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

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

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

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

Additional Information

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

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

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

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

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[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on September 26, 2020 and December 31, 2019 and therefore are not submitted in this IDS.

[ ] Other:

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

May 25, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
Attorney for Applicant
Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

158747 7590 04/20/2021

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

EXAMINER
TAYONG, HELENE E

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 04/20/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	07/20/2021

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), by mail or fax, or via EFS-Web.

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

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

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

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

158747 7590 04/20/2021
LADAS & PARRY
E-MAIL
4525 WILSHIRE BOULEVARD
SUITE 240
LOS ANGELES, CA 90010

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	07/20/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
TAYONG, HELENE E	2631	375-262000

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 03-09 or more recent) attached. **Use of a Customer Number is required.**

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

1_____
2_____
3_____

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

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

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

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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 _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

158747 7590 04/20/2021

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

EXAMINER	
TAYONG, HELENE E	
ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 04/20/2021

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/731,031	Applicant(s) Son et al.	
	Examiner HELENE E TAYONG	Art Unit 2631	AIA (FITF) Status Yes

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

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

1. ☑ This communication is responsive to 04/06/21.
   ☐ 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 21,24-27 and 30-33 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

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

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

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

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

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631

Notice of Pre-AIA or AIA Status

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

Response to Amendments

2. This Office Action is responsive to the Amendment filed on **04/06/2021**. Claims 21,24-27,30-33 of which claims 21 and 27 are independent, were pending in this application and have been considered below.

Claims 1-20, 22-23 and 28-29 are cancelled.

Response to Arguments

3. Applicant's arguments, see Remarks, filed **04/06/2021**, with respect to the rejection of claims 21,26, 27, 32 and 33 under 35 U.S.C. 103 as being unpatentable over Lim Dongguk et al (WO2016208830 A1)(see IDS) in view of Sun et al (US 20160156438A1) (see IDS) and further in view of IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS) have been fully considered and are persuasive. The rejection of claims has been withdrawn because of amendments.

Examiner's Amendment

4. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided

by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

5. The application is amended as follows:

- Claim 27 is amended as follow:

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

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decode the received HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output (MU-MIMO) transmission, a format of user ~~filed(s)~~ field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A,,

wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

Allowable Subject Matter

6. Claims 21, 24-27,30-33 are allowed.

7. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

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

9. **The following is a statement of reasons for allowance:**

Regarding claims 21 and 27, the prior art of record, specifically **Lim Dongguk et al (WO2016208830 A1)(see IDS)** teaches a wireless communication terminal (see fig. 30, and claim 1, receiving a signal from a station(STA) in a wireless LAN system) , the terminal comprising: a communication unit {copper line); and
a processor (see claim 12, — And a processor)) configured to process signals transmitted and received through the communication unit (for processing the preferences sent over the copper line) wherein the processor is configured to:
receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12, in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A fieid jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit

blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field), and decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B), see [142]-[143], fig.23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted over 20 MHz, 40 MHz, or 180 MHz bandwidths. Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, HE-SIG-A and HE-SIG-B are set in Ix symbol It can be set in symbol (12.8us) units. Also see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)). Is a wireless mobile terminal that specifies. However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, Lim Dongguk et al discloses that the ‘STA’ is a SIG-A and SIG-B field. The MU frame containing the information obtained from the SIG-A field, see [197], The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz

bandwidth based on orthogonal frequency division multiple access (OFDMA)) and see [199], The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can use information obtained from the SIG-A field, e.g., information on multiple MCS levels) for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS) teaches *in section 26.3.3.7.4 An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A full bandwidth MU Ml MO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users fieid(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1,...., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-*

SIG-B content channel 2. (#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams fora designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding. When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA IDs. The user position is indicated by the block index. From a multiplexing information lookup table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.

However, none of the prior arts cited alone or in combination provides the motivation to teach decode the received HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a

format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A, wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation as recited in claims 21 and 27.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-

my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
April 10, 2021

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

CPC - Searched*		
Symbol	Date	Examiner
H04B7/0452 , H04B7/028 , H04L5/0023 , H04L5/0048	06/20/2020	HT

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
375	262	06/20/2020	HT

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

Search Notes		
Search Notes	Date	Examiner
EAST: USPAT,USPG PUB,EPO,JPO, and DERWENT	06/20/2020	HT
NPL: Google	06/20/2020	HT
INVENTORS and Assignee NAME SEARCH on palm and East	06/20/2020	HT
Search for parent and/or provisional Application	01/01/2021	HT
Updated search	01/01/2021	HT
updated search (EAST)	04/10/2021	HT

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
same as above	same as above	04/10/2021	HT

/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

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

CLAIMS

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

CLAIM		DATE								
Final	Original	06/20/2020	01/01/2021	04/10/2021						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	-	-	-						
	6	-	-	-						
	7	-	-	-						
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	16	-	-	-						
	17	-	-	-						
	18	-	-	-						
	19	-	-	-						
	20	-	-	-						
1	21	✓	✓	=						
	22	O	-	-						
	23	✓	O	-						
2	24	✓	O	=						
3	25	✓	O	=						
4	26	✓	✓	=						
6	27	✓	✓	=						
	28	O	-	-						
	29	✓	O	-						
7	30	✓	O	=						
8	31	✓	O	=						
9	32	✓	✓	=						
5	33		✓	=						

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

CPC						
Symbol					Type	Version
H04B	/	7	/	0452	F	2013-01-01
H04B	/	7	/	028	I	2013-01-01
H04L	/	5	/	0023	I	2013-01-01
H04L	/	5	/	0048	I	2013-01-01

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	10 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210410

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H04L	/	5	/	12	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
375	262

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	10 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210410

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12	1	21	7	30								
	4		13		22	8	31								
	5		14		23	9	32								
	6		15	2	24	5	33								
	7		16	3	25										
	8		17	4	26										
	9		18	6	27										

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	9	
/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	10 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210410

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	WO-2016175614-$.did.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/04/10 13:49
L7	12	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)and (MU-MIMO with user$1) and (user with fields with MU-MIMO with allocation) and (user with fields with non-MU-MIMO with allocation)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/04/10 14:40

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	308	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)and (multi with user with MIMO or (MU-MIMO))	US-PGPUB; USPAT	OR	OFF	2021/04/10 13:52
L3	8	((SIG-B) with compression with field with (HE-SIG-A)) and (full with bandwidth with MU-MIMO)	US-PGPUB; USPAT	OR	OFF	2021/04/10 13:52
L4	9	(decode with received with (HE MU PPDU)) and (information with (HE-SIG-A))and (subfield with (HE-SIG-A))and (wireless with communicat$3 with terminal)	US-PGPUB; USPAT	OR	OFF	2021/04/10 13:52
L5	9	(high with efficiency with multi with user with PHY with protocol with data with unit or (HEMUPPDU))and (wireless with communicat$3 with terminal)	US-PGPUB; USPAT	OR	OFF	2021/04/10 13:52
L6	214	((high with efficiency with multi with user with PHY with protocol with data with unit or (HE MU PPDU))and (wireless with communicat$3 with terminal)).clm.	US-PGPUB; USPAT	OR	OFF	2021/04/10 13:54
L8	12	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)and (MU-MIMO with user$1) and (user with fields with MU-MIMO with allocation) and (user with fields with non-MU-MIMO with allocation)	US-PGPUB; USPAT	OR	ON	2021/04/10 14:44

4/10/2021 3:38:14 PM
C:\Users\htayong\Documents\EAST\Workspaces\16731031-processor receives high efficiency multi-user PHY protocol data unit and He-SIG-A and HE-SIG-B field..wsp

Enter please

04/10/21
HT

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Juhyung SON	) Examiner:	Tayong, Helene E
Application No.:	16/731,031	) Confirmation No.:	3714
Filing Date:	December 31, 2019	) Group Art Unit:	2631
Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET		) Attorney Docket:	B-10010CON2 632450-9
		) Date: April 6, 2021	
		) Re:	**Response to Final Office Action of January 6, 2021**

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

RESPONSE TO OFFICE ACTION

Sir:

This paper is timely submitted in response to the Final Office Action mailed on January 6, 2021 for the subject application. Please amend the application as follows and consider the Remarks/Arguments set forth below.

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

Remarks/Arguments begin on page 5 of this paper.

All Amendments and Remarks/Arguments are made without prejudice or disclaimer.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Juhyung SON	) Examiner:	Tayong, Helene E
Application No.:	16/731,031	) Confirmation No.:	3714
Filing Date:	December 31, 2019	) Group Art Unit:	2631
Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET		) Attorney Docket:	B-10010CON2 632450-9
		) Date:	April 6, 2021
		) Re:	**Response to Final Office Action of January 6, 2021**

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

RESPONSE TO OFFICE ACTION

Sir:

This paper is timely submitted in response to the Final Office Action mailed on January 6, 2021 for the subject application. Please amend the application as follows and consider the Remarks/Arguments set forth below.

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

Remarks/Arguments begin on page 5 of this paper.

All Amendments and Remarks/Arguments are made without prejudice or disclaimer.

AMENDMENTS TO THE CLAIMS

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

Listing of claims

1-20. (Canceled).

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

a communication unit; and

a processor configured to process signals transmitted and received through the communication unit,

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU),

wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A,

wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

22-23. (Canceled).

24. (Previously Presented) The wireless communication terminal of claim 21,

wherein the user field(s) for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

25. (Currently Amended) The wireless communication terminal of claim 21, [[~~23,~~]] wherein the user field(s) for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

26. (Previously Presented) The wireless communication terminal of claim 21, wherein the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

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

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user filed(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A,

wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

28-29. (Canceled).

30. (Previously Presented) The wireless communication method of claim 27,

wherein the user field(s) for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

31. (Currently Amended) The wireless communication method of claim 27, [[~~29,~~]] wherein the user field(s) for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

32. (Previously Presented) The wireless communication method of claim 27, wherein the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

33. (Previously Presented) The wireless communication terminal of claim 21,

wherein the HE-SIG-A includes the SIG-B compression field and the specific subfield, and

wherein the SIG-B compression field indicates whether full bandwidth MU-MIMO transmission is used, and

when the SIG-B compression field indicates full bandwidth MU-MIMO transmission, the specific subfield indicates the number of MU-MIMO users.

REMARKS/ARGUMENTS

The following Remarks/Arguments are in response to the Final Office Action mailed on January 6, 2021 (hereinafter "Office Action") for the subject application. Pending in the application are claims 21, 23-27 and 29-33.

The Applicant notes with appreciation the Examiner's indication of allowable subject matter of claims 23-25 and 29-31.

In the Office Action, claims 21, 26, 27, 32 and 33 stand rejected under 35 U.S.C. §103 as allegedly being obvious over International Patent Application Publication No. WO 2016/208830 (hereinafter "Lim") in view of U.S. Patent Application Publication No. 2016/0156438 (hereinafter "Sun") and IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445 (hereinafter "IEEE 802.1 lax/D0.5").

In this response, claim 21 is amended to incorporate claim 23, and claim 27 is amended to incorporate claim 29. Claims 25 and 31 are amended for clarification purposes only. No new matter is presented as a result of these amendments. No claim is added. Claims 1-20, 22, 23, 28, and 29 have been canceled. Accordingly, the claims pending in this application after entry of this response are claims 21, 24-27 and 30-33.

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

Claim Rejections – 35 U.S.C. §103

In the Office Action, claims 21, 26, 27, 32 and 33 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Lim in view of Sun and IEEE 802.1 lax/D0.5 (See Office Action: page 3). These rejections are hereby traversed, and reconsideration and withdrawal are respectfully requested.

Claim 21

Claim 21 recites:

> *A wireless communication terminal, the terminal comprising:*
> *a communication unit; and*
> *a processor configured to process signals transmitted and received through the communication unit,*
> *wherein the processor is configured to:*

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU),

wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A,

wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claim 21 is amended to incorporate claim 23 which is indicated as being allowable in the Office Action. Specifically, the limitation of "*wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation*" is added to claim 21. Accordingly, the Applicant respectfully submits that claim 21 is allowable, and requests reconsideration and withdrawal of the §103 rejection of claim 21.

Claim 27

Claim 27 recites:

A wireless communication method of a wireless communication terminal, the method comprising:

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user filed(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A,

wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claim 27 is amended to incorporate claim 29 which is indicated as being allowable in the Office Action. Specifically, the limitation of "*wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation*" is added to claim 27. Therefore, the Applicant respectfully submits that claim 27 is allowable, and requests reconsideration and withdrawal of the §103 rejection of claim 27.

Claims 26, 32 and 33

Claims 26, 32 and 33 depend from claim 21 or 27. As discussed above, claims 21 and 27 are allowable. Accordingly, the Applicant respectfully submits that claims 26, 32 and 33 are allowable at least by way of their dependencies from claim 21 or 27, and requests reconsideration and withdrawal of the §103 rejections of claims 26, 32 and 33.

Allowable Subject Matter

The Applicant notes with appreciation the Examiner's indication of allowable subject matter of claims 23-25 and 29-31. The Examiner indicates that "Claims 23-25, 29-31 … would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims" (Office Action: page 12). Claims 23 and 29 are incorporated into claims 21 and 27, respectively. Accordingly, allowance of claims 21, 24-25, 27 and 30-31 is respectfully requested.

CONCLUSION

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

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

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

April 6, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

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Electronic Acknowledgement Receipt

EFS ID:	42384595
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021-04-06_632450_Response_to_Final_OA_1-6-2021.pdf	72593 b86598ec49bd555f7783089813 2e98696eca83e0	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	8
Warnings:			
Information:			
	Total Files Size (in bytes):	72593	

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/731,031	Filing Date 12/31/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		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), (i), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	04/06/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 9	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

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

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

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

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

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16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

158747 7590 01/06/2021

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EXAMINER	
TAYONG, HELENE E	

ART UNIT	PAPER NUMBER
2631	

NOTIFICATION DATE	DELIVERY MODE
01/06/2021	ELECTRONIC

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

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

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

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

Office Action Summary	Application No. 16/731,031	Applicant(s) Son et al.	
	Examiner HELENE E TAYONG	Art Unit 2631	AIA (FITF) Status Yes

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

Period for Reply

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

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

Status

1)☑ Responsive to communication(s) filed on 09/26/20.

☐ 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) 21,23-27 and 29-33 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) 21,26-27 and 32-33 is/are rejected.

8) ☑ Claim(s) 23-25 and 29-31 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 _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

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

Response to Amendment

2. Acknowledgement is made of the amendment filed **09/28/20**.

Claims 21, 23-27 and 29-33 remain pending in the application.

• Claim objections are withdrawn because of amendments.

• Claims 21,23-27,30, 32 are currently amended.

• Claims 1-20, 22 and 28 are canceled.

• Claim 33 is new.

Response to Arguments

3. (i) Applicant's arguments filed **09/28/20** with respect to the rejection(s) of claims 21 and 27 under 35 U.S.C. 103 as being unpatentable over Lim Dongguk et al (WO2016208830 A1)(see IDS) in view of Sun et al (US 20160156438A1) (see IDS) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS).

(ii) Applicant's arguments filed **09/26/20** with respect to claims 21, 27 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 21, 22, 28 and 29 of copending Application No. 16798197 in view of Wu Tianyu et al (EP3139532A1) is withdrawn because of amendments.

Applicant's arguments: *Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claims 21 and 27 are amended to incorporate claims 22 and 28 which are indicated as being allowable in the Office Action. Therefore, the Applicant respectfully submits that claims 21 and 27 as amended are allowable, and requests reconsideration and withdrawal of the §103 rejection of claims 21 and 27.*

Examiner's response: See new IDS submitted and rejections to amended claims below.

Claim Rejections - 35 USC § 103

4. 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.

5. Claims 21, 26, 27, 32 and 33 are rejected under 35 U.S.C. 103 as being unpatentable over Lim Dongguk et al (WO2016208830 A1)(see IDS) in view of Sun et al (US 20160156438A1) (see IDS) and further in view of IEEE 802.1 lax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445(see IDS).

With regards to **claim 21,** Lim Dongguk et al discloses **a wireless communication terminal** (see fig. 30, and claim 1, *receiving a signal from a station(STA) in* ***a wireless LAN system***) , **the terminal comprising:**

a communication unit (*copper line*); and

a processor (see claim 12, --- *And* ***a processor***)) **configured to process signals transmitted and received through the communication unit** (for processing the preferences sent over the copper line)

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12**,** *in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A fieid jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field*)**, and**

decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B*),* ***see [142]-[143]****,* fig.*23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted over 20 MHz, 40 MHz, or 180 MHz bandwidths.*

Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, ***HE-SIG-A*** *and* ***HE-SIG-B*** *are set in lx symbol It can be set in symbol (12.8us) units. Also* ***see [197]****, The first STA transmits an MU frame including the* ***SIG-A and SiG-B fields*** *(S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)).* Is a wireless mobile terminal that specifies.

However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, but Lim Dongguk et al is not explicit about **wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.**

However, Lim Dongguk et al discloses that the 'STA' is a **SIG-A** and **SIG-B** field. The MU frame containing the information obtained from the SIG-A field, **see [197],** *The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA))* ***and see*** **[199],** *The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can* ***use information obtained from the SIG-A field****, e.g., information on* ***multiple MCS levels****)* for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

However, **IEEE 802.1 lax/D0.5** discloses in **section 26.3.3.7.4** *An AP that transmits an **HE MU PPDU** shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A **full bandwidth MU M1MO transmission** using HE MU PPDU format has a value of 1 for the S1GB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users field(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1, ..., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-SIG-B content channel 2.(#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams for a designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding .*

When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA IDs. The user position is indicated by the block index. From a multiplexing information lookup table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to incorporate features from the invention of Lim Dongguk et al as taught by IEEE 802.1 lax/D0.5 and include wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.

Rationale: Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention

To reject a claim based on this rationale, Office personnel must resolve the Graham factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

(2) a finding that there was reasonable expectation of success; and

(3) whatever additional findings based on the Graham factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

In this case:

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to incorporate features from the invention of Lim Dongguk et al as taught by IEEE 802.1 Iax/D0.5 and include wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A with a reasonable expectation of success, thus improved communication methods (see IEEE 802.1 Iax/D0.5, section 26.3.2.1 Introduction).

Therefore, the claimed subject matter would have been obvious to a person having ordinary skill in the art before the effective filing date of the invention.

With regards to **claim 27,** the combination of Lim Dongguk et al and IEEE 802.1 lax/D0.5 **discloses** a wireless communication method of a wireless communication terminal, the method comprising: (The invention of claim 27 is identical to claim 21, therefore claim 27 is rejected similarly as in claim 21, **see rejection above**).

With regards to **claims 26 and 32,** the combination of Lim Dongguk et al and IEEE 802.1 lax/D0.5 **discloses** the wireless communication terminal of claim 21, wherein the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A (**section 26.3.3.7.4** *An AP that transmits an* ***HE MU PPDU*** *shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A* ***full bandwidth MU M1MO transmission*** *using HE MU PPDU format has a value of 1 for the S1GB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser,r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-*

MIMO Users field(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1, ..., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-SIG-B content channel 2.(#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams for a designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding) .

With regards to claim 33, the combination of Lim Dongguk et al and IEEE 802.1 lax/D0.5 discloses the wireless communication terminal of claim 21, wherein the HE-SIG-A includes the SIG-B compression field and the specific subfield, and wherein the SIG-B compression field indicates whether full bandwidth MU-MIMO transmission is used, and when the SIG-B compression field indicates full bandwidth MU-MIMO transmission, the specific subfield indicates the number of MU-MIMO users **(IEEE 802.1 lax/D0.5** discloses in **section 26.3.3.7.4** *An AP that transmits an **HE MU PPDU** shall set the UL/DL field in the HE-SIG-A field to 0.(#1862) A **full bandwidth MU M1MO transmission** using HE MU PPDU format has a value of 1 for the S1GB Compression field in HE-SIG-A and the SIGB Common field is not present.(#2126) If the value of SIGB Compression field in HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of RUs in current PPDU bandwidth and the*

number of STAs on each RU for SU/MU-MIMO(#1507) transmission. The number of users in RU r for MU-MIMO transmission, Nuser, r is indicated together with the RU allocation as defined in RU allocation signaling: arrangement and number of MU-MIMO al. If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO(#1507) group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users field(#853) in HE-SIG-A. For bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e., for a k user MU-MIMO PPDU, 1, ..., ceil(k/2) User fblock fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, ...,k User block fields in HE-SIG-B content channel 2.(#1005) The number of spatial streams, Nss.r.u, is indicated by the NSTS field in user specific block as defined in Fields of the HE-SIG-B user field for an and Fields of the HE-SIG-B user field for an.(#946) The allocated spatial streams for a designated MU-MIMO(#1507) user and the total number of spatial streams on the RU are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO(#1507) STA as defined in Spatial Configuration subfield encoding .

When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership status, i.e., if it belongs to a beamformee group in a certain RU. If Nuser,r STAs are scheduled in RU r, there are AW,r user specific blocks for RU r. Each user specific block has an 11-bit field indicating the STA ID. A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the STA IDs. The user position is indicated by the block index. From a multiplexing information lookup

table for NUSer,r, the ordered number of spatial streams for all members in the beamformee group in RU r, Nss.r.u, u = 1, ...,Nmer,r, is obtained. The spatial streams of different users are ordered in accordance to user position values, i.e., the spatial streams for the user in user position 0 come fust, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on.)

Allowable Subject Matter

6. Claims 23-25, 29-31 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: none of the prior arts cited alone or in combination provides the motivation to teach the wireless communication terminal of claim 21, wherein when the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation (In 26.3.9.9 and 26.3.9.8, the HE-SIG-B consists of a common field and a User-specific field) as recited in claims 23 and 29;

-the wireless communication terminal of claim 21, wherein the user field(s) for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and wherein the user field for non-MU-MIMO

allocation includes a number of space time streams (NSTS) field as recited in claims 24 and 30.

-the wireless communication terminal of claim 23, wherein the user field(s) for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation as recited in claims 25 and 31.

Conclusion

8. Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on **09/26/20** prompted the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609.04(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
January 1, 2021

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	**Art Unit**
	HELENE E TAYONG	2631

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

CLAIMS

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

CLAIM		DATE								
Final	Original	06/20/2020	01/01/2021							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
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	14	-	-							
	15	-	-							
	16	-	-							
	17	-	-							
	18	-	-							
	19	-	-							
	20	-	-							
	21	✓	✓							
	22	O	-							
	23	✓	O							
	24	✓	O							
	25	✓	O							
	26	✓	✓							
	27	✓	✓							
	28	O	-							
	29	✓	O							
	30	✓	O							
	31	✓	O							
	32	✓	✓							
	33		✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

CPC - Searched*		
Symbol	Date	Examiner
H04B7/0452 , H04B7/028 , H04L5/0023 , H04L5/0048	06/20/2020	HT

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
375	262	06/20/2020	HT

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

Search Notes		
Search Notes	Date	Examiner
EAST: USPAT,USPG PUB,EPO,JPO, and DERWENT	06/20/2020	HT
NPL: Google	06/20/2020	HT
INVENTORS and Assignee NAME SEARCH on palm and East	06/20/2020	HT
Search for parent and/or provisional Application	01/01/2021	HT
Updated search	01/01/2021	HT

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

/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	

September 25, 2020

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0126456	May 4, 2017	Lee et al.			
	2.	2017/0230155	August 10, 2017	Lee et al.			
	3.	2017/0048844	Feb. 16, 2017	Chen et al.			
	4.	2016/0330300	Nov. 10, 2016	Josiam et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	5.	2016/087917	June 9, 2016	WO			Espacenet
	6.	10-2016-0063282	June 3, 2016	KR			KIPRIS
	7.	3 226 641	Oct. 4, 2017	EP			
	8.	2016/208330	Dec. 29, 2016	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	9.	Office Action dated June 25, 2020 for US Patent Application No 16/798,197
	10.	Extended European Search Report dated July 31, 2020 for European Patent Application No. 18736375.9
	11.	IEEE 802.11ax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445
	12.	Office Action dated August 12, 2020 for Chinese Patent Application No 201880005845.6 and its English translation provided by Applicant's foreign counsel
	13.	Office Action dated August 31, 2020 for Japanese Patent Application No 2019-537309 and its English translation from Global Dossier
	14.	Stacey et al., IEEE 802.11-16/0024r1, "Proposed TGax Draft Specification", March 2, 2016
	15.	Oteri et al., IEEE 802.11-16/0866r4, "Comment Resolutions on Clause 26.3.13", July 24, 2016
	16.	Stacey et al., IEEE 802.11-15/0132r17, "Specification Framework for TGax", May 25, 2016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

September 25, 2020

EXAMINER	*DATE CONSIDERED*
/HELENE E TAYONG/	01/01/2021

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Juhyung SON	) Examiner:	Tayong, Helene E
Application No.:	16/731,031	) Confirmation No.:	3714
Filing Date:	December 31, 2019	) Group Art Unit:	2631
Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET		) Attorney Docket:	B-10010CON2 632450-9
		) Date:	September 28, 2020
		) Re:	**Response to Non-Final Office Action of June 25, 2020**

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

RESPONSE TO OFFICE ACTION

Sir:

This paper is submitted in response to the non-Final Office Action mailed on June 25, 2020 for the subject application. The Applicant hereby petitions under the provisions of 37 C.F.R. §1.136(a) for an extension of time in which to respond to the outstanding Office Action and includes a fee as set forth in 37 C.F.R. §1.17(a) with this response for such extension of time. Please amend the application as follows and consider the Remarks/Arguments set forth below.

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

Remarks/Arguments begin on page 5 of this paper.

All Amendments and Remarks/Arguments are made without prejudice or disclaimer.

AMENDMENTS TO THE CLAIMS

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

Listing of claims

1-20. (Canceled).

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

a communication unit; and

a processor configured to process signals transmitted and received through the communication unit,

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU),

wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a ~~configuration~~ format of user field(s) included in a user specific field of the HE-SIG-B is identified based on ~~information on the~~ a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.

22. (Canceled).

23. (Currently Amended) The wireless communication terminal of claim 21,

wherein when ~~the information on~~ the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when ~~the information on~~ the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

24. (Currently Amended) The wireless communication terminal of claim [[23]] 21,

wherein the user field(s) for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

25. (Currently Amended) The wireless communication terminal of claim 23, wherein the user field(s) for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

26. (Currently Amended) The wireless communication terminal of claim 21, wherein ~~the information on~~ the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

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

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decode the received HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a ~~configuration~~ format of user filed(s) included in a user specific field of the HE-SIG-B is identified based on ~~information on the~~ a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.

28. (Canceled).

29. (Currently Amended) The wireless communication method of claim 27,

wherein when ~~the information on~~ the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when ~~the information on~~ the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

30. (Currently Amended) The wireless communication method of claim [[29]] 27,

wherein the user field(s) for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

31. (Currently Amended) The wireless communication method of claim 29, wherein the user field(s) for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

32. (Currently Amended) The wireless communication method of claim 27, wherein ~~the information on~~ the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

33.(New) The wireless communication terminal of claim 21,

wherein the HE-SIG-A includes the SIG-B compression field and the specific subfield, and

wherein the SIG-B compression field indicates whether full bandwidth MU-MIMO transmission is used, and

when the SIG-B compression field indicates full bandwidth MU-MIMO transmission, the specific subfield indicates the number of MU-MIMO users.

REMARKS/ARGUMENTS

The following Remarks/Arguments are in response to the non-Final Office Action mailed on June 25, 2020 (hereinafter "Office Action") for the subject application. Pending in the application are claims 21-32.

The Applicant notes with appreciation the Examiner's indication of allowable subject matter of claims 22 and 28.

In the Office Action, claims 21-32 are objected to as allegedly containing informalities. Claims 21, 23-27 and 29-32 stand rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1-6 and 12-18 of U.S. Patent No. 10,567,047. Claims 21 and 27 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 21, 22, 28 and 29 of copending Application No. 16/798,197 in view of EP 3139532 (hereinafter "Wu"). Claims 21 and 27 stand rejected under 35 U.S.C. §103 as allegedly being obvious over International Patent Application Publication No. WO 2016/208830 (hereinafter "Lim") in view of U.S. Patent Application Publication No. 2016/0156438 (hereinafter "Sun").

In this response, claims 21, 23-27 and 29-32 are amended. New claim 33 is added. No new matter is presented as a result of these amendments. Claims 22 and 28 are canceled. Claims 1-20 were previously canceled. Accordingly, the claims pending in this application after entry of this response are claims 21-23-27 and 29-33.

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

Claim Objections

In the Office Action, claims 21-32 are objected to as allegedly containing informalities (See Office Action: item 2 at page 2). The Examiner opines that:

> In claims 21 and 27, define "MU-MIMO". This can be corrected by changing "MU-MIMO" to - - -Multi User-Multiple Input Multiple Output (MU-MIMO) - - -.

(Office Action: item 2 at page 2). In response to this opinion, claims 21 and 27 are amended as the Examiner suggested. Accordingly, the Applicant respectfully requests reconsideration and withdrawal of the objections to claims 21-32.

Double Patenting

In the Office Action, claims 21, 23-27 and 29-32 stand rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1-6 and 12-18 of U.S. Patent No. 10,567,047 (See Office Action: item 4 at page 3). Claims 21 and 27 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 21, 22, 28 and 29 of copending Application No. 16/798,197 in view of Wu (See Office Action: item 5 at page 7). Claim 22 is incorporated into claim 21, and claim 28 is incorporated into claim 27. Therefore, the Applicant respectfully requests reconsideration and withdrawal of the double patenting rejections of claims 21, 23-27 and 29-32.

Claim Rejections – 35 U.S.C. §103

In the Office Action, claims 21 and 27 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Lim in view of Sun (See Office Action: item 7 at page 8). These rejections are hereby traversed, and reconsideration and withdrawal are respectfully requested.

Claim 21

Claim 21 recites:

> *A wireless communication terminal, the terminal comprising:*
> *a communication unit; and*
> *a processor configured to process signals transmitted and received through the communication unit,*
> *wherein the processor is configured to:*
> *receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU),*
> *wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and*
> *decode the received HE MU PPDU based on information obtained from the preamble,*
> *wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user field(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.*

Although the Applicant respectfully disagrees with the Examiner, solely to expedite

prosecution of the present application and allowance of the claims, claim 21 is amended to incorporate claim 22 which is indicated as being allowable in the Office Action. Accordingly, the Applicant respectfully submits that claim 21 as amended is allowable, and requests reconsideration and withdrawal of the §103 rejection of claim 21.

Claim 27

Claim 27 recites:

> *A wireless communication method of a wireless communication terminal, the method comprising:*
> *receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and*
> *decode the received HE MU PPDU based on information obtained from the preamble,*
> *wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth multi User-Multiple Input Multiple Output(MU-MIMO) transmission, a format of user filed(s) included in a user specific field of the HE-SIG-B is identified based on a number of MU-MIMO users indicated by a subfield of the HE-SIG-A.*

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claim 27 is amended to incorporate claim 28 which is indicated as being allowable in the Office Action. Therefore, the Applicant respectfully submits that claim 27 as amended is allowable, and requests reconsideration and withdrawal of the §103 rejection of claim 27.

Allowable Subject Matter

The Applicant notes with appreciation the Examiner's indication of allowable subject matter of claims 22 and 28. The Examiner indicates that "Claims 22 and 28 … would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims" (Office Action: item 8 at page 13). Claim 22 is incorporated into claim 21, and claim 28 is incorporated into claim 27. Thus, allowance of claims 21 and 27 is respectfully requested.

CONCLUSION

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

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

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

September 28, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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Los Angeles, CA 90036
Tel No.: (323) 934-2300
Fax No.: (323) 934-0202

Electronic Patent Application Fee Transmittal	
Application Number:	16731031
Filing Date:	31-Dec-2019
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Filer:	Young Seok Koo/Azatuhi Chinaryan
Attorney Docket Number:	B-10010CON2 632450-9
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

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

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
			Total in USD ($)	**200**

Electronic Acknowledgement Receipt	
EFS ID:	40694600
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	28-SEP-2020
Filing Date:	31-DEC-2019
Time Stamp:	19:45:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$200
RAM confirmation Number	E20209RJ45182542
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2020-09-28_632450_Response_to_Non-Final_OA_6-25-2020.pdf	76827 ab2ac43ec3912a6d90b9adf5b040386cc015f303	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	8

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31122 66ca77f03fec2ac309d5f86c087041f2edb37291	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	107949		

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/731,031	Filing Date 12/31/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		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), (i), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	09/28/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

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

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

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

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

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. 16/731,031
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE December 31, 2019
		GROUP NO. 2631

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0126456	May 4, 2017	Lee et al.			
	2.	2017/0230155	August 10, 2017	Lee et al.			
	3.	2017/0048844	Feb. 16, 2017	Chen et al.			
	4.	2016/0330300	Nov. 10, 2016	Josiam et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	5.	2016/087917	June 9, 2016	WO			Espacenet
	6.	10-2016-0063282	June 3, 2016	KR			KIPRIS
	7.	3 226 641	Oct. 4, 2017	EP			
	8.	2016/208330	Dec. 29, 2016	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	9.	Office Action dated June 25, 2020 for US Patent Application No 16/798,197
	10.	Extended European Search Report dated July 31, 2020 for European Patent Application No. 18736375.9
	11.	IEEE 802.11ax/D0.5, "High Efficiency (HE) PHY specification". September, 2016, XP068137445
	12.	Office Action dated August 12, 2020 for Chinese Patent Application No 201880005845.6 and its English translation provided by Applicant's foreign counsel
	13.	Office Action dated August 31, 2020 for Japanese Patent Application No 2019-537309 and its English translation from Global Dossier
	14.	Stacey et al., IEEE 802.11-16/0024r1, "Proposed TGax Draft Specification", March 2, 2016
	15.	Oteri et al., IEEE 802.11-16/0866r4, "Comment Resolutions on Clause 26.3.13", July 24, 2016
	16.	Stacey et al., IEEE 802.11-15/0132r17, "Specification Framework for TGax", May 25, 2016

EXAMINER	*DATE CONSIDERED*

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

STATEMENT UNDER 37 C.F.R. 1.97(e)(1)

Each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

Date: 2020. 04. 24

Minjun KIM
Patent Attorney
QUS INT'L PATENT & LAW GROUP
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Fax: +82.31.712.0524

Electronic Acknowledgement Receipt

EFS ID:	40679107
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Arpine Gamazyan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	26-SEP-2020
Filing Date:	31-DEC-2019
Time Stamp:	00:26:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		632450_IDS_pdf.pdf	282445 ba8d42413af73cb7deb6690afa33c28dde7c505a	yes	5

	Multipart Description/PDF files in .zip description			
	Document Description	**Start**	**End**	
	Transmittal Letter	1	3	
	Information Disclosure Statement (IDS) Form (SB08)	4	5	
Warnings:				
Information:				
2	Transmittal Letter	Statement_Under_37.pdf	156020 0da3b3f5a0f2b199a2c48fe03a00bb7c3caeba3f	no	1
Warnings:				
Information:				
3	Foreign Reference	Ref_1_1stpart1-50.pdf	11276112 de834987acfadeec12aec69db445968ae0a9d01b	no	50
Warnings:				
Information:				
4	Foreign Reference	Ref_1_2part51-100_pdf.pdf	3580605 1517e03613755b91bd7bd63c72da6ed30c1735cb	no	50
Warnings:				
Information:				
5	Foreign Reference	Ref_1_3part101-172_pdf.pdf	3562004 6e8233a26e26b963e16572637e51d63a6395fb26	no	72
Warnings:				
Information:				
6	Foreign Reference	Ref_10-2016-0063282_pdf.pdf	893228 b92df5cce9045688b44c5e6379f097608c7eaaa2	no	50
Warnings:				
Information:				
7	Foreign Reference	Ref_EP3226641.pdf	5859388 148c022f81bf90251cf43f888df23b0c13364069	no	76
Warnings:				

Information:					
8	Foreign Reference	Ref_2016208330_pdf3.pdf	15093812 a09bb3445af76073f9857b2a5ece103eb860091a	no	73
Warnings:					
Information:					
9	Other Reference-Patent/App/Search documents	Ref_US16798197_1stOA.pdf	16650099 183f5dcc31d348b10df0935cbb180e246780589c	no	18
Warnings:					
Information:					
10	Other Reference-Patent/App/Search documents	Ref_EP187363759_EESR_pdf.pdf	5581182 7064627273b0a729b201dbb283ff09df52c4785d	no	31
Warnings:					
Information:					
11	Non Patent Literature	Ref_XP068137445.pdf	11902614 c0e7985da4bdce644ca218529510cf3b060f4ba8	no	207
Warnings:					
Information:					
12	Other Reference-Patent/App/Search documents	Ref_CN2018800058456_1stOA_pdf.pdf	1528601 a5ca10d07d9dca81268f1d6ffd7ba20be25948b5	no	10
Warnings:					
Information:					
13	Other Reference-Patent/App/Search documents	Ref_2019537309_JPOA.pdf	208409 e277c66bf2eabe937f82aec6c451336c7566f3b2	no	8
Warnings:					
Information:					
14	Non Patent Literature	Ref_IEEE_80211-15_0132r17_pdf.pdf	2033020 cdffd5abe67b3841dd2f65215d5d3a235e51aeec	no	61
Warnings:					
Information:					

15	Non Patent Literature	Ref_IEEE_80211-16_0024r1_pdf.pdf	2299853 8c2e69bb5e194b64f63e0a36a47b4728b29d46f6	no	159
Warnings:					
Information:					
16	Non Patent Literature	Ref_IEEE_80211-16_0866r4_pdf.pdf	295214 d0e4a0f029a3c4ca2fb7bf3084d2cbcb1bf577ce	no	8
Warnings:					
Information:					
		Total Files Size (in bytes):	81202606		

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

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

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New International Application Filed with the USPTO as a Receiving Office

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	Examiner: Juhyung SON
Serial No.: 16/731,031	Art Unit: 2631
Filing or 371 (c) Date: December 31, 2019	Conf. No.: 3714
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	Our Ref: B-10010CON2 632450-9
Date: September 25, 2020	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

---

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

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

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

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

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

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

Items Disclosed

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

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

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

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

Additional Information

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

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

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

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

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

[ ] Other:

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

September 25, 2020
(Date of Transmission)

Arpine Gamazyan
(Name of Person Transmitting)

/ Arpine Gamazyan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

Young Seok Koo
Attorney for Applicant
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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
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9

CONFIRMATION NO. 3714

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

PUBLICATION NOTICE



Title:WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

Publication No.US-2020-0204223-A1
Publication Date:06/25/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9	3714

158747 7590 06/25/2020

LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

EXAMINER
TAYONG, HELENE E

ART UNIT	PAPER NUMBER
2631	

NOTIFICATION DATE	DELIVERY MODE
06/25/2020	ELECTRONIC

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

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

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

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

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 16/731,031	Applicant(s) Son et al.	
	Examiner HELENE E TAYONG	Art Unit 2631	AIA (FITF) Status Yes

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

Period for Reply

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

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

Status

1)☑ Responsive to communication(s) filed on 12/31/19.

☐ 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) 21-32 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) 21,23-27 and 29-32 is/are rejected.

8) ☑ Claim(s) 22 and 28 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 12/31/19 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

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

Claim Objections

2. Claims 21-26 and 27-32 are objected to because of the following informalities: In claims 21 and 27, define "MU-MIMO". This can be corrected by changing "MU-MIMO" to - - -Multi User-Multiple Input Multiple Output (MU-MIMO) - - -. Appropriate correction is required.

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 21,23-27, and 29-32 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6, 12-18 of U.S. Patent No. **10,567,047 B2**. Although the conflicting claims are not identical, they are not patentably distinct from each other because it would be obvious to one of ordinary skill in the art that in order to perform the method of U.S. Patent **10,567,047 B2**, it is necessary to have the complimentary device of the instant application. U.S. Patent No. **10,567,047 B2**, therefore, anticipates the instant application.

Instant Application	U.S. Patent No. **10,567,047 B2**
21. (New) A wireless communication terminal, the terminal comprising: a communication unit; and a processor configured to process signals transmitted and received through the communication unit, wherein the processor is configured to:	1. A wireless communication terminal, the terminal comprising: a communication unit; and a processor configured to process signals transmitted and received through the communication unit, wherein the processor is configured to: receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B),

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and decode the HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, a configuration of a user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by a subfield of the HE-SIG-A.	and decode the received HE MU PPDU based on information obtained from the HE-SIG-A, wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A, and wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth Multi User-Multiple Input Multiple Output (MU-MIMQ) transmission so that a common field is not present in the HE-SIG-B, a configuration of a user specific field of the HE-SIG-B is identified based on information obtained from the at least one subfield of the HE-SIG-A.
22. (New) The wireless communication terminal of claim 21, wherein a format of user field(s) included in the user specific field of the HE-SIG-B is identified based on the number of MU-MIMO users.	
23. (New) The wireless communication terminal of claim 21, wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.	3. The wireless communication terminal of claim 2, wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.
24. (New) The wireless communication terminal of claim 23, wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and	4. The wireless communication terminal of claim 3, wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating a total number of spatial streams in the MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and wherein the user field for non-MU-MIMO allocation

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.	includes a number of space time streams (NSTS) field.
25. (New) The wireless communication terminal of claim 23, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.	5. The wireless communication terminal of claim 3, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.
26. (New) The wireless communication terminal of claim 21, wherein the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.	6. The wireless communication terminal of claim 2, wherein when the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.
27. (New) A wireless communication method of a wireless communication terminal, the method comprising: receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and decoding the HE MU PPDU based on information obtained from the preamble, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, a configuration of a user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by a subfield of the HE-SIG-A.	12. A wireless communication method of a wireless communication terminal, the method comprising: receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and decoding the received HE MU PPDU based on information obtained from the HE-SIG-A, wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A, and wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth Multi User-Multiple Input Multiple Output (MU-MIMQ) transmission so that a common field is not present in the HE-SIG-B, a configuration of a user specific field of the HE-SIG-B is identified based on information obtained from the at least one subfield of the HE-SIG-A.
28. (New) The wireless communication method of claim 27, wherein a format of user field(s) included in the user specific field of the HE-SIG-B is identified based on the number of MU-MIMO users.	

29. (New) The wireless communication method of claim 27, wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.	14. The wireless communication method of claim 13, wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.
30. (New) The wireless communication method of claim 29, wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.	15. The wireless communication method of claim 14, wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating a total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.
31. (New) The wireless communication method of claim 29, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.	16. The wireless communication method of claim 14, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.
32. (New) The wireless communication method of claim 27, wherein the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.	17. The wireless communication method of claim 13, wherein when the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

5. Claims 21, 27 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 21, 22, 28 and 29 of copending Application No. 16798197 in view of Wu Tianyu et al (EP3139532A1).

With regards to **claims 21, 27**, copending Application No. 16798197 claims 21, 22, 28 and 29 discloses all of the limitations except for **a SIG-B compression filed of the HE-SIG-A indicates full bandwidth MU-MIMO transmission**

However, Tianyu et al discloses in abstract, *MU-MIMO is used for operation bandwidth of 160 MHz and a compression indicator is set in the HE-SIG-A field indicating a saving of all RA LUTS in the HE-SIG-B common field. Also in [0018], a fixed format common field in the HE-SIG-B is defined for each operation bandwidth. Therefore, the length and the format of the common field are predefined*.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to incorporate features from the invention of Wu Tianyu et al such as MU-MIMO used for operation bandwidth of 160 MHz and a compression indicator is set in the HE-SIG-A field indicating a saving of all RA LUTS in the HE-SIG-B common field, within the system of copending Application No. 16798197 claims 21 and 22 in order to improve on the use of the HE-SIG-B field for efficient resource allocation ([0003]).

Further evidence is by John (Ju-Hyung) Son IEEE P802.11 Wireless LANs CIDs on Signalling for UL HE MU PPDU, 2017-01-16, pages 1-3, John Son et al., WILUS LNC,) see page 3, subsection 28.3.10.8 HE SIG-B, 28.3.10.8.1 Encoding and modulation " **when the SIG compression field is the HE-SIG-A field of an HE MU**

PPDU is set to 1 (indicating full bandwidth MU-MIMO transmission , the common block is not present and the content channel consists of only the User specific filed)

This is a provisional nonstatutory double patenting rejection.

Claim Rejections - 35 USC § 103

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

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

7. Claims 21 and 27 are rejected under 35 U.S.C. 103 as being unpatentable over Lim Dongguk et al (WO2016208830 A1)(see IDS) in view of Sun et al (US 20160156438A1) (see IDS).

With regards to **claim 21,** Lim Dongguk et al discloses **a wireless communication terminal** (see fig. 30, and claim 1, *receiving a signal from a station(STA) in* ***a wireless LAN system***) , **the terminal comprising:**

a communication unit (*copper line*); and

a processor (see claim 12, --- *And* ***a processor***)) **configured to process signals transmitted and received through the communication unit** (for processing the preferences sent over the copper line)

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B) (see claim 12**,** *in a station (STA), an MU frame (multi user SiG-B) including a SIG-B field and a SIG-A fieid jointly encoded by N individual unit blocks smaller than M a user frame: And a processor for decoding the SIG-B field based on the SIG-A field and obtaining an individual user SIG-B of the station from the decoded SIG-B field, wherein the unit blocks are different Multiple MGS levels are set respectively, and the MCS levels set in the unit blocks are indicated by the SIG-A field*)**, and**

decode the HE MU PPDU based on information obtained from the preamble (The processor then sends the HE MU PPDU (high efficiency multi-user PHY protocol data. The preamble (HE-SIG-A) (High Efficiency Signal A) and (HE-SIG-A, HE-SIG-B (High Efficiency Signal B*),* ***see [142]-[143]****,* fig.*23A is a diagram illustrating an example of a HE Efficiency PPDU format according to an embodiment of the present invention. The HE PPDU format can be used on IEEE 802.11 ax systems. As described above, since the types of PPDU formats can be variously set, the scope of rights of the present invention is not limited to the HE PPDUs in FIG. 23A. For purposes of illustration, FIG. 23 illustrates an HE PPDU format set at 20 MHz units on an 80 MHz bandwidth, but HE PPDUs may be transmitted over 20 MHz, 40 MHz, or 180 MHz bandwidths.*

Referring to FIG. 23A, the HE PPDU includes an L part (L-STF. L-LTF, L-8IG, RL-SIG) and HE parts (HE-SIG-A, HE-STF, HE-B). HE-STF, L-LTF, L-SIG, RL-SIG, ***HE-SIG-A*** *and* ***HE-SIG-B*** *are set in lx symbol It can be set in symbol (12.8us) units. Also* ***see [197]****, The first STA transmits an MU frame including the* ***SIG-A and SiG-B fields***

(S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA)). Is a wireless mobile terminal that specifies.

However, the HE MUs that have been repaired based on the information obtained from the HE SIG-A, PPDU is decoded, but Lim Dongguk et al is not explicit about **wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A**.

However, Lim Dongguk et al discloses that the 'STA' is a **SIG-A** and **SIG-B** field. The MU frame containing the information obtained from the SIG-A field, **see [197],** *The first STA transmits an MU frame including the SIG-A and SiG-B fields (S3615). The MU frame may be transmitted on a 20 MHz, 40 MHz, 80 MHz or 180 MHz bandwidth based on orthogonal frequency division multiple access (OFDMA))* ***and see*** **[199],** *The second STA decodes the SIG-B field based on the SIG-A field (S3625). The second STA decodes the SiG-B field, and can* ***use information obtained from the SIG-A field****, e.g., information on* ***multiple MCS levels****)* for decoding the SIG-B field based on information on the MCS levels, which can be easily conceived by those of ordinary skill in the art.

However, further evidence is by Sun et al in the same endeavor (wireless communication, see fig.1, [0013], wireless local area networks (WLANs) typically include an access point (AP) and one or more client stations). In [0070], in an embodiment, each of the **HE-SIG-A 220**, the **HE-SIG-B 222** and the **HE-SIG-C 235**

generally carries information about the format of the data unit 200, such as **information needed to properly decode** at least a portion of the data unit 200.

In [0073], FIG. 3A, is an example of **HE-SIG-A 300** that includes a plurality of subfields 302. The subfields 302 include a bandwidth (BW) subfield 302-2, a basic service set (BSS) color subfield 302-4, **a number of SIG-B OFDM symbols subfield 302-6**, **a SIG-B modulation and coding (MCS) subfield 302-8**, an L-SIG cyclic redundancy check (CRC) subfield 302-10, an HE-SIG-A CRC subfield 302-12, and tail bits 302-14. The number of SIG-B OFDM symbols subfield 302-6 indicates the number of OFDM symbols in the HE-SIB-B 222 that follows the HE-SIG-A 300 in the data unit 200, in an embodiment. The SIB-B MCS subfield 302-8 indicates a modulation and coding scheme used for the HE-SIB-B 222 that follows the HE-SIG-A 220 in the data unit 200, in an embodiment.

Also in [0140], in an embodiment in which the OFDM/OFDMA information **subfield 2000** is included in the **HE-SIG-B 222**, the total number of OFDM symbols in the HE-SIG-B 222 is signaled by a "*number of OFDM symbols in SIG-B*" **indication included in the HE-SIG-A 220**. Alternatively, in another embodiment in which the OFDM/OFDMA information subfield 2000 is included in the HE-SIG-B 222, a "number of OFDM symbols in SIG-B" indication included in the HE-SIG-A 220 indicates a number of OFDM symbols that cover the DL parameter portion, and an additional subfield is included in the DL parameter portion to indicate a number of OFDM symbols that cover the UL parameter portion.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to incorporate features from the invention of

Lim Dongguk et al as taught by Sun et al such that wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

Rationale: Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention

To reject a claim based on this rationale, Office personnel must resolve the Graham factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

(2) a finding that there was reasonable expectation of success; and

(3) whatever additional findings based on the Graham factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

In this case:

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to incorporate features from the invention of Lim Dongguk et al as taught by Sun et al such that wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-

SIG-A with a reasonable expectation of success, thus provide even greater throughputs (see Sun et al, [0013]).

Therefore, the claimed subject matter would have been obvious to a person having ordinary skill in the art at the time the invention was made.

With regards to **claim 27,** a wireless communication method of a wireless communication terminal, the method comprising: (The invention of claim 27 is identical to claim 21, therefore claim 27 is rejected similarly as in claim 21, **see rejection above**).

Allowable Subject Matter

8. Claims 22 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter: the prior arts made of record fail to teach or suggest or make obvious in combination, the wireless communication terminal of claim 21, wherein a format of user field(s) included in the user specific field of the HE-SIG-B is identified based on the number of MU-MIMO users as recited in claims 22 and 28.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. **Moon et al (US 9641234B2)(see IDS)** discloses preamble and payload for high efficiency (HE) transmission.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HELENE E TAYONG whose telephone number is (571)270-1675. The examiner can normally be reached on 9am-5pm.

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, Shuwang Liu can be reached on 571-272-3036. 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.

/HELENE E TAYONG/
Primary Examiner, Art Unit 2631
June 20, 2020

Notice of References Cited	Application/Control No. 16/731,031	Applicant(s)/Patent Under Reexamination Son et al.	
	Examiner HELENE E TAYONG	Art Unit 2631	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-20150349995-A1	12-2015	ZHANG; Hongyuan	H04L27/2613	375/295
*	B	US-10219271-B1	02-2019	Hedayat; Ahmad Reza	H04W72/0446	1/1
*	C	US-20150334708-A1	11-2015	LEE; ILGU	H04L1/0083	370/329
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	EP 3139532	07-2016	EP	Wu,Tianyu	
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	John (Ju-Hyung) Son IEEE P802.11 Wireless LANs CIDs on Signalling for UL HE MU PPDU, 2017-01-16, pages 1-3, John Son et al., WILUS INC.)
	V	John (Ju-Hyung) Son IEEE P802.11-17/0110r0 Discussions on Signalling for UL HE MU PPDU, 2017-01-16, slides 1-9, John Son et al., WILUS)
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	Art Unit
	HELENE E TAYONG	2631

CPC - Searched*		
Symbol	Date	Examiner
H04B7/0452 , H04B7/028 , H04L5/0023 , H04L5/0048	06/20/2020	HT

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
375	262	06/20/2020	HT

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

Search Notes		
Search Notes	Date	Examiner
EAST	06/20/2020	HT
NPL	06/20/2020	HT
INVENTORS NAME SEARCH	06/20/2020	HT

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

/HELENE E TAYONG/ Primary Examiner, Art Unit 2631	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/731,031	Son et al.
	Examiner	**Art Unit**
	HELENE E TAYONG	2631

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

CLAIMS

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

CLAIM		DATE								
Final	Original	06/20/2020								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
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	28	O								
	29	✓								
	30	✓								
	31	✓								
	32	✓								

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.

Serial No.: Not Yet Assigned

Filing Date: Concurrently Herewith

For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"

Date: December 30, 2019

Examiner: Not Yet Assigned

Art Unit: N/A

Conf. No.: N/A

Our Ref: B-10010CON2 632450-9

Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

December 30, 2019

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

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

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

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

[ ] accompanied by the fee set forth in § 1.17(p), or

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

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

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

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

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

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

Items Disclosed

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

December 30, 2019

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

Non-Final Rejection dated August 30, 2019 for U.S. Patent Application No. 16/505,664.

Notice of Allowance dated October 2, 2019 for U.S. Patent Application No. 16/505,664.

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

International Search Report for PCT/KR2018/000443 mailed on May 4, 2018.

Written Opinion of the International Searching Authority for PCT/KR2018/000443 mailed on May 4, 2018.

Additional Information

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

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

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

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

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

[ ] Other:

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
Attorney for Applicant
Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

December 30, 2019

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. N/A
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	FILING DATE Concurrently Herewith
		GROUP NO. N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2016/0156438	June 2, 2016	Sun et al.			
	2.	9,641,234	May 2, 2017	Moon et al.			
	3.	10,219,271	Feb. 26, 2019	Hedayat et al.			
	4.	2017/0006608	Jan. 5, 2017	Josiam et al.			
	5.	2016/0366666	Dec. 15, 2016	Yang et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	6.	2016/208830	Dec. 29, 2016	WO			Espacenet
	7.	2016/182412	Nov. 17, 2016	WO			Espacenet
	8.	2017/003193	Jan. 5, 2017	WO			Espacenet
	9.	2016/088956	Jun. 9, 2016	WO			Espacenet
	10.	2016/175435	Nov. 3, 2016	WO			Espacenet
	11.	2018/128530	Jul. 12, 2018	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	12.	International Search Report for PCT/KR2018/000443 mailed on May 4, 2018 and its English translation from WIPO (now published as WO 2018/128530)
	13.	Written Opinion of the International Searching Authority for PCT/KR2018/000443 mailed on May 4, 2018 and its English translation by Google Translate (now published as WO 2018/128530)
	14.	Robert Stacey, "Comments on TGax/D1.0", IEEE P802.11 Wireless LANs; doc.: IEEE 802.11-17/0010r0, January 9, 2017. Pages 1-249
	15.	John Son et al., WILUS: "Discussions on Signaling for UL HE MU PPDU", doc.: IEEE P802.11-17/0110r0; January 16, 2017. Slides 1-9
	16.	John Son et al., WILUS: "CIDs on Signaling for UL HE MU PPDU", IEEE P802.11 Wireless LANs; doc.: IEEE 802.11-17/0173r0, January 19, 2017. Pages 1-3.
	17.	Non-Final Rejection dated August 30, 2019 for U.S. Patent Application No. 16/505,664 (published as 2019/0334590)
	18.	Notice of Allowance dated October 2, 2019 for U.S. Patent Application No. 16/505,664 (published as 2019/0334590)

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

December 30, 2019

EXAMINER	*DATE CONSIDERED*
/HELENE E TAYONG/	06/20/2020

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.E.T/

Bibliographic Data

Application No: 16/731,031

Foreign Priority claimed: ◉ Yes ○ No

35 USC 119 (a-d) conditions met: ☑ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /HELENE E TAYONG/ (Examiner's Signature) | HT (Initials)

Title: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/31/2019	375	2631	B-10010CON2 632450-9
RULE			

APPLICANTS

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., Gyeonggi-do, KOREA, REPUBLIC OF

SK TELECOM CO., LTD., Seoul, KOREA, REPUBLIC OF

INVENTORS

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Geonjung Ko Gyeonggi-do, KOREA, REPUBLIC OF

Woojin Ahn Gyeonggi-do, KOREA, REPUBLIC OF

CONTINUING DATA

This application is a CON of 16505664 07/08/2019 PAT 10567047

16505664 is a CON of PCT/KR2018/000443 01/09/2018

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2017-0003147 01/09/2017

KOREA, REPUBLIC OF 10-2017-0008927 01/18/2017

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/31/2020

STATE OR COUNTRY

KOREA, REPUBLIC OF

ADDRESS

LADAS & PARRY

E-MAIL

4525 Wilshire Boulevard

Suite 240

LOS ANGELES, CA 90010
UNITED STATES

FILING FEE RECEIVED

$1,720

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	668	((("SK") near3 ("TELECOM") near3 ("CO") near3 ("LTD"))).AS,AANM.	USPAT	OR	OFF	2020/06/20 17:58
S2	205	((("Son") near3 ("Juhyung"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/20 17:58
S3	376	((("Kwak") near3 ("Jinsam"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/20 17:59
S4	86	((("Ko") near3 ("Geonjung"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/20 17:59
S5	70	((("Ahn") near3 ("Woojin"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/20 18:00
S6	1,580	(375/262).ccls.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 18:01
S7	88,832	(H04B7/0452 or H04B7/028 or H04L5/0023 or H04L5/0048).cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 18:02
S8	5	("10219271" | "20160156438" | "20160366666" | "20170006608" | "9641234").PN.	US-PGPUB; USPAT	OR	OFF	2020/06/20 18:03
S9	1	"10567047".pn.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 18:16
S10	10	(high with efficiency with multi with user with PHY with protocol with data with unit or (HEMUPPDU))and (wireless with communicat$3 with terminal)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 22:59

S13	305	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:03
S14	876	(field with (HE-SIG-A)) and (field with (HE-SIG-B))	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:03
S15	876	(field with (HE-SIG-A)) and (field with (HE-SIG-B)) and (high with efficiency with multi with user with PHY with protocol with data with unit or (HE MU PPDU))	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:04
S16	4	(field with (HE-SIG-A)) and (field with (HE-SIG-B)) and (high with efficiency with multi with user with PHY with protocol with data with unit or (HE MU PPDU))and (preamble with (SIG-B) with compression with field)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:06
S17	261	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)and (multi with user with MIMO or (MU-MIMO))	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:09
S18	3	(HE-SIG-A) and (HE-SIG-B)and (wireless with communicat$3 with terminal)and (multi with user with MIMO or (MU-MIMO)) and (high with efficiency with multi-user with PHY with protocol with data with unit)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:10
S19	1,580	(375/262).ccls.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:26
S20	88,832	(H04B7/0452 or H04B7/028 or H04L5/0023 or H04L5/0048).cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:26
S21	57	(S19 and S20)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:26
S28	139	(decode with received with (HE MU PPDU)) and (information with (HE-SIG-A))	US-PGPUB;	OR	OFF	2020/06/20 23:30

			USPAT; USOCR; FPRS			
S29	17	(decode with received with (HE MU PPDU)) and (information with (HE-SIG-A))and (subfield with (HE-SIG-A))	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:31
S30	7	(decode with received with (HE MU PPDU)) and (information with (HE-SIG-A))and (subfield with (HE-SIG-A))and (wireless with communicat$3 with terminal)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:32
S31	6	("10219271" | "20150334708" | "20150349995" | "20160366666" | "20170006608" | "20190124657").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/20 23:42
S34	165	((high with efficiency with multi with user with PHY with protocol with data with unit or (HE MU PPDU))and (wireless with communicat$3 with terminal)).clm.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/20 23:51
S36	1	WO-2017146431-$.did.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/21 11:07
S37	2	"20170048844"	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/21 11:09
S38	5	((SIG-B) with compression with field with (HE-SIG-A)) and (full with bandwidth with MU-MIMO)	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/21 11:12
S39	2	EP-3139532-$.did.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2020/06/21 11:15

EAST Search History (Interference)

<This search history is empty>

6/21/2020 12:19:47 PM
C:\Users\htayong\Documents\EAST\Workspaces\16731031-processor receives high efficiency multi-user PHY protocol data unit and He-SIG-A and HE-SIG-B field..wsp

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/731,031

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	12 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/731,031	12/31/2019		1720	B-10010CON2 632450-9	12	2

CONFIRMATION NO. 3714

UPDATED FILING RECEIPT

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

Date Mailed: 03/17/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Juhyung Son, Gyeonggi-do, KOREA, REPUBLIC OF;
Jinsam Kwak, Gyeonggi-do, KOREA, REPUBLIC OF;
Geonjung Ko, Gyeonggi-do, KOREA, REPUBLIC OF;
Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;

Applicant(s)

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

Power of Attorney: The patent practitioners associated with Customer Number 158747

Domestic Priority data as claimed by applicant

This application is a CON of 16/505,664 07/08/2019 PAT 10567047
which is a CON of PCT/KR2018/000443 01/09/2018

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2017-0003147 01/09/2017 Access Code Provided
REPUBLIC OF KOREA 10-2017-0008927 01/18/2017 Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 01/31/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/731,031**

Projected Publication Date: 06/25/2020

Non-Publication Request: No

Early Publication Request: No

Title

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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【발명의 영문명칭】 METHOD AND APPARATUS OF WIRELESS COMMUNICATIONS USING NON-CONTIGUOUS CHANNELS

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【발명의 설명】

【발명의 명칭】

불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말{METHOD AND APPARATUS OF WIRELESS COMMUNICATIONS USING NON-CONTIGUOUS CHANNELS}

【기술분야】

【0001】 본 발명은 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말에 관한 것으로서, 불연속 채널 할당 정보를 효율적으로 시그널링하기 위한 무선 통신 방법 및 무선 통신 단말에 관한 것이다.

【발명의 배경이 되는 기술】

【0002】 최근 모바일 기기의 보급이 확대됨에 따라 이들에게 빠른 무선 인터넷 서비스를 제공할 수 있는 무선랜(Wireless LAN) 기술이 많은 각광을 받고 있다. 무선랜 기술은 근거리에서 무선 통신 기술을 바탕으로 스마트 폰, 스마트 패드, 랩탑 컴퓨터, 휴대형 멀티미디어 플레이어, 임베디드 기기 등과 같은 모바일 기기들을 가정이나 기업 또는 특정 서비스 제공지역에서 무선으로 인터넷에 접속할 수 있도록 하는 기술이다.

【0003】 IEEE(Institute of Electrical and Electronics Engineers) 802.11은 2.4GHz 주파수를 이용한 초기의 무선랜 기술을 지원한 이래, 다양한 기술의 표준을 실용화 또는 개발 중에 있다. 먼저, IEEE 802.11b는 2.4GHz 밴드의 주파수를 사용하면서 최고 11Mbps의 통신 속도를 지원한다. IEEE 802.11b 이후에 상용화된

IEEE 802.11a는 2.4GHz 밴드가 아닌 5GHz 밴드의 주파수를 사용함으로써 상당히 혼잡한 2.4GHz 밴드의 주파수에 비해 간섭에 대한 영향을 줄였으며, OFDM 기술을 사용하여 통신 속도를 최대 54Mbps까지 향상시켰다. 그러나 IEEE 802.11a는 IEEE 802.11b에 비해 통신 거리가 짧은 단점이 있다. 그리고 IEEE 802.11g는 IEEE 802.11b와 마찬가지로 2.4GHz 밴드의 주파수를 사용하여 최대 54Mbps의 통신속도를 구현하며, 하위 호환성(backward compatibility)을 만족하고 있어 상당한 주목을 받았는데, 통신 거리에 있어서도 IEEE 802.11a보다 우위에 있다.

【0004】그리고 무선랜에서 취약점으로 지적되어온 통신 속도에 대한 한계를 극복하기 위하여 제정된 기술 규격으로서 IEEE 802.11n이 있다. IEEE 802.11n은 네트워크의 속도와 신뢰성을 증가시키고, 무선 네트워크의 운영 거리를 확장하는데 목적을 두고 있다. 보다 구체적으로, IEEE 802.11n에서는 데이터 처리 속도가 최대 540Mbps 이상인 고처리율(High Throughput, HT)을 지원하며, 또한 전송 에러를 최소화하고 데이터 속도를 최적화하기 위해 송신부와 수신부 양단 모두에 다중 안테나를 사용하는 MIMO(Multiple Inputs and Multiple Outputs) 기술에 기반을 두고 있다. 또한, 이 규격은 데이터 신뢰성을 높이기 위해 중복되는 사본을 여러 개 전송하는 코딩 방식을 사용할 수 있다.

【0005】무선랜의 보급이 활성화되고 또한 이를 이용한 어플리케이션이 다양화됨에 따라, IEEE 802.11n이 지원하는 데이터 처리 속도보다 더 높은 처리율(Very High Throughput, VHT)을 지원하기 위한 새로운 무선랜 시스템에 대한 필요성이 대두되었다. 이 중 IEEE 802.11ac는 5GHz 주파수에서 넓은 대역폭(80MHz~160MHz)을

지원한다. IEEE 802.11ac 표준은 5GHz 대역에서만 정의되어 있으나 기존 2.4GHz 대역 제품들과의 하위 호환성을 위해 초기 11ac 칩셋들은 2.4GHz 대역에서의 동작도 지원할 것이다. 이론적으로, 이 규격에 따르면 다중 스테이션의 무선랜 속도는 최소 1Gbps, 최대 단일 링크 속도는 최소 500Mbps까지 가능하게 된다. 이는 더 넓은 무선 주파수 대역폭(최대 160MHz), 더 많은 MIMO 공간적 스트림(최대 8개), 다중 사용자 MIMO, 그리고 높은 밀도의 변조(최대 256 QAM) 등 802.11n에서 받아들인 무선 인터페이스 개념을 확장하여 이루어진다. 또한, 기존 2.4GHz/5GHz 대신 60GHz 밴드를 사용해 데이터를 전송하는 방식으로 IEEE 802.11ad가 있다. IEEE 802.11ad는 빔포밍 기술을 이용하여 최대 7Gbps의 속도를 제공하는 전송규격으로서, 대용량의 데이터나 무압축 HD 비디오 등 높은 비트레이트 동영상 스트리밍에 적합하다. 하지만 60GHz 주파수 밴드는 장애물 통과가 어려워 근거리 공간에서의 디바이스들 간에만 이용이 가능한 단점이 있다.

【0006】 한편, 최근에는 802.11ac 및 802.11ad 이후의 차세대 무선랜 표준으로서, 고밀도 환경에서의 고효율 및 고성능의 무선랜 통신 기술을 제공하기 위한 논의가 계속해서 이루어지고 있다. 즉, 차세대 무선랜 환경에서는 고밀도의 스테이션과 AP(Access Point)의 존재 하에 실내/외에서 높은 주파수 효율의 통신이 제공되어야 하며, 이를 구현하기 위한 다양한 기술들이 필요하다.

【발명의 내용】

【해결하고자 하는 과제】

【0007】 본 발명은 전술한 바와 같이 고밀도 환경에서의 고효율/고성능의 무선랜 통신을 제공하기 위한 목적을 가지고 있다.

【과제의 해결 수단】

【0008】 본 발명의 실시예에 따르면, 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법이 제공될 수 있다.

【발명의 효과】

【0009】 본 발명은 무선 통신 방법으로서, 더욱 상세하게는 실내외 환경에서 다중 사용자 동시 전송을 지원하는 무선랜 물리 계층 헤더 필드 구성 방법에 관한 것이다.

【도면의 간단한 설명】

【0010】 도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 나타낸 도면.

도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템을 나타낸 도면.

도 3은 본 발명의 일 실시예에 따른 스테이션의 구성을 나타낸 블록도.

도 4는 본 발명의 일 실시예에 따른 액세스 포인트의 구성을 나타낸 블록도.

도 5는 본 발명의 일 실시예에 따른 PPDU 포맷에 따른 HE-SIG-A 필드의 구성을 도시한 것이다.

도 6는 본 발명의 일 실시예에 따른 HE MU PPDU 포맷의 HE-SIG-B 필드의 구성을 도시한 것이다.

도 7은 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를

도시한다.

도 8은 본 발명의 실시예에 따른 불연속 채널 할당 방법을 도시한다.

도 9는 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 세분화된 PHY-CCA.indication 방법을 도시한다.

도 10은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQRP/BQR 교환 및 시그널링 방법을 도시한다.

도 11은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQR 전송 및 시그널링 방법을 도시한다.

【발명을 실시하기 위한 구체적인 내용】

【0011】 본 명세서에서 사용되는 용어는 본 발명에서의 기능을 고려하면서 가능한 현재 널리 사용되는 일반적인 용어를 선택하였으나, 이는 당 분야에 종사하는 기술자의 의도, 관례 또는 새로운 기술의 출현 등에 따라 달라질 수 있다. 또한 특정 경우는 출원인이 임의로 선정한 용어도 있으며, 이 경우 해당되는 발명의 설명 부분에서 그 의미를 기재할 것이다. 따라서 본 명세서에서 사용되는 용어는, 단순한 용어의 명칭이 아닌 그 용어가 가진 실질적인 의미와 본 명세서의 전반에 걸친 내용을 토대로 해석되어야 함을 밝혀두고자 한다.

【0012】 명세서 전체에서, 어떤 구성이 다른 구성과 "연결"되어 있다고 할 때, 이는 "직접적으로 연결"되어 있는 경우뿐 아니라, 그 중간에 다른 구성요소를 사이에 두고 "전기적으로 연결"되어 있는 경우도 포함한다. 또한 어떤 구성

이 특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

【0013】도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 도시하고 있다. 무선랜 시스템은 하나 또는 그 이상의 베이직 서비스 세트(Basic Service Set, BSS)를 포함하는데, BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 기기들의 집합을 나타낸다. 일반적으로 BSS는 인프라스트럭쳐 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭쳐 BSS를 나타내고 있다.

【0014】도 1에 도시된 바와 같이 인프라스트럭쳐 BSS(BSS1, BSS2)는 하나 또는 그 이상의 스테이션(STA-1, STA-2, STA-3, STA-4, STA-5), 분배 서비스(Distribution Service)를 제공하는 스테이션인 액세스 포인트(PCP/AP-1, PCP/AP-2), 및 다수의 액세스 포인트(PCP/AP-1, PCP/AP-2)를 연결시키는 분배 시스템(Distribution System, DS)을 포함한다.

【0015】스테이션(Station, STA)은 IEEE 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리층(Physical Layer) 인터페이스를 포함하는 임의의 디바이스로서, 광의로는 비 액세스 포인트(Non-AP) 스테이션뿐만 아니라 액세스 포인트(AP)를 모두 포함한다. 또한, 본 명

세서에서는 스테이션과 AP 등의 무선랜 통신 디바이스를 모두 포함하는 개념으로서 '단말' 이라는 용어가 사용될 수 있다. 무선 통신을 위한 스테이션은 프로세서(Processor)와 트랜시버(transceiver)를 포함하고, 실시예에 따라 유저 인터페이스부와 디스플레이 유닛 등을 더 포함할 수 있다. 프로세서는 무선 네트워크를 통해 전송할 프레임을 생성하거나 또는 상기 무선 네트워크를 통해 수신된 프레임을 처리하며, 그 밖에 스테이션을 제어하기 위한 다양한 처리를 수행할 수 있다. 그리고, 트랜시버는 상기 프로세서와 기능적으로 연결되어 있으며 스테이션을 위하여 무선 네트워크를 통해 프레임을 송수신한다.

【0016】 액세스 포인트(Access Point, AP)는 자신에게 결합된(associated) 스테이션을 위하여 무선 매체를 경유하여 분배시스템(DS)에 대한 접속을 제공하는 개체이다. 인프라스트럭쳐 BSS에서 비 AP 스테이션들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이지만, 다이렉트 링크가 설정된 경우에는 비AP 스테이션들 사이에서도 직접 통신이 가능하다. 한편, 본 발명에서 AP는 PCP(Personal BSS Coordination Point)를 포함하는 개념으로 사용되며, 광의적으로는 집중 제어기, 기지국(Base Station, BS), 노드-B, BTS(Base Transceiver System), 또는 사이트 제어기 등의 개념을 모두 포함할 수 있다.

【0017】 복수의 인프라스트럭쳐 BSS는 분배 시스템(DS)을 통해 상호 연결될 수 있다. 이때, 분배 시스템을 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다.

【0018】 도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템인 독립 BSS를 도시하고 있다. 도 2의 실시예에서 도 1의 실시예와 동일하거나 상응하는 부분은 중복적인 설명을 생략하도록 한다.

【0019】 도 2에 도시된 BSS-3는 독립 BSS이며 AP를 포함하지 않기 때문에, 모든 스테이션(STA-6, STA-7)이 AP와 접속되지 않은 상태이다. 독립 BSS는 분배 시스템으로의 접속이 허용되지 않으며, 자기 완비적 네트워크(self-contained network)를 이룬다. 독립 BSS에서 각각의 스테이션들(STA-6, STA-7)은 다이렉트로 서로 연결될 수 있다.

【0020】 도 3은 본 발명의 일 실시예에 따른 스테이션(100)의 구성을 나타낸 블록도이다.

【0021】 도시된 바와 같이, 본 발명의 실시예에 따른 스테이션(100)은 프로세서(110), 네트워크 인터페이스 카드(NIC, 120), 유저 인터페이스부(140), 디스플레이 유닛(150) 및 메모리(160)를 포함할 수 있다.

【0022】 먼저, 네트워크 인터페이스 카드(120)는 무선랜 접속을 수행하기 위한 모듈이며, 스테이션(100)을 위한 패킷 전송과 수신을 수행한다. 네트워크 인터페이스 카드(120)는 스테이션(100)에 내장되거나 외장으로 구비될 수 있으며, 실시예에 따라 서로 다른 주파수 밴드를 이용하는 적어도 하나의 네트워크 인터페이스 카드 모듈을 포함할 수 있다. 이를 테면, 상기 네트워크 인터페이스 카드는 2.4GHz, 5GHz 및 60GHz 등의 서로 다른 주파수 밴드의 네트워크 인터페이스 카드

모듈을 포함할 수 있다. 일 실시예에 따르면, 스테이션(100)은 6GHz 이상의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈을 구비할 수 있다. 각각의 네트워크 인터페이스 카드 모듈은 해당 네트워크 인터페이스 카드 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 AP 또는 외부 스테이션과 무선 통신을 수행할 수 있다. 네트워크 인터페이스 카드(120)는 스테이션(100)의 성능 및 요구 사항에 따라 한 번에 하나의 네트워크 인터페이스 카드 모듈만을 동작시키거나 동시에 다수의 네트워크 인터페이스 카드 모듈을 함께 동작시킬 수 있다. 스테이션(100)이 복수의 네트워크 인터페이스 카드 모듈을 포함할 경우, 각 네트워크 인터페이스 카드 모듈은 각각 독립된 형태로 구비될 수도 있으며, 하나의 칩으로 통합되어 구비될 수도 있다.

【0023】 다음으로, 유저 인터페이스부(140)는 스테이션(100)에 구비된 다양한 형태의 입/출력 수단을 포함한다. 즉, 유저 인터페이스부(140)는 다양한 입력 수단을 이용하여 유저의 입력을 수신할 수 있으며, 프로세서(110)는 수신된 유저 입력에 기초하여 스테이션(100)을 제어할 수 있다. 또한, 유저 인터페이스부(140)는 다양한 출력 수단을 이용하여 프로세서(110)의 명령에 기초한 출력을 수행할 수 있다.

【0024】 다음으로, 디스플레이 유닛(150)은 디스플레이 화면에 이미지를 출력한다. 상기 디스플레이 유닛(150)은 프로세서(110)에 의해 실행되는 컨텐츠 또는 프로세서(110)의 제어 명령에 기초한 유저 인터페이스 등의 다양한 디스플레이

오브젝트를 출력할 수 있다. 또한, 메모리(160)는 스테이션(100)에서 사용되는 제어 프로그램 및 그에 따른 각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션(100)이 AP 또는 외부 스테이션과 접속을 수행하는데 필요한 접속 프로그램이 포함될 수 있다.

【0025】 본 발명의 프로세서(110)는 다양한 명령 또는 프로그램을 실행하고, 스테이션(100) 내부의 데이터를 프로세싱 할 수 있다. 또한, 상기 프로세서(110)는 상술한 스테이션(100)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(110)는 메모리(160)에 저장된 AP와의 접속을 위한 프로그램을 실행하고, AP가 전송한 통신 설정 메시지를 수신할 수 있다. 또한, 프로세서(110)는 통신 설정 메시지에 포함된 스테이션(100)의 우선 조건에 대한 정보를 판독하고, 스테이션(100)의 우선 조건에 대한 정보에 기초하여 AP에 대한 접속을 요청할 수 있다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

【0026】 도 3에 도시된 스테이션(100)은 본 발명의 일 실시예에 따른 블록도로서, 분리하여 표시한 블록들은 디바이스의 엘리먼트들을 논리적으로 구별하여 도시한 것이다. 따라서 상술한 디바이스의 엘리먼트들은 디바이스의 설계에 따라 하나의 칩으로 또는 복수의 칩으로 장착될 수 있다. 또한, 본 발명의 실시예에서 상기 스테이션(100)의 일부 구성들, 이를 테면 유저 인터페이스부(140) 및 디스플레이 유닛(150) 등은 스테이션(100)에 선택적으로 구비될 수 있다.

【0027】 도 4는 본 발명의 일 실시예에 따른 AP(200)의 구성을 나타낸 블록도이다.

【0028】 도시된 바와 같이, 본 발명의 실시예에 따른 AP(200)는 프로세서(210), 네트워크 인터페이스 카드(220) 및 메모리(260)를 포함할 수 있다. 도 4에서 AP(200)의 구성 중 도 3의 스테이션(100)의 구성과 동일하거나 상응하는 부분에 대해서는 중복적인 설명을 생략하도록 한다.

【0029】 도 4를 참조하면, 본 발명에 따른 AP(200)는 적어도 하나의 주파수 밴드에서 BSS를 운영하기 위한 네트워크 인터페이스 카드(220)를 구비한다. 도 3의 실시예에서 전술한 바와 같이, 상기 AP(200)의 네트워크 인터페이스 카드(220) 또한 서로 다른 주파수 밴드를 이용하는 복수의 네트워크 인터페이스 카드 모듈을 포함할 수 있다. 즉, 본 발명의 실시예에 따른 AP(200)는 서로 다른 주파수 밴드, 이를 테면 2.4GHz, 5GHz, 60GHz 중 두 개 이상의 네트워크 인터페이스 카드 모듈을 함께 구비할 수 있다. 바람직하게는, AP(200)는 6GHz 이상의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈을 구비할 수 있다. 각각의 네트워크 인터페이스 카드 모듈은 해당 네트워크 인터페이스 카드 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 스테이션과 무선 통신을 수행할 수 있다. 상기 네트워크 인터페이스 카드(220)는 AP(200)의 성능 및 요구 사항에 따라 한 번에 하나의 네트워크 인터페이스 카드 모듈만을 동작시키거나 동시에 다수의 네트워크 인터페이스 카드 모듈을 함께 동작시킬 수 있다.

【0030】 다음으로, 메모리(260)는 AP(200)에서 사용되는 제어 프로그램 및 그에 따른 각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션의 접속을 관리하는 접속 프로그램이 포함될 수 있다. 또한, 프로세서(210)는 AP(200)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(210)는 메모리(260)에 저장된 스테이션과의 접속을 위한 프로그램을 실행하고, 하나 이상의 스테이션에 대한 통신 설정 메시지를 전송할 수 있다. 이때, 통신 설정 메시지에는 각 스테이션의 접속 우선 조건에 대한 정보가 포함될 수 있다. 또한, 프로세서(210)는 스테이션의 접속 요청에 따라 접속 설정을 수행한다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

【0032】 도 5는 본 발명의 일 실시예에 따른 PPDU 포맷에 따른 HE-SIG-A 필드의 구성을 도시한 것이다.

【0033】 HE PPDU 포맷은 HE SU PPDU, HE Extended Range SU PPDU, HE MU PPDU, HE Trigger-based PPDU로 구분되며, 각각의 PPDU 포맷에서 HE-SIG-A 필드의 서브필드 구성은 도 5(a), (b), (c)와 같다.

【0034】 도 5(a)의 HE-SIG-A 필드 구성은 HE SU PPDU와 HE Extended Range SU PPDU 전송에서 사용되며, 단일 AP와 단일 STA간의 통신에서의 시그널링을 위해 사용되며 추가적인 HE-SIG-B는 전송되지 않는다.

【0035】 도 5(b)의 HE-SIG-A 필드 구성은 HE MU PPDU 전송에서 사용되며, 단일 AP와 다중 STA간의 하향 동시 통신 또는 단일 STA와 단일 AP와의 상향 통신을 위해 사용할 수 있으며 도 6에서 나타내는 HE-SIG-B 필드와 협력하여 시그널링을 수행하게 된다.

【0036】 HE MU PPDU가 단일 AP와 다중 STA간의 하향 동시 통신에 사용되는 경우, HE-SIG-A는 PPDU의 전체적인 구성과 모든 STA들에게 공통적인 설정에 대한 시그널링을 담당하며 HE-SIG-B는 OFDMA/MIMO에서 주파수 대역 할당 정보 및 개별 STA들에게 별도로 적용되는 설정에 대한 시그널링을 담당한다.

【0037】 그러나 HE MU PPDU가 단일 STA와 단일 AP간의 상향 통신에 사용되는 경우, HE-SIG-A와 HE-SIG-B의 각 필드들은 본 발명의 실시예들에 따라 서로 다른 설정을 시그널링 할 수 있다.

【0038】 첫째, HE-SIG-A의 BW 서브필드는 3비트로서, DL MU의 경우 하향 PPDU의 대역폭을 나타내고, 20/40/80/160MHz와 Preamble Puncturing 모드 대역폭 80A/80B/160A/160B를 나타낼 수 있다. 이때 상기 Preamble Puncturing 모드 대역폭은 DL MU 전송에서만 가능하며, 이에 대한 상세한 설명은 도 8을 참조한다. 본 발명의 실시예에 따라 UL MU의 경우 상향 PPDU의 대역폭을 나타내고, 20/40/80/160MHz와 협대역 상향 전송 모드 대역폭 right-106-tone/left-106-tone을 나타낼 수 있다. 이때 right-106-tone/left-106-tone 시그널링은 각각 단일 STA이 단일 AP에게 UL MU PPDU로 상향 전송을 수행할 때 Primary 20MHz 채널에서 전체 242tone의 데이터 Resource Unit들 중에서 왼쪽 또는 오른쪽 106 tone RU만을 사용

하여 협대역으로 전송하는 것을 시그널링 한다. 즉 상향 UL MU PPDU 전송에서는 20MHz 내의 106-tone만을 활용하는 협대역 전송을 허용하되, 이에 대한 시그널링 오버헤드를 최소로 하기 위해 HE-SIG-A의 BW 필드에서 하향 전송에서만 존재하는 Preamble Puncturing 모드 대역폭 옵션들을 상향 전송에서는 다른 의미(협대역 전송)로 매핑하여 시그널링 하는 것이다. 만약 UL MU의 협대역 전송을 HE-SIG-B를 활용하여 시그널링 하는 경우, 도 6에서 설명하는 바와 같이 HE-SIG-B의 RU Allocation 필드와 User Specific Info 부분들을 중복적으로 사용하여 시그널링 하므로, 오버헤드가 증가할 수 있기 때문이다.

【0039】둘째, SIG-B Compression 서브필드는 1비트로서, DL MU의 경우 Full-BW MU-MIMO 전송을 의미하며, SIG-B의 Common Block에 해당하는 RU Allocation 필드가 전송되지 않는다. 이는 전대역 MU-MIMO 전송의 경우 PPDU 전체 대역폭을 분할하여 전송하는 OFDMA 전송이 아니므로 별도의 RU Allocation 필드의 전송이 불필요하기 때문이다. 또한 이 경우 SIG-A의 Num of SIG-B Sym 서브필드는 MU-MIMO User의 수를 지시하고, SIG-B의 User Specific Info 부분은 도 6(d)-2와 같은 MU-MIMO User Specific info의 포맷을 사용하게 된다.

【0040】본 발명의 실시예에 따라 UL MU의 경우 상기 SIG-B Compression 서브필드는 항상 1로 설정할 수 있으며, 이는 전대역 MU-MIMO가 아니더라도 UL MU의 경우에는 SIG-B 오버헤드를 줄이기 위해 SIG-B의 RU Allocation 서브필드를 생략할 수 있도록 SIG-B Compression 필드를 1로 셋팅하는 경우이며, 이 경우에도 SIG-A의 Num of SIG-B Sym은 SIG-B 심볼의 갯수를 지시하고, SIG-B의 User Specific Info

부분은 도 6(d)-1의 OFDMA user specific info 필드를 사용하는 것을 특징으로 한다. 이는 단일 STA의 상향 UL MU PPDU 전송에서는 SIG-B의 RU Allocation 필드의 시그널링이 불필요하므로 이를 제외할 수 있는 SIG-B Compression 서브필드를 1로 설정하지만, 이는 기존의 하향 전송에서의 전대역 MU-MIMO를 의미하는 것은 아니므로 기존의 Num of SIG-B Sym 서브필드는 그대로 유지하고, SIG-B의 User Specific Info 부분도 OFDMA 기반의 정보 형태로 유지하는 것이다.

【0041】 셋째, Num of SIG-B Sym 서브필드는 4비트로서, DL MU의 경우 SIG-B 필드의 심볼수를 나타내며 만약 SIG-B Compression 서브필드의 값이 1인 경우에만 Full-BW MU-MIMO에서의 User 수를 지시한다. 본 발명의 실시예에 따라 UL MU의 경우에도 SIG-B 필드의 심볼수를 나타내며 만약 SIG-B Compression 서브필드의 값이 1인 경우에도 SIG-B 심볼수를 계속 지시한다. 또한 본 발명의 또 다른 실시예에 따라 UL MU PPDU의 경우 SIG-B Compression 서브필드를 항상 1로 설정하여 SIG-B의 RU Allocation 서브필드를 전송하지 않음으로써 시그널링 오버헤드를 최소화할 수 있다.

【0042】 도 5(c)의 HE-SIG-A 필드 구성은 HE Trigger-based PPDU 전송에서 사용되며, 다중 STA와 단일 AP간의 통신에서의 시그널링을 위해 사용되며 추가적인 HE-SIG-B는 전송되지 않는다.

【0044】 도 6는 본 발명의 일 실시예에 따른 HE MU PPDU 포맷의 HE-SIG-B 필드의 구성을 도시한 것이다.

【0045】 HE-SIG-B 필드는 HE MU PPDU에 존재하며, 20MHz 단위로 전송된다. 또한, HE-SIG-B 필드는 HE MU PPDU를 수신하기 위해 필요한 정보를 지시한다. 도 6(a)에 도시된 바와 같이, HE-SIG-B는 공통 블록 필드와 사용자 특정 필드로 구성된다.

【0046】 도 6(b)는 HE-SIG-B의 공통 블록 필드의 서브필드 구성의 일 실시예를 도시한다. 먼저, 공통 블록 필드는 리소스 유닛 할당(RA) 필드를 포함한다. 도 6(c)는 RA 필드의 일 실시예를 도시한다.

【0047】 도 6(c)를 참조하면, RA 필드는 주파수 도메인에서 특정 대역폭(예를 들어, 20MHz)의 리소스 유닛 할당에 대한 정보를 포함한다. 더욱 구체적으로, RA 필드는 8비트 단위로 구성되며, 특정 대역폭을 구성하는 리소스 유닛들의 크기와 주파수 도메인에서의 그들의 배열을 인덱싱한다. 또한, RA 필드는 각 리소스 유닛에서의 사용자 수를 지시할 수 있다. PPDU가 전송되는 총 대역폭이 기 설정된 대역폭 (예를 들어, 40MHz) 보다 클 경우, RA 필드는 8비트의 배수의 크기로 설정되어 상기 특정 대역폭 단위로 정보를 전달할 수 있다.

【0048】 분할된 각 리소스 유닛은 일반적으로 하나의 사용자에게 할당된다. 그러나 일정 대역폭(예를 들어, 106-톤) 이상의 리소스 유닛은 MU-MIMO를 이용하여 복수의 사용자에게 할당될 수 있다. 이때, RA 필드는 해당 리소스 유닛의 사용자

수 정보를 지시할 수 있다. 뿐만 아니라, RA 필드는 사용자 특정 필드가 전송되지 않는 특정 리소스 유닛 즉, 사용자에게 할당되지 않는 특정 리소스 유닛(즉, 빈 RU)을 기 설정된 인덱스를 통해 지시할 수 있다. 일 실시예에 따르면, 특정 리소스 유닛은 20MHz 채널의 배수의 대역폭을 갖는 리소스 유닛(RU) 즉, 242-톤 RU, 484-톤 RU, 996-톤 RU 등을 포함한다. 상기 인덱스 값이 지시하는 빈(empty) RU에서는 데이터 전송이 수행되지 않는다. 이와 같이, 단말은 HE-SIG-B의 RA 필드의 기 설정된 인덱스를 통해 20MHz 단위의 불연속 채널 할당 정보를 시그널링 할 수 있다.

【0049】 본 발명의 실시예에 따르면, 80MHz 이상의 총 대역폭으로 PPDU가 전송될 경우, 공통 블록 필드는 80MHz에서의 중앙 26-톤 RU가 사용자에게 할당되었는지 여부를 나타내는 필드(이하, C26 필드)를 더 포함할 수 있다. 상기 C26 필드는 공통 블록 필드 내에서 RA 필드 이전 또는 이후에 위치하는 1비트 지시자로 구성될 수 있다.

【0050】 한편, 사용자 특정 필드는 복수의 사용자 필드들로 구성되며, 할당된 각 리소스 유닛에 지정된 STA를 위한 정보를 전달한다. 사용자 특정 필드에 포함될 사용자 필드의 총 개수는 RA 필드 및 C26 필드에 기초하여 결정될 수 있다. 복수의 사용자 필드들은 사용자 블록 필드 단위로 전송된다. 사용자 블록 필드는 2개의 사용자 필드와 CRC 필드 및 테일 필드의 결합으로 만들어진다. 사용자 필드들의 총 개수에 따라 마지막 사용자 블록 필드는 1개 또는 2개의 STA를 위한 정보를 포함할 수 있다. 예를 들어, 총 3개의 사용자(즉, STA1, STA 및 STA3)가 지정된 경우, 첫 번째 사용자 블록 필드에서는 STA1 및 STA2를 위한 정보가 코딩 되어 CRC/

테일 필드와 함께 전송되고, 마지막 사용자 블록 필드에서는 STA3를 위한 정보가 코딩 되어 CRC/테일 필드와 함께 전송 될 수 있다.

【0051】 도 6(d)-1 및 도 6(d)-2는 각각 HE-SIG-B의 사용자 필드의 서브필드 구성의 실시예들을 도시한다. 도 6(d)-1은 OFDMA 전송을 위한 사용자 필드를 나타내며, 도 6(d)-2는 MU-MIMO 전송을 위한 사용자 필드를 나타낸다. 각각의 사용자 필드는 대응하는 리소스 유닛의 수신자 AID를 지시한다. 예외적으로, HE MU PPDU가 상향 전송에 사용될 경우, 사용자 필드는 송신자 AID를 지시할 수 있다. 하나의 리소스 유닛에 하나의 사용자가 할당된 경우(즉, non-MU-MIMO 할당), 사용자 필드는 도 6(d)-1에 도시된 바와 같이 NSTS(Number of Spatial Streams), TxBF, MCS, DCM 및 코딩 필드를 포함한다. 반면에, 하나의 리소스 유닛에 다수의 사용자가 할당된 경우(즉, MU-MIMO 할당), 사용자 필드는 도 6(d)-2에 도시된 바와 같이 공간 구성 필드(SCF), MCS, DCM 및 코딩 필드를 포함한다. MU-MIMO 할당을 통해 PPDU를 수신하는 각 STA는 해당 리소스 유닛에서 자신을 위한 공간적 스트림의 위치와 개수를 식별해야 한다. 이를 위해, MU-MIMO 전송을 위한 사용자 필드는 공간 구성 필드(SCF)를 포함한다.

【0052】 도 6(e)는 HE-SIG-B의 SCF의 일 실시예를 도시한다. SCF는 각 STA를 위한 공간적 스트림 개수와 MU-MIMO 할당에서의 공간적 스트림 총 개수를 지시한다. 각 STA는 RA 필드를 통해 해당 PPDU의 OFDMA 및/또는 MIMO 할당을 식별하고, 사용자 특정 필드 상에서 호출된 순서에 따라 해당 STA가 MU-MIMO 할당을 통해 데이터를 수신하는지 여부를 식별한다. 만약 STA가 non-MU-MIMO 할당을 통해 데

이터를 수신하는 경우, 사용자 필드를 도 6(d)-1의 포맷에 따라 해석한다. 그러나 STA가 MU-MIMO 할당을 통해 데이터를 수신하는 경우, 사용자 필드를 도 6(d)-2의 포맷에 따라 해석한다. 한편, SIG-B 압축 필드가 전체 대역폭 MU-MIMO를 지시할 경우, HE-SIG-B에는 RA 필드가 존재하지 않는다. 이때, 사용자 특정 필드에서 시그널링 되는 모든 STA들은 MU-MIMO 할당을 통해 데이터를 수신하므로, 상기 STA들은 사용자 필드를 도 6(d)-2의 포맷에 따라 해석한다.

【0053】 본 발명의 일 실시예에 따르면 UL MU PPDU의 경우 상기 HE-SIG-B의 공통 블록 필드가 항상 전송되지 않는 것을 특징으로 한다. 즉 단일 STA가 단일 AP에게 전송하는 UL MU PPDU의 경우 상기 HE-SIG-B의 공통 블록 필드내의 C26 필드와 RA 필드의 시그널링 정보가 불필요하기 때문에 HE MU PPDU의 HE-SIG-A의 DL/UL Indication에서 UL을 지시하는 경우 HE-SIG-B의 공통 블록 필드는 전송하지 않는 것을 특징으로 한다. 이때 HE-SIG-A의 SIG-B Compression 필드를 1로 셋팅하여 상기 공통 블록 필드가 전송되지 않음을 추가적으로 명시적으로 시그널링 할 수 있으나, 이 경우에도 해당 UL MU PPDU는 전대역 MU-MIMO 전송을 의미하는 것은 아니다. 따라서 SIG-B Compression 필드가 1로 셋팅되었음에도 HE-SIG-B의 사용자 특정 필드는 도 6(d)-1의 non-MU-MIMO 할당 구성을 기반으로 시그널링 할 수 있다.

【0055】 도 7은 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를 도시한다.

【0056】 전술한 바와 같이, HE MU PPDU는 하향 DL MU 전송뿐만 아니라 상향

UL MU 전송에서도 사용될 수 있다.

【0057】 도 7은 단일 STA의 상향 전송에서 HE MU PPDU가 사용되는 일 실시예를 도시한다.

【0058】 본 발명의 실시예에 따르면, STA는 도 7(a)에 도시된 바와 같이 20MHz 대역폭 이하의 리소스 유닛(즉, 협대역)을 이용하여 전송을 수행할 수 있다. STA는 특정 리소스 유닛에 전송 파워를 집중함으로 데이터의 전송 거리를 증가시킬 수 있다. 도 7(b) 내지 도 7(d)는 이러한 협대역 전송을 시그널링하는 실시예들을 도시한다.

【0059】 본 발명의 실시예에 따르면, 협대역 전송은 도 7(b)에 도시된 바와 같이 HE-SIG-A의 필드들을 활용하여 시그널링 될 수 있다. 예를 들어, 상향 전송에서 HE MU PPDU가 사용될 경우, HE-SIG-A에서 BW 필드, SIG-B Compression 필드, HE-SIG-B 심볼의 개수 필드들은 다른 용도로 사용될 수 있다. BW 필드의 3비트 값들 중에서 Preamble Puncturing에 해당하는 4~7의 값은 UL MU 전송에서는 협대역 106-톤 전송의 시그널링을 위해 사용될 수 있다. 이 경우 SIG-B Compression 필드는 1로 설정하여 HE-SIG-B의 공통 블록 필드의 전송을 하지 않음으로써 오버헤드를 줄일 수 있으며, HE-SIG-B의 사용자 특정 필드에서는 OFDMA 기반의 사용자 특정 정보가 1개 전송되는 것을 특징으로 한다. 또한 이 경우 HE-SIG-B 심볼의 개수 필드는 SIG-B Compression 필드가 1로 설정된 경우에도 MU-MIMO User의 숫자가 아닌 SIG-B 심볼의 갯수를 계속 지시할 수 있다.

【0060】 본 발명의 일 실시예에 따르면, 협대역 전송은 도 7(c)에 도시된 바

와 같이 HE-SIG-B의 사용자 필드에 삽입되는 널 STA ID를 통해 시그널링 될 수 있다. 더욱 구체적으로, HE-SIG-B의 RA 필드는 특정 채널에서의 리소스 유닛 분할 형태에 대한 정보를 지시할 수 있다. 예를 들어, 20MHz의 대역폭이 OFDMA에 기반하여 2개의 106 리소스 유닛들로 분할되고 중앙의 26 리소스 유닛은 사용하지 않는 경우, RA 필드는 도 6(c)에 도시된 바와 같이 "0110zzzz"을 시그널링할 수 있다. 이때, 분할된 2개의 106 리소스 유닛들 중 상향 데이터 전송에 사용되는 리소스 유닛에 대응하는 사용자 필드에 수신자 또는 송신자의 AID가 삽입될 수 있다. 반면에, 데이터 전송이 수행되지 않는 나머지 리소스 유닛에 대응하는 사용자 필드에는 널 STA ID가 삽입될 수 있다.

【0061】 예를 들어, 2개의 106 리소스들 중 2번째 106-톤 RU를 통해서만 데이터가 전송되는 경우, 1번째 사용자 필드에는 널 STA ID가 삽입될 수 있다.

【0062】 본 발명의 다른 실시예에 따르면, 도 7(d)에 도시된 바와 같이 협대역 전송을 위해 HE-SIG-B의 RA 필드에 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다. 더욱 구체적으로, HE-SIG-B의 RA 필드는 상향 전송이 수행되는 특정 106-톤 RU를 명시적으로 인덱싱할 수 있다. 이 경우, RA 필드에서 지시하는 리소스 유닛에 대응하는 하나의 사용자 필드만 운반되므로 시그널링 오버헤드가 크게 줄어들 수 있다. 일 실시예에 따르면, 상향 리소스 유닛 할당의 인덱스 값들은 DL MU 전송을 위한 RA 필드 구성의 미 할당된(즉, TBD) 인덱스들 중에서 사용될 수 있다. 다른 실시예에 따르면, RA 필드 내에서 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다.

【0063】 한편 본 발명의 또 다른 실시예에 따르면, 도 7(e)에 도시된 바와 같이 HE MU PPDU를 이용한 상향 전송은 협대역 뿐만 아니라 20MHz, 40MHz, 80MHz, 160MHz(80+80MHz)의 전체 대역폭을 통해서도 수행될 수 있다. 이때, HE-SIG-A의 대역폭 필드는 PPDU의 총 대역폭을 지시하며, SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시할 수 있다. 따라서, 상향 HE MU PPDU에서 HE-SIG-B의 RA 필드는 생략될 수 있다. 한편, 하향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, HE-SIG-B 심볼의 개수 필드는 MU-MIMO User의 수를 지시하고, HE-SIG-B의 사용자 특정 필드에서는 MU-MIMO 기반의 사용자 특정 정보가 지시될 수 있었다. 그러나 상향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우에는, HE-SIG-B 심볼의 개수 필드는 여전히 SIG-B 심볼의 개수를 지시하고, HE-SIG-B에서는 OFDMA 기반의 사용자 특정 정보가 지시될 수 있다.

【0065】 도 8은 본 발명의 실시예에 따른 불연속 채널 할당 방법을 도시한다.

【0066】 도 8의 실시예에 따르면, 20MHz 별로 다른 정보가 전송되지만 40MHz 단위로는 같은 정보가 전송되는 2개의 독립적인 HE-SIG-B 콘텐츠 채널들 중 적어도 하나가 전송되는 위치는 가변적일 수 있다. 이때, 수신자는 HE-SIG-B 콘텐츠 채널을 수신하기 위한 디코딩 채널을 가변적으로 설정할 수 있어야 한다. 도 8의 실시예에서는, P20 채널에서 HE-SIG-B 콘텐츠 채널 1이 전송되고, HE-SIG-B 콘텐츠 채널 2가 전송되는 채널이 가변될 수 있다고 가정한다. 그러나 P40 채널 내에서의

P20 채널의 물리적 주파수 순서에 따라, P20 채널에서 HE-SIG-B 콘텐츠 채널 2가 전송될 수도 있다. 이때에는, 채널 구성에 따라 HE-SIG-B 콘텐츠 채널 1이 전송되는 채널이 가변 될 수 있다. 본 발명의 실시예에 따른 불연속 채널 할당 정보는 도 8에 나열된 채널 구성들 중 적어도 일부의 구성을 지원할 수 있다.

【0067】 도 8(a)는 P80(Primary 80MHz) 대역 중 P20 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 2는 P80 대역에서 전송되지 않는다. 도 8(b)는 P80 대역 중 P40 채널이 기본적으로 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 모두는 적어도 P40 채널을 통해 전송될 수 있다. 실시예에 따라, S40 채널의 2개의 20MHz 채널들 중 어느 하나 즉, S40A 채널 또는 S40B 채널이 할당된 불연속 채널이 사용될 수 있다. S40A 채널 및 S40B 채널이 모두 할당되면 80MHz 또는 160MHz 대역폭의 연속 채널이 구성된다.

【0068】 도 8(c)는 P80 대역 중 P20 채널과 S40 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1은 P20 채널 및 S40A 채널을 통해 전송되고, HE-SIG-B 콘텐츠 채널 2는 S40B 채널을 통해 전송될 수 있다. 도 8(c)의 실시예의 경우, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2는 본 발명의 실시예에 따른 HE-SIG-B 콘텐츠 채널 전송 규칙에 맞게 전송될 수 있다.

【0069】 한편, HE-SIG-A의 대역폭 필드(BW)의 비트 수 제한으로 인해, 대역폭 필드는 상기 채널 구성들 중 일부의 구성을 지시할 수 있다. 대역폭 필드가 3비트로 구성될 경우, 대역폭 필드는 4가지 추가적인 불연속 채널 할당 정보를 인덱싱

할 수 있다. 본 발명의 실시예에 따르면, 대역폭 필드는 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링 되는 일부 채널 정보를 지시할 수 있다. 이때, 총 대역폭은 80MHz 대역폭과 160MHz(또는, 80+80MHz) 대역폭 중 어느 하나일 수 있다. 본 발명의 일 실시예에 따르면, 대역폭 필드는 도 8(c)에 도시된 S20 채널의 펑처링, 도 8(b)에 도시된 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 각각 인덱싱할 수 있다.

【0070】 본 발명의 실시예에 따르면, HE-SIG-A의 대역폭 필드가 지시하는 채널 구성에서, 추가적인 펑처링 정보는 HE-SIG-B의 RA 필드를 통해 지시될 수 있다. 예를 들어, 대역폭 필드가 80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 어느 하나의 펑처링을 지시할 경우 (도 8(b)의 3번째 및 5번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑처링 되는지를 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우(도 8(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑처링 되는지를 지시할 수 있다. 이에 더하여, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑처링을 지시할 경우(도 8(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑처링을 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S20 채널의 펑처링을 지시할 경우(도 8(c)의 2번째 채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑처링을 지시할

수 있다.

【0071】 이와 같이 펑쳐링이 지시된 채널들은 사용자에게 할당되지 않는다. 불연속 PPDU를 수신한 단말은 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑쳐링 되는 채널 정보를 해당 PPDU의 HE-SIG-A의 대역폭 필드를 통해 획득할 수 있다. 또한, 단말은 추가적인 채널 펑쳐링 정보를 해당 PPDU의 HE-SIG-B의 RA 필드를 통해 획득할 수 있다. 단말은 이와 같이 획득된 불연속 채널 할당 정보에 기초하여 PPDU를 디코딩한다.

【0073】 도 9는 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 세분화된 PHY-CCA.indication 방법을 도시한다.

【0074】 도 9(a)의 실시예에 따르면, 160MHz 대역에서 DL MU PPDU를 전송하고자 하는 STA는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 채널들을 이용하여 PPDU를 전송할 수 있다. 이때 도 9(a)에서와 같이 P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 현재 무선랜 표준의 CCA indication 기법에 기반하면 도 9(a)와 같이 P40의 PPDU 전송만이 가능하다. 이는 현재 무선랜 STA 내부의 PHY 계층과 MAC 계층간의 내부 시그널링 primitive 에서 정의된 PHY 계층의 CCA 결과를 보고하는 PHY-CCA.indication primitive가 primary, secondary, secondary40, secondary80의 채널 지시자 4개 값만을 지시할 수 있기 때문이다. 즉 최대 160MHz 대역폭에서 실질적으로 busy한 채널들이 S40A와 S80B의 2개의 20MHz

채널들 뿐이라 하더라도, PHY 계층에서 해당 busy 채널들을 MAC 계층에 지시해 줄 방법이 없으므로, 현재는 PHY 계층에서 PHY-CCA.indication(BUSY, {secondary40}) 을 MAC 계층으로 리포트하게 되고, MAC은 idle 한것으로 판별된 primary, secondary 채널을 조합한 40MHz PPDU 전송만을 수행할 수 있다. 이는 기존의 연속적인 채널 할당을 통한 PPDU 전송에서는 전혀 문제가 되지 않는다.

【0075】 그러나 도 8과 같은 불연속 채널 할당을 통한 DL MU PPDU 전송을 위해서는 보다 세밀한 PHY-CCA.indication 방법이 필요하다. 이를 위해서 PHY 계층이 MAC 계층에 CCA 결과를 보고하는 primitive의 채널 단위는 primary, secondary, secondary40A, secondary40B, secondary80A, secondary80B, secondary80C, secondary80D 또는 이와 유사한 형태로 20MHz 채널 단위로 세분화 할 수 있다. 또한 primary를 제외한 나머지 채널들이 busy한 경우에만 해당 busy한 채널들의 리스트를 모두 보고할 수 있다. 예를 들어 기존에는 secondary 채널이 busy한 경우에는 이후의 secondary40, secondary80 채널의 busy 여부는 MAC 계층에 indication 하지 않았던 것에 반하여, 새롭게 제안하는 방법에서는 primary 채널이 idle한 경우에는 busy로 판별되는 모든 채널들을 동시에 보고할 수 있게 된다. 예를 들어 도 9(a)와 같은 상황의 CCA 결과는 PHY-CCA.indication(BUSY, {secondary40A, secondary80B})로 보고할 수 있다. 그러나 만약 primary 채널이 busy하면 busy로 판별되는 secondary 채널들의 정보는 추가적으로 indication하지 않는다. 이와 같은 개선된 PHY-CCA.indication primitive를 사용하여 MAC 계층은 도 9(b)와 같은 불연속 채널 할당 기반 DL MU PPDU 전송을 수행할 수 있게 된다.

【0077】 도 10은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQRP/BQR 교환 및 시그널링 방법을 도시한다.

【0078】 도 10(a)의 실시예에 따르면, 160MHz 대역에서 DL MU PPDU를 전송하고자 하는 AP는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 채널들을 이용하여 DL MU PPDU를 전송할 수 있다. 이때 도 10(a)에서와 같이 다수의 STA들에게 MU-RTS를 전송하는 경우 해당 MU-RTS는 non-HT/non-HT duplicate 또는 HE SU PPDU와 같은 연속적인 채널 할당 기반 전송만 가능하므로, P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 도 9(a)와 같이 Primary 40MHz를 점유하는 MU-RTS의 전송만이 가능하다. 이후 MU-RTS에서 지시한 다수의 STA들로부터 동시 CTS를 수신할 수 있으나, 이를 기반으로 각 STA들의 가용 채널은 인지할 수 없다. 이를 위해 AP는 불연속 채널 할당 기반 전송이 가능한 DL MU PPDU 포맷을 사용하여 BQRP(Bandwidth Query Report Poll) 프레임을 전송할 수 있고, 이에 대한 응답으로 각 STA들로부터 BQR(Bandwidth Query Report) 프레임을 수신하여 해당 STA들에게 해당 채널들이 available한지를 파악할 수 있다. 이러한 BQRP/BQR 시퀀스를 통해 STA들의 가용 채널 정보를 확인하여 AP는 불연속 채널 할당 기반 DL MU PPDU 전송을 수행할 수 있다. 도 10(a)의 예에서 AP는 자신이 idle하다고 감지한 채널들 중에서 P40 채널에서 STA1, S40B 채널에서 STA2, S80A 채널에서 STA3, S80C 채널에서 STA4, S80D 채널에서 STA5에게 BQRP를 전송하였다. 이후 AP는 STA1, STA3, STA5로

부터 BQR 리포트를 수신하였으므로, S40B와 S80C에 할당한 STA2와 STA4의 응답은 수신하지 못하였으므로 해당 채널들이 해당 STA들에게 busy함을 인지할 수 있다.

【0079】도 10(b)의 실시예에 따르면, BQR 필드의 포맷은 2비트 BW Indication 필드와 8비트 BW Bitmap 필드로 구성될 수 있다. 또한 본 발명의 실시예에 따라서 BW Indication 필드는 생략될 수 있다. 도 10(a)와 같은 예제에서 BQRP를 수신한 후 전송하는 solicited BQR에서 각 STA들 (예: STA1, STA3, STA5)은 자신의 BQR을 전송할 때 각각 20/40/80/160(80+80)MHz로 설정된 BW Bitmap들 중 어떤 BW indication을 사용할 것인지에 대한 결정이 필요할 수 있으며 본 발명의 실시예들은 다음과 같다. 이때 20MHz 비트맵을 리포트 하는 경우 Primary 20MHz 채널을 지시하며, 40MHz 비트맵을 리포트하는 경우 Primary 40MHz 채널을 지시하며 첫번째 비트는 Primary 20MHz 채널을 지시한다. 이때 80MHz 비트맵을 리포트 하는 경우 Primary 80MHz 채널을 지시하며 첫번째~네번째 비트들은 80MHz 대역폭내에서 주파수 절대값이 낮은 20MHz 채널들을 순차적으로 지시한다. 이때 160(80+80)MHz 비트맵을 리포트 하는 경우 Primary 160(80+80)MHz 채널을 지시하며 첫번째~여덟번째 비트들은 160(80+80)MHz 대역폭내에서 주파수 절대값이 낮은 20MHz 채널들을 순차적으로 지시한다.

【0080】첫째, 각 STA들은 BQRP를 수신한 후 SIFS 동안에 자신이 수행할 수 있었던 CCA 결과 값들을 임의의 BW Indication 값을 사용하여 개별적으로 시그널링 한다. 예를 들어 STA1이 BQRP를 수신한 40MHz에 대해서만 CCA를 수행한 경우 BW Indication 필드를 40MHz를 지시하고 BW Bitmap 필드에서 2개의 bitmap 결과만을

전송할 수 있다. 또한 STA1이 80MHz에 대한 CCA를 수행한 경우 BW indication 필드를 80MHz를 지시하고 BW Bitmap 필드에서 4개의 bitmap 결과들을 전송할 수 있다. 이 방법의 경우 각 non-AP STA들이 자신들의 CCA 수행 능력에 기반하여 자율적으로 BQR의 BW Bitmap 지시 대역폭을 설정할 수 있다는 장점이 있으나, AP 입장에서는 특정 STA의 BQR 정보가 부족하게 수신될 수 있다.

【0081】 둘째, 각 STA들은 BQRP가 전송된 DL MU PPDU의 전체 대역 또는 BQR이 전송되는 Trigger-based PPDU의 전체 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA들에게 자명하므로 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 방법의 경우 non-AP STA들의 CCA 수행 능력을 고려하지 않고 일괄적인 BW Bitmap 지시 대역폭이 결정된다는 단점이 있다. 만약 특정 STA이 AP가 요구하는 대역폭에 대한 CCA를 수행하지 못하였을 경우 해당 채널들은 Busy 상태로 설정하여 BQR을 전송해야 한다.

【0082】 셋째, 각 STA들은 BQRP나 BQR이 전송되는 PPDU의 전체 대역폭에 상관없이, 해당 BSS가 운영되는 전체 대역폭 또는 자신이 지원하는 전체 대역폭들 중 작은 값을 기반으로 해당 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명한 경우 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 경우는 BQRP/BQR이 전송되는 PPDU의 대역폭보다 더 넓은 대역폭으로 이후에 DL MU PPDU가 전송될 수 있음을 고려하여 해당 BSS 또는 자신이 지원하는 최대 대역폭의 채널 상태를 지시하는 BQR을 송신하는 것이다.

【0084】 도 11은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQR 전송 및 시그널링 방법을 도시한다.

【0085】 도 11(a)-1의 실시예에 따르면, UL SU PPDU를 전송하고자 하는 STA는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 연속 채널들을 이용하여 UL SU PPDU를 전송할 수 있다. 이때 도 11(a)-1에서와 같이 HE SU PPDU는 연속적인 채널 할당 기반 전송만 가능하므로, P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 도 10(a)와 같이 Primary 40MHz를 점유하는 SU PPDU의 전송만이 가능하다. 이때 해당 SU PPDU에서 상기 STA는 자신이 감지한 CCA 결과를 BQR(Bandwidth Query Report) 프레임을 통하여 추가적으로 전송할 수 있다. 이를 수신한 AP는 해당 STA에게 어떤 채널들이 available 한지를 파악할 수 있다.

【0086】 또한 도 11(a)-2의 실시예에 따르면, AP로부터 BQRP가 포함되지 않은 일반적인 DL Trigger 프레임을 수신하고 이에 대한 응답으로 Trigger-based PPDU를 전송하고자 하는 STA는 PHY 계층에서 CCA 과정을 수행한 후 이 결과를 기반으로 BQR 프레임을 포함하여 전송할 수 있다. 이를 수신한 AP는 각 STA들에게 어떤 채널들이 available 한지를 파악할 수 있다. 이러한 Unsolicited BQR 시퀀스를 통해 AP는 각 STA들의 가용 채널 정보를 수시로 확인하고 이에 기반하여 AP는 불연속 채널 할당 기반 DL MU PPDU 전송을 수행할 수 있다.

【0087】 도 11(b)의 실시예에 따르면, BQR 필드의 포맷은 2비트 BW

Indication 필드와 8비트 BW Bitmap 필드로 구성될 수 있다. 또한 본 발명의 실시예에 따라서 BW Indication 필드는 생략될 수 있다. 도 11(a)-1/2와 같은 예제에서 unsolicited BQR을 전송하는 STA는 자신의 BQR을 전송할 때 각각 20/40/80/160(80+80)MHz로 설정된 BW Bitmap들 중 어떤 BW indication을 사용할 것인지에 대한 결정이 필요할 수 있으며 본 발명의 실시예들은 다음과 같다.

【0088】 첫째, 각 STA들은 자신이 BQR을 포함한 PPDU를 전송하기 위해 수행할 수 있었던 CCA 결과 값들을 임의의 BW Indication 값을 사용하여 개별적으로 시그널링 한다. 예를 들어 STA이 40MHz PPDU를 전송하기 전 해당 40MHz에 대해서만 CCA를 수행한 경우 BW Indication 필드를 40MHz를 지시하고 BW Bitmap 필드에서 2개의 bitmap 결과만을 전송할 수 있다. 그러나 STA이 40MHz PPDU를 전송하기 전 해당 PPDU의 BW보다 더 넓은 160MHz에 대한 CCA를 수행한 경우 BW indication 필드를 160MHz를 지시하고 BW Bitmap 필드에서 8개의 bitmap 결과들을 전송할 수 있다. 이 방법의 경우 각 non-AP STA들이 자신들의 CCA 수행 능력에 기반하여 자율적으로 BQR의 BW Bitmap 지시 대역폭을 설정할 수 있다는 장점이 있다.

【0089】 둘째, 각 STA들은 BQR이 전송되는 PPDU의 전체 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명하므로 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 방법의 경우 non-AP STA들의 CCA 수행 능력을 고려하지 않고 일괄적인 BW Bitmap 지시 대역폭이 결정된다는 단점이 있다. 만약 특정 STA이 자신이 전송하는 PPDU의 전체 대역폭에 대한 CCA를 수행하지 못하였을 경우 unsolicited

BQR 전송을 수행하지 않거나, BQR 전송을 수행하는 경우에는 CCA를 수행하지 못한 채널들은 Busy 상태로 설정하여 BQR을 전송해야 한다. 이는 Trigger-based PPDU의 전송과 같이 전체 PPDU의 대역폭이 자신이 실제 데이터를 전송하는 대역폭보다 큰 경우에 발생할 수 있다.

【0090】셋째, 각 STA들은 BQR이 전송되는 PPDU의 전체 대역폭에 상관없이, 해당 BSS가 운영되는 전체 대역폭 또는 자신이 지원하는 전체 대역폭들 중 작은 값을 기반으로 해당 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명한 경우 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. . 이 경우는 BQR이 전송되는 PPDU의 대역폭보다 더 넓은 대역폭으로 이후에 DL MU PPDU가 전송될 수 있음을 고려하여 해당 BSS 또는 자신이 지원하는 최대 대역폭의 채널 상태를 지시하는 BQR을 송신하는 것이다.

【0092】상기와 같이 무선랜 통신을 예로 들어 본 발명을 설명하였지만, 본 발명은 이에 한정하지 않으며 셀룰러 통신 등 다른 통신 시스템에서도 동일하게 적용될 수 있다. 또한 본 발명의 방법, 장치 및 시스템은 특정 실시예와 관련하여 설명되었지만, 본 발명의 구성 요소, 동작의 일부 또는 전부는 범용 하드웨어 아키텍쳐를 갖는 컴퓨터 시스템을 사용하여 구현될 수 있다.

【0093】 전술한 본 발명의 설명은 예시를 위한 것이며, 본 발명이 속하는 기술분야의 통상의 지식을 가진 자는 본 발명의 기술적 사상이나 필수적인 특징을 변경하지 않고서 다른 구체적인 형태로 쉽게 변형이 가능하다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시예들은 모든 면에서 예시적인 것이며 한정적인 것이 아는 것으로 해석해야 한다. 예를 들어, 단일형으로 설명되어 있는 각 구성 요소는 분산되어 실시될 수도 있으며, 마찬가지로 분산된 것으로 설명되어 있는 구성 요소들도 결합된 형태로 실시될 수 있다.

【0094】 본 발명의 범위는 상기 상세한 설명보다는 후술하는 특허청구범위에 의하여 나타내어지며, 특허청구범위의 의미 및 범위 그리고 그 균등 개념으로부터 도출되는 모든 변경 또는 변형된 형태가 본 발명의 범위에 포함되는 것으로 해석되어야 한다.

【특허청구범위】

【청구항 1】

단말의 무선 통신 방법으로서,

특정 채널의 무선 신호를 수신하는 단계;

상기 수신된 무선 신호의 프리앰블 정보를 이용하여 해당 신호의 길이 정보 및 해당 데이터 시퀀스의 전체 길이 정보 중 적어도 하나를 획득하는 단계;

를 포함하는 것을 특징으로 하는 무선 통신 방법.

재출 일자 : 2017-01-09

【요약서】

【요약】

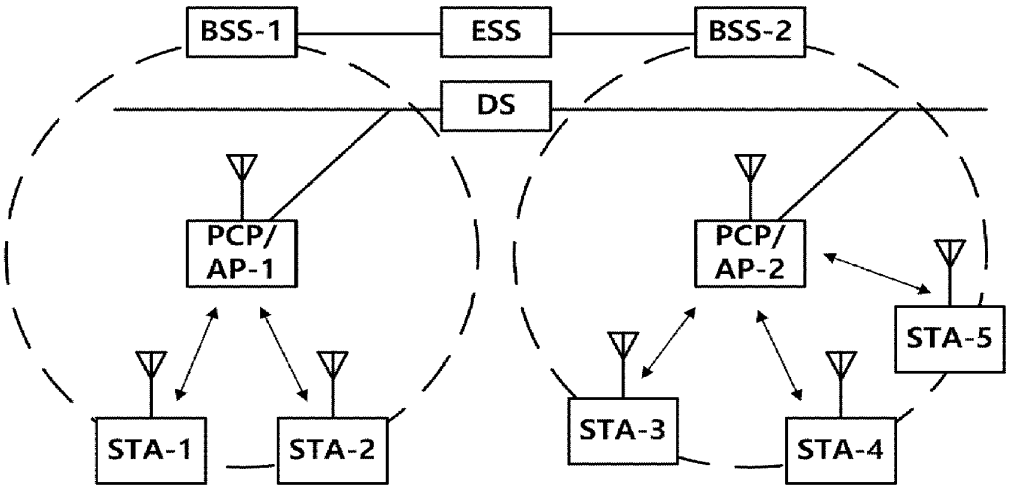
무선랜을 위한 장치, 시스템 및 무선랜 통신 방법이 게시된다. 본 발명의 실시예에 따르면 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말이 제공될 수 있다.

【대표도】

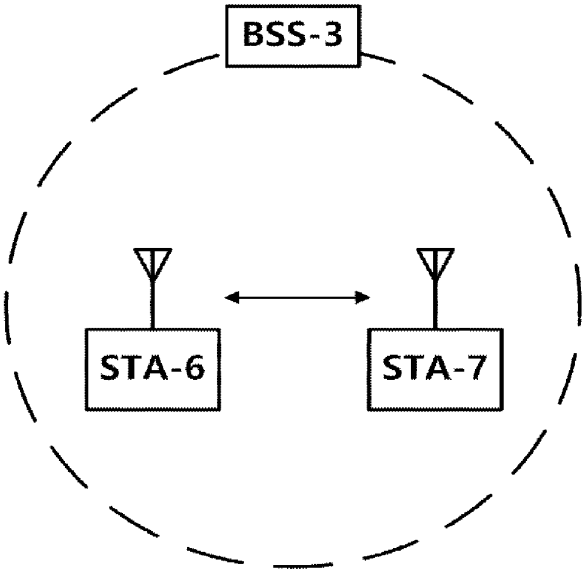
도 10

【도면】

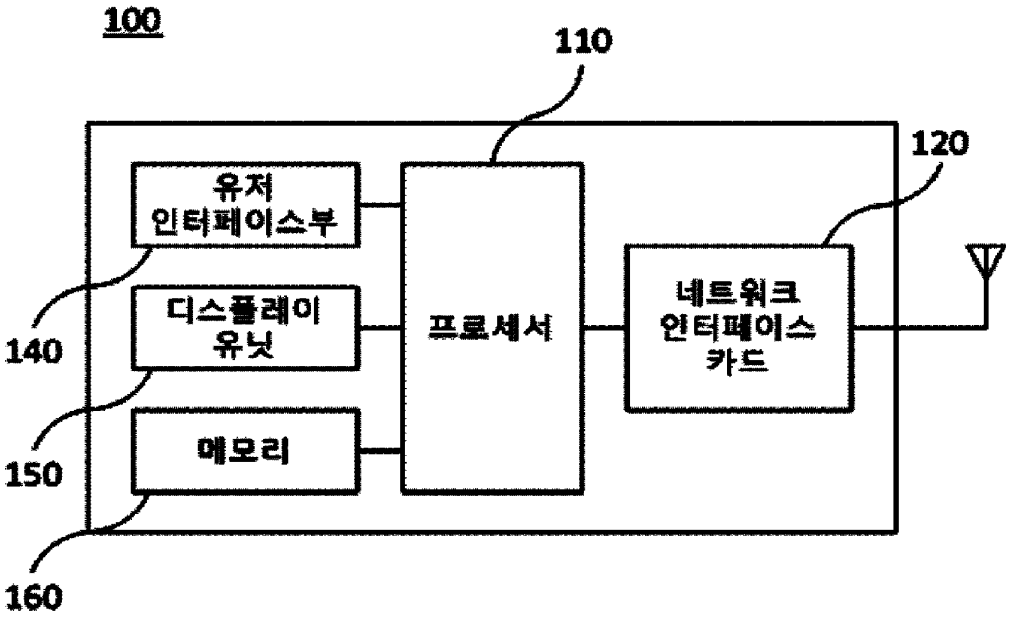
【도 1】



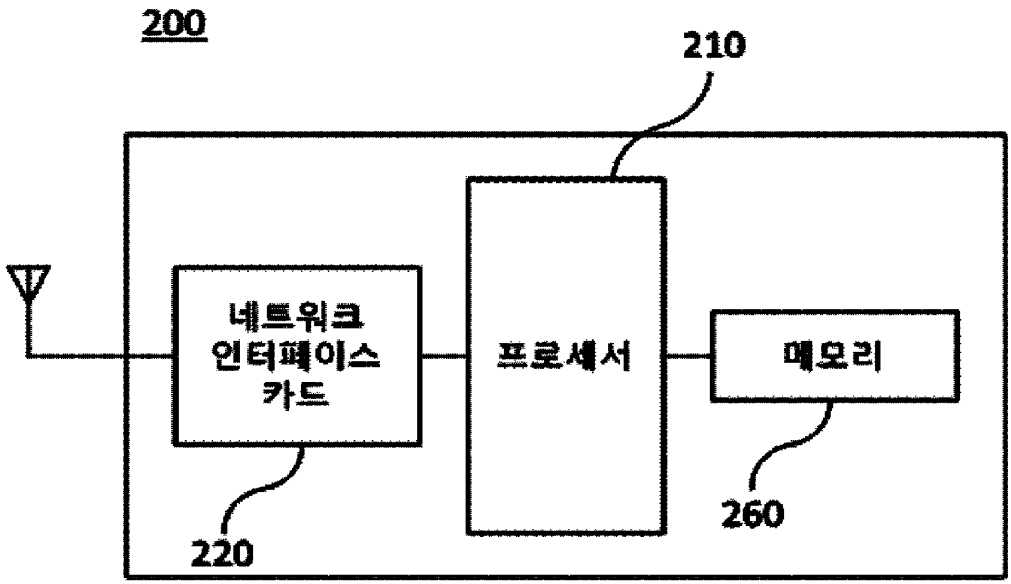
【도 2】



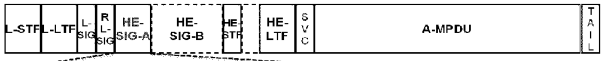
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
프로세서
네트워크
인터페이스
카드
140
150
메모리
160

【도 4】



【도 5】



(a) SU PPDU/EXT SU PPDU

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
Beam Change	1	
UL/DL	1	0:DL, 1:UL
MCS	4	
DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Reserved	1	
Spatial Reuse	4	TBD
Bandwidth	2	20/40/80/160(80+80)MHz
GI+LTF Size	3	1x_LTF+0.8us_GI 2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
NSTS	3	1~8 space time streams
TXOP Duration	7	
Coding	1	0:BCC, 1:LDPC
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
TxBF	1	Beamforming
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
Reserved	1	
Doppler	1	
CRC	4	
Tail	6	

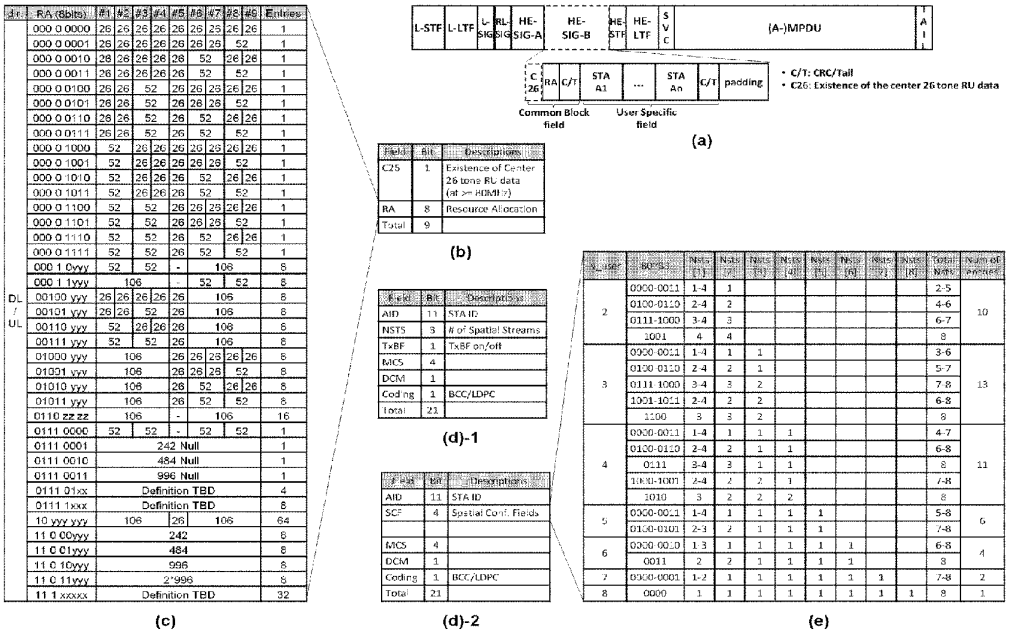
(b) MU PPDU

Field	Bit	Descriptions
UL/DL	1	0:DL, 1:UL
SIGB MCS	3	MCS0~MCS5
SIGB DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Spatial Reuse	4	TBD
Bandwidth	3	(DL) 20/40/80/160(80+80), 80A, 80B, 160A, 160B (UL) 20/40/80/160(80+80), left-1996tone, right-996tone, reserved
Num of SIG-B Sym	4	if SIG-B Compression is 1 (DL) Num of MU-MIMO Users (UL) Num of SIG-B Sym
SIG-B Compression	1	(DL) Set to 1 in Full BW MU-MIMO (UL) Always set to 1 to remove RU Allocation subfield
GI+LTF Size	3	2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
Doppler	1	
TXOP Duration	7	
Reserved	1	
Num of HE-LTF Sym	3	1, 2, 4, 6, 8
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
CRC	4	
Tail	6	

(c) Trigger-based PPDU

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
BSS Color	6	BSS identification info
Spatial Reuse1	4	Spatial Reuse Parameter
Spatial Reuse2	4	Spatial Reuse Parameter
Spatial Reuse3	4	Spatial Reuse Parameter
Spatial Reuse4	4	Spatial Reuse Parameter
Reserved	1	
Bandwidth	2	20/40/80/160(80+80)MHz
TXOP Duration	7	
Reserved	9	
CRC	4	
Tail	6	

【도 6】



(c)

Field	Bit	Description
C25	1	Existence of Center 26 tone RU data (at >= 80MHz)
RA	8	Resource Allocation
Total	9	

(b)

Field	Bit	Description
AID	11	STA ID
NSTS	3	# of Spatial Streams
TxBF	1	TxBF on/off
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

(d)-1

Field	Bit	Description
AID	11	STA ID
SCF	4	Spatial Conf. Fields
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

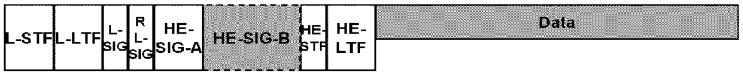
(d)-2

# of User	RU Index	Nsts (1)	Nsts (2)	Nsts (3)	Nsts (4)	Nsts (5)	Nsts (6)	Nsts (7)	Nsts (8)	Total Nsts	Num of Indices
2	0000-0011	1-4	1							2-5	10
	0100-0110	2-4	2							4-6	
	0111-1000	3-4	3							6-7	
	1001	4	4							8	
3	0000-0011	1-4	1	1						3-6	13
	0100-0110	2-4	2	1						5-7	
	0111-1000	3-4	3	2						7-8	
	1001-1011	2-4	2	2						6-8	
	1100	3	3	2						8	
4	0000-0011	1-4	1	1	1					4-7	11
	0100-0110	2-4	2	1	1					6-8	
	0111	3-4	3	1	1					8	
	1000-1001	2-4	2	2	1					7-8	
	1010	3	2	2	2					8	
5	0000-0011	1-4	1	1	1	1				5-8	6
	0100-0101	2-3	2	1	1	1				7-8	
6	0000-0010	1-3	1	1	1	1	1			6-8	4
	0011	2	2	1	1	1	1			8	
7	0000-0001	1-2	1	1	1	1	1	1		7-8	2
8	0000	1	1	1	1	1	1	1	1	8	1

(e)

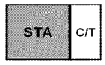
【도 7】

(a) UL HE MU PPDU (Narrow band TX)



(b) HE-SIG-A (BW subfield)

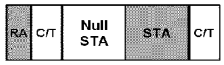
Field	Bit	Descriptions
BW	3	DL HE MU PPDU case - 20/40/80/160(80+80)MHz - 80A, 80B, 160A, 160B (Preamble Puncturing) UL HE MU PPDU case - 20/40/80/160(80+80)MHz **- 20MHz-left 106 tone** **- 20MHz-right 106 tone**



(OFDMA User Specific Info)

(c) HE-SIG-B (Resource Allocation)

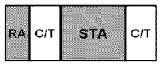
RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
1110zzzz	106				-	106				16



(OFDMA User Specific Info)

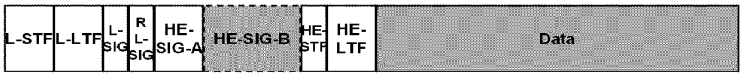
(d) HE-SIG-B (User Specific Info)

RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
TBD	106				-					1
TBD	-				106					1



(OFDMA User Specific Info)

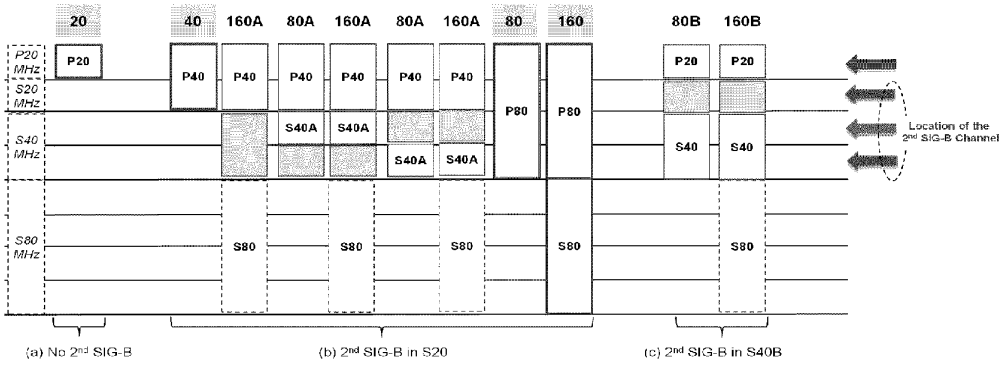
(e) UL HE MU PPDU (Full band TX)



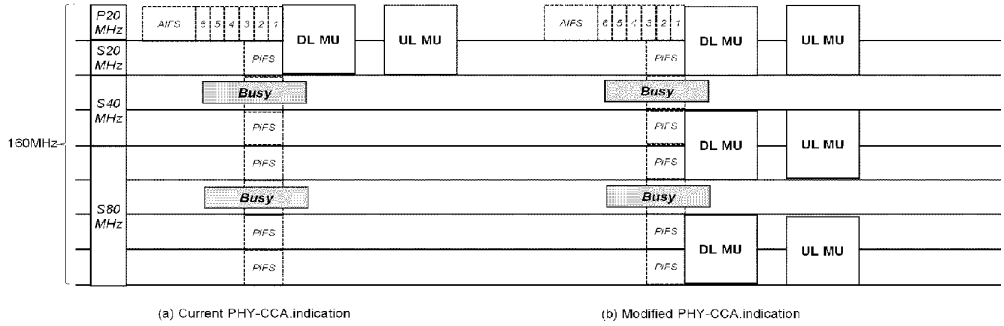
(f) HE-SIG-A (SIG-B Compression)

Field	Bit	Descriptions
SIG-B Compression	1	DL HE MU PPDU case - "0"refer RA field in SIG-B - "1" MU-MIMO user specific info UL HE MU PPDU case - Always set to "1" - Use OFDMA user specific info

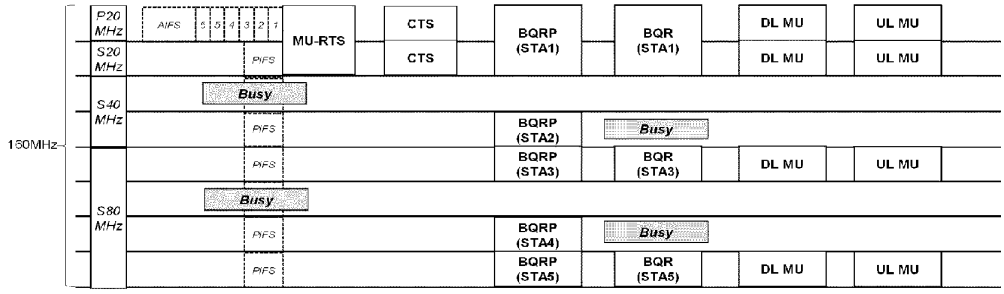
【도 8】


20
40
160A
80A
160A
80A
160A
80
160
80B
160B
P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
S40A
P80
S40
S80
Location of the 2nd SIG-B Channel
(a) No 2nd SIG-B
(b) 2nd SIG-B in S20
(c) 2nd SIG-B in S40B

【도 9】

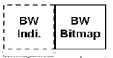

P20 MHz
S20 MHz
S40 MHz
S80 MHz
160MHz
AIFS
PIFS
Busy
DL MU
UL MU
(a) Current PHY-CCA.indication
(b) Modified PHY-CCA.indication

【도 10】



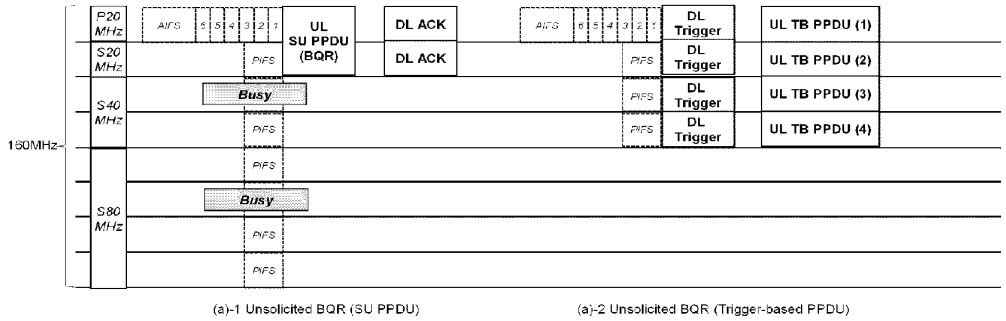
(a) BQRP/BQR Exchange Sequence (Solicited BQR)

(b) BQR (Bandwidth Query Report)

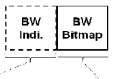


BW Indication	BW Bitmap							
20MHz	Idle /Busy	-	-	-	-	-	-	-
40MHz	Idle /Busy	Idle /Busy	-	-	-	-	-	-
80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	-	-	-	-
160MHz, 80+80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy

【도 11】



(b) BQR (Bandwidth Query Report)



BW Indication	BW Bitmap							
20MHz	Idle /Busy	-	-	-	-	-	-	-
40MHz	Idle /Busy	Idle /Busy	-	-	-	-	-	-
80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	-	-	-	-
160MHz, 80+80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy

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Application Number

출 원 년 월 일 : 2017년 01월 18일
Filing Date Jan. 18, 2017

출 원 인 : 주식회사 윌러스표준기술연구소

Applicant(s) WILUS Institute of Standards and Technology Inc.

2020년 03월 17일

특 허 청
COMMISSIONER

제출 일자 : 2017-01-18

【서지사항】

【서류명】 특허출원서

【참조번호】 170014HEW

【출원구분】 특허출원

【출원인】

【명칭】 주식회사 윌러스표준기술연구소

【특허고객번호】 1-2013-022334-3

【대리인】

【성명】 임국일

【대리인번호】 9-2014-000874-4

【포괄위임등록번호】 2014-036557-3

【발명의 국문명칭】 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말

【발명의 영문명칭】 METHOD AND APPARATUS OF WIRELESS COMMUNICATIONS USING NON-CONTIGUOUS CHANNELS

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【주민등록번호】 770724-1XXXXXX

【우편번호】 437-810

【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1114동 302호

【국적】 KR

【발명자】

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【국적】 KR

【발명자】

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【성명의 영문표기】 Geonjung KO

【주민등록번호】 860909-1XXXXXX

【우편번호】 443-794

【주소】 경기도 수원시 영통구 동탄원천로915번길 36, 301동 606호 (주공그린빌 3단지)

【국적】 KR

【발명자】

【성명】 안우진

【성명의 영문표기】 Woojin AHN

【주민등록번호】 831010-1XXXXXX

【우편번호】 122-957

【주소】 서울특별시 은평구 서오릉로13길 18-1

【국적】 KR

제출 일자 : 2017-01-18

【출원언어】 국어

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 R0166-16-1030

【부처명】 미래창조과학부

【연구관리 전문기관】 정보통신기술진흥센터

【연구사업명】 정보통신방송표준개발지원

【연구과제명】 IEEE802.11 High Efficiency WLAN (HEW) 표준개발

【기여율】 1/1

【주관기관】 (주)윌러스표준기술연구소

【연구기간】 2014.04.01 ~ 2017.02.28

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 임국일 (서명 또는 인)

【수수료】

【출원료】 0 면 46,000 원

【가산출원료】 43 면 0 원

【우선권주장료】 0 건 0 원

【심사청구료】 0 항 0 원

【합계】 46,000 원

【감면사유】 소기업(70%감면)[1]

【감면후 수수료】 13,800 원

제출 일자 : 2017-01-18

【첨부서류】 1.중소기업기본법 제2조의 규정에 따른 소기업에 해당함을 증명하는 서류_1통

제출 일자 : 2017-01-18

【발명의 설명】

【발명의 명칭】

불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말{METHOD AND APPARATUS OF WIRELESS COMMUNICATIONS USING NON-CONTIGUOUS CHANNELS}

【기술분야】

【0001】 본 발명은 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말에 관한 것으로서, 불연속 채널 할당 정보를 효율적으로 시그널링하기 위한 무선 통신 방법 및 무선 통신 단말에 관한 것이다.

【발명의 배경이 되는 기술】

【0002】 최근 모바일 기기의 보급이 확대됨에 따라 이들에게 빠른 무선 인터넷 서비스를 제공할 수 있는 무선랜(Wireless LAN) 기술이 많은 각광을 받고 있다. 무선랜 기술은 근거리에서 무선 통신 기술을 바탕으로 스마트 폰, 스마트 패드, 랩탑 컴퓨터, 휴대형 멀티미디어 플레이어, 임베디드 기기 등과 같은 모바일 기기들을 가정이나 기업 또는 특정 서비스 제공지역에서 무선으로 인터넷에 접속할 수 있도록 하는 기술이다.

【0003】 IEEE(Institute of Electrical and Electronics Engineers) 802.11은 2.4GHz 주파수를 이용한 초기의 무선랜 기술을 지원한 이래, 다양한 기술의 표준을 실용화 또는 개발 중에 있다. 먼저, IEEE 802.11b는 2.4GHz 밴드의 주파수를 사용하면서 최고 11Mbps의 통신 속도를 지원한다. IEEE 802.11b 이후에 상용화된

IEEE 802.11a는 2.4GHz 밴드가 아닌 5GHz 밴드의 주파수를 사용함으로써 상당히 혼잡한 2.4GHz 밴드의 주파수에 비해 간섭에 대한 영향을 줄였으며, OFDM 기술을 사용하여 통신 속도를 최대 54Mbps까지 향상시켰다. 그러나 IEEE 802.11a는 IEEE 802.11b에 비해 통신 거리가 짧은 단점이 있다. 그리고 IEEE 802.11g는 IEEE 802.11b와 마찬가지로 2.4GHz 밴드의 주파수를 사용하여 최대 54Mbps의 통신속도를 구현하며, 하위 호환성(backward compatibility)을 만족하고 있어 상당한 주목을 받았는데, 통신 거리에 있어서도 IEEE 802.11a보다 우위에 있다.

【0004】그리고 무선랜에서 취약점으로 지적되어온 통신 속도에 대한 한계를 극복하기 위하여 제정된 기술 규격으로서 IEEE 802.11n이 있다. IEEE 802.11n은 네트워크의 속도와 신뢰성을 증가시키고, 무선 네트워크의 운영 거리를 확장하는데 목적을 두고 있다. 보다 구체적으로, IEEE 802.11n에서는 데이터 처리 속도가 최대 540Mbps 이상인 고처리율(High Throughput, HT)을 지원하며, 또한 전송 에러를 최소화하고 데이터 속도를 최적화하기 위해 송신부와 수신부 양단 모두에 다중 안테나를 사용하는 MIMO(Multiple Inputs and Multiple Outputs) 기술에 기반을 두고 있다. 또한, 이 규격은 데이터 신뢰성을 높이기 위해 중복되는 사본을 여러 개 전송하는 코딩 방식을 사용할 수 있다.

【0005】무선랜의 보급이 활성화되고 또한 이를 이용한 어플리케이션이 다양화됨에 따라, IEEE 802.11n이 지원하는 데이터 처리 속도보다 더 높은 처리율(Very High Throughput, VHT)을 지원하기 위한 새로운 무선랜 시스템에 대한 필요성이 대두되었다. 이 중 IEEE 802.11ac는 5GHz 주파수에서 넓은 대역폭(80MHz~160MHz)을

지원한다. IEEE 802.11ac 표준은 5GHz 대역에서만 정의되어 있으나 기존 2.4GHz 대역 제품들과의 하위 호환성을 위해 초기 11ac 칩셋들은 2.4GHz 대역에서의 동작도 지원할 것이다. 이론적으로, 이 규격에 따르면 다중 스테이션의 무선랜 속도는 최소 1Gbps, 최대 단일 링크 속도는 최소 500Mbps까지 가능하게 된다. 이는 더 넓은 무선 주파수 대역폭(최대 160MHz), 더 많은 MIMO 공간적 스트림(최대 8개), 다중 사용자 MIMO, 그리고 높은 밀도의 변조(최대 256 QAM) 등 802.11n에서 받아들인 무선 인터페이스 개념을 확장하여 이루어진다. 또한, 기존 2.4GHz/5GHz 대신 60GHz 밴드를 사용해 데이터를 전송하는 방식으로 IEEE 802.11ad가 있다. IEEE 802.11ad는 빔포밍 기술을 이용하여 최대 7Gbps의 속도를 제공하는 전송규격으로서, 대용량의 데이터나 무압축 HD 비디오 등 높은 비트레이트 동영상 스트리밍에 적합하다. 하지만 60GHz 주파수 밴드는 장애물 통과가 어려워 근거리 공간에서의 디바이스들 간에만 이용이 가능한 단점이 있다.

【0006】 한편, 최근에는 802.11ac 및 802.11ad 이후의 차세대 무선랜 표준으로서, 고밀도 환경에서의 고효율 및 고성능의 무선랜 통신 기술을 제공하기 위한 논의가 계속해서 이루어지고 있다. 즉, 차세대 무선랜 환경에서는 고밀도의 스테이션과 AP(Access Point)의 존재 하에 실내/외에서 높은 주파수 효율의 통신이 제공되어야 하며, 이를 구현하기 위한 다양한 기술들이 필요하다.

【발명의 내용】

【해결하고자 하는 과제】

【0007】 본 발명은 전술한 바와 같이 고밀도 환경에서의 고효율/고성능의 무선랜 통신을 제공하기 위한 목적을 가지고 있다.

【과제의 해결 수단】

【0008】 본 발명의 실시예에 따르면, 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법이 제공될 수 있다.

【발명의 효과】

【0009】 본 발명은 무선 통신 방법으로서, 더욱 상세하게는 실내외 환경에서 다중 사용자 동시 전송을 지원하는 무선랜 물리 계층 헤더 필드 구성 방법에 관한 것이다.

【도면의 간단한 설명】

【0010】 도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 나타낸 도면.

도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템을 나타낸 도면.

도 3은 본 발명의 일 실시예에 따른 스테이션의 구성을 나타낸 블록도.

도 4는 본 발명의 일 실시예에 따른 액세스 포인트의 구성을 나타낸 블록도.

도 5는 본 발명의 일 실시예에 따른 PPDU 포맷에 따른 HE-SIG-A 필드의 구성을 도시한 것이다.

도 6는 본 발명의 일 실시예에 따른 HE MU PPDU 포맷의 HE-SIG-B 필드의 구성을 도시한 것이다.

도 7은 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를

도시한다.

도 8은 본 발명의 실시예에 따른 불연속 채널 할당 방법을 도시한다.

도 9는 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 세분화된 PHY-CCA.indication 방법을 도시한다.

도 10은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQRP/BQR 교환 및 시그널링 방법을 도시한다.

도 11은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQR 전송 및 시그널링 방법을 도시한다.

【발명을 실시하기 위한 구체적인 내용】

【0011】 본 명세서에서 사용되는 용어는 본 발명에서의 기능을 고려하면서 가능한 현재 널리 사용되는 일반적인 용어를 선택하였으나, 이는 당 분야에 종사하는 기술자의 의도, 관례 또는 새로운 기술의 출현 등에 따라 달라질 수 있다. 또한 특정 경우는 출원인이 임의로 선정한 용어도 있으며, 이 경우 해당되는 발명의 설명 부분에서 그 의미를 기재할 것이다. 따라서 본 명세서에서 사용되는 용어는, 단순한 용어의 명칭이 아닌 그 용어가 가진 실질적인 의미와 본 명세서의 전반에 걸친 내용을 토대로 해석되어야 함을 밝혀두고자 한다.

【0012】 명세서 전체에서, 어떤 구성이 다른 구성과 "연결"되어 있다고 할 때, 이는 "직접적으로 연결"되어 있는 경우뿐 아니라, 그 중간에 다른 구성요소를 사이에 두고 "전기적으로 연결"되어 있는 경우도 포함한다. 또한 어떤 구성

이 특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

【0013】도 1은 본 발명의 일 실시예에 따른 무선랜 시스템을 도시하고 있다. 무선랜 시스템은 하나 또는 그 이상의 베이직 서비스 세트(Basic Service Set, BSS)를 포함하는데, BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 기기들의 집합을 나타낸다. 일반적으로 BSS는 인프라스트럭쳐 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭쳐 BSS를 나타내고 있다.

【0014】도 1에 도시된 바와 같이 인프라스트럭쳐 BSS(BSS1, BSS2)는 하나 또는 그 이상의 스테이션(STA-1, STA-2, STA-3, STA-4, STA-5), 분배 서비스(Distribution Service)를 제공하는 스테이션인 액세스 포인트(PCP/AP-1, PCP/AP-2), 및 다수의 액세스 포인트(PCP/AP-1, PCP/AP-2)를 연결시키는 분배 시스템(Distribution System, DS)을 포함한다.

【0015】스테이션(Station, STA)은 IEEE 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리층(Physical Layer) 인터페이스를 포함하는 임의의 디바이스로서, 광의로는 비 액세스 포인트(Non-AP) 스테이션뿐만 아니라 액세스 포인트(AP)를 모두 포함한다. 또한, 본 명

세서에서는 스테이션과 AP 등의 무선랜 통신 디바이스를 모두 포함하는 개념으로서 '단말' 이라는 용어가 사용될 수 있다. 무선 통신을 위한 스테이션은 프로세서(Processor)와 트랜시버(transceiver)를 포함하고, 실시예에 따라 유저 인터페이스부와 디스플레이 유닛 등을 더 포함할 수 있다. 프로세서는 무선 네트워크를 통해 전송할 프레임을 생성하거나 또는 상기 무선 네트워크를 통해 수신된 프레임을 처리하며, 그 밖에 스테이션을 제어하기 위한 다양한 처리를 수행할 수 있다. 그리고, 트랜시버는 상기 프로세서와 기능적으로 연결되어 있으며 스테이션을 위하여 무선 네트워크를 통해 프레임을 송수신한다.

【0016】 액세스 포인트(Access Point, AP)는 자신에게 결합된(associated) 스테이션을 위하여 무선 매체를 경유하여 분배시스템(DS)에 대한 접속을 제공하는 개체이다. 인프라스트럭쳐 BSS에서 비 AP 스테이션들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이지만, 다이렉트 링크가 설정된 경우에는 비AP 스테이션들 사이에서도 직접 통신이 가능하다. 한편, 본 발명에서 AP는 PCP(Personal BSS Coordination Point)를 포함하는 개념으로 사용되며, 광의적으로는 집중 제어기, 기지국(Base Station, BS), 노드-B, BTS(Base Transceiver System), 또는 사이트 제어기 등의 개념을 모두 포함할 수 있다.

【0017】 복수의 인프라스트럭쳐 BSS는 분배 시스템(DS)을 통해 상호 연결될 수 있다. 이때, 분배 시스템을 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다.

【0018】 도 2는 본 발명의 다른 실시예에 따른 무선랜 시스템인 독립 BSS를 도시하고 있다. 도 2의 실시예에서 도 1의 실시예와 동일하거나 상응하는 부분은 중복적인 설명을 생략하도록 한다.

【0019】 도 2에 도시된 BSS-3는 독립 BSS이며 AP를 포함하지 않기 때문에, 모든 스테이션(STA-6, STA-7)이 AP와 접속되지 않은 상태이다. 독립 BSS는 분배 시스템으로의 접속이 허용되지 않으며, 자기 완비적 네트워크(self-contained network)를 이룬다. 독립 BSS에서 각각의 스테이션들(STA-6, STA-7)은 다이렉트로 서로 연결될 수 있다.

【0020】 도 3은 본 발명의 일 실시예에 따른 스테이션(100)의 구성을 나타낸 블록도이다.

【0021】 도시된 바와 같이, 본 발명의 실시예에 따른 스테이션(100)은 프로세서(110), 네트워크 인터페이스 카드(NIC, 120), 유저 인터페이스부(140), 디스플레이 유닛(150) 및 메모리(160)를 포함할 수 있다.

【0022】 먼저, 네트워크 인터페이스 카드(120)는 무선랜 접속을 수행하기 위한 모듈이며, 스테이션(100)을 위한 패킷 전송과 수신을 수행한다. 네트워크 인터페이스 카드(120)는 스테이션(100)에 내장되거나 외장으로 구비될 수 있으며, 실시예에 따라 서로 다른 주파수 밴드를 이용하는 적어도 하나의 네트워크 인터페이스 카드 모듈을 포함할 수 있다. 이를 테면, 상기 네트워크 인터페이스 카드는 2.4GHz, 5GHz 및 60GHz 등의 서로 다른 주파수 밴드의 네트워크 인터페이스 카드

모듈을 포함할 수 있다. 일 실시예에 따르면, 스테이션(100)은 6GHz 이상의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈을 구비할 수 있다. 각각의 네트워크 인터페이스 카드 모듈은 해당 네트워크 인터페이스 카드 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 AP 또는 외부 스테이션과 무선 통신을 수행할 수 있다. 네트워크 인터페이스 카드(120)는 스테이션(100)의 성능 및 요구 사항에 따라 한 번에 하나의 네트워크 인터페이스 카드 모듈만을 동작시키거나 동시에 다수의 네트워크 인터페이스 카드 모듈을 함께 동작시킬 수 있다. 스테이션(100)이 복수의 네트워크 인터페이스 카드 모듈을 포함할 경우, 각 네트워크 인터페이스 카드 모듈은 각각 독립된 형태로 구비될 수도 있으며, 하나의 칩으로 통합되어 구비될 수도 있다.

【0023】 다음으로, 유저 인터페이스부(140)는 스테이션(100)에 구비된 다양한 형태의 입/출력 수단을 포함한다. 즉, 유저 인터페이스부(140)는 다양한 입력 수단을 이용하여 유저의 입력을 수신할 수 있으며, 프로세서(110)는 수신된 유저 입력에 기초하여 스테이션(100)을 제어할 수 있다. 또한, 유저 인터페이스부(140)는 다양한 출력 수단을 이용하여 프로세서(110)의 명령에 기초한 출력을 수행할 수 있다.

【0024】 다음으로, 디스플레이 유닛(150)은 디스플레이 화면에 이미지를 출력한다. 상기 디스플레이 유닛(150)은 프로세서(110)에 의해 실행되는 컨텐츠 또는 프로세서(110)의 제어 명령에 기초한 유저 인터페이스 등의 다양한 디스플레이

오브젝트를 출력할 수 있다. 또한, 메모리(160)는 스테이션(100)에서 사용되는 제어 프로그램 및 그에 따른 각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션(100)이 AP 또는 외부 스테이션과 접속을 수행하는데 필요한 접속 프로그램이 포함될 수 있다.

【0025】 본 발명의 프로세서(110)는 다양한 명령 또는 프로그램을 실행하고, 스테이션(100) 내부의 데이터를 프로세싱 할 수 있다. 또한, 상기 프로세서(110)는 상술한 스테이션(100)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(110)는 메모리(160)에 저장된 AP와의 접속을 위한 프로그램을 실행하고, AP가 전송한 통신 설정 메시지를 수신할 수 있다. 또한, 프로세서(110)는 통신 설정 메시지에 포함된 스테이션(100)의 우선 조건에 대한 정보를 판독하고, 스테이션(100)의 우선 조건에 대한 정보에 기초하여 AP에 대한 접속을 요청할 수 있다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

【0026】 도 3에 도시된 스테이션(100)은 본 발명의 일 실시예에 따른 블록도로서, 분리하여 표시한 블록들은 디바이스의 엘리먼트들을 논리적으로 구별하여 도시한 것이다. 따라서 상술한 디바이스의 엘리먼트들은 디바이스의 설계에 따라 하나의 칩으로 또는 복수의 칩으로 장착될 수 있다. 또한, 본 발명의 실시예에서 상기 스테이션(100)의 일부 구성들, 이를 테면 유저 인터페이스부(140) 및 디스플레이 유닛(150) 등은 스테이션(100)에 선택적으로 구비될 수 있다.

【0027】 도 4는 본 발명의 일 실시예에 따른 AP(200)의 구성을 나타낸 블록도이다.

【0028】 도시된 바와 같이, 본 발명의 실시예에 따른 AP(200)는 프로세서(210), 네트워크 인터페이스 카드(220) 및 메모리(260)를 포함할 수 있다. 도 4에서 AP(200)의 구성 중 도 3의 스테이션(100)의 구성과 동일하거나 상응하는 부분에 대해서는 중복적인 설명을 생략하도록 한다.

【0029】 도 4를 참조하면, 본 발명에 따른 AP(200)는 적어도 하나의 주파수 밴드에서 BSS를 운영하기 위한 네트워크 인터페이스 카드(220)를 구비한다. 도 3의 실시예에서 전술한 바와 같이, 상기 AP(200)의 네트워크 인터페이스 카드(220) 또한 서로 다른 주파수 밴드를 이용하는 복수의 네트워크 인터페이스 카드 모듈을 포함할 수 있다. 즉, 본 발명의 실시예에 따른 AP(200)는 서로 다른 주파수 밴드, 이를 테면 2.4GHz, 5GHz, 60GHz 중 두 개 이상의 네트워크 인터페이스 카드 모듈을 함께 구비할 수 있다. 바람직하게는, AP(200)는 6GHz 이상의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈과, 6GHz 이하의 주파수 밴드를 이용하는 네트워크 인터페이스 카드 모듈을 구비할 수 있다. 각각의 네트워크 인터페이스 카드 모듈은 해당 네트워크 인터페이스 카드 모듈이 지원하는 주파수 밴드의 무선랜 규격에 따라 스테이션과 무선 통신을 수행할 수 있다. 상기 네트워크 인터페이스 카드(220)는 AP(200)의 성능 및 요구 사항에 따라 한 번에 하나의 네트워크 인터페이스 카드 모듈만을 동작시키거나 동시에 다수의 네트워크 인터페이스 카드 모듈을 함께 동작시킬 수 있다.

【0030】 다음으로, 메모리(260)는 AP(200)에서 사용되는 제어 프로그램 및 그에 따른 각종 데이터를 저장한다. 이러한 제어 프로그램에는 스테이션의 접속을 관리하는 접속 프로그램이 포함될 수 있다. 또한, 프로세서(210)는 AP(200)의 각 유닛들을 제어하며, 유닛들 간의 데이터 송수신을 제어할 수 있다. 본 발명의 실시예에 따르면, 프로세서(210)는 메모리(260)에 저장된 스테이션과의 접속을 위한 프로그램을 실행하고, 하나 이상의 스테이션에 대한 통신 설정 메시지를 전송할 수 있다. 이때, 통신 설정 메시지에는 각 스테이션의 접속 우선 조건에 대한 정보가 포함될 수 있다. 또한, 프로세서(210)는 스테이션의 접속 요청에 따라 접속 설정을 수행한다. 이에 대한 구체적인 실시예는 추후 기술하기로 한다.

【0032】 도 5는 본 발명의 일 실시예에 따른 PPDU 포맷에 따른 HE-SIG-A 필드의 구성을 도시한 것이다.

【0033】 HE PPDU 포맷은 HE SU PPDU, HE Extended Range SU PPDU, HE MU PPDU, HE Trigger-based PPDU로 구분되며, 각각의 PPDU 포맷에서 HE-SIG-A 필드의 서브필드 구성은 도 5(a), (b), (c)와 같다.

【0034】 도 5(a)의 HE-SIG-A 필드 구성은 HE SU PPDU와 HE Extended Range SU PPDU 전송에서 사용되며, 단일 AP와 단일 STA간의 통신에서의 시그널링을 위해 사용되며 추가적인 HE-SIG-B는 전송되지 않는다.

【0035】 도 5(b)의 HE-SIG-A 필드 구성은 HE MU PPDU 전송에서 사용되며, 단일 AP와 다중 STA간의 하향 동시 통신 또는 단일 STA와 단일 AP와의 상향 통신을 위해 사용할 수 있으며 도 6에서 나타내는 HE-SIG-B 필드와 협력하여 시그널링을 수행하게 된다.

【0036】 HE MU PPDU가 단일 AP와 다중 STA간의 하향 동시 통신에 사용되는 경우, HE-SIG-A는 PPDU의 전체적인 구성과 모든 STA들에게 공통적인 설정에 대한 시그널링을 담당하며 HE-SIG-B는 OFDMA/MIMO에서 주파수 대역 할당 정보 및 개별 STA들에게 별도로 적용되는 설정에 대한 시그널링을 담당한다.

【0037】 그러나 HE MU PPDU가 단일 STA와 단일 AP간의 상향 통신에 사용되는 경우, HE-SIG-A와 HE-SIG-B의 각 필드들은 본 발명의 실시예들에 따라 서로 다른 설정을 시그널링 할 수 있다.

【0038】 첫째, HE-SIG-A의 BW 서브필드는 3비트로서, DL MU의 경우 하향 PPDU의 대역폭을 나타내고, 20/40/80/160MHz와 Preamble Puncturing 모드 대역폭 80A/80B/160A/160B를 나타낼 수 있다. 이때 상기 Preamble Puncturing 모드 대역폭은 DL MU 전송에서만 가능하며, 이에 대한 상세한 설명은 도 8을 참조한다. 본 발명의 실시예에 따라 UL MU의 경우 상향 PPDU의 대역폭을 나타내고, 20/40/80/160MHz와 협대역 상향 전송 모드 대역폭 right-106-tone/left-106-tone을 나타낼 수 있다. 이때 right-106-tone/left-106-tone 시그널링은 각각 단일 STA이 단일 AP에게 UL MU PPDU로 상향 전송을 수행할 때 Primary 20MHz 채널에서 전체 242tone의 데이터 Resource Unit들 중에서 왼쪽 또는 오른쪽 106 tone RU만을 사용

하여 협대역으로 전송하는 것을 시그널링 한다. 즉 상향 UL MU PPDU 전송에서는 20MHz 내의 106-tone만을 활용하는 협대역 전송을 허용하되, 이에 대한 시그널링 오버헤드를 최소로 하기 위해 HE-SIG-A의 BW 필드에서 하향 전송에서만 존재하는 Preamble Puncturing 모드 대역폭 옵션들을 상향 전송에서는 다른 의미(협대역 전송)로 매핑하여 시그널링 하는 것이다. 만약 UL MU의 협대역 전송을 HE-SIG-B를 활용하여 시그널링 하는 경우, 도 6에서 설명하는 바와 같이 HE-SIG-B의 RU Allocation 필드와 User Specific Info 부분들을 중복적으로 사용하여 시그널링 하므로, 오버헤드가 증가할 수 있기 때문이다.

【0039】 둘째, SIG-B Compression 서브필드는 1비트로서, DL MU의 경우 Full-BW MU-MIMO 전송을 의미하며, SIG-B의 Common Block에 해당하는 RU Allocation 필드가 전송되지 않는다. 이는 전대역 MU-MIMO 전송의 경우 PPDU 전체 대역폭을 분할하여 전송하는 OFDMA 전송이 아니므로 별도의 RU Allocation 필드의 전송이 불필요하기 때문이다. 또한 이 경우 SIG-A의 Num of SIG-B Sym 서브필드는 MU-MIMO User의 수를 지시하고, SIG-B의 User Specific Info 부분은 도 6(d)-2와 같은 MU-MIMO User Specific info의 포맷을 사용하게 된다.

【0040】 본 발명의 실시예에 따라 UL MU의 경우 상기 SIG-B Compression 서브필드는 항상 1로 설정할 수 있으며, 이는 전대역 MU-MIMO가 아니더라도 UL MU의 경우에는 SIG-B 오버헤드를 줄이기 위해 SIG-B의 RU Allocation 서브필드를 생략할 수 있도록 SIG-B Compression 필드를 1로 셋팅하는 경우이며, 이 경우에도 SIG-A의 Num of SIG-B Sym은 SIG-B 심볼의 갯수를 지시하고, SIG-B의 User Specific Info

부분은 도 6(d)-1의 OFDMA user specific info 필드를 사용하는 것을 특징으로 한다. 이는 단일 STA의 상향 UL MU PPDU 전송에서는 SIG-B의 RU Allocation 필드의 시그널링이 불필요하므로 이를 제외할 수 있는 SIG-B Compression 서브필드를 1로 설정하지만, 이는 기존의 하향 전송에서의 전대역 MU-MIMO를 의미하는 것은 아니므로 기존의 Num of SIG-B Sym 서브필드는 그대로 유지하고, SIG-B의 User Specific Info 부분도 OFDMA 기반의 정보 형태로 유지하는 것이다.

【0041】 셋째, Num of SIG-B Sym 서브필드는 4비트로서, DL MU의 경우 SIG-B 필드의 심볼수를 나타내며 만약 SIG-B Compression 서브필드의 값이 1인 경우에만 Full-BW MU-MIMO에서의 User 수를 지시한다. 본 발명의 실시예에 따라 UL MU의 경우에도 SIG-B 필드의 심볼수를 나타내며 만약 SIG-B Compression 서브필드의 값이 1인 경우에도 SIG-B 심볼수를 계속 지시한다. 또한 본 발명의 또 다른 실시예에 따라 UL MU PPDU의 경우 SIG-B Compression 서브필드를 항상 1로 설정하여 SIG-B의 RU Allocation 서브필드를 전송하지 않음으로써 시그널링 오버헤드를 최소화할 수 있다. 또한 본 발명의 또 다른 실시예에 따르면 DL 또는 UL MU PPDU 구성에서, SIG-B Compression 서브필드가 1로 설정하여 Full-BW MU MIMO를 지시하였고, 따라서 Num of SIG-B Sym 서브필드가 MU MIMO User 수를 지시하는 경우에도, 만약 해당 User 수가 1개로 지시되는 경우에는 도 6(d)-1에서 도시한 HE-SIG-B의 사용자 정보 필드를 MU-MIMO 기반의 사용자 정보가 아닌 OFDMA 기반의 사용자 정보 필드로 설정한다. 이는 Full-BW MU MIMO를 지시하였으나 1명의 수신자를 지시하는 경우 이는 다중 사용자 MIMO라고 볼수 없으며 도 16(d)-2와 같은 MU MIMO 사용자 정보를 이용

하여 1명의 수신자에게 전송되는 시공간 스트림의 개수를 표시하는 것이 불가능하기 때문이다. 이는 상향 UL MU PPDU와 같이 1개의 non-AP STA가 1개의 AP에게 Full-BW MU PPDU를 전송하는 경우에 사용될 수 있다. 이 경우 SIG-B Compression 필드를 1로 셋팅하여 HE-SIG-B의 Common Block 필드의 전송을 없애서 시그널링 오버헤드를 줄이는 경우에도 HE-SIG-B의 User Specific 필드의 사용자 정보 (SIG-B 채널별로 1개가 전송)는 OFDMA 기반의 사용자 정보를 전송함으로써 수신자가 받아야 할 시공간 스트림의 개수를 정확히 지시하기 위함이다.

【0042】 도 5(c)의 HE-SIG-A 필드 구성은 HE Trigger-based PPDU 전송에서 사용되며, 다중 STA와 단일 AP간의 통신에서의 시그널링을 위해 사용되며 추가적인 HE-SIG-B는 전송되지 않는다.

【0044】 도 6는 본 발명의 일 실시예에 따른 HE MU PPDU 포맷의 HE-SIG-B 필드의 구성을 도시한 것이다.

【0045】 HE-SIG-B 필드는 HE MU PPDU에 존재하며, 20MHz 단위로 전송된다. 또한, HE-SIG-B 필드는 HE MU PPDU를 수신하기 위해 필요한 정보를 지시한다. 도 6(a)에 도시된 바와 같이, HE-SIG-B는 공통 블록 필드와 사용자 특정 필드로 구성된다.

【0046】 도 6(b)는 HE-SIG-B의 공통 블록 필드의 서브필드 구성의 일 실시예를 도시한다. 먼저, 공통 블록 필드는 리소스 유닛 할당(RA) 필드를 포함한다. 도

6(c)는 RA 필드의 일 실시예를 도시한다.

【0047】 도 6(c)를 참조하면, RA 필드는 주파수 도메인에서 특정 대역폭(예를 들어, 20MHz)의 리소스 유닛 할당에 대한 정보를 포함한다. 더욱 구체적으로, RA 필드는 8비트 단위로 구성되며, 특정 대역폭을 구성하는 리소스 유닛들의 크기와 주파수 도메인에서의 그들의 배열을 인덱싱한다. 또한, RA 필드는 각 리소스 유닛에서의 사용자 수를 지시할 수 있다. PPDU가 전송되는 총 대역폭이 기 설정된 대역폭 (예를 들어, 40MHz) 보다 클 경우, RA 필드는 8비트의 배수의 크기로 설정되어 상기 특정 대역폭 단위로 정보를 전달할 수 있다.

【0048】 분할된 각 리소스 유닛은 일반적으로 하나의 사용자에게 할당된다. 그러나 일정 대역폭(예를 들어, 106-톤) 이상의 리소스 유닛은 MU-MIMO를 이용하여 복수의 사용자에게 할당될 수 있다. 이때, RA 필드는 해당 리소스 유닛의 사용자 수 정보를 지시할 수 있다. 뿐만 아니라, RA 필드는 사용자 특정 필드가 전송되지 않는 특정 리소스 유닛 즉, 사용자에게 할당되지 않는 특정 리소스 유닛(즉, 빈 RU)을 기 설정된 인덱스를 통해 지시할 수 있다. 일 실시예에 따르면, 특정 리소스 유닛은 20MHz 채널의 배수의 대역폭을 갖는 리소스 유닛(RU) 즉, 242-톤 RU, 484-톤 RU, 996-톤 RU 등을 포함한다. 상기 인덱스 값이 지시하는 빈(empty) RU에서는 데이터 전송이 수행되지 않는다. 이와 같이, 단말은 HE-SIG-B의 RA 필드의 기 설정된 인덱스를 통해 20MHz 단위의 불연속 채널 할당 정보를 시그널링 할 수 있다.

【0049】 본 발명의 실시예에 따르면, 80MHz 이상의 총 대역폭으로 PPDU가 전송될 경우, 공통 블록 필드는 80MHz에서의 중앙 26-톤 RU가 사용자에게 할당되었는

지 여부를 나타내는 필드(이하, C26 필드)를 더 포함할 수 있다. 상기 C26 필드는 공통 블록 필드 내에서 RA 필드 이전 또는 이후에 위치하는 1비트 지시자로 구성될 수 있다.

【0050】 한편, 사용자 특정 필드는 복수의 사용자 필드들로 구성되며, 할당된 각 리소스 유닛에 지정된 STA를 위한 정보를 전달한다. 사용자 특정 필드에 포함될 사용자 필드의 총 개수는 RA 필드 및 C26 필드에 기초하여 결정될 수 있다. 복수의 사용자 필드들은 사용자 블록 필드 단위로 전송된다. 사용자 블록 필드는 2개의 사용자 필드와 CRC 필드 및 테일 필드의 결합으로 만들어진다. 사용자 필드들의 총 개수에 따라 마지막 사용자 블록 필드는 1개 또는 2개의 STA를 위한 정보를 포함할 수 있다. 예를 들어, 총 3개의 사용자(즉, STA1, STA 및 STA3)가 지정된 경우, 첫 번째 사용자 블록 필드에서는 STA1 및 STA2를 위한 정보가 코딩 되어 CRC/테일 필드와 함께 전송되고, 마지막 사용자 블록 필드에서는 STA3를 위한 정보가 코딩 되어 CRC/테일 필드와 함께 전송 될 수 있다.

【0051】 도 6(d)-1 및 도 6(d)-2는 각각 HE-SIG-B의 사용자 필드의 서브필드 구성의 실시예들을 도시한다. 도 6(d)-1은 OFDMA 전송을 위한 사용자 필드를 나타내며, 도 6(d)-2는 MU-MIMO 전송을 위한 사용자 필드를 나타낸다. 각각의 사용자 필드는 대응하는 리소스 유닛의 수신자 AID를 지시한다. 예외적으로, HE MU PPDU가 상향 전송에 사용될 경우, 사용자 필드는 송신자 AID를 지시할 수 있다. 하나의 리소스 유닛에 하나의 사용자가 할당된 경우(즉, non-MU-MIMO 할당), 사용자 필드는 도 6(d)-1에 도시된 바와 같이 NSTS(Number of Spatial Streams), TxBF, MCS, DCM

및 코딩 필드를 포함한다. 반면에, 하나의 리소스 유닛에 다수의 사용자가 할당된 경우(즉, MU-MIMO 할당), 사용자 필드는 도 6(d)-2에 도시된 바와 같이 공간 구성 필드(SCF), MCS, DCM 및 코딩 필드를 포함한다. MU-MIMO 할당을 통해 PPDU를 수신하는 각 STA는 해당 리소스 유닛에서 자신을 위한 공간적 스트림의 위치와 개수를 식별해야 한다. 이를 위해, MU-MIMO 전송을 위한 사용자 필드는 공간 구성 필드(SCF)를 포함한다.

【0052】 도 6(e)는 HE-SIG-B의 SCF의 일 실시예를 도시한다. SCF는 각 STA를 위한 공간적 스트림 개수와 MU-MIMO 할당에서의 공간적 스트림 총 개수를 지시한다. 각 STA는 RA 필드를 통해 해당 PPDU의 OFDMA 및/또는 MIMO 할당을 식별하고, 사용자 특정 필드 상에서 호출된 순서에 따라 해당 STA가 MU-MIMO 할당을 통해 데이터를 수신하는지 여부를 식별한다. 만약 STA가 non-MU-MIMO 할당을 통해 데이터를 수신하는 경우, 사용자 필드를 도 6(d)-1의 포맷에 따라 해석한다. 그러나 STA가 MU-MIMO 할당을 통해 데이터를 수신하는 경우, 사용자 필드를 도 6(d)-2의 포맷에 따라 해석한다. 한편, SIG-B 압축 필드가 전체 대역폭 MU-MIMO를 지시할 경우, HE-SIG-B에는 RA 필드가 존재하지 않는다. 이때, 사용자 특정 필드에서 시그널링 되는 모든 STA들은 MU-MIMO 할당을 통해 데이터를 수신하므로, 상기 STA들은 사용자 필드를 도 6(d)-2의 포맷에 따라 해석한다.

【0053】 본 발명의 일 실시예에 따르면 UL MU PPDU의 경우 상기 HE-SIG-B의 공통 블록 필드가 항상 전송되지 않는 것을 특징으로 한다. 즉 단일 STA가 단일 AP에게 전송하는 UL MU PPDU의 경우 상기 HE-SIG-B의 공통 블록 필드내의 C26 필드와

RA 필드의 시그널링 정보가 불필요하기 때문에 HE MU PPDU의 HE-SIG-A의 DL/UL Indication에서 UL을 지시하는 경우 HE-SIG-B의 공통 블록 필드는 전송하지 않는 것을 특징으로 한다. 이때 HE-SIG-A의 SIG-B Compression 필드를 1로 셋팅하여 상기 공통 블록 필드가 전송되지 않음을 추가적으로 명시적으로 시그널링 할 수 있으나, 이 경우에도 해당 UL MU PPDU는 전대역 MU-MIMO 전송을 의미하는 것은 아니다. 따라서 SIG-B Compression 필드가 1로 셋팅되었음에도 HE-SIG-B의 사용자 특정 필드는 도 6(d)-1의 non-MU-MIMO 할당 구성을 기반으로 시그널링 할 수 있다.

【0055】 도 7은 단일 STA와 AP간에 HE MU PPDU를 이용한 전송이 수행되는 실시예를 도시한다.

【0056】 전술한 바와 같이, HE MU PPDU는 하향 DL MU 전송뿐만 아니라 상향 UL MU 전송에서도 사용될 수 있다.

【0057】 도 7은 단일 STA의 상향 전송에서 HE MU PPDU가 사용되는 일 실시예를 도시한다.

【0058】 본 발명의 실시예에 따르면, STA는 도 7(a)에 도시된 바와 같이 20MHz 대역폭 이하의 리소스 유닛(즉, 협대역)을 이용하여 전송을 수행할 수 있다. STA는 특정 리소스 유닛에 전송 파워를 집중함으로 데이터의 전송 거리를 증가시킬 수 있다. 도 7(b) 내지 도 7(d)는 이러한 협대역 전송을 시그널링하는 실시예들을 도시한다.

【0059】본 발명의 실시예에 따르면, 협대역 전송은 도 7(b)에 도시된 바와 같이 HE-SIG-A의 필드들을 활용하여 시그널링 될 수 있다. 예를 들어, 상향 전송에서 HE MU PPDU가 사용될 경우, HE-SIG-A에서 BW 필드, SIG-B Compression 필드, HE-SIG-B 심볼의 개수 필드들은 다른 용도로 사용될 수 있다. BW 필드의 3비트 값들 중에서 Preamble Puncturing에 해당하는 4~7의 값은 UL MU 전송에서는 협대역 106-톤 전송의 시그널링을 위해 사용될 수 있다. 이 경우 SIG-B Compression 필드는 1로 설정하여 HE-SIG-B의 공통 블록 필드의 전송을 하지 않음으로써 오버헤드를 줄일 수 있으며, HE-SIG-B의 사용자 특정 필드에서는 OFDMA 기반의 사용자 특정 정보가 1개 전송되는 것을 특징으로 한다. 또한 이 경우 HE-SIG-B 심볼의 개수 필드는 SIG-B Compression 필드가 1로 설정된 경우에도 MU-MIMO User의 숫자가 아닌 SIG-B 심볼의 갯수를 계속 지시할 수 있다.

【0060】본 발명의 일 실시예에 따르면, 협대역 전송은 도 7(c)에 도시된 바와 같이 HE-SIG-B의 사용자 필드에 삽입되는 널 STA ID를 통해 시그널링 될 수 있다. 더욱 구체적으로, HE-SIG-B의 RA 필드는 특정 채널에서의 리소스 유닛 분할 형태에 대한 정보를 지시할 수 있다. 예를 들어, 20MHz의 대역폭이 OFDMA에 기반하여 2개의 106 리소스 유닛들로 분할되고 중앙의 26 리소스 유닛은 사용하지 않는 경우, RA 필드는 도 6(c)에 도시된 바와 같이 “0110zzzz”을 시그널링할 수 있다. 이때, 분할된 2개의 106 리소스 유닛들 중 상향 데이터 전송에 사용되는 리소스 유닛에 대응하는 사용자 필드에 수신자 또는 송신자의 AID가 삽입될 수 있다. 반면에, 데이터 전송이 수행되지 않는 나머지 리소스 유닛에 대응하는 사용자 필드

에는 널 STA ID가 삽입될 수 있다.

【0061】 예를 들어, 2개의 106 리소스들 중 2번째 106-톤 RU를 통해서만 데이터가 전송되는 경우, 1번째 사용자 필드에는 널 STA ID가 삽입될 수 있다.

【0062】 본 발명의 다른 실시예에 따르면, 도 7(d)에 도시된 바와 같이 협대역 전송을 위해 HE-SIG-B의 RA 필드에 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다. 더욱 구체적으로, HE-SIG-B의 RA 필드는 상향 전송이 수행되는 특정 106-톤 RU를 명시적으로 인덱싱할 수 있다. 이 경우, RA 필드에서 지시하는 리소스 유닛에 대응하는 하나의 사용자 필드만 운반되므로 시그널링 오버헤드가 크게 줄어들 수 있다. 일 실시예에 따르면, 상향 리소스 유닛 할당의 인덱스 값들은 DL MU 전송을 위한 RA 필드 구성의 미 할당된(즉, TBD) 인덱스들 중에서 사용될 수 있다. 다른 실시예에 따르면, RA 필드 내에서 상향 리소스 유닛 할당의 인덱스 값들이 새롭게 정의될 수 있다.

【0063】 한편 본 발명의 또 다른 실시예에 따르면, 도 7(e)에 도시된 바와 같이 HE MU PPDU를 이용한 상향 전송은 협대역 뿐만 아니라 20MHz, 40MHz, 80MHz, 160MHz(80+80MHz)의 전체 대역폭을 통해서도 수행될 수 있다. 이때, HE-SIG-A의 대역폭 필드는 PPDU의 총 대역폭을 지시하며, SIG-B 압축 필드는 HE-SIG-B 필드의 압축 모드를 지시할 수 있다. 따라서, 상향 HE MU PPDU에서 HE-SIG-B의 RA 필드는 생략될 수 있다. 한편, 하향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우, HE-SIG-B 심볼의 개수 필드는 MU-MIMO User의 수를 지시하고, HE-SIG-B의 사용자 특정 필드에서는 MU-MIMO 기반의 사용자 특정 정보가 지시

될 수 있었다. 그러나 상향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시할 경우에는, HE-SIG-B 심볼의 개수 필드는 여전히 SIG-B 심볼의 개수를 지시하고, HE-SIG-B에서는 OFDMA 기반의 사용자 특정 정보가 지시될 수 있다. 또한 상향 또는 하향 HE MU PPDU에서 SIG-B 압축 필드가 HE-SIG-B 필드의 압축 모드를 지시하고, HE-SIG-B 심볼의 개수 필드가 MU-MIMO 사용자의 수를 지시하는 경우, 만약 MU-MIMO의 사용자 개수를 1명으로 지시한다면, HE-SIG-B의 사용자 특정 필드에서는 MU-MIMO 기반의 사용자 특정 정보가 아닌 OFDMA 기반의 사용자 특정 정보가 지시될 수 있다. 이는 도 6(d)-2에서 지시한 MU-MIMO 기반의 사용자 특정 정보의 경우 그 안에 포함된 Spatial Configuration Field의 필드 구성 (도 6(e))이 최소 2명 이상의 수신자들의 각각의 시공간 스트림의 개수 분배만을 지시하기 때문에, 1명의 수신자인 경우에는 MU-MIMO 기반의 사용자 특정 정보를 통하여 시공간 스트림의 개수를 지시하는 것이 불가능하기 때문이다.

【0065】도 8은 본 발명의 실시예에 따른 불연속 채널 할당 방법을 도시한다.

【0066】도 8의 실시예에 따르면, 20MHz 별로 다른 정보가 전송되지만 40MHz 단위로는 같은 정보가 전송되는 2개의 독립적인 HE-SIG-B 콘텐츠 채널들 중 적어도 하나가 전송되는 위치는 가변적일 수 있다. 이때, 수신자는 HE-SIG-B 콘텐츠 채널을 수신하기 위한 디코딩 채널을 가변적으로 설정할 수 있어야 한다. 도 8의 실시예에서는, P20 채널에서 HE-SIG-B 콘텐츠 채널 1이 전송되고, HE-SIG-B 콘텐츠 채

널 2가 전송되는 채널이 가변될 수 있다고 가정한다. 그러나 P40 채널 내에서의 P20 채널의 물리적 주파수 순서에 따라, P20 채널에서 HE-SIG-B 콘텐츠 채널 2가 전송될 수도 있다. 이때에는, 채널 구성에 따라 HE-SIG-B 콘텐츠 채널 1이 전송되는 채널이 가변 될 수 있다. 본 발명의 실시예에 따른 불연속 채널 할당 정보는 도 8에 나열된 채널 구성들 중 적어도 일부의 구성을 지원할 수 있다.

【0067】 도 8(a)는 P80(Primary 80MHz) 대역 중 P20 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 2는 P80 대역에서 전송되지 않는다. 도 8(b)는 P80 대역 중 P40 채널이 기본적으로 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2 모두는 적어도 P40 채널을 통해 전송될 수 있다. 실시예에 따라, S40 채널의 2개의 20MHz 채널들 중 어느 하나 즉, S40A 채널 또는 S40B 채널이 할당된 불연속 채널이 사용될 수 있다. S40A 채널 및 S40B 채널이 모두 할당되면 80MHz 또는 160MHz 대역폭의 연속 채널이 구성된다.

【0068】 도 8(c)는 P80 대역 중 P20 채널과 S40 채널만 할당되는 채널 구성을 도시한다. 이때, HE-SIG-B 콘텐츠 채널 1은 P20 채널 및 S40A 채널을 통해 전송되고, HE-SIG-B 콘텐츠 채널 2는 S40B 채널을 통해 전송될 수 있다. 도 8(c)의 실시예의 경우, HE-SIG-B 콘텐츠 채널 1 및 HE-SIG-B 콘텐츠 채널 2는 본 발명의 실시예에 따른 HE-SIG-B 콘텐츠 채널 전송 규칙에 맞게 전송될 수 있다.

【0069】 한편, HE-SIG-A의 대역폭 필드(BW)의 비트 수 제한으로 인해, 대역폭 필드는 상기 채널 구성들 중 일부의 구성을 지시할 수 있다. 대역폭 필드가 3비

트로 구성될 경우, 대역폭 필드는 4가지 추가적인 불연속 채널 할당 정보를 인덱싱할 수 있다. 본 발명의 실시예에 따르면, 대역폭 필드는 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑쳐링 되는 일부 채널 정보를 지시할 수 있다. 이때, 총 대역폭은 80MHz 대역폭과 160MHz(또는, 80+80MHz) 대역폭 중 어느 하나일 수 있다. 본 발명의 일 실시예에 따르면, 대역폭 필드는 도 8(c)에 도시된 S20 채널의 펑쳐링, 도 8(b)에 도시된 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑쳐링을 각각 인덱싱할 수 있다.

【0070】 본 발명의 실시예에 따르면, HE-SIG-A의 대역폭 필드가 지시하는 채널 구성에서, 추가적인 펑쳐링 정보는 HE-SIG-B의 RA 필드를 통해 지시될 수 있다. 예를 들어, 대역폭 필드가 80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 어느 하나의 펑쳐링을 지시할 경우 (도 8(b)의 3번째 및 5번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑쳐링 되는지를 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑쳐링을 지시할 경우(도 8(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S40 채널 중 어느 20MHz 채널이 펑쳐링 되는지를 지시할 수 있다. 이에 더하여, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S40 채널의 2개의 20MHz 채널들 중 적어도 하나의 펑쳐링을 지시할 경우(도 8(b)의 2번째, 4번째 및 6번째 채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑쳐링을 지시할 수 있다. 또한, 대역폭 필드가 160MHz 또는 80+80MHz의 총 대역폭에서 S20 채널의 펑쳐링을 지시할 경우(도 8(c)의 2번째

채널 구성), 리소스 유닛 할당 필드는 S80 채널에서의 추가적인 펑처링을 지시할 수 있다.

【0071】 이와 같이 펑처링이 지시된 채널들은 사용자에게 할당되지 않는다. 불연속 PPDU를 수신한 단말은 PPDU가 전송되는 총 대역폭 정보 및 상기 총 대역폭 내에서 펑처링 되는 채널 정보를 해당 PPDU의 HE-SIG-A의 대역폭 필드를 통해 획득할 수 있다. 또한, 단말은 추가적인 채널 펑처링 정보를 해당 PPDU의 HE-SIG-B의 RA 필드를 통해 획득할 수 있다. 단말은 이와 같이 획득된 불연속 채널 할당 정보에 기초하여 PPDU를 디코딩한다.

【0073】 도 9는 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 세분화된 PHY-CCA.indication 방법을 도시한다.

【0074】 도 9(a)의 실시예에 따르면, 160MHz 대역에서 DL MU PPDU를 전송하고자 하는 STA는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 채널들을 이용하여 PPDU를 전송할 수 있다. 이때 도 9(a)에서와 같이 P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 현재 무선랜 표준의 CCA indication 기법에 기반하면 도 9(a)와 같이 P40의 PPDU 전송만이 가능하다. 이는 현재 무선랜 STA 내부의 PHY 계층과 MAC 계층간의 내부 시그널링 primitive 에서 정의된 PHY 계층의 CCA 결과를 보고하는 PHY-CCA.indication primitive가 primary, secondary, secondary40, secondary80의 채널 지시자 4개 값만을 지시할 수 있기 때문이다. 즉

최대 160MHz 대역폭에서 실질적으로 busy한 채널들이 S40A와 S80B의 2개의 20MHz 채널들 뿐이라 하더라도, PHY 계층에서 해당 busy 채널들을 MAC 계층에 지시해 줄 방법이 없으므로, 현재는 PHY 계층에서 PHY-CCA.indication(BUSY, {secondary40}) 을 MAC 계층으로 리포트하게 되고, MAC은 idle 한것으로 판별된 primary, secondary 채널을 조합한 40MHz PPDU 전송만을 수행할 수 있다. 이는 기존의 연속적인 채널 할당을 통한 PPDU 전송에서는 전혀 문제가 되지 않는다.

【0075】 그러나 도 8과 같은 불연속 채널 할당을 통한 DL MU PPDU 전송을 위해서는 보다 세밀한 PHY-CCA.indication 방법이 필요하다. 이를 위해서 PHY 계층이 MAC 계층에 CCA 결과를 보고하는 primitive의 채널 단위는 primary, secondary, secondary40A, secondary40B, secondary80A, secondary80B, secondary80C, secondary80D 또는 이와 유사한 형태로 20MHz 채널 단위로 세분화 할 수 있다. 또한 primary를 제외한 나머지 채널들이 busy한 경우에만 해당 busy한 채널들의 리스트를 모두 보고할 수 있다. 예를 들어 기존에는 secondary 채널이 busy한 경우에는 이후의 secondary40, secondary80 채널의 busy 여부는 MAC 계층에 indication 하지 않았던 것에 반하여, 새롭게 제안하는 방법에서는 primary 채널이 idle한 경우에는 busy로 판별되는 모든 채널들을 동시에 보고할 수 있게 된다. 예를 들어 도 9(a)와 같은 상황의 CCA 결과는 PHY-CCA.indication(BUSY, {secondary40A, secondary80B})로 보고할 수 있다. 그러나 만약 primary 채널이 busy하면 busy로 판별되는 secondary 채널들의 정보는 추가적으로 indication하지 않는다. 이와 같은 개선된 PHY-CCA.indication primitive를 사용하여 MAC 계층은 도 9(b)와 같은 불연속 채널

할당 기반 DL MU PPDU 전송을 수행할 수 있게 된다.

【0077】 도 10은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQRP/BQR 교환 및 시그널링 방법을 도시한다.

【0078】 도 10(a)의 실시예에 따르면, 160MHz 대역에서 DL MU PPDU를 전송하고자 하는 AP는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 채널들을 이용하여 DL MU PPDU를 전송할 수 있다. 이때 도 10(a)에서와 같이 다수의 STA들에게 MU-RTS를 전송하는 경우 해당 MU-RTS는 non-HT/non-HT duplicate 또는 HE SU PPDU와 같은 연속적인 채널 할당 기반 전송만 가능하므로, P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 도 9(a)와 같이 Primary 40MHz를 점유하는 MU-RTS의 전송만이 가능하다. 이후 MU-RTS에서 지시한 다수의 STA들로부터 동시 CTS를 수신할 수 있으나, 이를 기반으로 각 STA들의 가용 채널은 인지할 수 없다. 이를 위해 AP는 불연속 채널 할당 기반 전송이 가능한 DL MU PPDU 포맷을 사용하여 BQRP(Bandwidth Query Report Poll) 프레임을 전송할 수 있고, 이에 대한 응답으로 각 STA들로부터 BQR(Bandwidth Query Report) 프레임을 수신하여 해당 STA들에게 해당 채널들이 available한지를 파악할 수 있다. 이러한 BQRP/BQR 시퀀스를 통해 STA들의 가용 채널 정보를 확인하여 AP는 불연속 채널 할당 기반 DL MU PPDU 전송을 수행할 수 있다. 도 10(a)의 예에서 AP는 자신이 idle하다고 감지한 채널들 중에서 P40 채널에서 STA1, S40B 채널에서 STA2, S80A 채널에서 STA3, S80C 채널에서

STA4, S80D 채널에서 STA5에게 BQRP를 전송하였다. 이후 AP는 STA1, STA3, STA5로부터 BQR 리포트를 수신하였으므로, S40B와 S80C에 할당한 STA2와 STA4의 응답은 수신하지 못하였으므로 해당 채널들이 해당 STA들에게 busy함을 인지할 수 있다.

【0079】도 10(b)의 실시예에 따르면, BQR 필드의 포맷은 2비트 BW Indication 필드와 8비트 BW Bitmap 필드로 구성될 수 있다. 또한 본 발명의 실시예에 따라서 BW Indication 필드는 생략될 수 있다. 도 10(a)와 같은 예제에서 BQRP를 수신한 후 전송하는 solicited BQR에서 각 STA들 (예: STA1, STA3, STA5)은 자신의 BQR을 전송할 때 각각 20/40/80/160(80+80)MHz로 설정된 BW Bitmap들 중 어떤 BW indication을 사용할 것인지에 대한 결정이 필요할 수 있으며 본 발명의 실시예들은 다음과 같다. 이때 20MHz 비트맵을 리포트 하는 경우 Primary 20MHz 채널을 지시하며, 40MHz 비트맵을 리포트하는 경우 Primary 40MHz 채널을 지시하며 첫번째 비트는 Primary 20MHz 채널을 지시한다. 이때 80MHz 비트맵을 리포트 하는 경우 Primary 80MHz 채널을 지시하며 첫번째~네번째 비트들은 80MHz 대역폭내에서 주파수 절대값이 낮은 20MHz 채널들을 순차적으로 지시한다. 이때 160(80+80)MHz 비트맵을 리포트 하는 경우 Primary 160(80+80)MHz 채널을 지시하며 첫번째~여덟번째 비트들은 160(80+80)MHz 대역폭내에서 주파수 절대값이 낮은 20MHz 채널들을 순차적으로 지시한다.

【0080】첫째, 각 STA들은 BQRP를 수신한 후 SIFS 동안에 자신이 수행할 수 있었던 CCA 결과 값들을 임의의 BW Indication 값을 사용하여 개별적으로 시그널링 한다. 예를 들어 STA1이 BQRP를 수신한 40MHz에 대해서만 CCA를 수행한 경우 BW

Indication 필드를 40MHz를 지시하고 BW Bitmap 필드에서 2개의 bitmap 결과만을 전송할 수 있다. 또한 STA1이 80MHz에 대한 CCA를 수행한 경우 BW indication 필드를 80MHz를 지시하고 BW Bitmap 필드에서 4개의 bitmap 결과들을 전송할 수 있다. 이 방법의 경우 각 non-AP STA들이 자신들의 CCA 수행 능력에 기반하여 자율적으로 BQR의 BW Bitmap 지시 대역폭을 설정할 수 있다는 장점이 있으나, AP 입장에서는 특정 STA의 BQR 정보가 부족하게 수신될 수 있다.

【0081】 둘째, 각 STA들은 BQRP가 전송된 DL MU PPDU의 전체 대역 또는 BQR이 전송되는 Trigger-based PPDU의 전체 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA들에게 자명하므로 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 방법의 경우 non-AP STA들의 CCA 수행 능력을 고려하지 않고 일괄적인 BW Bitmap 지시 대역폭이 결정된다는 단점이 있다. 만약 특정 STA이 AP가 요구하는 대역폭에 대한 CCA를 수행하지 못하였을 경우 해당 채널들은 Busy 상태로 설정하여 BQR을 전송해야 한다.

【0082】 셋째, 각 STA들은 BQRP나 BQR이 전송되는 PPDU의 전체 대역폭에 상관없이, 해당 BSS가 운영되는 전체 대역폭 또는 자신이 지원하는 전체 대역폭들 중 작은 값을 기반으로 해당 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명한 경우 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 경우는 BQRP/BQR이 전송되는 PPDU의 대역폭보다 더 넓은 대역폭으로 이후에 DL MU PPDU가 전송될 수 있음을 고려하여 해당 BSS 또는 자신이 지원하는 최대 대역폭의 채널 상태를 지시

하는 BQR을 송신하는 것이다.

【0084】 도 11은 본 발명의 실시예에 따른 불연속 채널 할당 기반 DL MU PPDU 전송을 위한 BQR 전송 및 시그널링 방법을 도시한다.

【0085】 도 11(a)-1의 실시예에 따르면, UL SU PPDU를 전송하고자 하는 STA는 PHY 계층에서 160MHz 대역에서의 CCA 과정을 수행한 후 이 결과를 기반으로 idle로 판별된 연속 채널들을 이용하여 UL SU PPDU를 전송할 수 있다. 이때 도 11(a)-1에서와 같이 HE SU PPDU는 연속적인 채널 할당 기반 전송만 가능하므로, P20 채널부터 순차적으로 번호를 부여하였을 시 3번째와 5번째 채널, 또는 S40A와 S80B 채널이 busy인 경우에 도 10(a)와 같이 Primary 40MHz를 점유하는 SU PPDU의 전송만이 가능하다. 이때 해당 SU PPDU에서 상기 STA는 자신이 감지한 CCA 결과를 BQR(Bandwidth Query Report) 프레임을 통하여 추가적으로 전송할 수 있다. 이를 수신한 AP는 해당 STA에게 어떤 채널들이 available 한지를 파악할 수 있다.

【0086】 또한 도 11(a)-2의 실시예에 따르면, AP로부터 BQRP가 포함되지 않은 일반적인 DL Trigger 프레임을 수신하고 이에 대한 응답으로 Trigger-based PPDU를 전송하고자 하는 STA는 PHY 계층에서 CCA 과정을 수행한 후 이 결과를 기반으로 BQR 프레임을 포함하여 전송할 수 있다. 이를 수신한 AP는 각 STA들에게 어떤 채널들이 available 한지를 파악할 수 있다. 이러한 Unsolicited BQR 시퀀스를 통해 AP는 각 STA들의 가용 채널 정보를 수시로 확인하고 이에 기반하여 AP는 불연속 채널 할당 기반 DL MU PPDU 전송을 수행할 수 있다.

【0087】도 11(b)의 실시예에 따르면, BQR 필드의 포맷은 2비트 BW Indication 필드와 8비트 BW Bitmap 필드로 구성될 수 있다. 또한 본 발명의 실시예에 따라서 BW Indication 필드는 생략될 수 있다. 도 11(a)-1/2와 같은 예제에서 unsolicited BQR을 전송하는 STA는 자신의 BQR을 전송할 때 각각 20/40/80/160(80+80)MHz로 설정된 BW Bitmap들 중 어떤 BW indication을 사용할 것인지에 대한 결정이 필요할 수 있으며 본 발명의 실시예들은 다음과 같다.

【0088】첫째, 각 STA들은 자신이 BQR을 포함한 PPDU를 전송하기 위해 수행할 수 있었던 CCA 결과 값들을 임의의 BW Indication 값을 사용하여 개별적으로 시그널링 한다. 예를 들어 STA이 40MHz PPDU를 전송하기 전 해당 40MHz에 대해서만 CCA를 수행한 경우 BW Indication 필드를 40MHz를 지시하고 BW Bitmap 필드에서 2개의 bitmap 결과만을 전송할 수 있다. 그러나 STA이 40MHz PPDU를 전송하기 전 해당 PPDU의 BW보다 더 넓은 160MHz에 대한 CCA를 수행한 경우 BW indication 필드를 160MHz를 지시하고 BW Bitmap 필드에서 8개의 bitmap 결과들을 전송할 수 있다. 이 방법의 경우 각 non-AP STA들이 자신들의 CCA 수행 능력에 기반하여 자율적으로 BQR의 BW Bitmap 지시 대역폭을 설정할 수 있다는 장점이 있다.

【0089】둘째, 각 STA들은 BQR이 전송되는 PPDU의 전체 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명하므로 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. 이 방법의 경우 non-AP STA들의 CCA 수행 능력을 고려하지 않고 일괄적인 BW Bitmap 지시 대역폭이 결정된다는 단점이 있다. 만약 특정 STA이 자신이

전송하는 PPDU의 전체 대역폭에 대한 CCA를 수행하지 못하였을 경우 unsolicited BQR 전송을 수행하지 않거나, BQR 전송을 수행하는 경우에는 CCA를 수행하지 못한 채널들은 Busy 상태로 설정하여 BQR을 전송해야 한다. 이는 Trigger-based PPDU의 전송과 같이 전체 PPDU의 대역폭이 자신이 실제 데이터를 전송하는 대역폭보다 큰 경우에 발생할 수 있다.

【0090】셋째, 각 STA들은 BQR이 전송되는 PPDU의 전체 대역폭에 상관없이, 해당 BSS가 운영되는 전체 대역폭 또는 자신이 지원하는 전체 대역폭들 중 작은 값을 기반으로 해당 대역에 대한 CCA를 수행하고 해당 bitmap 결과들을 전송할 수 있다. 이 경우는 해당 대역폭 BW가 BQR 전송 STA와 수신 AP에게 자명한 경우 별도의 BW Indication 필드의 전송이 필요치 않을 수 있다. . 이 경우는 BQR이 전송되는 PPDU의 대역폭보다 더 넓은 대역폭으로 이후에 DL MU PPDU가 전송될 수 있음을 고려하여 해당 BSS 또는 자신이 지원하는 최대 대역폭의 채널 상태를 지시하는 BQR을 송신하는 것이다.

【0092】상기와 같이 무선랜 통신을 예로 들어 본 발명을 설명하였지만, 본 발명은 이에 한정하지 않으며 셀룰러 통신 등 다른 통신 시스템에서도 동일하게 적용될 수 있다. 또한 본 발명의 방법, 장치 및 시스템은 특정 실시예와 관련하여 설명되었지만, 본 발명의 구성 요소, 동작의 일부 또는 전부는 범용 하드웨어 아키텍쳐를 갖는 컴퓨터 시스템을 사용하여 구현될 수 있다.

【0093】전술한 본 발명의 설명은 예시를 위한 것이며, 본 발명이 속하는 기

술분야의 통상의 지식을 가진 자는 본 발명의 기술적 사상이나 필수적인 특징을 변경하지 않고서 다른 구체적인 형태로 쉽게 변형이 가능하다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시예들은 모든 면에서 예시적인 것이며 한정적인 것이 아는 것으로 해석해야 한다. 예를 들어, 단일형으로 설명되어 있는 각 구성 요소는 분산되어 실시될 수도 있으며, 마찬가지로 분산된 것으로 설명되어 있는 구성 요소들도 결합된 형태로 실시될 수 있다.

【0094】 본 발명의 범위는 상기 상세한 설명보다는 후술하는 특허청구범위에 의하여 나타내어지며, 특허청구범위의 의미 및 범위 그리고 그 균등 개념으로부터 도출되는 모든 변경 또는 변형된 형태가 본 발명의 범위에 포함되는 것으로 해석되어야 한다.

【특허청구범위】

【청구항 1】

단말의 무선 통신 방법으로서,

특정 채널의 무선 신호를 수신하는 단계;

상기 수신된 무선 신호의 프리앰블 정보를 이용하여 해당 신호의 길이 정보 및 해당 데이터 시퀀스의 전체 길이 정보 중 적어도 하나를 획득하는 단계;

를 포함하는 것을 특징으로 하는 무선 통신 방법.

재출 일자 : 2017-01-18

【요약서】

【요약】

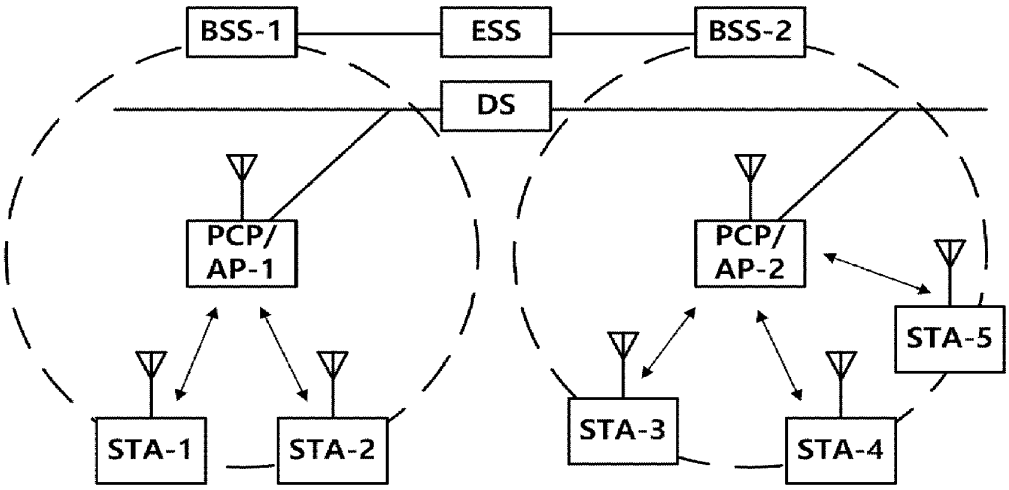
무선랜을 위한 장치, 시스템 및 무선랜 통신 방법이 게시된다. 본 발명의 실시예에 따르면 불연속 채널을 이용한 무선 통신 방법 및 무선 통신 단말이 제공될 수 있다.

【대표도】

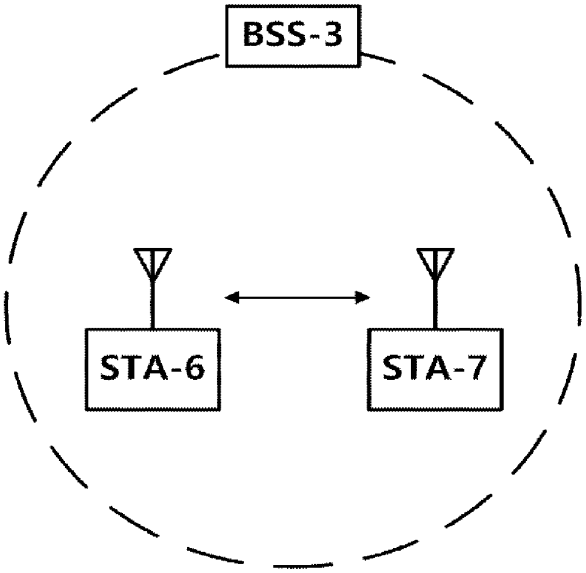
도 10

【도면】

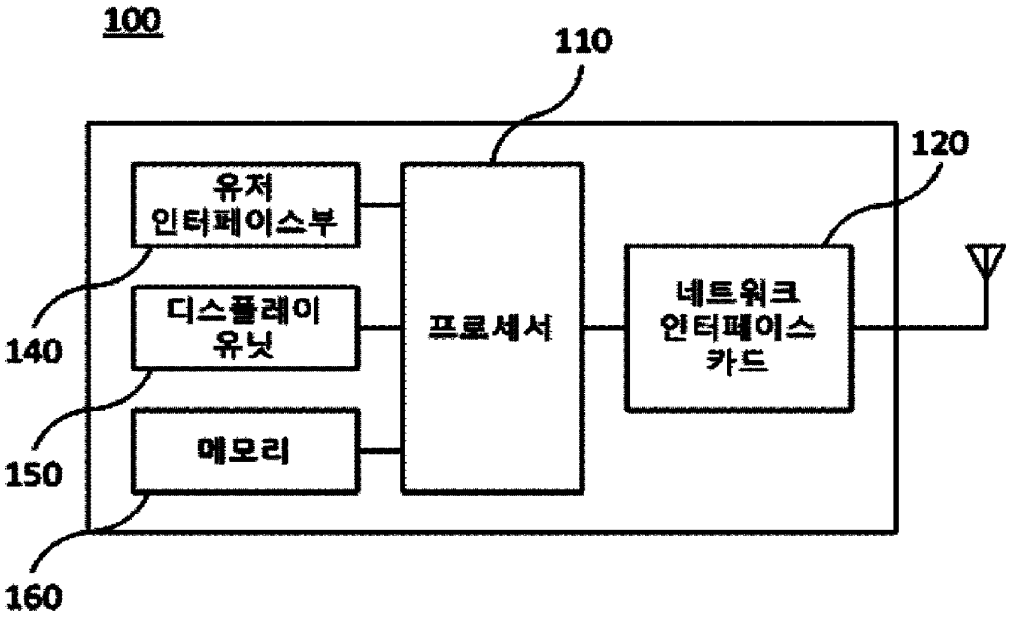
【도 1】



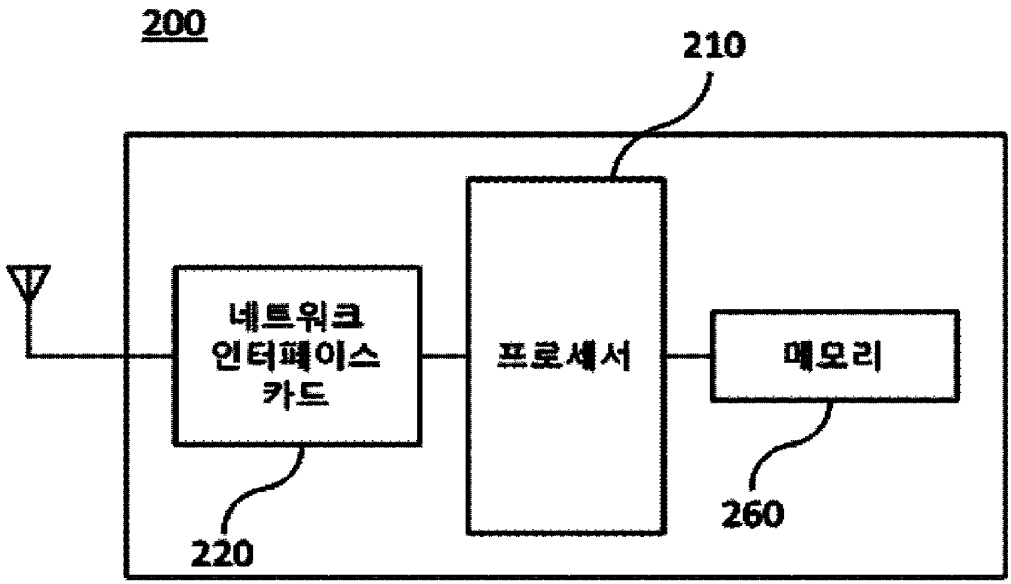
【도 2】



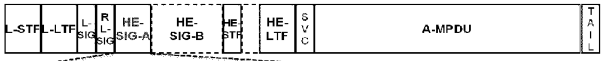
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
메모리
프로세서
네트워크
인터페이스
카드
140
150
160

【도 4】



【도 5】



(a) SU PPDU/EXT SU PPDU

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
Beam Change	1	
UL/DL	1	0:DL, 1:UL
MCS	4	
DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Reserved	1	
Spatial Reuse	4	TBD
Bandwidth	2	20/40/80/160(80+80)MHz
GI+LTF Size	3	1x_LTF+0.8us_GI 2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
NSTS	3	1~8 space time streams
TXOP Duration	7	
Coding	1	0:BCC, 1:LDPC
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
TxBF	1	Beamforming
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
Reserved	1	
Doppler	1	
CRC	4	
Tail	6	

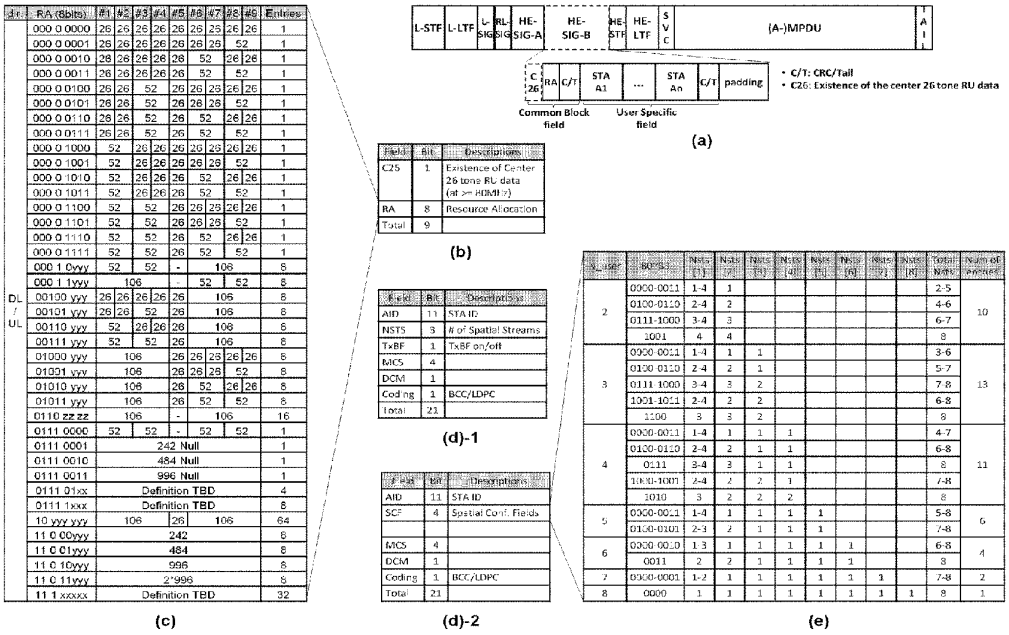
(b) MU PPDU

Field	Bit	Descriptions
UL/DL	1	0:DL, 1:UL
SIGB MCS	3	MCS0~MCS5
SIGB DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Spatial Reuse	4	TBD
Bandwidth	3	(DL) 20/40/80/160(80+80), 80A, 80B, 160A, 160B (UL) 20/40/80/160(80+80), left-106tone, right-106tone, reserved
Num of SIG-B Sym	4	if SIG-B Compression is 1 (DL) Num of MU-MIMO Users (UL) Num of SIG-B Sym
SIG-B Compression	1	(DL) Set to 1 in Full BW MU-MIMO (UL) Always set to 1 to remove RU Allocation subfield
GI+LTF Size	3	2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
Doppler	1	
TXOP Duration	7	
Reserved	1	
Num of HE-LTF Sym	3	1, 2, 4, 6, 8
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
CRC	4	
Tail	6	

(c) Trigger-based PPDU

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
BSS Color	6	BSS identification info
Spatial Reuse1	4	Spatial Reuse Parameter
Spatial Reuse2	4	Spatial Reuse Parameter
Spatial Reuse3	4	Spatial Reuse Parameter
Spatial Reuse4	4	Spatial Reuse Parameter
Reserved	1	
Bandwidth	2	20/40/80/160(80+80)MHz
TXOP Duration	7	
Reserved	9	
CRC	4	
Tail	6	

【도 6】



(a)

Field	Bit	Description
C25	1	Existence of Center 26 tone RU data (at >= 80MHz)
RA	8	Resource Allocation
Total	9	

(b)

Field	Bit	Description
AID	11	STA ID
NSTS	3	# of Spatial Streams
TxBF	1	TxBF on/off
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

(d)-1

Field	Bit	Description
AID	11	STA ID
SCF	4	Spatial Conf. Fields
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

(d)-2

Ind.	RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
DL / UL	000 0 0000	26	26	26	26	26	26	26	26		1
	000 0 0001	26	26	26	26	26	26	26	52		1
	000 0 0010	26	26	26	26	26	52		26	26	1
	000 0 0011	26	26	26	26	26	52		52		1
	000 0 0100	26	26	52		26	26	26	26	26	1
	000 0 0101	26	26	52		26	26	26	52		1
	000 0 0110	26	26	52		26	52		26	26	1
	000 0 0111	26	26	52		26	52		52		1
	000 0 1000	52		26	26	26	26	26	26		1
	000 0 1001	52		26	26	26	26	26	52		1
	000 0 1010	52		26	26	26	52		26	26	1
	000 0 1011	52		26	26	26	52		52		1
	000 0 1100	52		52		26	26	26	26		1
	000 0 1101	52		52		26	26	26	52		1
	000 0 1110	52		52		26	52		26	26	1
	000 0 1111	52		52		26	52		52		1
	000 1 0yyy	52		52		-	106				8
	000 1 1yyy	106				-	52		52		8
	00100 yyy	26	26	26	26	26	106				8
	00101 yyy	26	26	52		26	106				8
	00110 yyy	52		26	26	26	106				8
	00111 yyy	52		52		26	106				8
	01000 yyy	106				26	26	26	26	26	8
	01001 yyy	106				26	26	26	52		8
	01010 yyy	106				26	52		26	26	8
	01011 yyy	106				26	52		52		8
	0110 zz zz	106				-	106				16
	0111 0000	52		52		-	52		52		1
	0111 0001	242 Null									1
	0111 0010	484 Null									1
	0111 0011	996 Null									1
	0111 01xx	Definition TBD									4
	0111 1xxx	Definition TBD									8
	10 yyy yyy	106				26	106				64
	11 0 00yyy	242									8
	11 0 01yyy	484									8
	11 0 10yyy	996									8
	11 0 11yyy	2*996									8
	11 1 xxxxx	Definition TBD									32

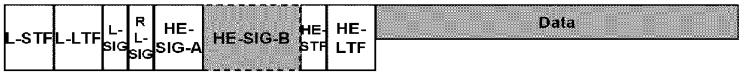
(c)

# of User	RU No.	Nsts (1)	Nsts (2)	Nsts (3)	Nsts (4)	Nsts (5)	Nsts (6)	Nsts (7)	Nsts (8)	Total Nsts	Num of cases
2	0000-0011	1-4	1							2-5	10
	0100-0110	2-4	2							4-6	
	0111-1000	3-4	3							6-7	
	1001	4	4							8	
3	0000-0011	1-4	1	1						3-6	13
	0100-0110	2-4	2	1						5-7	
	0111-1000	3-4	3	2						7-8	
	1001-1011	2-4	2	2						6-8	
	1100	3	3	2						8	
4	0000-0011	1-4	1	1	1					4-7	11
	0100-0110	2-4	2	1	1					6-8	
	0111	3-4	3	1	1					8	
	1000-1001	2-4	2	2	1					7-8	
	1010	3	2	2	2					8	
5	0000-0011	1-4	1	1	1	1				5-8	6
	0100-0101	2-3	2	1	1	1				7-8	
6	0000-0010	1-3	1	1	1	1	1			6-8	4
	0011	2	2	1	1	1	1			8	
7	0000-0001	1-2	1	1	1	1	1	1		7-8	2
8	0000	1	1	1	1	1	1	1	1	8	1

(e)

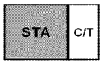
【도 7】

(a) UL HE MU PPDU (Narrow band TX)



(b) HE-SIG-A (BW subfield)

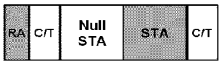
Field	Bit	Descriptions
BW	3	DL HE MU PPDU case - 20/40/80/160(80+80)MHz - 80A, 80B, 160A, 160B (Preamble Puncturing) UL HE MU PPDU case - 20/40/80/160(80+80)MHz **- 20MHz-left 106 tone** **- 20MHz-right 106 tone**



(OFDMA User Specific Info)

(c) HE-SIG-B (Resource Allocation)

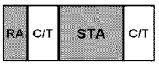
RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
1110zzzz	106				-	106				16



(OFDMA User Specific Info)

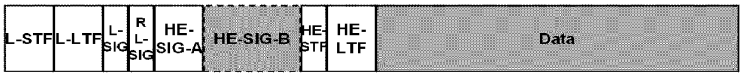
(d) HE-SIG-B (User Specific Info)

RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
TBD	106				-					1
TBD	-				106					1



(OFDMA User Specific Info)

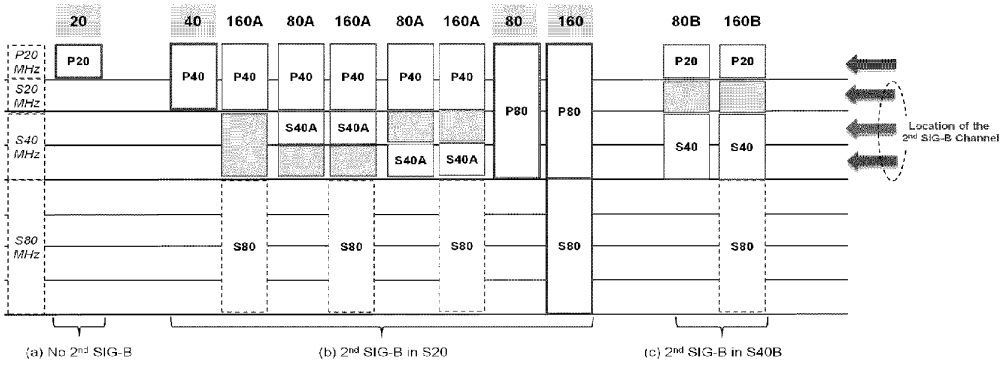
(e) UL HE MU PPDU (Full band TX)



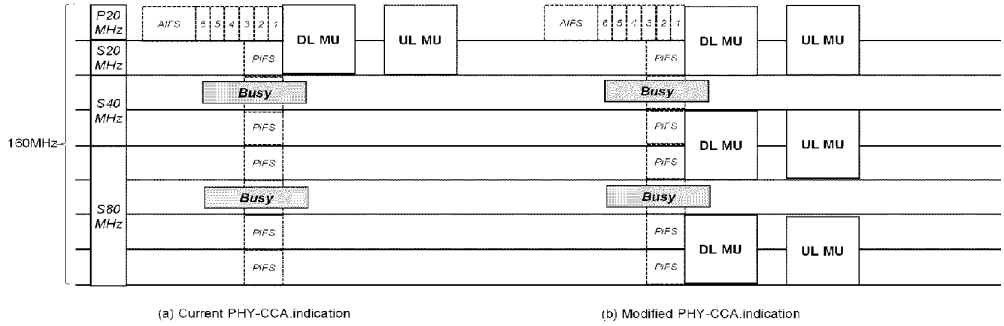
(f) HE-SIG-A (SIG-B Compression)

Field	Bit	Descriptions
SIG-B Compression	1	DL HE MU PPDU case - "0"refer RA field in SIG-B - "1" MU-MIMO user specific info UL HE MU PPDU case - Always set to "1" - Use OFDMA user specific info

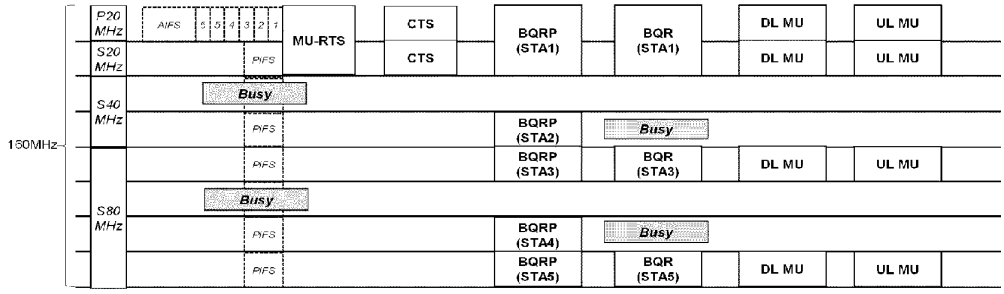
【도 8】


20
40
160A
80A
160A
80A
160A
80
160
80B
160B
P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
S40A
P80
S40
S80
Location of the 2nd SIG-B Channel
(a) No 2nd SIG-B
(b) 2nd SIG-B in S20
(c) 2nd SIG-B in S40B

【도 9】

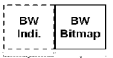

P20 MHz
S20 MHz
S40 MHz
S80 MHz
160MHz
AIFS
PIFS
Busy
DL MU
UL MU
(a) Current PHY-CCA.indication
(b) Modified PHY-CCA.indication

【도 10】



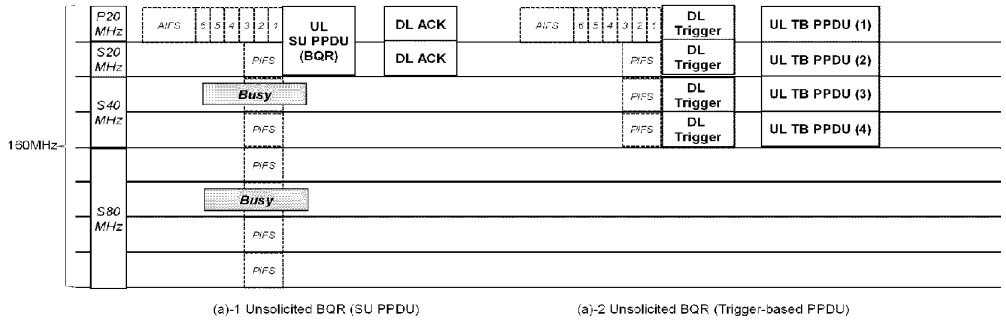
(a) BQRP/BQR Exchange Sequence (Solicited BQR)

(b) BQR (Bandwidth Query Report)



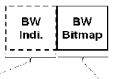
BW Indication	BW Bitmap							
20MHz	Idle /Busy	-	-	-	-	-	-	-
40MHz	Idle /Busy	Idle /Busy	-	-	-	-	-	-
80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	-	-	-	-
160MHz, 80+80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy

【도 11】



(a)-1 Unsolicited BQR (SU PPDU) (a)-2 Unsolicited BQR (Trigger-based PPDU)

(b) BQR (Bandwidth Query Report)



BW Indication	BW Bitmap							
20MHz	Idle /Busy	-	-	-	-	-	-	-
40MHz	Idle /Busy	Idle /Busy	-	-	-	-	-	-
80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	-	-	-	-
160MHz, 80+80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16731031 Document Date: 03/13/2020

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

Form Revision Date: March 1, 2019

Electronic Acknowledgement Receipt

EFS ID:	38839202
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	13-MAR-2020
Filing Date:	31-DEC-2019
Time Stamp:	20:48:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings-other than black and white line drawings	632450_ReplacementDrawings.pdf	594007 7c3819be2efa3fed5719b9e69dfd3d1485ebd66d	no	2
Warnings:					

Information:					
2	Applicant Response to Pre-Exam Formalities Notice	2020-03-11_632450_Response_to_NFCAP.pdf	97782 94ba345c4fb086a81507f0ac45589236a532095d	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	691789		

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.



Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
Beam Change	1	
UL/DL	1	0:DL, 1:UL
MCS	4	
DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Reserved	1	
Spatial Reuse	4	TBD
Bandwidth	2	20/40/80/160(80+80)MHz
GI+LTF Size	3	1x_LTF+0.8us_GI 2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
NSTS	3	1~8 space time streams
TXOP Duration	7	
Coding	1	0:BCC, 1:LDPC
LDPC Extra Sym	1	
STBC	1	Space Time Block Coding
TxBF	1	Beamforming
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
Reserved	1	
Doppler	1	
CRC	4	
Tail	6	

(a)

Field	Bit	Descriptions
UL/DL	1	0:DL, 1:UL
SIGB MCS	3	MCS0~MCS5
SIGB DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Spatial Reuse	4	TBD
Bandwidth	3	(DL) 20/40/80/160(80+80), 80A, 80B_160A, 160B (UL) 20/40/80/160(80+80), left-106t one, right-106tone, reserved
Num of SIG-B Sym	4	if SIG-B Compression is 1 (DL) Num of MU-MIMO Users (UL) Num of SIG-B Sym
SIG-B Compression	1	(DL) Set to 1 in Full BW MU-MIMO (UL) Always set to 1 to remove RU Allocation subfield
GI+LTF Size	3	2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
Doppler	1	
TXOP Duration	7	
Reserved	1	
Num of HE-LTF Sym	3	1, 2, 4, 6, 8
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
CRC	4	
Tail	6	

(b)

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
BSS Color	6	BSS identification info
Spatial Reuse1	4	Spatial Reuse Parameter
Spatial Reuse2	4	Spatial Reuse Parameter
Spatial Reuse3	4	Spatial Reuse Parameter
Spatial Reuse4	4	Spatial Reuse Parameter
Reserved	1	
Bandwidth	2	20/40/80/160(80+80)MHz
TXOP Duration	7	
Reserved	9	
CRC	4	
Tail	6	

(c)

FIG. 12

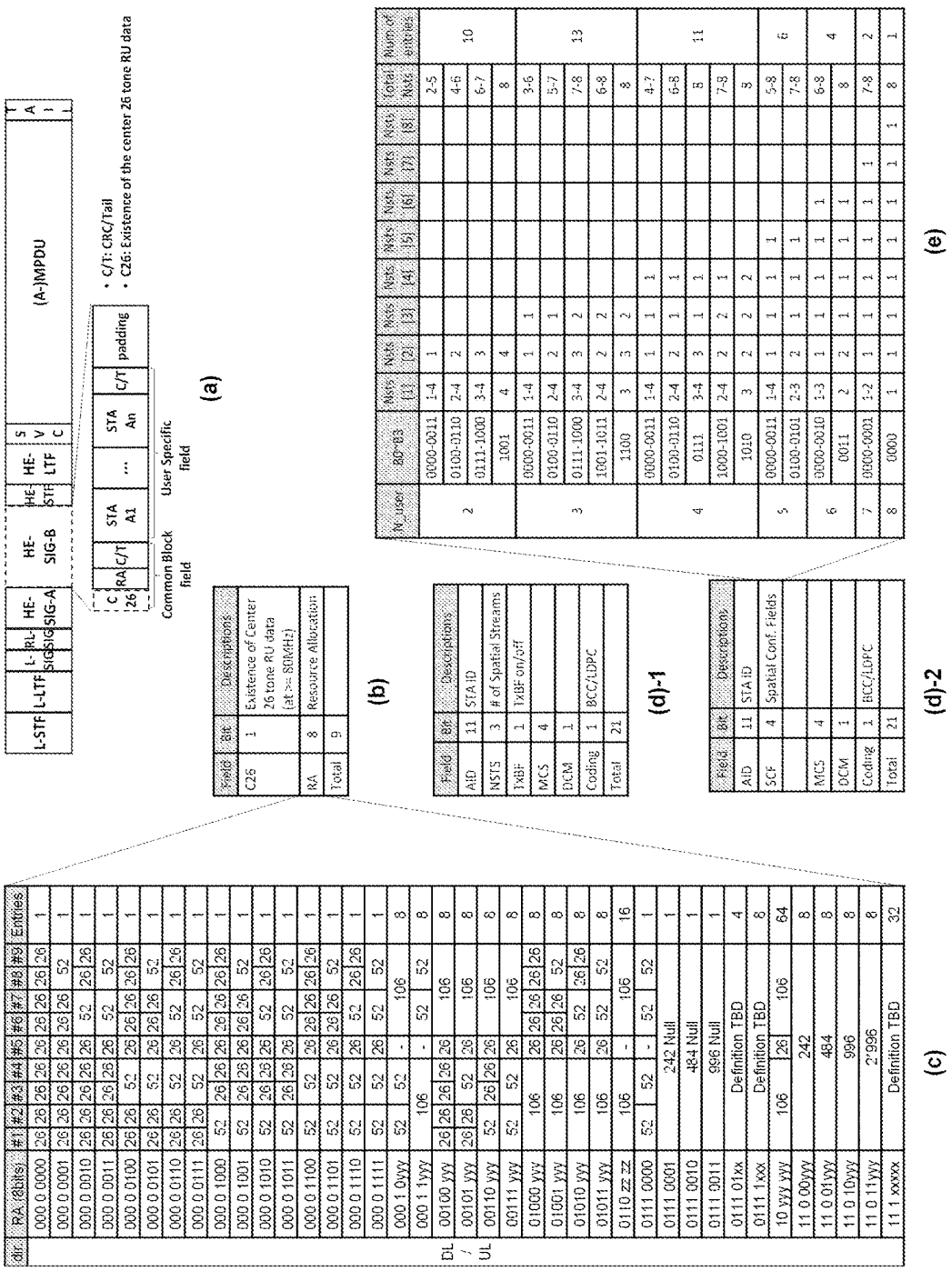

L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
S V C
(A-)MPDU
T A I L
C
26
RA
C/T
STA A1
...
STA An
C/T
padding
Common Block field
User Specific field
• C/T: CRC/Tail
• C26: Existence of the center 26 tone RU data
(a)
(b)
(c)
(d)-1
(d)-2
(e)

FIG. 13

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE *Patent*

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	)	***Re.: Response to Notice to File Corrected Application Papers***
Application No.: 16/731,031	)	Group: N/A
Filing Date: December 31, 2019	)	Examiner: Not yet assigned
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	)	Our Ref.: B-10010CON2 632450-9
	)	Date: March 13, 2020

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

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Sir:

This paper is timely submitted in response to the Notice to File Corrected Application Papers mailed on February 4, 2020 for the subject application. Prior to examination of the above-identified U.S. patent application, please enter the following Amendments and Remarks into the prosecution history of the above-identified U.S. patent application.

Amendments to the Drawings begin on page 2 of this paper.

Remarks begin on page 3 of this paper.

Replacement Sheet is attached following page 3 of this Response.

AMENDMENTS TO THE DRAWINGS

The attached "Replacement Sheets" of drawings include changes to FIGS. 12 and 13. The Replacement Sheets, including FIGS. 12 and 13, replace the original sheets including FIGS. 12 and 13. In the Replacement Sheets, FIGS. 12 and 13 are amended to correct figure numbers, letters and reference characters to measure at least 0.32 cm (1/8 inch) in height.

Attachment: Replacement Sheets (2 pages)

* * *

REMARKS

In response to the Notice to File Corrected Application Papers of February 4, 2020 for the subject application, FIGS. 12 and 13 are amended in compliance with 37 CFR 1.84 and 37 CFR 1.121(d). No new matter is presented as a result of this amendment. It is respectfully requested that the Amendment be entered in the above-referenced application.

* * *

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or may contain characterizations of claim scope or referenced art, the Applicant is not conceding that any previously pending claims are unpatentable in view of the cited reference(s). Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent child or related prosecution history shall not reasonably infer that the Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

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

March 13, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Very truly yours,

/Young Seok Koo 76,255/

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Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd. Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice
(323) 266-0373 facsimile

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/731,031

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			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	12 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9

CONFIRMATION NO. 3714

158747
LADAS & PARRY
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4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

FORMALITIES LETTER

OC000000114975417

Date Mailed: 02/27/2020

NOTICE OF INCOMPLETE REPLY (NONPROVISIONAL)

Filing Date Granted

The U.S. Patent and Trademark Office has received your reply on 02/21/2020 to the NOTICE TO FILE CORRECTED APPLICATION PAPERS (Notice) mailed 02/04/2020 and it has been entered into the application. The reply, however, is not a complete reply for the reason(s) listed below. A complete reply must be timely filed to prevent ABANDONMENT of the above-identified application. Replies should be mailed to: Mail Stop Missing Parts, Commissioner for Patents, P.O.Box 1450, Alexandria VA 22313-1450.

The period for reply continues to run from the date of the Notice mailed 02/04/2020. Applicant must submit all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the appropriate extension fee under the provisions of 37 CFR 1.136(a).

Applicant's reply to the Notice mailed on 02/04/2020 was received in the U.S. Patent and Trademark Office on 02/21/2020, after the expiration of the two month period for reply set forth in the Notice. The application will become abandoned unless applicant obtains an extension of the period for reply, as above. The petition must be accompanied by the appropriate fee as set forth in 37 CFR 1.17 (see the current fees below). The date on which the reply, the petition, and the fee have been filed is the date of the reply and also the date for purposes of determining the period of extension and the corresponding amount of the fee due. The expiration of the time period is determined by the amount of the fee paid. Applicant is advised that extensions may not be granted under 37 CFR 1.136(a) for more than FIVE MONTHS beyond the time period set in the Notice.

Items Required to Avoid Abandonment:

The required items noted below SHOULD be filed along with any items required above.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - Numbers, letters, and reference characters on the drawings must measure at least 0.32 cm (1/8 inch) in height. See Figure(s) 12, 13.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Mail date of Notice: 02/04/2020

Last date that extension may be obtained: (Note: The petition and fee must be received by this date, or include a proper certificate of mailing under 37 CFR 1.8 with a date on or before this date, and extend the time to include this date.) 09/04/2020

Length of Extension of Time	Fee under 37 CFR 1.17(a) effective March 19, 2013		
(response due on or before)	Undiscounted	Small Entity	Micro Entity
One Month (05/04/2020)	$200	$100	$50
Two Months (06/04/2020)	$600	$300	$150
Three Months (07/04/2020)	$1400	$700	$350
Four Months (08/04/2020)	$2200	$1100	$550
Five Months (09/04/2020)	$3000	$1500	$750

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

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**.

/dgela/

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

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	)	***Re.: Preliminary Amendment***
	)	Group: 3714
USSN: 16/731,031	)	Examiner: Not Yet Assigned
Filing Date: December 31, 2019	)	Our Ref.: B-10010CON2 632450-9
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	)	Date: February 21, 2020

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified U.S. patent application, please enter the following amendments and remarks into the prosecution history of the above-identified U.S. patent application without prejudice or disclaimer.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 6 of this paper.

AMENDMENTS TO THE SPECIFICATION

Please insert the following paragraph and section entitled "CROSS-REFERENCE TO RELATED APPLICATIONS" on page 1, immediately after the title "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET" and before the section entitled "Technical Field", to read as follows:

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Patent Application No. 16/505,664 filed on July 8, 2019, which is a continuation of International Patent Application No. PCT/KR2018/000443 filed on January 9, 2018, which claims the priority to Korean Patent Application No. 10-2017-0008927 filed in the Korean Intellectual Property Office on January 18, 2017 and Korean Patent Application No. 10-2017-0003147 filed in the Korean Intellectual Property Office on January 9, 2017, the entire contents of which are incorporated herein by reference.

* * *

AMENDMENTS TO THE CLAIMS

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

Listing of claim

1-20. (Cancelled).

21. (New) A wireless communication terminal, the terminal comprising:

a communication unit; and

a processor configured to process signals transmitted and received through the communication unit,

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and

decode the HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, a configuration of a user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by a subfield of the HE-SIG-A.

22. (New) The wireless communication terminal of claim 21, wherein a format of user field(s) included in the user specific field of the HE-SIG-B is identified based on the number of MU-MIMO users.

23. (New) The wireless communication terminal of claim 21,

wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

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

wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

25. (New) The wireless communication terminal of claim 23, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

26. (New) The wireless communication terminal of claim 21, wherein the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

27. (New) A wireless communication method of a wireless communication terminal, the method comprising:

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decoding the HE MU PPDU based on information obtained from the preamble,

wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, a configuration of a user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by a subfield of the HE-SIG-A.

28. (New) The wireless communication method of claim 27, wherein a format of user field(s) included in the user specific field of the HE-SIG-B is identified based on the number of MU-MIMO users.

29. (New) The wireless communication method of claim 27,

wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

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

wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

31. (New) The wireless communication method of claim 29, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

32. (New) The wireless communication method of claim 27, wherein the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

REMARKS

In this Preliminary Amendment, the section of the "CROSS-REFERENCE TO RELATED APPLICATIONS" is inserted to include reference to the earlier applications. This amendment is to comply with 37 C.F.R. §1.77. A substitute specification should not be required as this amendment only adds a benefit claim.

Claims 1-20 are cancelled and new claims 21-32 are added.

Amendment of the subject application is respectfully requested.

* * *

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or may contain characterizations of claim scope or referenced art, the Applicant is not conceding that any previously pending claims are unpatentable in view of the cited reference(s). Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent child or related prosecution history shall not reasonably infer that the Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

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

February 21, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

Young Seok Koo
Attorney for Applicant
Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

Electronic Acknowledgement Receipt	
EFS ID:	38662124
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung Son
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	21-FEB-2020
Filing Date:	31-DEC-2019
Time Stamp:	19:20:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2020-02-12_632450_Preliminary_Amendment.pdf	112863 53075bed52b26ad5efd385744c065c1516afe9dd	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Specification	2	2
	Claims	3	5
	Applicant Arguments/Remarks Made in an Amendment	6	7
Warnings:			
Information:			
	Total Files Size (in bytes):	112863	

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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/731,031

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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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
16/731,031	12/31/2019	Juhyung Son	B-10010CON2 632450-9

CONFIRMATION NO. 3714

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

FORMALITIES LETTER

OC000000114394962

Date Mailed: 02/04/2020

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - Numbers, letters, and reference characters on the drawings must measure at least 0.32 cm (1/8 inch) in height. See Figure(s) 12, 13.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

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**.

/sibrahim/

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/731,031	12/31/2019		1720	B-10010CON2 632450-9	20	2

CONFIRMATION NO. 3714

FILING RECEIPT

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

OC000000114394981

Date Mailed: 02/04/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Juhyung Son, Gyeonggi-do, KOREA, REPUBLIC OF;
Jinsam Kwak, Gyeonggi-do, KOREA, REPUBLIC OF;
Geonjung Ko, Gyeonggi-do, KOREA, REPUBLIC OF;
Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;

Applicant(s)

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

Power of Attorney: The patent practitioners associated with Customer Number 158747

Domestic Priority data as claimed by applicant

This application is a CON of 16/505,664 07/08/2019 PAT 10567047
which is a CON of PCT/KR2018/000443 01/09/2018

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2017-0003147 01/09/2017 Access Code Provided
REPUBLIC OF KOREA 10-2017-0008927 01/18/2017 Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 01/31/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/731,031**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

Title

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16731031 Document Date: 12/31/2019

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

Form Revision Date: March 1, 2019

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	Examiner: Not Yet Assigned
Serial No.: Not Yet Assigned	Art Unit: N/A
Filing Date: Concurrently Herewith	Conf. No.: N/A
For: "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET"	Our Ref: B-10010CON2 632450-9
Date: December 30, 2019	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

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

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

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

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

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

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

Items Disclosed

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

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

Non-Final Rejection dated August 30, 2019 for U.S. Patent Application No. 16/505,664.

Notice of Allowance dated October 2, 2019 for U.S. Patent Application No. 16/505,664.

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

International Search Report for PCT/KR2018/000443 mailed on May 4, 2018.

Written Opinion of the International Searching Authority for PCT/KR2018/000443 mailed on May 4, 2018.

Additional Information

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

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

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

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

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

[ ] Other:

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
Attorney for Applicant
Registration No. 76,255
LADAS & PARRY LLP
4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-10010CON2 632450-9	U.S. SERIAL NO. N/A
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	FILING DATE Concurrently Herewith
		GROUP NO. N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2016/0156438	June 2, 2016	Sun et al.			
	2.	9,641,234	May 2, 2017	Moon et al.			
	3.	10,219,271	Feb. 26, 2019	Hedayat et al.			
	4.	2017/0006608	Jan. 5, 2017	Josiam et al.			
	5.	2016/0366666	Dec. 15, 2016	Yang et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	6.	2016/208830	Dec. 29, 2016	WO			Espacenet
	7.	2016/182412	Nov. 17, 2016	WO			Espacenet
	8.	2017/003193	Jan. 5, 2017	WO			Espacenet
	9.	2016/088956	Jun. 9, 2016	WO			Espacenet
	10.	2016/175435	Nov. 3, 2016	WO			Espacenet
	11.	2018/128530	Jul. 12, 2018	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	12.	International Search Report for PCT/KR2018/000443 mailed on May 4, 2018 and its English translation from WIPO (now published as WO 2018/128530)
	13.	Written Opinion of the International Searching Authority for PCT/KR2018/000443 mailed on May 4, 2018 and its English translation by Google Translate (now published as WO 2018/128530)
	14.	Robert Stacey, "Comments on TGax/D1.0", IEEE P802.11 Wireless LANs; doc.: IEEE 802.11-17/0010r0, January 9, 2017. Pages 1-249
	15.	John Son et al., WILUS: "Discussions on Signaling for UL HE MU PPDU", doc.: IEEE P802.11-17/0110r0; January 16, 2017. Slides 1-9
	16.	John Son et al., WILUS: "CIDs on Signaling for UL HE MU PPDU", IEEE P802.11 Wireless LANs; doc.: IEEE 802.11-17/0173r0, January 19, 2017. Pages 1-3.
	17.	Non-Final Rejection dated August 30, 2019 for U.S. Patent Application No. 16/505,664 (published as 2019/0334590)
	18.	Notice of Allowance dated October 2, 2019 for U.S. Patent Application No. 16/505,664 (published as 2019/0334590)

EXAMINER	*DATE CONSIDERED*

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2018/000443

A. CLASSIFICATION OF SUBJECT MATTER

H04W 28/06(2009.01)i, H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 72/04(2009.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 28/06; H04L 1/00; H04B 7/26; H04W 72/12; H04L 29/08; H04L 29/06; H04W 52/02; H04L 27/26; H04W 74/08; H04W 84/12; H04W 72/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: HE MU PPDU(high efficiency multi-user PHY protocol data unit), HE-SIG-A(High Efficiency Signal A field), HE-SIG-B(High Efficiency Signal B field), decoding, subfield, upward/downward field

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2016-208830 A1 (LG ELECTRONICS INC.) 29 December 2016 See paragraphs [142]-[143], [197]-[199]; and claim 12.	1,13
A		2-12,14-20
A	WO 2016-182412 A1 (LG ELECTRONICS INC.) 17 November 2016 See paragraph [125]; and figure 12.	1-20
A	WO 2017-003193 A1 (WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.) 05 January 2017 See paragraphs [148]-[152]; and claim 1.	1-20
A	WO 2016-088956 A1 (LG ELECTRONICS INC.) 09 June 2016 See paragraphs [0058]-[0096]; and claim 1.	1-20
A	WO 2016-175435 A1 (LG ELECTRONICS INC.) 03 November 2016 See paragraphs [156]-[159]; and figure 5.	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 MAY 2018 (04.05.2018)	**04 MAY 2018 (04.05.2018)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. +82-42-481-8578	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2018/000443

Patent document cited in search report	Publication date	Patent family member	Publication date
WO 2016-208830 A1	29/12/2016	NONE	
WO 2016-182412 A1	17/11/2016	WO 2016-182415 A1 WO 2016-195402 A1	17/11/2016 08/12/2016
WO 2017-003193 A1	05/01/2017	KR 10-2018-0016603 A	14/02/2018
WO 2016-088956 A1	09/06/2016	NONE	
WO 2016-175435 A1	03/11/2016	EP 3291611 A1	07/03/2018

Form PCT/ISA/210 (patent family annex) (January 2015)

특 허 협 력 조 약

PCT

국 제 조 사 보 고 서
(PCT 제 18 조 및 PCT규칙 43 및 44)

출원인 또는 대리인의 서류참조기호 WILP180004WO	추가적인 조치	서식 PCT/ISA/220 및 아래 5.(해당하는경우) 참조
국제출원번호 **PCT/KR2018/000443**	국제출원일 *(일/월/년)* 2018년 01월 09일 (09.01.2018)	(최) 우선일 *(일/월/년)* 2017년 01월 09일 (09.01.2017)
출원인 주식회사 윌러스표준기술연구소		

본 국제조사보고서는 본 국제조사기관에 의하여 작성되었으며 PCT 제18조의 규정에 따라 출원인에게 송부됩니다. 이 국제조사보고서의 사본은 국제사무국에 송부됩니다.

본 국제조사보고서는 총 **3** 매로 구성되어 있습니다.

☒ 본 보고서에서 인용된 각 선행기술 문헌의 사본도 첨부되어 있습니다.

1. **보고서의 기초**
   a. **언어**와 관련하여, 국제조사는 아래에 기초하여 수행되었습니다.
      ☒ 출원시의 언어로 된 국제출원
      ☐ 국제조사를 위해 _____ 로 번역되어 제출된 국제출원의 번역문(PCT규칙 12.3(a) 및 23.1(b))
   b. ☐ 본 국제조사보고서는 PCT규칙 91의 규정에 따라 당해 기관이 허가하였거나 또는 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43.6의2(a)).
   c. ☐ 국제출원에 개시된 **핵산염기 및/또는 아미노산 서열**에 관하여는 제1기재란을 참조하십시오.
2. ☐ **일부 청구항은 조사할 수 없습니다**(제2기재란 참조).
3. ☐ **발명의 단일성이 결여되어 있습니다**(제3기재란 참조).
4. **발명의 명칭**과 관련하여,
   ☒ 출원인이 제출한 대로 승인합니다.
   ☐ 본 국제조사기관이 다음과 같이 발명의 명칭을 작성하였습니다:
5. **요약서**와 관련하여,
   ☒ 출원인이 제출한 대로 승인합니다.
   ☐ PCT규칙 38.2의 규정에 따라 본 기관이 제4기재란에 표시된 대로 요약서를 작성하였습니다. 출원인은 본 국제조사보고서의 발송일부터 1월 이내에 본 기관에 의견를 제출할 수 있습니다.
6. **도면**과 관련하여,
   a. 요약서와 함께 공개될 **도면**은 제 12 도이며
      ☒ 출원인이 제안하였습니다.
      ☐ 출원인이 도면의 번호를 제안하지 않았기 때문에 본 기관이 선택하였습니다.
      ☐ 본 도면이 발명의 특징을 더 잘 나타내고 있기 때문에 본 기관이 선택하였습니다.
   b. ☐ 요약서와 함께 공개될 도면이 없습니다.

국 제 조 사 보 고 서

국제출원번호
PCT/KR2018/000443

A. 발명이 속하는 기술분류(국제특허분류(IPC))

H04W 28/06(2009.01)i, H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 72/04(2009.01)i

B. 조사된 분야

조사된 최소문헌(국제특허분류를 기재)
H04W 28/06; H04L 1/00; H04B 7/26; H04W 72/12; H04L 29/08; H04L 29/06; H04W 52/02; H04L 27/26; H04W 74/08; H04W 84/12; H04W 72/04

조사된 기술분야에 속하는 최소문헌 이외의 문헌
한국등록실용신안공보 및 한국공개실용신안공보: 조사된 최소문헌란에 기재된 IPC
일본등록실용신안공보 및 일본공개실용신안공보: 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))
eKOMPASS(특허청 내부 검색시스템) & 키워드: HE MU PPDU(high efficiency multi-user PHY protocol data unit), HE-SIG-A(High Efficiency Signal A field), HE-SIG-B(High Efficiency Signal B field), 디코딩, 서브필드, 상향/하향 필드

C. 관련 문헌

카테고리*	인용문헌명 및 관련 구절(해당하는 경우)의 기재	관련 청구항
X	WO 2016-208830 A1 (LG ELECTRONICS INC.) 2016.12.29 단락 [142]-[143], [197]-[199]; 및 청구항 12 참조.	1,13
A		2-12,14-20
A	WO 2016-182412 A1 (LG ELECTRONICS INC.) 2016.11.17 단락 [125]; 및 도면 12 참조.	1-20
A	WO 2017-003193 A1 (WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.) 2017.01.05 단락 [148]-[152]; 및 청구항 1 참조.	1-20
A	WO 2016-088956 A1 (LG ELECTRONICS INC.) 2016.06.09 단락 [0058]-[0096]; 및 청구항 1 참조.	1-20
A	WO 2016-175435 A1 (LG ELECTRONICS INC.) 2016.11.03 단락 [156]-[159]; 및 도면 5 참조.	1-20

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

☒ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허 문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허문헌에 속하는 문헌

국제조사의 실제 완료일	국제조사보고서 발송일
2018년 05월 04일 (04.05.2018)	2018년 05월 04일 (04.05.2018)

ISA/KR의 명칭 및 우편주소
대한민국 특허청
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김성우
전화번호 +82-42-481-3348

서식 PCT/ISA/210 (두 번째 용지) (2015년 1월)

국 제 조 사 보 고 서
대응특허에 관한 정보

국제출원번호
PCT/KR2018/000443

국제조사보고서에서 인용된 특허문헌	공개일	대응특허문헌	공개일
WO 2016-208830 A1	2016/12/29	없음	
WO 2016-182412 A1	2016/11/17	WO 2016-182415 A1 WO 2016-195402 A1	2016/11/17 2016/12/08
WO 2017-003193 A1	2017/01/05	KR 10-2018-0016603 A	2018/02/14
WO 2016-088956 A1	2016/06/09	없음	
WO 2016-175435 A1	2016/11/03	EP 3291611 A1	2018/03/07

서식 PCT/ISA/210 (대응특허 추가용지) (2015년 1월)

특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 13595 경기도 성남시 분당구 황새울로 216, 5층

PCT

국제조사기관의 견해서

(PCT규칙 43의2.1)

발송일 *(일/월/년)*	2018년 05월 04일 (04.05.2018)
출원인 또는 대리인의 서류참조기호 WILP180004WO	**추가적인 조치** 아래 2를 참조

국제출원번호	국제출원일 *(일/월/년)*	우선일 *(일/월/년)*
PCT/KR2018/000443	2018년 01월 09일 (09.01.2018)	2017년 01월 09일 (09.01.2017)

국제특허분류(IPC)
H04W 28/06(2009.01)i, H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 72/04(2009.01)i

출원인
주식회사 윌러스표준기술연구소

1. 본 견해서는 다음 기재란에 관한 내용을 포함합니다.

- ☒ 제1기재란 견해서의 기초
- ☐ 제2기재란 우선권
- ☐ 제3기재란 신규성, 진보성 및 산업상이용가능성에 관한 견해 부작성
- ☐ 제4기재란 발명의 단일성 결여
- ☒ 제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명
- ☐ 제6기재란 특이 인용문헌
- ☐ 제7기재란 국제출원의 흠결
- ☐ 제8기재란 국제출원에 관한 의견

2. **추가적인 조치**

국제예비심사가 청구되면, 본 견해서는 국제예비심사기관("IPEA")의 견해서로 간주될 것입니다. 다만, 출원인이 본 기관 이외의 기관을 IPEA로 선택하고, 그 선택된 IPEA가 PCT규칙 66.1의2(b)에 따라 본 국제조사기관의 견해서가 위와 같이 간주되지 않을 것임을 국제사무국에 통보한 경우에는 그러하지 않습니다.

본 견해서가 상기와 같이 IPEA의 견해서로 간주되는 경우, 출원인은 서식 PCT/ISA/220의 발송일로부터 3월 또는 우선일부터 22월 중 늦게 만료되는 날 이전에 의견서 및 보정서(해당하는 경우)를 IPEA에 제출할 수 있습니다.

다른 선택사항에 대하여는 서식 PCT/ISA/220에 대한 안내문을 참조하십시오.

ISA/KR의 명칭 및 우편주소	본 견해서의 완료일	심사관
대한민국 특허청 (35208) 대전광역시 서구 청사로 189, 4동 (둔산동, 정부대전청사) 팩스번호 +82-42-481-8578	2018년 05월 04일 (04.05.2018)	김성우 전화번호 +82-42-481-3348

서식 PCT/ISA/237 (표지) (2015년 1월)

국제조사기관의 견해서

국제출원번호
PCT/KR2018/000443

제1기재란 본 견해서의 기초

1. **언어**와 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

☒ 출원시의 언어로 된 국제출원

☐ 국제조사를 위하여 _____ 로 번역되어 제출된 국제출원의 번역문
(PCT규칙 12.3(a) 및 23.1(b))

2. ☐ 본 견해서는 PCT규칙 91에 따라 당해 기관이 허가하였거나 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43의2.1(a)).

3. ☐ 국제출원에 개시된 핵산염기 및/또는 아미노산 서열과 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

a. ☐ 아래의 형태로 출원시 국제출원의 일부를 구성하는 서열목록

☐ 부록 C/ST.25 텍스트 파일

☐ 서면 혹은 이미지 파일

b. ☐ PCT 규칙 13의3.1(a)에 따라 국제출원과 함께 국제조사만을 목적으로 부록 C/ST.25 텍스트 파일의 형태로 제출된 서열목록

c. ☐ 국제조사만을 목적으로 국제출원일 이후에 아래 형태로 제출된 서열목록

☐ 부록 C/ST.25 텍스트 파일 (규칙 13의3.1(a))

☐ 서면 혹은 이미지 파일 (규칙 13의3.1(b) 및 시행세칙 713)

4. ☐ 추가로 서열목록에 대하여 하나 이상의 버전이나 사본이 제출된 경우, 후속 버전 또는 추가된 사본에 기재되어 있는 정보가 출원시 출원의 일부를 구성하는 정보와 동일하거나 또는 출원시의 개시범위를 벗어나지 않는다는 진술서가 제출되었습니다.

5. 추가 의견:

국제조사기관의 견해서

국제출원번호
PCT/KR2018/000443

제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명

1. 견해

신규성 (N)	청구항	1-20	있음
	청구항	없음	없음
진보성 (IS)	청구항	2-12,14-20	있음
	청구항	1,13	없음
산업상 이용가능성 (IA)	청구항	1-20	있음
	청구항	없음	없음

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: WO 2016-208830 A1 (LG ELECTRONICS INC.) 2016.12.29

D2: WO 2016-182412 A1 (LG ELECTRONICS INC.) 2016.11.17

D3: WO 2017-003193 A1(WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.) 2017.01.05

D4: WO 2016-088956 A1 (LG ELECTRONICS INC.) 2016.06.09

D5: WO 2016-175435 A1 (LG ELECTRONICS INC.) 2016.11.03

2.1 신규성 및 진보성

2.1.1 청구항 제1항-제12항

청구항 제1항에 기재된 발명과 가장 근접한 인용문헌 D1에는 '통신부 (D1: 청구항 12 참조); 및 통신부를 통해 송신되는 신호를 처리하는 프로세서 (D1: 청구항 12 참조)를 포함하고, 프로세서는 통신부를 통해 HE MU PPDU(high efficiency multi-user PHY protocol data unit)를 수신하되, HE MU PPDU의 프리앰블은 HE-SIG-A(High Efficiency Signal A field) 및 HE-SIG-B(High Efficiency Signal B field)를 포함하는 것 (D1: 단락 [142]-[143], [197] 참조)을 특징으로 하는 무선 통신 단말'이 제시되어 있습니다.

다만, 청구항 제1항의 특징인 'HE-SIG-A로부터 획득된 정보에 기초하여 수신된 HE MU PPDU를 디코딩하되, HE-SIG-B의 구성은 HE-SIG-A의 적어도 하나의 서브필드로부터 획득된 정보에 기초하여 식별되는 점'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 상기 인용문헌 D1의 'STA이 SIG-A 및 SIG-B 필드를 포함하는 MU 프레임을 수신하고, SIG-A 필드로부터 획득된 정보, 예컨대, 다중의 MCS 레벨들에 대한 정보를 기초하여 SIG-B 필드를 디코딩하는 점 (D1: 단락 [197], [199] 참조)'으로부터 이 기술분야에서 통상의 지식을 가진 자가 쉽게 생각해 낼 수 있는 사항입니다. 따라서 청구항 제1항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다 (PCT 제33조(3)).

추가 기재란에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
제5 기재란의 연속

청구항 제1항의 종속항인 청구항 제2항에 기재된 발명은 'HE-SIG-A의 SIG-B 압축 필드가 전체 대역폭 MU-MIMO 전송을 지시하여 HE-SIG-B에 공통 필드가 존재하지 않을 경우, HE-SIG-B의 사용자 특정 필드의 구성은 HE-SIG-A의 적어도 하나의 서브필드로부터 획득된 정보에 기초하여 식별되는 점'에서 상기 인용문헌 D1에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌들에도 기재되어 있지 않으며, 이 기술분야에서 통상의 지식을 가진 자에게 자명하지도 않습니다. 따라서 청구항 제2항에 기재된 발명은 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

청구항 제3항-제7항은 청구항 제2항의 직/간접적인 종속항이므로 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

청구항 제1항의 종속항인 청구항 제8항에 기재된 발명은 'HE-SIG-A는 PPDU가 상향으로 전송되는지 지시하는 또는 하향으로 전송되는지를 지시하는 상향/하향 필드를 포함하고, PPDU의 HE SIG-A의 적어도 하나의 서브 필드는 상향/하향 필드가 지시하는 값에 기초하여 서로 다른 정보를 지시하거나 서로 다르게 설정되는 점'에서 상기 인용문헌 D1에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌들에도 기재되어 있지 않으며, 이 기술분야에서 통상의 지식을 가진 자에게 자명하지도 않습니다. 따라서 청구항 제8항에 기재된 발명은 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

청구항 제9항-제12항은 청구항 제8항의 직/간접적인 종속항이므로 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

2.1.2 청구항 제13항-제20항
청구항 제1항은 '무선 통신 단말'에 관한 발명이고, 청구항 제13항은 '무선 통신 방법'에 관한 발명으로, 청구항 제13항은 청구항 제1항과 기술적 특징이 실질적으로 동일합니다. 따라서 청구항 제1항이 진보성이 없으므로, 청구항 제13항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제13항의 종속항인 청구항 제14항에 기재된 발명은 'HE-SIG-A의 SIG-B 압축 필드가 전체 대역폭 MU-MIMO 전송을 지시하여 HE-SIG-B에 공통 필드가 존재하지 않을 경우, HE-SIG-B의 사용자 특정 필드의 구성은 HE-SIG-A의 적어도 하나의 서브필드로부터 획득된 정보에 기초하여 식별되는 점'에서 상기 인용문헌 D1에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌들에도 기재되어 있지 않으며, 이 기술분야에서 통상의 지식을 가진 자에게 자명하지도 않습니다. 따라서 청구항 제14항에 기재된 발명은 신규성 및 진보

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

성이 있습니다(PCT 제33조(2) 및 (3)).

청구항 제15항-제19항은 청구항 제14항의 직/간접적인 종속항이므로 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

청구항 제13항의 종속항인 청구항 제20항에 기재된 발명은 'HE-SIG-A는 PPDU가 상향으로 전송되는지 지시하는 또는 하향으로 전송되는지를 지시하는 상향/하향 필드를 포함하고, PPDU의 HE SIG-A의 적어도 하나의 서브 필드는 상향/하향 필드가 지시하는 값에 기초하여 서로 다른 정보를 지시하거나 서로 다르게 설정되는 점'에서 상기 인용문헌 D1에 기재된 발명과 차이가 있으며, 상기 차이는 다른 인용문헌들에도 기재되어 있지 않으며, 이 기술분야에서 통상의 지식을 가진 자에게 자명하지도 않습니다. 따라서 청구항 제20항에 기재된 발명은 신규성 및 진보성이 있습니다(PCT 제33조(2) 및 (3)).

2.2 산업상 이용가능성
청구항 제1항-제20항에 기재된 발명은 산업상 이용 가능합니다(PCT 제33조(4)).

PCT / KR2018 / 000443
Patent Cooperation Treaty
International Research Organization
repair·
Moth
Republic of Korea 13595 Seongnam-si, Gyeonggi-do,
Pentosis
PCT
Opinion of the International Searching Authority
(2 1 of PCT Regulation 43)
Shipping Earl
(Days / Will / year)
May 2018 (4th (04.05.2018)
References to documents filed or written by Daerian
WILP180004WO
Defense of international application
PCT / KR2018 / 000443
International Patent Classification (IPC)
Additional action
I International Application
2018 Jan 09 (09.01.2010)
See below 2
First of all,
Jan 09, 2017 (09/01/2017)
H04W 28106 (2009.01) i, H04W 74108 (2009.01) i, H04W 84112 (2009.01) i, H04W 72104 (2009.01) i
Filed
Wilus Standard Technology Laboratory Co., Ltd.
l 'Include information on the following fields,
~ The basis of the opinion
Ordinance 2
Written comment on the novelty, the inventive step, and the possibility of using the leaves in the third column
For example,
~ Article 5 The opinion on novelty, inventive step, or availability of acid leaves (2.1 (a) (i) of PCT Rule 43), the supporting documents
And description
In the sixth column,
Article 7 Deficiency of International Application
Article 8 Comments on the international application
2. Additional Actions
If an international preliminary examination is requested, the views of the International Preliminary Examining Authority ("IPEA") will be deemed mutually exclusive,
If an IPEA chooses another agency and the selected IPEA complies with PCT Rule 66.1b (b), the written opinion of the manufacturer of the home country
This is not the case if the International Bureau is notified that it will not be a week

In the case where the IPEA's views are considered to be identical to each other as above, the filing application shall be filed in the form of the PCT /ISA /
(If applicable) to the IPEA prior to the expiration date of late to 22 months
For other options, please refer to the leaflet on Form PCT / ISA / 220.
Name and postal address of ISA / KR

Korea Intellectual Property Office
(35208) Daejeon Optical History Seo-gu Office 189,
4th Dong (Dunsan-dong, Government Daejeon Government Complex)
Fax number 10 82 42 481 8578
Format PCT / ISA237 (Cover) (2015 l Will)
Completely new
2018 05 May 04 (04.05.2018)
Examiner
zl, shah.
Mouth.- "
Phone number +82 82 42 481 3348

Defense of international application
The International Searching Authority
PCT / ItR2018 / 000443
Article 171
2.
In terms of language, it is based on the following:
~ International application in the applicant's language
Translation of the international application filed and translated for international search
(PCT Rule 12.3 (a) and 23.l (b))
This opinion is based on the consideration of the correction of obvious errors which have been granted by the body or notified to the body in accordance with PCT Rule 91
(PCT Rule 43bis.1 (a)) '
3. Regarding the nucleic acid base and / or amino acid sequence disclosed in the international application, it is based on the following,
4.
a "in the form below: a. a sequence listing constituting part of the international application
Appendix Appendix C / ST.25 Text
Writing black is image fir
(b) In accordance with PCT Rule 13bis.3 (a), in the form of an annex C / ST.25 text fal
Submitted sequence list
c. For the purpose of international search only, the following sequence listing
Text Annex C / ST.25 Textual (Rule 13bis.3 (a))
Mouth
(1) of Article 13 of the Rules and Article 713 of the Enforcement Decree)
In addition, if more than one version or copy of the Sequence Listing has been submitted, it shall be listed in a subsequent version or in an additional copy
The information provided is consistent with the information constituting the part of the applicant's application or does not fall outside the scope of the applicant's disclosure

Your statement has been submitted.
5. Additional comments'
Format PCT/ISA / 237 (Article l) (2015 l Will)
The International Searching Authority
Defense of international application
PCT / KR2018 / 000443
Article 571 (a) (i) of PCT Rule 43: (a) the opinion on novelty, inventive step or industrial applicability;
Explanations and explanations supporting this
l 'opinion
Novelty (N) claim 1 20
Claim
Progressive (IS) Claim 2 12,14 20
Claims
Acid availability (IA) Claim 1 20
Claim
2. Disclaimers and Explanations'
The following is a cited document.

Dl: WO 2016-208830 A1 (LG ELECTRONICS INC.) 2016.12.29
D2: WO 2016-182412 A1 (LG ELECTRONICS INC.) 2016.11.17
D3: WO 2017-003193 Al (WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.)2017.01.05
D4: WO 2016-088956 A1 (LG ELECTRONICS INC.) 2016.06.09
D5: WO 2016-175435 A1 (LG ELECTRONICS INC.) 2016.11.03

2.1 Preliminary and Advancement
2.1.1 Claims Clauses 1 to 12
In the reference document Dl closest to the invention described in claim 1, there is a 'copper line (D1:
article); And a processor (D1: see claim 12) for processing the preferences sent over the copper line
The processor then sends the HE MU PPDU (high εfficiency multi-usεr PHY protocol data
The HE-SIG-A (High Efficiency Signal A H ∈ ld) and HE-SIG-A
HE-SIG-B (High Efficiency Signal B Hεld) (see Dl: paragraphs [142] - [143], [197]
Is a wireless mobile terminal that specifies
However, the HE MUs that have been repaired based on the information obtained from the HE-SIG-A,
PPDU is decoded, but the structure of HE-SIG-B is obtained from one subfield of HE-SIG-A.
& Lt; RTI ID = 0.0 & gt; D1 & lt; / RTI & gt; is not explicitly described in the above cited document D1
But the difference is that the 'STA' of the above-mentioned cited document D1 is a SIG-A and a SIG-B fill
The MU frame containing the information obtained from the SIG-A field, for example,
(Dl: Paragraphs [197], [199]) for decoding the SIG-B field based on information on the MCS levels,

Reference & quot;) & lt; / RTI & gt; which can be easily conceived by those of ordinary skill in the art.
Therefore, the invention described in claim 1 is not inventive by the reference document D1 (PCT Article 33 (3)).
Continue to add additional fields
Format PCT/SA, 237 (Article 571) (2015 l Will)
The International Searching Authority
Additional fields
If there is not enough space in the previous section,
Expanded - Continuation of the description column
Defense of international application
PCT / KR2018 / 000443
The invention according to claim 2, which is a dependent claim of claim 1, is characterized in that the 'SIG-B compression field of HE-SIG-A is
If a joint field is not present in HE-SIG-B by instructing full bandwidth MU-MIMO transmission,
The configuration of the user specific field of HE-SIG-B is obtained from at least one subfield of HE-SIG-A
Differs from the invention described in the above-mentioned cited document D1 in that it is identified on the basis of the information obtained from the above-
The above differences are not also present in the other citations, and the usual knowledge in the art
It is not self-evident to those who have it. Therefore, the invention described in claim 2 is characterized in that,
(PCT Article 33 (2) and (3)).
Claims (3) to (7) are direct / indirect dependent claims of claim 2,
(PCT Article 33 (2) and (3)).
.1 zeta
Pitch, λH
The invention according to claim 8, which is a dependent claim of claim 1, is characterized in that the 'HE-SIG-A'
The uplink / downlink field indicating whether the packet is transmitted or downlinked,
At least one sub-field of HE SIG-A of the PPDU is based on the value indicated by the up / down field
In the case where different information is designated or set differently from each other,
The difference is not included in other cited documents,
Nor is it obvious to those of ordinary skill in the art of liquor. Thus, in claim 8
The inventions are optional and progressive (PCT Article 33 (2) and (3)).
Claims 9 to 12 are direct / indirect dependent claims of claim 8,
(PCT Article 33 (2) and (3)).
2.1.2 Claims Claim 13 - 20
The claim 1 is an invention relating to a 'motion wire terminal', and the claim 13 relates to a 'motion wire method'
As an invention, claim 13 is substantially identical to claim 1 and technical specification.
Therefore, since the claim 1 has no inventive step, the invention described in claim 13 is applied to the reference document D1

(PCT Article 33 (3)).
The invention according to claim 14, which is a dependent claim of claim 13, is characterized in that the 'SIG-B compressed field of HE-SIG-A
If the common field is not present in the HE-SIG-B by instructing the overall bandwidth MU-MIMO transmission,
The configuration of the user specific field of HE-SIG-B is obtained from at least one subfield of HE-SIG-A
Differs from the invention described in the above-mentioned cited document D1 in that it is identified on the basis of the information obtained from the above-
The above differences are not also present in the other citations, and the usual knowledge in the art
It is not self-evident to those who have it. Therefore, the invention according to claim 14 is characterized in that,
Continued on next page

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The International Searching Authority
Additional fields
If there is not enough space in the previous section,
Continuation of the
(PCT Article 33 (2) and (3)).
Defense of international application
PCT / KR2018 / 000443
Claims 15 to 19 are direct / indirect dependent claims of claim 14,
(PCT Article 33 (2) and (3)).
The invention according to claim 20, which is a dependent claim of claim 13, is characterized in that the 'HE-SIG-A'
The uplink / downlink field indicating whether the packet is transmitted or downlinked,
At least one sub-field of HE SIG-A of the PPDU is based on the value indicated by the up / down field
In the case where different information is designated or set differently from each other,
The difference is not included in other cited documents,
Nor is it obvious to those of ordinary skill in the art of liquor. Therefore, in claim 20
The re-invented invention is optional and progressive (PCT Article 33 (2) and (3)).
2.2 Acid availability
Claims (1) - (20) The invention according to (20) is available in the form of an acid leaf (PCT Article 33 (4)).
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Juhyung		SON	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Gyeonggi-do	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	308-1402, 7 Naesonsunhwan-ro Uiwang-si		
Address 2			
City	Gyeonggi-do	**State/Province**	
Postal Code	16024	**Country** [i]	KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jinsam		KWAK	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Gyeonggi-do	Country of Residence [i]	KR

Mailing Address of Inventor:

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Address 2			
City	Gyeonggi-do	**State/Province**	
Postal Code	14071	**Country** [i]	KR

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Geonjung		KO	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Gyeonggi-do	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	301-606, 36 Dongtanwoncheon-ro
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City	Gyeonggi-do	State/Province	
Postal Code	16547	**Country** [i]	KR

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Woojin		AHN	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Gyeonggi-do	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	214-2803, 177 Anyangcheonseo-ro Manan-gu Anyang-si
Address 2	

City	Gyeonggi-do	State/Province	
Postal Code	14038	**Country** [i]	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	158747		
Email Address	LA_MAIL@LA.LADAS.COM	Add Email	Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Application Information:

Title of the Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET		
Attorney Docket Number	B-10010CON2 632450-9	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	158747		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16/505664	2019-07-08
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16/505664	Continuation of	PCT/KR2018/000443	2018-01-09

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

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0003147	KR	2017-01-09	1562
			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0008927	KR	2017-01-18	EED0

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

☐ 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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

Mailing Address Information For Applicant:

Address 1	5F 216 Hwangsaeul-ro Bundang-gu Seongnam-si		
Address 2			
City	Gyeonggi-do	**State/Province**	
Country	KR	Postal Code	13595
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Applicant 2

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	SK TELECOM CO., LTD.

Mailing Address Information For Applicant:

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City	Seoul	**State/Province**	
Country	KR	Postal Code	04539
Phone Number		Fax Number	
Email Address			

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Assignee Information including Non-Applicant Assignee Information:

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Assignee 1

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PTO/AIA/14 (02-18)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-10010CON2 632450-9
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET	

Organization Name			
Mailing Address Information For Assignee including Non-Applicant Assignee:			
Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

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This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Young Seok Koo 76255/			Date (YYYY-MM-DD)	2019-12-30
First Name	Young Seok	Last Name	Koo	Registration Number	76,255

Additional Signature may be generated within this form by selecting the Add button.

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung SON
Filer:	Young Seok Koo/Arpine Gamazyan
Attorney Docket Number:	B-10010CON2 632450-9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Electronic Acknowledgement Receipt	
EFS ID:	38168941
Application Number:	16731031
International Application Number:	
Confirmation Number:	3714
Title of Invention:	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET
First Named Inventor/Applicant Name:	Juhyung SON
Customer Number:	158747
Filer:	Young Seok Koo
Filer Authorized By:	
Attorney Docket Number:	B-10010CON2 632450-9
Receipt Date:	31-DEC-2019
Filing Date:	
Time Stamp:	00:07:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	E2019BU111186513
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	632450_Declaration.pdf	592967 7749fe65bb67f18892570e4d4f841ab86d246747	no	2

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2		632450_Spec_Drawings.pdf	747304 1bcd102b4f9a5addedc9b370b918ec17696eaa48	yes	79

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	60
Claims	61	66
Abstract	67	67
Drawings-other than black and white line drawings	68	79

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3	Assignee showing of ownership per 37 CFR 3.73	632450_Assignment_StatementUnder37.pdf	577879 67d2e07013a062620bcd91ce9ea72fe69af18446	no	9

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5	Information Disclosure Statement (IDS) Form (SB08)	632450_IDS_pdf.pdf	253149 549c0df3f1783fd1889e5d99d5b407ee3a8d3152	no	5
Warnings:					
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6	Foreign Reference	Ref_WO2016-208830.pdf	1512887 3c3f08b41b8a3ca1f15d6494a3e4728a4ec6dc42	no	73
Warnings:					
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7	Foreign Reference	Ref_WO2016-182412.pdf	1686339 8a843178cdb3a0114ed8e48a217c93061fb117aa	no	87
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8	Foreign Reference	Ref_WO2017-003193.pdf	1639870 bc1c48be8aadf0f1313ec1f349bfd689d7b2bdea	no	80
Warnings:					
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9	Foreign Reference	Ref_WO2016-088956.pdf	851095 5f9621b416becfe5365813bfd8ed569ef300e6fe	no	59
Warnings:					
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10	Foreign Reference	Ref_WO2016-175435.pdf	1013087 3d4c1855602b24b0007bbe3167733703774fd8a	no	62
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11	Foreign Reference	Ref_WO2018-128530.pdf	3664960 4a4d672400ee29126ab305ce83268d4e1161f582	no	83
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12	Other Reference-Patent/App/Search documents	Ref_PCTKR2018000443_ISR.pdf	230302 cb23dd81bcaccd9062da7ae3771b46b9b557119b	no	5
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13	Other Reference-Patent/App/Search documents	Ref_PCTKR2018000443_WROP.pdf	259252 b1dcd389ebec13e2ccc2b8565114b5e8aab711a3	no	10
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14	Non Patent Literature	Ref_11-17-0010-00-00ax-comments-on-tgax-d1-0.pdf	2205450 326304eccb216b97f14efd6b6b50b111377695f3	no	249
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Information:					
15	Non Patent Literature	Ref_11-17-0110-00-00ax-discussions-on-signaling-for-ul-he-mu-ppdu.pdf	798918 05319133ea9443dbc1e57a021bd866609568b024	no	10
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Information:					
16	Non Patent Literature	Ref_11-17-0173-00-00ax-cids-on-signaling-for-ul-he-mu-ppdu.pdf	135584 60a7631ace0f80f21297fbd8caa03216b534b121	no	4
Warnings:					
Information:					
17	Other Reference-Patent/App/Search documents	632450_Ref_OA.pdf	423630 5413891ff9059b9b69afc524bec6abd492b174d0	no	12
Warnings:					
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18	Other Reference-Patent/App/Search documents	632450_Ref_NOA.pdf	660900 fd49fdc3e6172b2dc8fdba63390428777624 0655	no	14
Warnings:					
Information:					
19	Application Data Sheet	632450_ADS_pdf.pdf	111795 dfb64d01a0ff3cb6b44deab5386d75fa416c 084f	no	10
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
20	Fee Worksheet (SB06)	fee-info.pdf	35342 d9fe9379a23c55d6410abd041a44db723b0 d5541	no	2
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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.

NOTE: 37 CFR 1.63(c) states, "A person may not execute an oath or declaration unless the person has reviewed and understands the contents of the application, including the claims and is aware of the duty to disclose to the Office all information known to be material to patentability as defined in § 1.56."

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

Title of Invention	WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

As the below named inventor, I hereby declare that:

This declaration is directed to:

☒ The attached application, or

☐ United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR (1)

Inventor: Juhyung SON Date (Optional): June 5 2019

Signature: _____

LEGAL NAME OF INVENTOR (2)

Inventor: Jinsam KWAK Date (Optional): June 7, 2019

Signature: _____

LEGAL NAME OF INVENTOR (3)

Inventor: Geonjung KO Date (Optional): June 5, 2019

Signature: [signature]

LEGAL NAME OF INVENTOR (4)

Inventor: Woojin AHN Date (Optional): 6 June 2019

Signature: [signature]

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

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[DESCRIPTION]

[Invention Title]

WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

[Technical Field]

The present invention relates to a wireless communication method and a wireless communication terminal for signaling a multi-user packet.

[Background Art]

In recent years, with supply expansion of mobile apparatuses, a wireless LAN technology that can provide a rapid wireless Internet service to the mobile apparatuses has been significantly spotlighted. The wireless LAN technology allows mobile apparatuses including a smart phone, a smart pad, a laptop computer, a portable multimedia player, an embedded apparatus, and the like to wirelessly access the Internet in home or a company or a specific service providing area based on a wireless communication technology in a short range.

Institute of Electrical and Electronics Engineers (IEEE) 802.11 has commercialized or developed various technological standards since an initial wireless LAN technology is supported using frequencies of 2.4 GHz. First, the IEEE 802.11b supports a communication speed of a maximum of 11 Mbps while using frequencies of a 2.4 GHz band. IEEE 802.11a which is commercialized after the IEEE 802.11b uses frequencies of not the 2.4 GHz band but a 5 GHz band to reduce an influence by interference as compared with the frequencies of the 2.4 GHz band which are significantly congested and improves the communication speed up to a maximum of 54 Mbps by using an OFDM technology. However, the IEEE 802.11a has a disadvantage in that a communication distance is shorter than the IEEE 802.11b. In addition, IEEE

802.11g uses the frequencies of the 2.4 GHz band similarly to the IEEE 802.11b to implement the communication speed of a maximum of 54 Mbps and satisfies backward compatibility to significantly come into the spotlight and further, is superior to the IEEE 802.11a in terms of the communication distance.

Moreover, as a technology standard established to overcome a limitation of the communication speed which is pointed out as a weak point in a wireless LAN, IEEE 802.11n has been provided. The IEEE 802.11n aims at increasing the speed and reliability of a network and extending an operating distance of a wireless network. In more detail, the IEEE 802.11n supports a high throughput (HT) in which a data processing speed is a maximum of 540 Mbps or more and further, is based on a multiple inputs and multiple outputs (MIMO) technology in which multiple antennas are used at both sides of a transmitting unit and a receiving unit in order to minimize a transmission error and optimize a data speed. Further, the standard can use a coding scheme that transmits multiple copies which overlap with each other in order to increase data reliability.

As the supply of the wireless LAN is activated and further, applications using the wireless LAN are diversified, the need for new wireless LAN systems for supporting a higher throughput (very high throughput (VHT)) than the data processing speed supported by the IEEE 802.11n has come into the spotlight. Among them, IEEE 802.11ac supports a wide bandwidth (80 to 160 MHz) in the 5 GHz frequencies. The IEEE 802.11ac standard is defined only in the 5 GHz band, but initial 11ac chipsets will support even operations in the 2.4 GHz band for the backward compatibility with the existing 2.4 GHz band products. Theoretically, according to the standard, wireless LAN speeds of multiple stations are enabled up to a minimum of 1 Gbps and a maximum single link speed is enabled up to a minimum of 500 Mbps. This is achieved by

extending concepts of a wireless interface accepted by 802.11n, such as a wider wireless frequency bandwidth (a maximum of 160 MHz), more MIMO spatial streams (a maximum of 8), multi-user MIMO, and high-density modulation (a maximum of 256 QAM). Further, as a scheme that transmits data by using a 60 GHz band instead of the existing 2.4 GHz/5 GHz, IEEE 802.11ad has been provided. The IEEE 802.11ad is a transmission standard that provides a speed of a maximum of 7 Gbps by using a beamforming technology and is suitable for high bit rate moving picture streaming such as massive data or non-compression HD video. However, since it is difficult for the 60 GHz frequency band to pass through an obstacle, it is disadvantageous in that the 60 GHz frequency band can be used only among devices in a short-distance space.

Meanwhile, in recent years, as next-generation wireless LAN standards after the 802.11ac and 802.11ad, discussion for providing a high-efficiency and high-performance wireless LAN communication technology in a high-density environment is continuously performed. That is, in a next-generation wireless LAN environment, communication having high frequency efficiency needs to be provided indoors/outdoors under the presence of high-density stations and access points (APs) and various technologies for implementing the communication are required.

[Disclosure]

[Technical Problem]

The present invention has an object to provide high-efficiency/high-performance wireless LAN communication in a high-density environment as described above.

[Technical Solution]

In order to achieve the objects, the present invention provides a wireless communication method and a wireless communication terminal as below.

First, an exemplary embodiment of the present invention provides a wireless communication terminal, the terminal including a communication unit; and a processor configured to process signals transmitted and received through the communication unit, wherein the processor receives, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and decodes the received HE MU PPDU based on information obtained from the HE-SIG-A, wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

In addition, an exemplary embodiment of the present invention provides a wireless communication method of a wireless communication terminal, the method including: receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and decoding the received HE MU PPDU based on information obtained from the HE-SIG-A, wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

When a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission so that a common field is not present in the HE-SIG-B, a configuration of a user specific field of the HE-SIG-B may be identified based on information obtained from at least one subfield of the HE-SIG-A.

When the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the configuration of the user specific field of the HE-SIG-B may be identified based on information on the number of MU-MIMO users indicated by the HE-SIG-A.

A type of a user field constituting the user specific field of the HE-SIG-B may include a user field for MU-MIMO allocation and a user field for non-MU-MIMO allocation. The user specific field of the HE-SIG-B may include user fields for MU-MIMO allocation when the information on the number of MU-MIMO users indicates two or more users. The user specific field of the HE-SIG-B may include one user field for non-MU-MIMO allocation when the information on the number of MU-MIMO users indicates a single user.

The user field for MU-MIMO allocation may include a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and the user field for non-MU-MIMO allocation may include a number of space time streams (NSTS) field.

The user field for non-MU-MIMO allocation may be a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

When the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the information on the number of MU-MIMO users may be indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

The HE-SIG-A may include a UL/DL field indicating whether the PPDU is transmitted on an uplink or transmitted on a downlink. At least one subfield of the HE-SIG-A of the PPDU may indicate different information or may be set differently based on a value indicated by the UL/DL field.

A specific value of a bandwidth field of the HE-SIG-A may indicate a predetermined non-contiguous band when the UL/DL field indicates a downlink transmission. The specific value of the bandwidth field of the HE-SIG-A may indicate a predetermined narrow band when the UL/DL field indicates an uplink transmission.

The predetermined narrow band may include at least one of a left-106-tone and a right-106-tone.

A SIG-B compression field of the HE-SIG-A may indicate whether to perform a full bandwidth MU-MIMO transmission in which a common field is not present in an HE-SIG-B field when the UL/DL field indicates a downlink transmission. The SIG-B compression field of the HE-SIG-A may always indicate that the common field is not present in the HE-SIG-B field when the UL/DL field indicates an uplink transmission.

When a SIG-B compression field of the HE-SIG-A indicates a compression mode of an HE-SIG-B field, a number of HE-SIG-B symbols field in the HE-SIG-A may indicate information on the number of MU-MIMO users if the UL/DL field indicates a downlink transmission, and the number of HE-SIG-B symbols field in the HE-SIG-A may indicate information on the number of OFDM symbols in the HE-SIG-B field.

[Advantageous Effects]

According to an embodiment of the present invention, a header field of a physical layer of a wireless LAN packet supporting simultaneous multi-user transmission in an indoor/outdoor environment can be efficiently configured.

According to an embodiment of the present invention, it is possible to increase the total resource utilization rate in the contention-based channel access system and improve the performance of the wireless LAN system.

[Description of Drawings]

FIG. 1 illustrates a wireless LAN system according to an embodiment of the present invention.

FIG. 2 illustrates a wireless LAN system according to another embodiment of

the present invention.

FIG. 3 illustrates a configuration of a station according to an embodiment of the present invention.

FIG. 4 illustrates a configuration of an access point according to an embodiment of the present invention.

FIG. 5 schematically illustrates a process in which a STA and an AP set a link.

FIG. 6 illustrates a carrier sense multiple access (CSMA)/collision avoidance (CA) method used in wireless LAN communication.

FIG. 7 illustrates a method for performing a distributed coordination function (DCF) using a request to send (RTS) frame and a clear to send (CTS) frame.

FIGS. 8 and 9 illustrate multi-user transmission methods according to an embodiment of the present invention.

FIG. 10 illustrates an embodiment of a legacy PPDU format and a non-legacy PPDU format.

FIG. 11 illustrates various HE PPDU formats and an indication method thereof according to an embodiment of the present invention.

FIG. 12 illustrates an embodiment of a configuration of an HE-SIG-A field according to the HE PPDU format.

FIG. 13 illustrates a configuration of an HE-SIG-B field according to an embodiment of the present invention.

FIGS. 14 to 15 illustrate specific embodiments in which a single STA transmits an UL MU PPDU to an AP.

FIG. 16 illustrates an encoding structure and a transmission method of the HE-SIG-B according to an embodiment of the present invention.

FIG. 17 illustrates a non-contiguous channel allocation method according to

an embodiment of the present invention.

FIG. 18 illustrates a wideband access method according an embodiment of the present invention.

FIG. 19 illustrates an embodiment of a method of exchanging and signaling BQRP and BQR for transmitting a non-contiguous PPDU.

FIG. 20 illustrates another embodiment of a method of transmitting and signaling BQR for transmitting a non-contiguous PPDU.

FIG. 21 illustrates a configuration of a BQR according to an embodiment of the present invention.

[Detailed Description of the Invention]

Terms used in the specification adopt general terms which are currently widely used by considering functions in the present invention, but the terms may be changed depending on an intention of those skilled in the art, customs, and emergence of new technology. Further, in a specific case, there is a term arbitrarily selected by an applicant and in this case, a meaning thereof will be described in a corresponding description part of the invention. Accordingly, it should be revealed that a term used in the specification should be analyzed based on not just a name of the term but a substantial meaning of the term and contents throughout the specification.

Throughout this specification and the claims that follow, when it is described that an element is “coupled” to another element, the element may be “directly coupled” to the other element or “electrically coupled” to the other element through a third element. Further, unless explicitly described to the contrary, the word “comprise” and variations such as “comprises” or “comprising”, will be understood to imply the inclusion of stated elements but not the exclusion of any other elements. Moreover, limitations such as "or more” or “or less” based on a specific threshold may be

appropriately substituted with "more than" or "less than", respectively.

This application claims priority to and the benefit of Korean Patent Application Nos. 10-2017-0003147 and 10-2017-0008927 filed in the Korean Intellectual Property Office and the embodiments and mentioned items described in the respective application, which forms the basis of the priority, shall be included in the Detailed Description of the present application.

FIG. 1 is a diagram illustrating a wireless LAN system according to an embodiment of the present invention. The wireless LAN system includes one or more basic service sets (BSS) and the BSS represents a set of apparatuses which are successfully synchronized with each other to communicate with each other. In general, the BSS may be classified into an infrastructure BSS and an independent BSS (IBSS) and FIG. 1 illustrates the infrastructure BSS between them.

As illustrated in FIG. 1, the infrastructure BSS (BSS1 and BSS2) includes one or more stations STA1, STA2, STA3, STA4, and STA5, access points PCP/AP-1 and PCP/AP-2 which are stations providing a distribution service, and a distribution system (DS) connecting the multiple access points PCP/AP-1 and PCP/AP-2.

The station (STA) is a predetermined device including medium access control (MAC) following a regulation of an IEEE 802.11 standard and a physical layer interface for a wireless medium, and includes both a non-access point (non-AP) station and an access point (AP) in a broad sense. Further, in the present specification, a term 'terminal' may be used to refer to a non-AP STA, or an AP, or to both terms. A station for wireless communication includes a processor and a communication unit and according to the embodiment, may further include a user interface unit and a display unit. The processor may generate a frame to be transmitted through a wireless network or process a frame received through the wireless network and besides, perform various processing for

controlling the station. In addition, the communication unit is functionally connected with the processor and transmits and receives frames through the wireless network for the station. According to the present invention, a terminal may be used as a term which includes user equipment (UE).

The access point (AP) is an entity that provides access to the distribution system (DS) via wireless medium for the station associated therewith. In the infrastructure BSS, communication among non-AP stations is, in principle, performed via the AP, but when a direct link is configured, direct communication is enabled even among the non-AP stations. Meanwhile, in the present invention, the AP is used as a concept including a personal BSS coordination point (PCP) and may include concepts including a centralized controller, a base station (BS), a node-B, a base transceiver system (BTS), and a site controller in a broad sense. In the present invention, an AP may also be referred to as a base wireless communication terminal. The base wireless communication terminal may be used as a term which includes an AP, a base station, an eNB (i.e. eNodeB) and a transmission point (TP) in a broad sense. In addition, the base wireless communication terminal may include various types of wireless communication terminals that allocate medium resources and perform scheduling in communication with a plurality of wireless communication terminals.

A plurality of infrastructure BSSs may be connected with each other through the distribution system (DS). In this case, a plurality of BSSs connected through the distribution system is referred to as an extended service set (ESS).

FIG. 2 illustrates an independent BSS which is a wireless LAN system according to another embodiment of the present invention. In the embodiment of FIG. 2, duplicative description of parts, which are the same as or correspond to the embodiment of FIG. 1, will be omitted.

Since a BSS3 illustrated in FIG. 2 is the independent BSS and does not include the AP, all stations STA6 and STA7 are not connected with the AP. The independent BSS is not permitted to access the distribution system and forms a self-contained network. In the independent BSS, the respective stations STA6 and STA7 may be directly connected with each other.

FIG. 3 is a block diagram illustrating a configuration of a station 100 according to an embodiment of the present invention. As illustrated in FIG. 3, the station 100 according to the embodiment of the present invention may include a processor 110, a communication unit 120, a user interface unit 140, a display unit 150, and a memory 160.

First, the communication unit 120 transmits and receives a wireless signal such as a wireless LAN packet, or the like and may be embedded in the station 100 or provided as an exterior. According to the embodiment, the communication unit 120 may include at least one communication module using different frequency bands. For example, the communication unit 120 may include communication modules having different frequency bands such as 2.4 GHz, 5 GHz, and 60 GHz. According to an embodiment, the station 100 may include a communication module using a frequency band of 6 GHz or more and a communication module using a frequency band of 6 GHz or less. The respective communication modules may perform wireless communication with the AP or an external station according to a wireless LAN standard of a frequency band supported by the corresponding communication module. The communication unit 120 may operate only one communication module at a time or simultaneously operate multiple communication modules together according to the performance and requirements of the station 100. When the station 100 includes a plurality of communication modules, each communication module may be implemented by

independent elements or a plurality of modules may be integrated into one chip. In an embodiment of the present invention, the communication unit 120 may represent a radio frequency (RF) communication module for processing an RF signal.

Next, the user interface unit 140 includes various types of input/output means provided in the station 100. That is, the user interface unit 140 may receive a user input by using various input means and the processor 110 may control the station 100 based on the received user input. Further, the user interface unit 140 may perform output based on a command of the processor 110 by using various output means.

Next, the display unit 150 outputs an image on a display screen. The display unit 150 may output various display objects such as contents executed by the processor 110 or a user interface based on a control command of the processor 110, and the like. Further, the memory 160 stores a control program used in the station 100 and various resulting data. The control program may include an access program required for the station 100 to access the AP or the external station.

The processor 110 of the present invention may execute various commands or programs and process data in the station 100. Further, the processor 110 may control the respective units of the station 100 and control data transmission/reception among the units. According to the embodiment of the present invention, the processor 110 may execute the program for accessing the AP stored in the memory 160 and receive a communication configuration message transmitted by the AP. Further, the processor 110 may read information on a priority condition of the station 100 included in the communication configuration message and request the access to the AP based on the information on the priority condition of the station 100. The processor 110 of the present invention may represent a main control unit of the station 100 and according to the embodiment, the processor 110 may represent a control unit for individually

controlling some component of the station 100, for example, the communication unit 120, and the like. That is, the processor 110 may be a modem or a modulator/demodulator for modulating and demodulating wireless signals transmitted to and received from the communication unit 120. The processor 110 controls various operations of wireless signal transmission/reception of the station 100 according to the embodiment of the present invention. A detailed embodiment thereof will be described below.

The station 100 illustrated in FIG. 3 is a block diagram according to an embodiment of the present invention, where separate blocks are illustrated as logically distinguished elements of the device. Accordingly, the elements of the device may be mounted in a single chip or multiple chips depending on design of the device. For example, the processor 110 and the communication unit 120 may be implemented while being integrated into a single chip or implemented as a separate chip. Further, in the embodiment of the present invention, some components of the station 100, for example, the user interface unit 140 and the display unit 150 may be optionally provided in the station 100.

FIG. 4 is a block diagram illustrating a configuration of an AP 200 according to an embodiment of the present invention. As illustrated in FIG. 4, the AP 200 according to the embodiment of the present invention may include a processor 210, a communication unit 220, and a memory 260. In FIG. 4, among the components of the AP 200, duplicative description of parts which are the same as or correspond to the components of the station 100 of FIG. 2 will be omitted.

Referring to FIG. 4, the AP 200 according to the present invention includes the communication unit 220 for operating the BSS in at least one frequency band. As described in the embodiment of FIG. 3, the communication unit 220 of the AP 200 may

also include a plurality of communication modules using different frequency bands. That is, the AP 200 according to the embodiment of the present invention may include two or more communication modules among different frequency bands, for example, 2.4 GHz, 5 GHz, and 60 GHz together. Preferably, the AP 200 may include a communication module using a frequency band of 6 GHz or more and a communication module using a frequency band of 6 GHz or less. The respective communication modules may perform wireless communication with the station according to a wireless LAN standard of a frequency band supported by the corresponding communication module. The communication unit 220 may operate only one communication module at a time or simultaneously operate multiple communication modules together according to the performance and requirements of the AP 200. In an embodiment of the present invention, the communication unit 220 may represent a radio frequency (RF) communication module for processing an RF signal.

Next, the memory 260 stores a control program used in the AP 200 and various resulting data. The control program may include an access program for managing the access of the station. Further, the processor 210 may control the respective units of the AP 200 and control data transmission/reception among the units. According to the embodiment of the present invention, the processor 210 may execute the program for accessing the station stored in the memory 260 and transmit communication configuration messages for one or more stations. In this case, the communication configuration messages may include information about access priority conditions of the respective stations. Further, the processor 210 performs an access configuration according to an access request of the station. According to an embodiment, the processor 210 may be a modem or a modulator/demodulator for modulating and demodulating wireless signals transmitted to and received from the communication unit

220. The processor 210 controls various operations such as wireless signal transmission/reception of the AP 200 according to the embodiment of the present invention. A detailed embodiment thereof will be described below.

FIG. 5 is a diagram schematically illustrating a process in which a STA sets a link with an AP.

Referring to FIG. 5, the link between the STA 100 and the AP 200 is set through three steps of scanning, authentication, and association in a broad way. First, the scanning step is a step in which the STA 100 obtains access information of BSS operated by the AP 200. A method for performing the scanning includes a passive scanning method in which the AP 200 obtains information by using a beacon message (S101) which is periodically transmitted and an active scanning method in which the STA 100 transmits a probe request to the AP (S103) and obtains access information by receiving a probe response from the AP (S105).

The STA 100 that successfully receives wireless access information in the scanning step performs the authentication step by transmitting an authentication request (S107a) and receiving an authentication response from the AP 200 (S107b). After the authentication step is performed, the STA 100 performs the association step by transmitting an association request (S109a) and receiving an association response from the AP 200 (S109b). In this specification, an association basically means a wireless association, but the present invention is not limited thereto, and the association may include both the wireless association and a wired association in a broad sense.

Meanwhile, an 802.1X based authentication step (S111) and an IP address obtaining step (S113) through DHCP may be additionally performed. In FIG. 5, the authentication server 300 is a server that processes 802.1X based authentication with the STA 100 and may be present in physical association with the AP 200 or present as a

separate server.

FIG. 6 is a diagram illustrating a carrier sense multiple access (CSMA)/collision avoidance (CA) method used in wireless LAN communication.

A terminal that performs a wireless LAN communication checks whether a channel is busy by performing carrier sensing before transmitting data. When a wireless signal having a predetermined strength or more is sensed, it is determined that the corresponding channel is busy and the terminal delays the access to the corresponding channel. Such a process is referred to as clear channel assessment (CCA) and a level to decide whether the corresponding signal is sensed is referred to as a CCA threshold. When a wireless signal having the CCA threshold or more, which is received by the terminal, indicates the corresponding terminal as a receiver, the terminal processes the received wireless signal. Meanwhile, when a wireless signal is not sensed in the corresponding channel or a wireless signal having a strength smaller than the CCA threshold is sensed, it is determined that the channel is idle.

When it is determined that the channel is idle, each terminal having data to be transmitted performs a backoff procedure after an inter frame space (IFS) time depending on a situation of each terminal, for instance, an arbitration IFS (AIFS), a PCF IFS (PIFS), or the like elapses. According to the embodiment, the AIFS may be used as a component which substitutes for the existing DCF IFS (DIFS). Each terminal stands by while decreasing slot time(s) as long as a random number determined by the corresponding terminal during an interval of an idle state of the channel and a terminal that completely exhausts the slot time(s) attempts to access the corresponding channel. As such, an interval in which each terminal performs the backoff procedure is referred to as a contention window interval.

When a specific terminal successfully accesses the channel, the corresponding

terminal may transmit data through the channel. However, when the terminal which attempts the access collides with another terminal, the terminals which collide with each other are assigned with new random numbers, respectively to perform the backoff procedure again. According to an embodiment, a random number newly assigned to each terminal may be decided within a range (2*CW) which is twice larger than a range (a contention window, CW) of a random number which the corresponding terminal is previously assigned. Meanwhile, each terminal attempts the access by performing the backoff procedure again in a next contention window interval and in this case, each terminal performs the backoff procedure from slot time(s) which remained in the previous contention window interval. By such a method, the respective terminals that perform the wireless LAN communication may avoid a mutual collision for a specific channel.

FIG. 7 is a diagram illustrating a method for performing a distributed coordination function using a request to send (RTS) frame and a clear to send (CTS) frame.

The AP and STAs in the BSS contend in order to obtain an authority for transmitting data. When data transmission at the previous step is completed, each terminal having data to be transmitted performs a backoff procedure while decreasing a backoff counter (alternatively, a backoff timer) of a random number assigned to each terminal after an AFIS time. A transmitting terminal in which the backoff counter expires transmits the request to send (RTS) frame to notify that corresponding terminal has data to transmit. According to an exemplary embodiment of FIG. 7, STA1 which holds a lead in contention with minimum backoff may transmit the RTS frame after the backoff counter expires. The RTS frame includes information on a receiver address, a transmitter address, and duration. A receiving terminal (i.e., the AP in FIG. 7) that

receives the RTS frame transmits the clear to send (CTS) frame after waiting for a short IFS (SIFS) time to notify that the data transmission is available to the transmitting terminal STA1. The CTS frame includes the information on a receiver address and duration. In this case, the receiver address of the CTS frame may be set identically to a transmitter address of the RTS frame corresponding thereto, that is, an address of the transmitting terminal STA1.

The transmitting terminal STA1 that receives the CTS frame transmits the data after a SIFS time. When the data transmission is completed, the receiving terminal AP transmits an acknowledgment (ACK) frame after a SIFS time to notify that the data transmission is completed. When the transmitting terminal receives the ACK frame within a predetermined time, the transmitting terminal regards that the data transmission is successful. However, when the transmitting terminal does not receive the ACK frame within the predetermined time, the transmitting terminal regards that the data transmission is failed. Meanwhile, adjacent terminals that receive at least one of the RTS frame and the CTS frame in the course of the transmission procedure set a network allocation vector (NAV) and do not perform data transmission until the set NAV is terminated. In this case, the NAV of each terminal may be set based on a duration field of the received RTS frame or CTS frame.

In the course of the aforementioned data transmission procedure, when the RTS frame or CTS frame of the terminals is not normally transferred to a target terminal (i.e., a terminal of the receiver address) due to a situation such as interference or a collision, a subsequent process is suspended. The transmitting terminal STA1 that transmitted the RTS frame regards that the data transmission is unavailable and participates in a next contention by being assigned with a new random number. In this case, the newly assigned random number may be determined within a range (2*CW)

twice larger than a previous predetermined random number range (a contention window, CW).

Basic sequence of UL-MU/DL-MU transmission

FIGS. 8 and 9 illustrate multi-user transmission methods according to an embodiment of the present invention. When using orthogonal frequency division multiple access (OFDMA) or multi-input multi-output (MIMO), one wireless communication terminal can simultaneously transmit data to a plurality of wireless communication terminals. Further, one wireless communication terminal can simultaneously receive data from a plurality of wireless communication terminals. For example, a downlink multi-user (DL-MU) transmission in which an AP simultaneously transmits data to a plurality of STAs, and an uplink multi-user (UL-MU) transmission in which a plurality of STAs simultaneously transmit data to the AP may be performed.

FIG. 8 illustrates a UL-MU transmission process according to an embodiment of the present invention. In order to perform the UL-MU transmission, the channel to be used and the transmission start time of each STA that performs uplink transmission should be adjusted. In order to efficiently schedule the UL-MU transmission, state information of each STA needs to be transmitted to the AP. According to an embodiment of the present invention, information for scheduling of a UL-MU transmission may be indicated through a predetermined field of a preamble of a packet and/or a predetermined field of a MAC header. For example, a STA may indicate information for UL-MU transmission scheduling through a predetermined field of a preamble or a MAC header of an uplink transmission packet, and may transmit the information to an AP. In this case, the information for UL-MU transmission scheduling includes at least one of buffer status information of each STA, and channel state information measured by each STA. The buffer status information of the STA may

indicate at least one of whether the STA has uplink data to be transmitted, the access category (AC) of the uplink data and the size (or the transmission time) of the uplink data.

According to an embodiment of the present invention, the UL-MU transmission process may be managed by the AP. The UL-MU transmission may be performed in response to a trigger frame transmitted by the AP. The STAs simultaneously transmit uplink data a predetermined IFS (e.g., SIFS) time after receiving the trigger frame. The trigger frame solicits UL-MU transmission of STAs and may inform channel (or subchannel) information allocated to the uplink STAs. Upon receiving the trigger frame from the AP, a plurality of STAs transmit uplink data through each allocated channel (or, subchannel) in response thereto. After the uplink data transmission is completed, the AP transmits an ACK to the STAs that have successfully transmitted the uplink data. In this case, the AP may transmit a predetermined multi-STA block ACK (M-BA) as an ACK for a plurality of STAs.

In the non-legacy wireless LAN system, subcarriers of a specific number, for example, 26, 52, or 106 tones may be used as a resource unit (RU) for a subchannel-based access in a channel of 20 MHz band. Accordingly, the trigger frame may indicate identification information of each STA participating in the UL-MU transmission and information of the allocated resource unit. The identification information of the STA includes at least one of an association ID (AID), a partial AID, and a MAC address of the STA. Further, the information of the resource unit includes the size and placement information of the resource unit.

On the other hand, in the non-legacy wireless LAN system, a UL-MU transmission may be performed based on a contention of a plurality of STAs for a specific resource unit. For example, if an AID field value for a specific resource unit is

set to a specific value (e.g., 0) that is not assigned to STAs, a plurality of STAs may attempt random access (RA) for the corresponding resource unit.

FIG. 9 illustrates a DL-MU transmission process according to an embodiment of the present invention. According to an embodiment of the present invention, RTS and/or CTS frames of a predetermined format may be used for NAV setting in the DL-MU transmission process. First, the AP transmits a multi-user RTS (MU-RTS) frame for NAV setting in the DL-MU transmission process. The duration field of the MU-RTS frame is set to a time until the end of the DL-MU transmission session. That is, the duration field of the MU-RTS frame is set based on a period until the downlink data transmission of the AP and ACK frame transmissions of the STAs are completed. The neighboring terminals of the AP set a NAV until the end of the DL-MU transmission session based on the duration field of the MU-RTS frame transmitted by the AP. According to an embodiment, the MU-RTS frame may be configured in the format of a trigger frame and requests simultaneous CTS (sCTS) frame transmissions of the STAs.

STAs (e.g., STA1 and STA2) receiving the MU-RTS frame from the AP transmit the sCTS frame. The sCTS frames transmitted by a plurality of STAs have the same waveform. That is, the sCTS frame transmitted by the STA1 on the first channel has the same waveform as the sCTS frame transmitted by the STA2 on the first channel. According to an embodiment, the sCTS frame is transmitted on the channel indicated by the MU-RTS frame. The duration field of the sCTS frame is set to a time until the DL-MU transmission session is terminated based on the information of the duration field of the MU-RTS frame. That is, the duration field of the sCTS frame is set based on the period until the downlink data transmission of the AP and the ACK frame transmissions of the STAs are completed. In FIG. 9, neighboring terminals of STA1 and STA2 set a NAV until the end of the DL-MU transmission session based on the duration field of the

sCTS frame.

According to an embodiment of the present invention, the MU-RTS frame and the sCTS frame may be transmitted on a 20 MHz channel basis. Accordingly, the neighboring terminals including legacy terminals can set the NAV by receiving the MU-RTS frame and/or the sCTS frame. When the transmission of the MU-RTS frame and the sCTS frame is completed, the AP performs a downlink transmission. FIG. 9 illustrates an embodiment in which the AP transmits DL-MU data to STA1 and STA2, respectively. The STAs receive the downlink data transmitted by the AP and transmit an uplink ACK in response thereto.

PPDU format

FIG. 10 illustrates an embodiment of a legacy PHY Protocol Data Unit (PPDU) format and a non-legacy PPDU format. More specifically, FIG. 10(a) illustrates an embodiment of a legacy PPDU format based on 802.11a/g, and FIG. 10(b) illustrates an embodiment of a non-legacy PPDU based on 802.11ax. In addition, FIG. 10(c) illustrates the detailed field configuration of L-SIG and RL-SIG commonly used in the PPDU formats.

Referring to FIG. 10(a), the preamble of the legacy PPDU includes a legacy short training field (L-STF), a legacy long training field (L-LTF), and a legacy signal field (L-SIG). In an embodiment of the present invention, the L-STF, L-LTF and L-SIG may be referred to as a legacy preamble. Referring to FIG. 10(b), the preamble of the HE PPDU includes a repeated legacy short training field (RL-SIG), a high efficiency signal A field (HE-SIG-A), a high efficiency signal B field, a high efficiency short training field (HE-STF), and a high efficiency long training field (HE-LTF) in addition to the legacy preamble. In an embodiment of the present invention, the RL-SIG, HE-SIG-A, HE-SIG-B, HE-STF and HE-LTF may be referred to as a non-legacy preamble.

The detailed configuration of the non-legacy preamble may be modified according to the HE PPDU format. For example, HE-SIG-B may only be used in some formats among the HE PPDU formats.

A 64 FFT OFDM is applied to the L-SIG included in the preamble of the PPDU and the L-SIG consists of 64 subcarriers in total. Among these, 48 subcarriers excluding guard subcarriers, a DC subcarrier and pilot subcarriers are used for data transmission of the L-SIG. If a modulation and coding scheme (MCS) of BPSK, Rate = 1/2 is applied, the L-SIG may include information of a total of 24 bits. FIG. 10(c) illustrates a configuration of 24-bit information of the L-SIG.

Referring to FIG. 10(c), the L-SIG includes an L_RATE field and an L_LENGTH field. The L_RATE field consists of 4 bits and represents the MCS used for data transmission. More specifically, the L_RATE field represents one of the transmission rates of 6/9/12/18/24/24/36/48/54Mbps by combining the modulation scheme such as BPSK/QPSK/16-QAM/64-QAM with the code rate such as 1/2, 2/3, 3/4. When combining the information of the L_RATE field and the L_LENGTH field, the total length of the corresponding PPDU can be represented. The non-legacy PPDU sets the L_RATE field to a 6 Mbps which is the minimum rate.

The L_LENGTH field consists of 12 bits, and may represent the length of the corresponding PPDU by a combination with the L_RATE field. In this case, the legacy terminal and the non-legacy terminal may interpret the L_LENGTH field in different ways.

First, a method of interpreting the length of a PPDU using a L_LENGTH field by a legacy terminal or a non-legacy terminal is as follows. When the L_RATE field is set to 6 Mbps, 3 bytes (i.e., 24 bits) can be transmitted for 4 us, which is one symbol duration of 64 FFT. Therefore, by adding 3 bytes corresponding to the SVC field and

the Tail field to the value of the L_LENGTH field and dividing it by 3 bytes, which is the transmission amount of one symbol, the number of symbols after the L-SIG is obtained on the 64FFT basis. The length of the corresponding PPDU, that is, the reception time (i.e., RXTIME) is obtained by multiplying the obtained number of symbols by 4us, which is one symbol duration, and then adding a 20us which is for transmitting L-STF, L-LTF and L-SIG. This can be expressed by the following Equation 1.

[Equation 1]

$$\mathbf{RXTIME(us)} = \left(\left\lceil \frac{\mathbf{L\_LENGTH+3}}{\mathbf{3}} \right\rceil\right) \times \mathbf{4} + \mathbf{20}$$

In this case, $\lceil x \rceil$ denotes the smallest natural number greater than or equal to x. Since the maximum value of the L_LENGTH field is 4095, the length of the PPDU can be set up to 5.464ms. The non-legacy terminal transmitting the PPDU should set the L_LENGTH field as shown in Equation 2 below.

[Equation 2]

$$\mathbf{L\_LENGTH(byte)} = \left(\left\lceil \frac{\mathbf{TXTIME-20}}{\mathbf{4}} \right\rceil\right) \times \mathbf{3} - \mathbf{3}$$

Herein, TXTIME is the total transmission time constituting the corresponding PPDU, and is expressed by Equation 3 below. In this case, TX represents the transmission time of X.

[Equation 3]

$$\mathbf{TXTIME(us)} = T_{\mathrm{L-STF}} + T_{\mathrm{L-LTF}} + T_{\mathrm{L-SIG}} + T_{\mathrm{RL-SIG}} + T_{\mathrm{HE-SIG-A}} + (T_{\mathrm{HE-SIG-B}}) + T_{\mathrm{HE-STF}} + N_{\mathrm{HE-LTF}} \cdot T_{\mathrm{HE-LTF}} + T_{\mathrm{Data}}$$

With reference to the above equations, the length of the PPDU is calculated based on the round-up value of L_LENGTH/3. Therefore, for any value of k, three

different values of L_LENGTH = {3k+1, 3k+2, 3(k+1)} indicate the same PPDU length. According to an embodiment of the present invention, the non-legacy terminal may perform additional signaling using three different L_LENGTH values indicating the same PPDU length information. More specifically, values corresponding to 3k+1 and 3k+2 among the three different L_LENGTH values may be used to indicate the HE PPDU format.

FIG. 11 illustrates various HE PPDU formats and an indication method thereof according to an embodiment of the present invention. According to an embodiment of the present invention, the HE PPDU format may be indicated based on the L_LENGTH field and HE-SIG-A of the corresponding PPDU. More specifically, the HE PPDU format is indicated based on at least one of the value of the L_LENGTH field and the modulation scheme applied to the HE-SIG-A symbol.

First, referring to FIG. 11(a), when the value of the L_LENGTH field is 3k+1 (i.e., when mod3 = 1), the corresponding PPDU is an HE SU PPDU or an HE Trigger-based PPDU. The HE SU PPDU is a PPDU used for a single-user transmission between an AP and a single STA. Furthermore, the HE Trigger-based PPDU is an uplink PPDU used for a transmission that is a response to a trigger frame. HE SU PPDU and HE Trigger-based PPDU have the same preamble format. In the cases of the HE SU PPDU and the HE Trigger-based PPDU, two symbols of HE-SIG-A are modulated with BPSK and BPSK, respectively.

According to a further embodiment of the present invention illustrated in FIG. 11(b), when the value of the L_LENGTH field is 3k+1 and the two symbols of HE-SIG-A are modulated with BPSK and QBPSK, respectively, the corresponding PPDU is an extended PPDU. The extended PPDU is used as a new PPDU format other than the PPDU formats supported by 802.11ax.

Next, when the value of the L_LENGTH field is 3k+2 (i.e., when mod3 = 2), the corresponding PPDU is an HE MU PPDU or an HE Extended Range (ER) SU PPDU. The HE MU PPDU is a PPDU used for a transmission to one or more terminals. The HE MU PPDU format is illustrate in FIG. 11(c) and additionally includes HE-SIG-B in the non-legacy preamble. In the case of the HE MU PPDU, the two symbols of HE-SIG-A are modulated with BPSK and BPSK, respectively. On the other hand, HE ER SU PPDU is used for a single-user transmission with a terminal in an extended range. The HE ER SU PPDU format is illustrated in FIG. 11(d), where HE-SIG-A of the non-legacy preamble is repeated on the time axis. In the case of the HE ER SU PPDU, the first two symbols of HE-SIG-A are modulated with BPSK and QBPSK, respectively. Thus, the non-legacy terminal can signal the PPDU format through the modulation scheme used for the two symbols of HE-SIG-A in addition to the value of the L_LENGTH field.

The HE MU PPDU illustrated in FIG. 11(c) may be used by an AP to perform a downlink transmission to a plurality of STAs. In this case, the HE MU PPDU may include scheduling information for a plurality of STAs to simultaneously receive the corresponding PPDU. In addition, the HE MU PPDU may be used by a single STA to perform an uplink transmission to the AP. In this case, the HE MU PPDU may transmit AID information of the receiver and/or the transmitter of the corresponding PPDU through a user specific field of the HE-SIG-B. Therefore, terminals receiving the HE MU PPDU may perform a spatial reuse operation based on the AID information obtained from the preamble of the corresponding PPDU. In addition, data transmission through some narrowband may be performed using the HE MU PPDU. Here, the narrowband may be a frequency band of less than 20 MHz. According to an embodiment, the HE MU PPDU may indicate allocation information of resource unit(s)

to be used for a narrowband transmission through the HE-SIG-B.

More specifically, the resource unit allocation (RA) field of HE-SIG-B contains information on the resource unit partition type in a specific bandwidth (e.g., 20 MHz) of the frequency domain. Further, information of a STA assigned to each partitioned resource unit may be transmitted through the user specific field of the HE-SIG-B. The user specific field includes one or more user fields corresponding to each partitioned resource unit.

When a narrowband transmission using a part of the partitioned resource units is performed, the resource unit used for the transmission may be indicated through the user specific field of the HE-SIG-B. According to an embodiment, an AID of a receiver or a transmitter may be contained in a user field corresponding to resource unit(s) on which data transmission is performed among a plurality of partitioned resource units. In addition, a predetermined Null STA ID may be contained in user field(s) corresponding to the remaining resource unit(s) in which data transmission is not performed. According to another embodiment of the present invention, the narrowband transmission may be signaled through a first user field corresponding to a resource unit in which data transmission is not performed and a second user field corresponding to a resource unit in which data transmission is performed. More specifically, a predetermined null STA ID may be contained in the first user field, and the placement information of the resource unit(s) on which data transmission is performed may be indicated through the remaining subfields of the corresponding user field. Next, the AID of the receiver or transmitter may be contained in the second user field. Thus, the terminal may signal the narrowband transmission through the location information contained in the first user field and the AID information contained in the second user field. In this case, since user fields less than the number of partitioned resource units are

used, the signaling overhead can be reduced.

Configuration of HE-SIG-A field and HE-SIG-B field in an HE PPDU

FIG. 12 illustrates an embodiment of a configuration of an HE-SIG-A field according to the HE PPDU format. HE-SIG-A consists of two symbols of 64 FFT, and indicates common information for reception of the HE PPDU. The first symbol of the HE-SIG-A is modulated with BPSK, and the second symbol of the HE-SIG-A is modulated with BPSK or QBPSK. In the HE ER SU PPDU, two symbols of the HE-SIG-A may be repeatedly transmitted. That is, the HE-SIG-A of the HE ER SU PPDU consists of four symbols, the first symbol and the second symbol of which have the same data bit, and the third symbol and the fourth symbol of which have the same data bit.

First, FIG. 12(a) illustrates a subfield configuration of the HE-SIG-A field of the HE SU PPDU. According to an embodiment, the HE-SIG-A field of the HE ER SU PPDU may be configured similarly. The function of each field included in HE-SIG-A will be described as follows.

The UL/DL field indicates a transmission direction of the corresponding PPDU. That is, the corresponding field indicates whether the corresponding PPDU is transmitted with uplink or is transmitted with downlink. The format field is used to differentiate an HE SU PPDU from an HE Trigger-based PPDU. The BSS color field consists of 6 bits and indicates an identifier of the BSS corresponding to a terminal that transmitted the corresponding PPDU. The spatial reuse field carries information such as signal to interference plus noise ratio (SINR), transmission power, etc., which can be referred to by terminals to perform spatial reuse transmission during the transmission of the corresponding PPDU.

The TXOP duration field indicates duration information for TXOP protection

and NAV setting. The corresponding field sets the duration of the TXOP interval in which consecutive transmission is to be performed after the corresponding PPDU, so that the neighboring terminals set a NAV for the corresponding duration. The bandwidth field indicates the total bandwidth in which the corresponding PPDU is transmitted. According to an embodiment, the bandwidth field may consist of 2 bits and indicate one of 20 MHz, 40 MHz, 80 MH and 160 MHz (including 80+80 MHz). The MCS field indicates an MCS value applied to the data field of the corresponding PPDU. The CP+LTF size field indicates the duration of the cyclic prefix (CP) or guard interval (GI) and the size of the HE-LTF. More specifically, the corresponding field indicates the combination of the HE-LTF size used among 1x, 2x, and 4x HE-LTF, and the CP (or GI) value used in the data field among 0.8us, 1.6us, and 3.2us.

The coding field may indicate which coding scheme is used between binary convolutional code (BCC) and low density parity check (LDPC). In addition, the corresponding field may indicate whether an extra OFDM symbol for LDPC is present. The number of space time streams (NSTS) field indicates the number of space-time streams used for MIMO transmission. The space time block coding (STBC) field indicates whether space-time block coding is used. The transmit beamforming (TxBF) field indicates whether beamforming is applied to the transmission of the corresponding PPDU. The dual carrier modulation (DCM) field indicates whether dual carrier modulation is applied to the data field. The dual carrier modulation transmits the same information through two subcarriers in order to cope with narrowband interference. The packet extension field indicates which level of packet extension is applied to the PPDU. The beam change field indicates whether the part before the HE-STF of the corresponding PPDU is mapped spatially different from the HE-LTF. The CRC field and the tail field are used to determine the authenticity of the HE-SIG-A field

information and to initialize the BCC decoder, respectively.

Next, FIG. 12(b) illustrates a subfield configuration of the HE-SIG-A field of the HE MU PPDU. Among the subfields shown in FIG. 12(b), the same subfields as those shown in FIG. 12(a) will not be described.

The UL/DL field indicates the transmission direction of the corresponding PPDU. That is, the corresponding field indicates whether the corresponding PPDU is transmitted with uplink or is transmitted with downlink. The bandwidth field of the HE MU PPDU may indicate extra bandwidths in addition to the bandwidths of the HE SU PPDU. That is, the bandwidth field of the HE MU PPDU consists of 3 bits and indicates one of 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80+80 MHz), and predetermined non-contiguous bands. The specific embodiments of the predetermined non-contiguous bands will be described later.

The SIG-B MCS field indicates the MCS applied to the HE-SIG-B field. Depending on the amount of information that requires signaling, variable MCS between MSC0 and MSC5 can be applied to the HE-SIG-B. The CP+LTF size field indicates the duration of the CP or GI and the size of the HE-LTF. The corresponding field indicates the combination of the HE-LTF size used among 2x and 4x HE-LTF, and the CP (or GI) value used in the data field among 0.8us, 1.6us, and 3.2us.

The SIG-B compression field indicates whether to use a compression mode of the HE-SIG-B field. When the HE MU PPDU is transmitted using an MU-MIMO in the full bandwidth, the resource unit allocation information for each 20 MHz band becomes unnecessary. Therefore, in the full bandwidth MU-MIMO transmission, the SIG-B compression field indicates the compression mode of the HE-SIG-B field. In this case, the common field containing the resource unit allocation field is not present in the HE-SIG-B field. The SIG-B DCM field indicates whether the HE-SIG-B field is modulated

with the DCM for reliable transmission of the HE-SIG-B field. The number of HE-SIG-B symbols field indicates information on the number of OFDM symbols in the HE-SIG-B field.

On the other hand, when the HE MU PPDU is transmitted in a band of 40 MHz or more as described later, the HE-SIG-B may consist of two kinds of content channels in units of 20 MHz. The content channels are referred to as HE-SIG-B content channel 1 and HE-SIG-B content channel 2, respectively. According to an embodiment of the present invention, the number of HE-SIG-B symbols in each channel can be kept similar by differentiating MCSs applied to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively. The HE-SIG-A field of the HE MU PPDU may include a SIG-B dual MCS field. In this case, it is indicated through the corresponding field whether the MCSs applied to the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 are different with each other.

According to the embodiment of the present invention, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field (i.e., when the full bandwidth MU-MIMO transmission is indicated), a specific field of the HE-SIG-A may indicate information on the number of MU-MIMO users. For example, when the full bandwidth MU-MIMO transmission is performed, the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 do not need to distribute the amount of information through different MCSs. Therefore, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the SIG-B dual MCS field of the HE-SIG-A may indicate information on the number of MU-MIMO users. Likewise, when the full bandwidth MU-MIMO transmission is performed, information on the number of symbols in each HE-SIG-B content channel need not be delivered separately. Therefore, when the SIG-B compression field indicates the compression mode of the

HE-SIG-B field, the number of HE-SIG-B symbols field in the HE-SIG-A may indicate the information on the number of MU-MIMO users. As described above, in the compression mode in which the resource unit allocation field of the HE-SIG-B is omitted, information on the number of MU-MIMO users may be indicated through a specific subfield of the HE-SIG-A.

According to a further embodiment of the present invention, some of the subfields of the HE-SIG-A field of the HE MU PPDU may signal information different from the above embodiments through a combination of a plurality of subfields. As described above, the HE MU PPDU may not only be used by the AP to perform a downlink transmission to a plurality of STAs, but may also be used by a single STA to perform an uplink transmission to the AP. According to an embodiment of the present invention, information based on the value indicated by the UL/DL field, the specific subfield of the HE-SIG-A field of the HE MU PPDU may be set differently from each other or indicate different information.

First, the bandwidth field may indicate different information based on the value indicated by the UL/DL field. When the UL/DL field indicates downlink transmission, the bandwidth field indicates any one of 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80+80 MHz), and predetermined non-contiguous bands. In a 3-bit bandwidth field, values of 0 to 3 indicate 20 MHz, 40 MHz, 80 MHz, and 160 MHz (including 80+80 MHz), respectively, and any one of values 4 to 7 indicates one of the predetermined non-contiguous bands. However, a PPDU with non-contiguous bandwidth may only be used for downlink transmission. Therefore, specific values of the bandwidth field (i.e., one or more values among 4 to 7) may indicate different information between when the UL/DL field indicates downlink transmission and when it indicates uplink transmission.

For example, if the UL/DL field indicates an uplink transmission, the bandwidth field indicates any one of 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80+80 MHz), and a predetermined narrow bandwidths. That is, in the 3-bit bandwidth field, values of 0 to 3 indicate 20 MHz, 40 MHz, 80 MHz, and 160 MHz (including 80+80 MHz), respectively, and any one of values 4 to 7 may indicate one of the predetermined narrow bandwidths. According to an embodiment, the predetermined narrow bandwidth may include a left-106-tone and a right-106-tone. In this case, among the 242-tone constituting a 20 MHz primary channel, the left-106-tone indicates the low-frequency 106-tone resource unit, and the right-106-tone indicates the high-frequency 106-tone resource unit. However, the present invention is not limited thereto, and the predetermined narrow bandwidth may include one or more of a 26-tone resource unit, a 52-tone resource unit, a 106-tone resource unit, or a combination thereof.

As described above, data transmission through a predetermined narrowband within the 20 MHz band may be performed when the UL MU PPDU is transmitted. The allocation information of the resource unit to be used for the narrowband transmission may be indicated through the resource unit allocation field and the user specific field of the HE-SIG-B. However, in this case, the signaling overhead may be large. Thus, according to an embodiment of the present invention, the uplink narrowband transmission may be indicated through the bandwidth field of the HE-SIG-A of the HE MU PPDU.

Next, the SIG-B compression field may be set differently based on the value indicated by the UL/DL field. The SIG-B compression field indicates whether to use the compression mode of the HE-SIG-B field. When the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the common field containing the resource unit allocation field is not present in the HE-SIG-B field. According to the embodiment

of the present invention, the SIG-B compression field may be set according to different rules between when the UL/DL field indicates downlink transmission and when it indicates uplink transmission.

More specifically, when the UL/DL field indicates downlink transmission, the SIG-B compression field indicates whether to perform the full bandwidth MU-MIMO transmission. That is, when the full-bandwidth MU-MIMO transmission is performed, the value of the SIG-B compression field is set to 1. Otherwise, the value of the SIG-B compression field is set to 0. However, the signaling of the resource unit allocation field may be unnecessary when a UL MU PPDU is transmitted by a single STA. Therefore, when the UL/DL field indicates uplink transmission, the value of the SIG-B compression field may be always set to 1. That is, when the UL/DL field indicates uplink transmission, the SIG-B compression field may always indicate that the common field is not present in the HE-SIG-B field. Although the full bandwidth MU-MIMO transmission is not performed, the compression mode of the HE-SIG-B field may be used to reduce the signaling overhead of the HE-SIG-B of the uplink transmission. Therefore, the common field may be omitted from the HE-SIG-B field of the UL MU PPDU.

Next, the number of HE-SIG-B symbols field may indicate different information based at least in part on the value indicated by the UL/DL field. More specifically, the number of HE-SIG-B symbols field may indicate different information based on the value indicated by the UL/DL field and the value of the SIG-B compression field.

The number of HE-SIG-B symbols field basically indicates the number of OFDM symbols in the HE-SIG-B field. However, as in the embodiments described above, when the UL/DL field indicates downlink transmission and the SIG-B

compression field indicates the compression mode of the HE-SIG-B field, the number of HE-SIG-B symbols field in the HE-SIG-A may indicate the information on the number of MU-MIMO user. In this case, the user specific field of the HE-SIG-B field may consist of a user field for MU-MIMO allocation. Meanwhile, when the value of the SIG-B compression field in the UL MU PPDU is set to 1, it may be intended to omit the resource unit allocation field rather than to indicate the full bandwidth MU-MIMO transmission. Therefore, when the UL/DL field indicates uplink transmission and the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the number of HE-SIG-B symbols field in the HE-SIG-A may indicate the number of OFDM symbols in the HE-SIG-B field as in the basic definition. In this case, the user specific field of the HE-SIG-B field may consist of a user field for non-MU-MIMO allocation. According to an embodiment, since the UL MU PPDU is transmitted to a single AP, the user specific field of the HE-SIG-B field may include only one user field for the non-MU-MIMO allocation.

Next, FIG. 12(c) illustrates a subfield configuration of the HE-SIG-A field of the HE trigger-based PPDU. Among the subfields shown in FIG. 12(c), the same subfields as those shown in FIG. 12(a) or 12(b) will not be described.

The format field is used to differentiate an HE SU PPDU from an HE Trigger-based PPDU. Also, the HE Trigger-based PPDU includes the above-described BSS color field and TXOP duration field. The spatial reuse field of the HE Trigger-based PPDU consists of 16 bits and carries information for spatial reuse operation in units of 20 MHz or 40 MHz according to the total bandwidth. The bandwidth field consists of 2 bits and may indicate one of 20 MHz, 40 MHz, 80 MHz and 160 MHz (including 80+80 MHz).

FIG. 13 illustrates a configuration of an HE-SIG-B field according to an

embodiment of the present invention. The HE-SIG-B field is present in the HE MU PPDU and is transmitted in units of 20 MHz. In addition, the HE-SIG-B field indicates information necessary for receiving the HE MU PPDU. As illustrated in FIG. 13(a), the HE-SIG-B consists of a common field and a user specific field.

FIG. 13(b) illustrates an embodiment of a subfield configuration of the common field of the HE-SIG-B. First, the common field includes a resource unit allocation (RA) field. FIG. 13(c) illustrates an embodiment of the RA field.

Referring to FIG. 13(c), the RA field contains information on resource unit allocation of a specific bandwidth (e.g., 20 MHz) in the frequency domain. More specifically, the RA field consists in units of 8 bits, and indexes the size of the resource units constituting the specific bandwidth and their placement in the frequency domain. Further, the RA field may indicate the number of users in each resource unit. When the total bandwidth through which the PPDU is transmitted is greater than a predetermined bandwidth (e.g., 40 MHz), the RA field may be set to a multiple of 8 bits to carry information in units of the specific bandwidth.

Each partitioned resource unit is generally assigned to one user. However, resource units of a certain bandwidth (e.g., 106-tones) or more can be assigned to a plurality of users using MU-MIMO. In this case, the RA field may indicate the number of users in the corresponding resource unit. In addition, the RA field may indicate, through a predetermined index, a specific resource unit in which a user specific field is not transmitted, i.e., a specific resource unit (i.e., an empty RU) that is not assigned to the user. According to an embodiment, the specific resource unit includes a resource unit (RU) having a bandwidth of a multiple of 20 MHz channels, i.e., 242-tone RU, 484-tone RU, 996-tone RU, and the like. In an empty RU indicated by the index value, data transmission is not performed. In this manner, the terminal may signal non-

contiguous channel allocation information in units of 20 MHz through a predetermined index of the RA field of the HE-SIG-B.

According to an embodiment of the present invention, when a PPDU is transmitted through a total bandwidth of 80 MHz or more, the common field further includes a field (hereinafter, referred to as C26 field) indicating whether a user is allocated to a center 26-tone RU of 80 MHz. The C26 field may consist of a 1-bit indicator before or after the RA field in the common field.

On the other hand, the user specific field consists of a plurality of user fields, and carries information for a designated STA to each allocated resource unit. The total number of user fields to be included in the user specific field may be determined based on the RA field and the C26 field. A plurality of user fields are transmitted in units of a user block field. The user block field is made up of an aggregation of two user fields, a CRC field and a tail field. Depending on the total number of user fields, the last user block field may contain information for one or two STAs. For example, if a total of three users (i.e., STA1, STA2, and STA3) are designated, information for STA1 and STA2 may be coded and transmitted along with the CRC/tail field in the first user block field, and information for STA3 may be coded and transmitted along with the CRC/tail field in the last user block field.

FIGS. 13(d)-1 and 13(d)-2 illustrate embodiments of the subfield configuration of the user field of the HE-SIG-B, respectively. FIG. 13(d)-1 illustrates a user field for an OFDMA transmission, and FIG. 13(d)-2 illustrates a user field for a MU-MIMO transmission. Each user field indicates a receiver AID of the corresponding resource unit. Exceptionally, when the HE MU PPDU is used for an uplink transmission, the user field may indicate a transmitter AID. When one user is allocated to one resource unit (i.e., non-MU-MIMO allocation), the user field includes a number of

space time streams (NSTS) field, a TxBF field, an MCS field, a DCM field and a coding field as illustrated in FIG. 13(d)-1. On the other hand, when a plurality of users are allocated to one resource unit (i.e., MU-MIMO allocation), the user field includes a spatial configuration field (SCF), an MCS field, a DCM field, and a coding field as illustrated in FIG. 13(d)-2. Each STA that receives a PPDU through an MU-MIMO allocation should identify the location and number of spatial streams for it in the corresponding resource unit. To this end, the user field for the MU-MIMO transmission includes a spatial configuration field (SCF).

FIG. 13(e) illustrates an embodiment of the SCF of the HE-SIG-B. The SCF indicates the number of spatial streams for each STA and the total number of spatial streams in the MU-MIMO allocation. Each STA identifies the OFDMA and/or MIMO allocation of the corresponding PPDU through the RA field and identifies whether the STA receives data through the MU-MIMO allocation according to the order indicated in the user specific field. When the STA receives data through the non-MU-MIMO allocation, the user field is interpreted according to the format of FIG. 13(d)-1. However, when the STA receives data through the MU-MIMO allocation, the user field is interpreted according to the format of FIG. 13(d)-2. On the other hand, when the SIG-B compression field indicates the full bandwidth MU-MIMO, the RA field is not present in the HE-SIG-B. In this case, since all the STAs signaled in the user specific field receive data through the MU-MIMO allocation, the STAs interpret the user field according to the format of FIG. 13(d)-2.

As described in the above embodiments, when the SIG-B compression field indicates the full bandwidth MU-MIMO, the specific subfield of the HE-SIG-A may indicate the information on the number of MU-MIMO users. That is, when the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the number

of HE-SIG-B symbols field of the HE-SIG-A may indicate the information on the number of MU-MIMO users. According to a further embodiment of the present invention, when the SIG-B compression field indicates the full bandwidth MU-MIMO, the configuration of the user specific field of the HE-SIG-B may be identified based on the information on the number of MU-MIMO users indicated by the number of HE-SIG-B symbols field. For example, the type of the user field constituting the user specific field may be determined to be either a user field for MU-MIMO allocation or a user field for non-MU-MIMO allocation based on the information on the number of MU-MIMO users.

More specifically, when the SIG-B compression field indicates the full bandwidth MU-MIMO and the number of HE-SIG-B symbols field indicates two or more users, the user specific field of the HE-SIG-B consists of user fields for MU-MIMO allocation. According to an embodiment, the number of HE-SIG-B symbols field may be set to a value of 1 or more when it indicates two or more users. In this case, the receiving terminal of the corresponding PPDU may receive data through the MU-MIMO allocation.

However, when the SIG-B compression field indicates the full bandwidth MU-MIMO and the number of HE-SIG-B symbols field indicates a single user, the user specific field of the HE-SIG-B consists of one user field for non-MU-MIMO allocation. According to an embodiment, the number of HE-SIG-B symbols field may be set to 0 when it indicates a single user. In this case, the receiving terminal of the corresponding PPDU may receive data through non-MU-MIMO allocation. It is because the transmission is not interpreted as an MU-MIMO transmission when the SIG-B compression field indicates full bandwidth MU-MIMO but a single recipient is indicated. When only one user is allocated for MU-MIMO transmission, spatial stream

information for the single user cannot be signaled through the SCF of the user field for MU-MIMO allocation shown in FIGS. 13(d) and 13(e). Thus, when the full bandwidth MU-MIMO is indicated with a single user, the user specific field of the HE-SIG-B may consist of a user field for non-MU-MIMO allocation. The configuration of the user specific field of the HE-SIG-B based on the information on the number of MU-MIMO users can be applied to both the uplink and downlink MU PPDUs.

According to a further embodiment of the present invention, in the UL MU PPDU, the common field may not always be present in the HE-SIG-B field. Signaling of the C26 field and the RA field in the common field may be unnecessary when a single STA transmits a UL MU PPDU. Therefore, when the UL/DL field indicates uplink transmission, the common field is not present in the HE-SIG-B field. According to an embodiment, the value of the SIG-B compression field of the HE-SIG-A in the UL MU PPDU may be set to 1 to explicitly signal that the common field is not included in the HE-SIG-B. However, in this case, the full bandwidth MU-MIMO transmission is not performed, but the compression mode of the HE-SIG-B field may be used to reduce the signaling overhead of the HE-SIG-B in the uplink transmission. According to another embodiment of the present invention, in the UL MU PPDU, the compression mode of the HE-SIG-B field may be implicitly indicated regardless of the value of the SIG-B compression field, so that the common field is not present in the HE-SIG-B field.

Also, according to the embodiment of the present invention, the user specific field of the HE-SIG-B in the UL MU PPDU may consist of one user field for non-MU-MIMO allocation. That is, even if the value of the SIG-B compression field of the UL MU PPDU is set to 1 so that the compression mode of the HE-SIG-B field (or the full bandwidth MU-MIMO) is indicated, the user specific field of the HE-SIG-B may consist of a user field for non-MU-MIMO allocation. In this way, when a single STA

performs uplink transmission to a single AP, a non-MU-MIMO-based (or OFDMA-based) user field is transmitted instead of a MU-MIMO-based user field so that information on the number of space-time streams to be received by the receiving terminal can be accurately transmitted.

A terminal according to an embodiment of the present invention may generate an HE MU PPDU including an HE-SIG-A field and an HE-SIG-B field configured according to the above-described methods, and transmit the generated HE MU PPDU. The terminal receiving the HE MU PPDU may decode the corresponding PPDU based on information obtained from the HE-SIG-A field of the received PPDU. In addition, the terminal may decode the HE-SIG-B field based on the information obtained from the HE-SIG-A field of the received HE MU PPDU. As described in the above embodiments, the configuration of the HE-SIG-B may be identified based on information obtained from at least one subfield of the HE-SIG-A. For example, the configuration of the HE-SIG-B may be identified based on at least one of the number of HE-SIG-B symbols field, the SIG-B compression field, and a combination thereof.

FIGS. 14 to 15 illustrate specific embodiments in which a single STA transmits an UL MU PPDU to an AP.

First, FIG. 14 illustrates an embodiment in which the STA performs a UL MU PPDU transmission through a narrowband. Here, the narrowband may be a resource unit less than a 20 MHz bandwidth. As shown in FIG. 14(a), the STA can increase the transmission distance of data by concentrating the transmission power on a specific resource unit of a narrowband. FIGS. 14(b) to 14(d) illustrate various embodiments for signaling such narrowband transmission.

First, the narrowband transmission may be signaled through at least one subfield of the HE-SIG-A as shown in FIG. 14(b). When the HE MU PPDU is used for

uplink transmission, the bandwidth field of the HE-SIG-A may indicate either 20 MHz, 40 MHz, 80 MHz, 160 MHz (including 80+80 MHz) or a predetermined narrow bandwidth. That is, in the 3-bit bandwidth field, values of 0 to 3 indicate 20 MHz, 40 MHz, 80 MHz, and 160 MHz (including 80+80 MHz), respectively, and any one of values 4 to 7 indicates one of the predetermined narrow bandwidths. According to an embodiment, the predetermined narrow bandwidth may include a left-106-tone and a right-106-tone. In this case, among the 242-tone constituting a 20 MHz primary channel, the left-106-tone indicates the low-frequency 106-tone resource unit, and the right-106-tone indicates the high-frequency 106-tone resource unit. However, the present invention is not limited thereto, and the predetermined narrow bandwidth may include one or more of a 26-tone resource unit, a 52-tone resource unit, a 106-tone resource unit, or a combination thereof.

Next, the narrowband transmission may be signaled through a null STA ID contained in the user field of the HE-SIG-B as shown in FIG. 14(c). More specifically, the RA field of the HE-SIG-A may indicate information on the resource unit partition type in a particular channel. For example, if the bandwidth of 20 MHz is partitioned into two 106-tone resource units based on the OFDMA and the center 26-tone resource unit is not used, then the RA field may signal "0110zzzz" as shown in FIG. 14(c). In this case, an AID of the receiver or the transmitter may be inserted into the user field corresponding to the resource unit used for uplink data transmission between the partitioned two 106-tone resource units. On the other hand, a null STA ID may be inserted into the user fields corresponding to the remaining resource units through which data transmission is not performed. For example, if data is transmitted only through the second RU between two 106-tone resource units, a null STA ID may be inserted into the first user field.

According to another embodiment of the present invention, as shown in FIG. 14(d), index values of the uplink resource unit allocation may be newly defined in the RA field of the HE-SIG-B for the narrowband transmission. More specifically, the RA field of the HE-SIG-B may index a specific 106-tone RU on which uplink transmission is performed. In this case, since only one user field corresponding to the resource unit indicated in the RA field is carried, the signaling overhead can be greatly reduced. According to an embodiment, the index values of the uplink resource unit allocation may be used among the unassigned (i.e., TBD) indices of the RA field configuration for DL-MU transmission. According to another embodiment, the index values of the uplink resource unit allocation may be newly defined in the RA field.

FIG. 15 illustrates an embodiment in which the STA performs UL MU PPDU transmission through a bandwidth of 20 MHz or more. As shown in FIG. 15(a), the uplink transmission using the HE MU PPDU may be performed not only through the narrowband but also through the full bandwidth of 20 MHz, 40 MHz, 80 MHz or 160 MHz (including 80+80 MHz). In this case, the bandwidth field of the HE-SIG-A indicates the total bandwidth of the PPDU. In addition, the SIG-B compression field may be always set to 1 as shown in FIG. 15(b) so that the common field is omitted from the HE-SIG-B field.

As described in the above embodiments, when the UL/DL field indicates downlink transmission and the SIG-B compression field indicates the compression mode of the HE-SIG-B field, the number of HE-SIG-B symbols field of the HE-SIG-A may indicate the information on the number of MU-MIMO users. In this case, the user specific field of the HE-SIG-B field may consist of user fields for MU-MIMO allocation. However, when the UL/DL field indicates uplink transmission and the SIG-B compression field indicates the compression mode of the HE-SIG-B field as in the

embodiment of FIG. 15, the number of HE-SIG-B symbols field may indicate the number of OFDM symbols in the HE-SIG-B field as in the basic definition. In this case, the user specific field of the HE-SIG-B field may consist of a user field for non-MU-MIMO allocation.

FIG. 16 illustrates an encoding structure and a transmission method of the HE-SIG-B according to an embodiment of the present invention. FIG. 16(a) illustrates the encoding structure of the HE-SIG-B, and FIG. 16(b) illustrates the transmission method of the HE-SIG-B in a bandwidth of 40 MHz or more.

Referring to FIG. 16(a), the HE-SIG-B consists of a common field and a user specific field. The detailed configuration of the common field and the user specific field is as described in the embodiment of FIG. 13. Each user field of the user specific field is arranged in order of allocated users in the resource unit arrangement indicated by the RA field of the common field.

The user specific field consists of a plurality of user fields, and a plurality of user fields are transmitted in units of a user block field. As described above, the user block field is made up of an aggregation of two user fields, a CRC field, and a tail field. If the total number of user fields is odd, the last user block field may contain one user field. At the end of the HE-SIG-B, padding may be added along the OFDM symbol boundary.

Referring to FIG. 16(b), HE-SIG-B is separately encoded on each 20 MHz band. In this case, the HE-SIG-B may consist of a maximum of two contents in units of 20 MHz, that is, an HE-SIG-B content channel 1 and an HE-SIG-B content channel 2. In the embodiment of FIG. 16(b), each box represents a 20 MHz band, and "1" and "2" in the boxes represent the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2, respectively. Each HE-SIG-B content channel in the total band is arranged in

order of the physical frequency band. That is, the HE-SIG-B content channel 1 is transmitted in the lowest frequency band, and the HE-SIG-B content channel 2 is transmitted in the next higher frequency band. Such a content channel configuration is then duplicated through content duplication in the next higher frequency bands. For example, for the first to fourth channels with an increasing order of the frequency constituting the entire 80 MHz band, the HE-SIG-B content channel 1 is transmitted on the first channel and the third channel, and the HE-SIG-B content channel 2 is transmitted on the second channel and the fourth channel. Likewise, for the first to eighth channels with an increasing order of the frequency constituting the entire 160 MHz band, the HE-SIG-B content channel 1 is transmitted on the first channel, the third channel, the fifth channel and the seventh channel, and the HE-SIG-B content channel 2 is transmitted on the second channel, the fourth channel, the sixth channel and the eighth channel. When the terminal can decode the HE-SIG-B content channel 1 through at least one channel and decode the HE-SIG-B content channel 2 through the other at least one channel, information on the MU PPDU configuration of the total bandwidth can be obtained. On the other hand, when the total bandwidth is 20 MHz, only one SIG-B content channel is transmitted.

Non-contiguous channel allocation

Hereinafter, a non-contiguous channel allocation method and a signaling method thereof according to an embodiment of the present invention will be described with reference to FIGS. 17 to 21. In the embodiment of the present invention, non-contiguous channel allocation refers to channel allocation in which a band occupied by the transmitted packet (i.e., PPDU) includes at least one non-contiguous channel (or non-contiguous resource unit). However, a full bandwidth 80+80 MHz channel is regarded as a contiguous channel like a full bandwidth 160 MHz channel. Thus, a non-

contiguous channel (or non-contiguous PPDU) in the embodiments of the present invention may refer to non-contiguous channels except for the full bandwidth 80+80 MHz channel.

In the following embodiments and drawings, the P20 channel indicates a 20 MHz primary channel, the S20 channel indicates a 20 MHz secondary channel, the S40 channel indicates a 40 MHz secondary channel, and the S80 channel indicates an 80 MHz secondary channel, respectively. Also, the S40A channel indicates the first 20MHz channel constituting the S40 channel, and the S40B channel indicates the second 20MHz channel constituting the S40 channel. Similarly, the S80A channel, the S80B channel, the S80C channel, and the S80D channel indicate the first 20MHz channel, the second 20MHz channel, the third 20MHz channel, and the fourth 20MHz channel constituting the S80 channel, respectively.

In the embodiment of the present invention, a transmitter (e.g., an AP) signals non-contiguous channel allocation information through embodiments illustrated in each figure or combinations thereof. The transmitter may perform a CCA of multiple channels for a wideband packet transmission. In this case, the wideband may refer to a band having a total bandwidth of 40 MHz or more, but the present invention is not limited thereto. The transmitter transmits a packet through at least one channel which is idle based on the result of performing the CCA of multiple channels. In this case, when the packet is transmitted through a non-contiguous channel, the transmitter signals non-contiguous channel allocation information via a non-legacy preamble of the packet. As such, the transmitter transmits a wireless packet in which non-contiguous channel allocation information is signaled. A receiver (e.g., a STA) receives the wireless packet and obtains the non-contiguous channel allocation information from the received packet. The receiver decodes the received packet based on the obtained non-contiguous channel

allocation information. In this case, the received packet may be an HE MU PPDU, but the present invention is not limited thereto.

FIG. 17 illustrates a non-contiguous channel allocation method according to an embodiment of the present invention. According to the embodiment of FIG. 17, the location where at least one of the HE-SIG-B content channels is transmitted may be variable. In this case, the receiver should be able to variably set the decoding channel for receiving the HE-SIG-B content channel. In the embodiment of FIG. 17, it is assumed that the HE-SIG-B content channel 1 is transmitted through the P20 channel and the channel through which the HE-SIG-B content channel 2 is transmitted may vary. However, depending on the physical frequency order of the P20 channel within the P40 channel, the HE-SIG-B content channel 2 may be transmitted through the P20 channel. In this case, the channel through which the HE-SIG-B content channel 1 is transmitted may vary depending on the channel configuration. The non-contiguous channel allocation information according to the embodiment of the present invention may support at least some configurations among the channel configurations listed in FIG. 17.

FIG. 17(a) illustrates a channel configuration in which only the P20 channel is allocated among the P80 (i.e., primary 80 MHz) band. In this case, the HE-SIG-B content channel 2 is not transmitted in the P80 band. FIG. 17(b) illustrates a channel configuration in which the P40 channel is basically allocated among the P80 band. In this case, both the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 may be transmitted through at least the P40 channel. According to the embodiment, a non-contiguous channel in which any one among the two 20 MHz channels, that is, the S40A channel and the S40B channel of the S40 channel is allocated may be used. When both the S40A channel and the S40B channel are allocated, a contiguous channel of 80 MHz or 160 MHz bandwidth is configured.

FIG. 17(c) illustrates a channel configuration in which only the P20 channel and the S40 channel are allocated among the P80 band. In this case, the HE-SIG-B content channel 1 may be transmitted through the P20 channel and the S40A channel, and the HE-SIG-B content channel 2 may be transmitted through the S40B channel. In the embodiments of FIG. 17(c), the HE-SIG-B content channel 1 and the HE-SIG-B content channel 2 may be transmitted based on the HE-SIG-B content channel transmission rule according to the embodiment of the present invention

Meanwhile, due to the limitation of the number of bits in the bandwidth field of the HE-SIG-A, the bandwidth field may indicate some configurations among the above channel configurations. When the bandwidth field consists of 3 bits, the bandwidth field may index four additional non-contiguous channel allocation information. According to the embodiment of the present invention, the bandwidth field may indicate the total bandwidth information through which the PPDU is transmitted and some channel information to be punctured within the total bandwidth. In this case, the total bandwidth may be either 80 MHz bandwidth or 160 MHz (or 80+80 MHz) bandwidth. According to an embodiment of the present invention, the bandwidth field may index puncturing of the S20 channel shown in FIG. 17(c), and puncturing of at least one of two 20 MHz channels in the S40 channel shown in FIG. 17(b), respectively.

According to the embodiment of the present invention, in the channel configuration indicated by the bandwidth field of the HE-SIG-A, additional puncturing information may be indicated via the RA field of the HE-SIG-B. For example, when the bandwidth field indicates puncturing of one of two 20 MHz channels in the S40 channel at the total bandwidth of 80 MHz (e.g., the third and fifth channel configuration in FIG. 17(b)), the resource unit allocation field may indicate which 20 MHz channel in the S40 channel is punctured. Also, when the bandwidth field indicates puncturing of at least

one of two 20 MHz channels in the S40 channel at the total bandwidth of 160 MHz or 80+80 MHz (e.g., the second, fourth and sixth channel configurations in FIG. 17(b)), the resource unit allocation field may indicate which 20 MHz channel in the S40 channel is punctured. In addition, when the bandwidth field indicates puncturing of at least one of two 20 MHz channels in the S40 channel in a total bandwidth of 160 MHz or 80+80 MHz (e.g., the second, fourth and sixth channel configurations in FIG. 17(b)), the resource unit allocation field may indicate additional puncturing in the S80 channel. Further, when the bandwidth field indicates puncturing of the S20 channel in the total bandwidth of 160 MHz or 80+80 MHz (e.g., the second channel configuration in FIG. 17(c)), the resource unit allocation field may indicate additional puncturing in the S80 channel.

Channels in which puncturing is indicated as described above are not assigned to the user. A terminal receiving the non-contiguous PPDU may obtain the total bandwidth information through which the PPDU is transmitted and the channel information to be punctured within the total bandwidth via the bandwidth field of the HE-SIG-A of the corresponding PPDU. Further, the terminal may obtain additional channel puncturing information via the RA field of the HE-SIG-B of the corresponding PPDU. The terminal decodes the PPDU based on the obtained non-contiguous channel allocation information.

FIG. 18 illustrates a wideband access method according to an embodiment of the present invention. After the transmission of the previous PPDU is completed, the terminal having data to be transmitted performs a backoff procedure on the P20 channel. The backoff procedure may be started when the P20 channel is idle for an AIFS time. The terminal obtains a backoff counter within a range of a contention window (CW) for the backoff procedure. The terminal performs a CCA and decreases the backoff counter

by one when the channel is idle. If the channel is busy, the terminal suspends the backoff procedure and resumes the backoff procedure an AIFS time after when the channel is idle again. When the backoff counter expires through the backoff procedure, the terminal may transmit data. In this case, the terminal performs a CCA for the secondary channels to transmit data for a PIFS time before the backoff counter expires.

The embodiment of FIG. 18 shows a situation in which the S40A channel and the S80B channel are busy in the 160 MHz band in which the CCA is performed. If at least a part of the secondary channels on which the CCA is performed is busy, the PPDU transmission band of the terminal may be determined based on the physical layer CCA indication information. The physical layer CCA indication information may be represented by a PHY-CCA.indication primitive defined in the wireless LAN standard.

More specifically, the PHY-CCA.indication is a primitive for the PHY to represent the current state of a channel (or medium) to the local MAC entity, and includes a state indicator and a channel indicator. The state indicator indicates a busy state or an idle state. If it is determined that the channel cannot be used as a result of the channel assessment by the physical layer, the value of the state indicator is set to the busy state. Otherwise, the value of the state indicator is the idle state. The channel indicator indicates a channel set including channel(s) in the busy state. If the value of the state indicator for a particular channel set is idle, the corresponding channel indicator is not present in the PHY-CCA.indication primitive.

FIG. 18(a) illustrates a wideband access method according to the first embodiment of the present invention. According to the first embodiment of the present invention, the physical layer CCA indication information may be represented by the PHY-CCA.indication primitive defined in the legacy wireless LAN system. That is, the channel indicator of the PHY-CCA.indication primitive may indicate only one of the

four values of primary, secondary, secondary40, and secondary80. Thus, the channel indicator of the PHY-CCA.indication primitive indicates the first channel set including channel(s) in the busy state along the channel set order of P20 channel, S20 channel, S40 channel and S80 channel. According to the embodiment of FIG. 18(a), the channel indicator of the PHY-CCA.indication primitive indicates the S40 channel including the S40A channel in the busy state. That is, the physical layer may report the PHY-CCA.indication (BUSY, {secondary40}) to the MAC layer. The terminal may transmit the PPDU through the 40MHz band (i.e., P40 channel) combining the P20 channel and the S20 channel determined to be idle.

However, in order to transmit the MU PPDU through the non-contiguous channel allocation as described in FIG. 17, it is necessary to transmit more detailed physical layer CCA indication information. In order to solve the problem, FIG. 18(b) illustrates a wideband access method according to the second embodiment of the present invention. According to the second embodiment of the present invention, the physical layer CCA indication information may be represented by the newly defined PHY-CCA.indication primitive. According to the second embodiment of the invention, the units of the channel set for which the CCA result is reported may be subdivided into each 20 MHz channel. That is, the channel indicator of the PHY-CCA.indication primitive may indicate at least one of primary, secondary, secondary40A, secondary40B, secondary80A, secondary80B, secondary80C, secondary80D, or similar types of 20 MHz channels.

According to the embodiment of the present invention, the channel indicator of the PHY-CCA.indication primitive reports all of the 20 MHz channel(s) determined to be busy, among eight 20 MHz channels constituting the 160 MHz band. According to the embodiment of FIG. 18(b), the channel indicator of the PHY-CCA.indication

primitive indicates S40A channel and S80B channel which are in busy state. That is, the physical layer may report the PHY-CCA.indication (BUSY, {secondary40A, secondary80B}) to the MAC layer. The terminal transmits a PPDU using channels that are not busy. Referring to FIG. 18(b), the terminal may transmit a non-contiguous PPDU through channels (i.e., P20, S20, S40B, S80A, S80C, and S80D) other than the S40A channel and the S80B channel which are determined to be busy.

According to another embodiment of the present invention, the CCA result per 20 MHz channel may be reported in a bitmap representation. That is, the channel indicator of the PHY-CCA.indication primitive may indicate the busy/idle state for each 20 MHz channel in a bitmap form. For example, the channel indicator of the PHY-CCA.indication primitive may consist of a bitmap having a length of 8 bits. Herein, each bit is set to 1 if the corresponding 20 MHz channel is busy and each bit is set to 0 if the corresponding 20 MHz channel is idle. In this case, the first to eighth bits of the bitmap indicate the busy/idle state of each of the eight 20 MHz channels in the order of the lowest frequency to the highest frequency within the 160 MHz (80+80 MHz) bandwidth.

According to a further embodiment of the present invention, the physical layer may report the CCA results per 20 MHz channel only if the P20 channel is idle. That is, the channel indicator of the PHY-CCA.indication primitive indicates all of the 20 MHz secondary channel(s) determined to be busy among the eight 20 MHz channels constituting the 160 MHz band only when the P20 channel is idle. Also, if the CCA result per 20 MHz channel is reported in a bitmap representation, the bit corresponding to the P20 channel in the bitmap may be set to 0. If the P20 channel is busy, the channel indicator of the PHY-CCA.indication primitive does not indicate secondary channel information in units of 20 MHz. That is, the channel indicator of the PHY-

CCA.indication primitive indicates only the first channel set including the busy channel(s) as in the legacy wireless LAN system.

FIG. 19 illustrates an embodiment of a method of exchanging and signaling BQRP and BQR for transmitting a non-contiguous PPDU. Referring to FIG. 19, an AP that intends to transmit a DL MU PPDU may perform a CCA in a physical layer and transmit the DL MU PPDU using channels determined to be idle based on the CCA result. According to an embodiment, an MU-RTS frame may be transmitted to one or more STAs before transmission of the DL MU PPDU, and sCTS frames may be transmitted from STAs that have received the MU-RTS frame. However, the MU-RTS may only be transmitted in the form of PPDUs based on contiguous channel allocation such as non-HT, non-HT duplicate or HE SU PPDU. Therefore, when the S40A channel and the S80B channel are busy as in the embodiment of FIG. 19, the MU-RTS may be transmitted only through the 40 MHz band (i.e., the P40 channel) including the P20 channel and the S20 channel. The AP can receive sCTS frames transmitted in response to the MU-RTS frame from the STAs, but cannot identify the available channel of each STA only by exchanging the MU-RTS frame and the sCTS frame.

Therefore, according to the embodiment of the present invention, the AP may transmit a bandwidth query report poll (BQRP) to help efficient resource allocation for MU PPDU transmission, and STAs may transmit a bandwidth query report (BQR) in response thereto . The BQR may include an available channel bitmap field representing available channel information of the corresponding STA. According to an embodiment, the BQR may be carried via the control field of the MAC header. The STA may implicitly carry the BQR through the BQR control field of a frame transmitted to the AP, or may explicitly carry the BQR through a frame transmitted in response to the BQRP trigger frame of the AP. According to the embodiment of the present invention, the

BQR transmitted in response to a BQRP trigger frame may be referred to as a solicited BQR, and the BQR transmitted regardless of the reception of the BQRP trigger frame may be referred to as an unsolicited BQR.

According to an embodiment, the AP may transmit a BQRP frame using an MU PPDU format capable of non-contiguous channel allocation-based transmission. The AP may determine whether each channel is available to the STA based on the BQR received from each STA. Through the BQRP/BQR transmission sequence, the AP may perform a non-contiguous channel allocation-based DL MU PPDU transmission by checking the available channel information of the STAs. Referring to the embodiment of FIG. 19, among the channels determined to be idle, the AP transmits the BQRP respectively to STA1 through the P40 channel, to STA2 through the S40B channel, to STA3 through the S80A channel, to STA4 through the S80C channel, and to STA 5 through the S80D channel. The BQRP transmitted to STA1, STA2, STA3, STA4 and STA5 can be carried via a non-contiguous MU PPDU. The AP receives BQR from STA1, STA3 and STA5 in response to BQRP. Thus, the AP can identify that the P40 channel is available to STA1, the S80A channel is available to STA3, and the S80D channel is available to STA5, respectively. However, the AP does not receive the BQR in response to BQRP from STA2 and STA4. Thus, the AP can identify that the S40B channel is not available to STA2, and the S80C channel is not available to STA4, respectively. The AP can perform DL MU PPDU transmission based on the collected available channel information of each STA.

FIG. 20 illustrates another embodiment of a method of transmitting and signaling BQR for transmitting a non-contiguous PPDU. As described above, the STA may implicitly carry the BQR through the BQR control field of the frame transmitted to the AP. The AP can perform a non-contiguous channel allocation-based DL MU PPDU

transmission by checking the available channel information of each STA through the unsolicited BQR received from the STAs at any time.

First, referring to FIG. 20(a), the BQR may be transmitted through a UL SU PPDU. The STA that intends to transmit a UL SU PPDU may perform a CCA in the physical layer and transmit the UL SU PPDU using channels determined to be idle based on the CCA result. However, the HE SU PPDU may only be transmitted on a contiguous channel allocation basis. Therefore, when the S40A channel and the S80B channel are busy as in the embodiment of FIG. 20(a), the UL SU PPDU may be transmitted through the 40 MHz band including the P20 channel and the S20 channel. In this case, the BQR may be carried via the BQR control field of the frame transmitted through the UL SU PPDU. The BQR may contain available channel information based on the CCA result detected by the corresponding STA.

Next, referring to FIG. 20(b), the BQR may be transmitted through an HE trigger-based (TB) PPDU. The STA that intends to transmit an HE-TB PPDU may perform a CCA in the physical layer and transmit the HE TB PPDU using channels determined to be idle based on the CCA result. In this case, the BQR may be carried via the BQR control field of the frame transmitted through the HE TB PPDU. The BQR may contain available channel information based on the CCA result detected by the corresponding STA.

As described above, the AP receiving the UL SU PPDU or the HE TB PPDU containing the BQR may check the available channel information of the corresponding STA and perform a DL PPDU transmission. Meanwhile, the BQR may indicate the available channel information according to various embodiments. A specific embodiment thereof will be described with reference to FIG. 21.

FIG. 21 illustrates a configuration of a BQR according to an embodiment of

the present invention. According to an embodiment of the present invention, the available channel information in the BQR may be represented by an available channel bitmap field. According to an embodiment, the BQR includes a bandwidth indication field and an available channel bitmap field (or a bandwidth bitmap field). However, the bandwidth indication field may be omitted from the BQR according to an embodiment.

The bandwidth indication field may represent the total bandwidth through which the available channel information is carried. According to an embodiment, the bandwidth indication field may consist of 2 bits and may indicate either 20 MHz, 40 MHz, 80 MHz or 160 MHz (including 80+80 MHz). In addition, the available channel bitmap field may consist of 8 bits and may indicate availability (or busy/idle state) of each 20 MHz channel. When the BQR reports available channel information in a total bandwidth of 20 MHz, the bandwidth indication field indicates 20 MHz (or P20 channel). In addition, when the BQR reports available channel information in a total bandwidth of 40 MHz, the bandwidth indication field indicates 40 MHz (or P40 channel). In this case, the first bit and the second bit of the available channel bitmap field indicate availability of each of the two 20 MHz channels in the order of the low frequency to the high frequency within the 40 MHz bandwidth. Next, when the BQR reports available channel information in a total bandwidth of 80 MHz, the bandwidth indication field indicates 80 MHz (or P80 channel). In this case, the first to fourth bits of the available channel bitmap field indicate availability of each of the four 20MHz channels in the order from the lowest frequency to the highest frequency within the 80MHz bandwidth. Next, when the BQR reports available channel information in a total bandwidth of 160 MHz (80+80 MHz), the bandwidth indication field indicates 160 MHz (80+80 MHz) (or P160 channel). In this case, the first to eighth bits of the available channel bitmap field indicate availability of each of the eight 20MHz channels

in the order of the lowest frequency to the highest frequency within the 160MHz (80+80MHz) bandwidth.

Meanwhile, the BQR may include only the available channel bitmap field without the bandwidth indication field. In this case, the available channel bitmap field may consist of 8 bits, and may indicate availability (or busy/idle state) of each 20 MHz channel. When a 20 MHz channel in which the CCA is not performed according to the CCA performance capability of the STA is present, the value of the bit of the available channel bitmap field corresponding to the channel may be set to 1 (i.e., busy state).

According to the embodiment of the present invention, the BQR may indicate the available channel information in various ways. According to the first embodiment of the present invention, the STA may explicitly signal, through the bandwidth indication field, bandwidth information through which the STA can perform the CCA before transmitting a PPDU including the BQR, and may indicate availability of each channel within the corresponding bandwidth through the available channel bitmap. For example, if the STA performed a CCA only for the corresponding 40 MHz bandwidth before transmitting the 40 MHz PPDU, the bandwidth indication field may indicate 40 MHz and the available channel bitmap field may carry only the CCA results of two 20 MHz channels. However, if the STA performs a CCA for a 160 MHz bandwidth that is wider than the bandwidth of the corresponding PPDU before transmitting the 40 MHz PPDU, the bandwidth indication field may indicate 160 MHz and the available channel bitmap field may carry the CCA result of eight 20 MHz channels. In such an embodiment, the STA may autonomously set the indicated bandwidth of the available channel bitmap field of the BQR based on its CCA performance capability.

Next, according to the second embodiment of the present invention, the STA may perform a CCA for the entire band through which the BQRP trigger frame is

received or the entire band through which the PPDU including the BQR is transmitted, and may indicate the availability of each channel within the corresponding bandwidth through the available channel bitmap. In this case, since the bandwidth information for which the available channel information is transmitted is obvious to the transmitter and the receiver, the bandwidth indication field may be omitted from the BQR. If there is a 20 MHz channel in which the CCA is not performed according to the CCA performance capability of the STA among the entire bandwidth in which the PPDU is transmitted, the STA may not perform the transmission of the unsolicited BQR. According to another embodiment, if there is a 20 MHz channel in which the CCA is not performed according to the CCA performance capability of the STA among the entire bands in which the PPDU is transmitted, the value of the bit of the available channel bitmap field corresponding to the channel may be set to 1 (i.e., busy state).

Next, according to the third embodiment of the present invention, the STA may perform a CCA for the total band operated by the BSS to which the corresponding STA is associated, and may indicate the availability of each channel within the corresponding bandwidth through the available channel bitmap. If the bandwidth that the STA can perform the CCA is smaller than the total bandwidth operated by the BSS according to the CCA performance capability of the STA, the availability of each channel within the bandwidth in which the STA can perform the CCA may be indicated through the available channel bitmap. That is, the STA may indicate the availability of each channel through the available channel bitmap based on a smaller value between the total bandwidth operated by the BSS and the bandwidth that the STA can perform the CCA, regardless of the entire band in which the BQRP trigger frame is received or the entire band in which the PPDU including the BQR is transmitted. In this case, since the bandwidth information for which the available channel information is transmitted is

obvious to the transmitter and the receiver, the bandwidth indication field may be omitted from the BQR. Therefore, the AP may transmit the DL MU PPDU based on the available channel information of the STA within the entire bandwidth regardless of the transmission bandwidth of the PPDU carrying the BQRP or BQR.

Although the present invention is described by using the wireless LAN communication as an example, the present invention is not limited thereto and the present invention may be similarly applied even to other communication systems such as cellular communication, and the like. Further, the method, the apparatus, and the system of the present invention are described in association with the specific embodiments, but some or all of the components and operations of the present invention may be implemented by using a computer system having universal hardware architecture.

The detailed described embodiments of the present invention may be implemented by various means. For example, the embodiments of the present invention may be implemented by a hardware, a firmware, a software, or a combination thereof.

In case of the hardware implementation, the method according to the embodiments of the present invention may be implemented by one or more of Application Specific Integrated Circuits (ASICSs), Digital Signal Processors (DSPs), Digital Signal Processing Devices (DSPDs), Programmable Logic Devices (PLDs), Field Programmable Gate Arrays (FPGAs), processors, controllers, micro-controllers, micro-processors, and the like.

In case of the firmware implementation or the software implementation, the method according to the embodiments of the present invention may be implemented by a module, a procedure, a function, or the like which performs the operations described above. Software codes may be stored in a memory and operated by a processor. The

processor may be equipped with the memory internally or externally and the memory may exchange data with the processor by various publicly known means.

The description of the present invention is used for exemplification and those skilled in the art will be able to understand that the present invention can be easily modified to other detailed forms without changing the technical idea or an essential feature thereof. Thus, it is to be appreciated that the embodiments described above are intended to be illustrative in every sense, and not restrictive. For example, each component described as a single type may be implemented to be distributed and similarly, components described to be distributed may also be implemented in an associated form.

The scope of the present invention is represented by the claims to be described below rather than the detailed description, and it is to be interpreted that the meaning and scope of the claims and all the changes or modified forms derived from the equivalents thereof come within the scope of the present invention.

[Industrial Applicability]

Various exemplary embodiments of the present invention have been described with reference to an IEEE 802.11 system, but the present invention is not limited thereto and the present invention can be applied to various types of mobile communication apparatus, mobile communication system, and the like.

[CLAIMS]

1. A wireless communication terminal, the terminal comprising:

a communication unit; and

a processor configured to process signals transmitted and received through the communication unit,

wherein the processor is configured to:

receive, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and

decode the received HE MU PPDU based on information obtained from the HE-SIG-A,

wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

2. The wireless communication terminal of claim 1, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission so that a common field is not present in the HE-SIG-B, a configuration of a user specific field of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

3. The wireless communication terminal of claim 2, wherein when the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the configuration of the user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by the HE-SIG-A.

4. The wireless communication terminal of claim 3,

wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

5. The wireless communication terminal of claim 4,

wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

6. The wireless communication terminal of claim 4, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

7. The wireless communication terminal of claim 3, wherein when the SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

8. The wireless communication terminal of claim 1,

wherein the HE-SIG-A includes a UL/DL field indicating whether the PPDU is transmitted on an uplink or transmitted on a downlink, and

wherein at least one subfield of the HE-SIG-A of the PPDU indicates different information or is set differently based on a value indicated by the UL/DL field.

9. The wireless communication terminal of claim 8,

wherein when the UL/DL field indicates a downlink transmission, a specific value of a bandwidth field of the HE-SIG-A indicates a predetermined non-contiguous band, and

wherein when the UL/DL field indicates an uplink transmission, the specific value of the bandwidth field of the HE-SIG-A indicates a predetermined narrow band.

10. The wireless communication terminal of claim 9, wherein the predetermined narrow band includes at least one of a left-106-tone and a right-106-tone.

11. The wireless communication terminal of claim 8,

wherein when the UL/DL field indicates a downlink transmission, a SIG-B compression field of the HE-SIG-A indicates whether to perform a full bandwidth MU-MIMO transmission in which a common field is not present in an HE-SIG-B field, and

wherein when the UL/DL field indicates an uplink transmission, the SIG-B compression field of the HE-SIG-A always indicates that the common field is not present in the HE-SIG-B field.

12. The wireless communication terminal of claim 8, wherein when a SIG-B compression field of the HE-SIG-A indicates a compression mode of an HE-SIG-B field,

a number of HE-SIG-B symbols field in the HE-SIG-A indicates information on the number of MU-MIMO users if the UL/DL field indicates a downlink transmission, and

the number of HE-SIG-B symbols field in the HE-SIG-A indicates information on the number of OFDM symbols in the HE-SIG-B field.

13. A wireless communication method of a wireless communication terminal, the method comprising:

receiving a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B); and

decoding the received HE MU PPDU based on information obtained from the HE-SIG-A,

wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

14. The wireless communication method of claim 13, wherein when a SIG-B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission so that a common field is not present in the HE-SIG-B, a configuration of a user specific field of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A.

15. The wireless communication method of claim 14, wherein when the SIG-

B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the configuration of the user specific field of the HE-SIG-B is identified based on information on the number of MU-MIMO users indicated by the HE-SIG-A.

16. The wireless communication method of claim 15,

wherein when the information on the number of MU-MIMO users indicates two or more users, the user specific field of the HE-SIG-B includes user fields for MU-MIMO allocation, and

wherein when the information on the number of MU-MIMO users indicates a single user, the user specific field of the HE-SIG-B includes one user field for non-MU-MIMO allocation.

17. The wireless communication method of claim 16,

wherein the user field for MU-MIMO allocation includes a spatial configuration field indicating the total number of spatial streams in an MU-MIMO allocation and the number of spatial streams for each terminal in the MU-MIMO allocation, and

wherein the user field for non-MU-MIMO allocation includes a number of space time streams (NSTS) field.

18. The wireless communication method of claim 16, wherein the user field for non-MU-MIMO allocation is a user field based on orthogonal frequency division multiple access (OFDMA) allocation.

19. The wireless communication method of claim 15, wherein when the SIG-

B compression field of the HE-SIG-A indicates full bandwidth MU-MIMO transmission, the information on the number of MU-MIMO users is indicated by a number of HE-SIG-B symbols field in the HE-SIG-A.

20. The wireless communication method of claim 13,

wherein the HE-SIG-A includes a UL/DL field indicating whether the PPDU is transmitted on an uplink or transmitted on downlink, and

wherein at least one subfield of the HE-SIG-A of the PPDU indicates different information or is set differently based on a value indicated by the UL/DL field.

[ABSTRACT]

The present invention relates to a wireless communication method and a wireless communication terminal for signaling a multi-user packet. More specifically, provided are a wireless communication terminal including a communication unit; and a processor configured to process signals transmitted and received through the communication unit, wherein the processor receives, through the communication unit, a high efficiency multi-user PHY protocol data unit (HE MU PPDU), wherein a preamble of the HE MU PPDU includes high efficiency signal A field (HE-SIG-A) and high efficiency signal B field (HE-SIG-B), and decodes the received HE MU PPDU based on information obtained from the HE-SIG-A, wherein a configuration of the HE-SIG-B is identified based on information obtained from at least one subfield of the HE-SIG-A and a wireless communication method using the same.

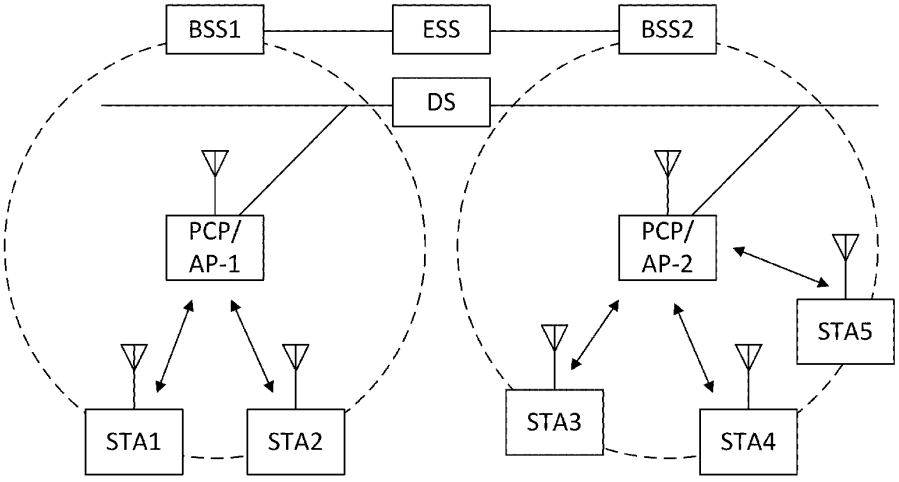

BSS1
ESS
BSS2
DS
PCP/
AP-1
PCP/
AP-2
STA5
STA1
STA2
STA3
STA4

FIG. 1

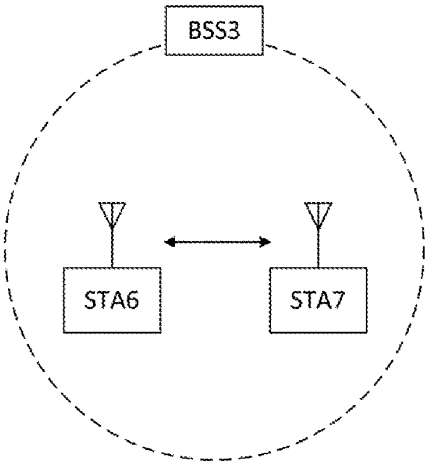

BSS3
STA6
STA7

FIG. 2

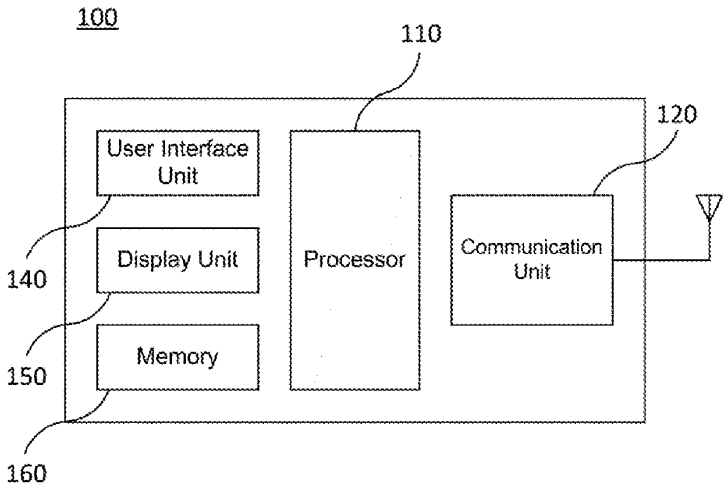

100
110
120
User Interface Unit
Display Unit
Memory
Processor
Communication Unit
140
150
160

FIG. 3

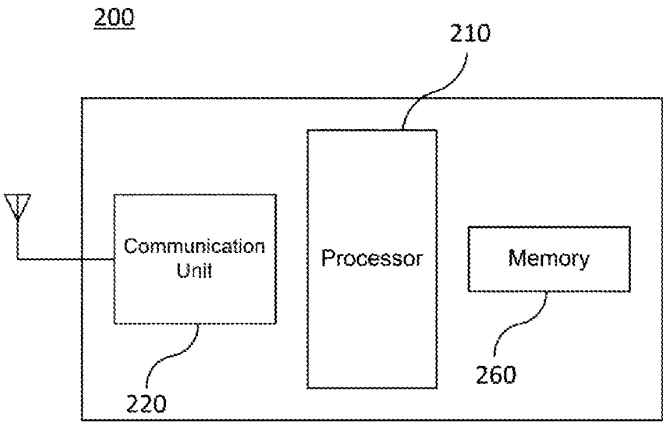

200
210
Communication Unit
Processor
Memory
220
260

FIG. 4

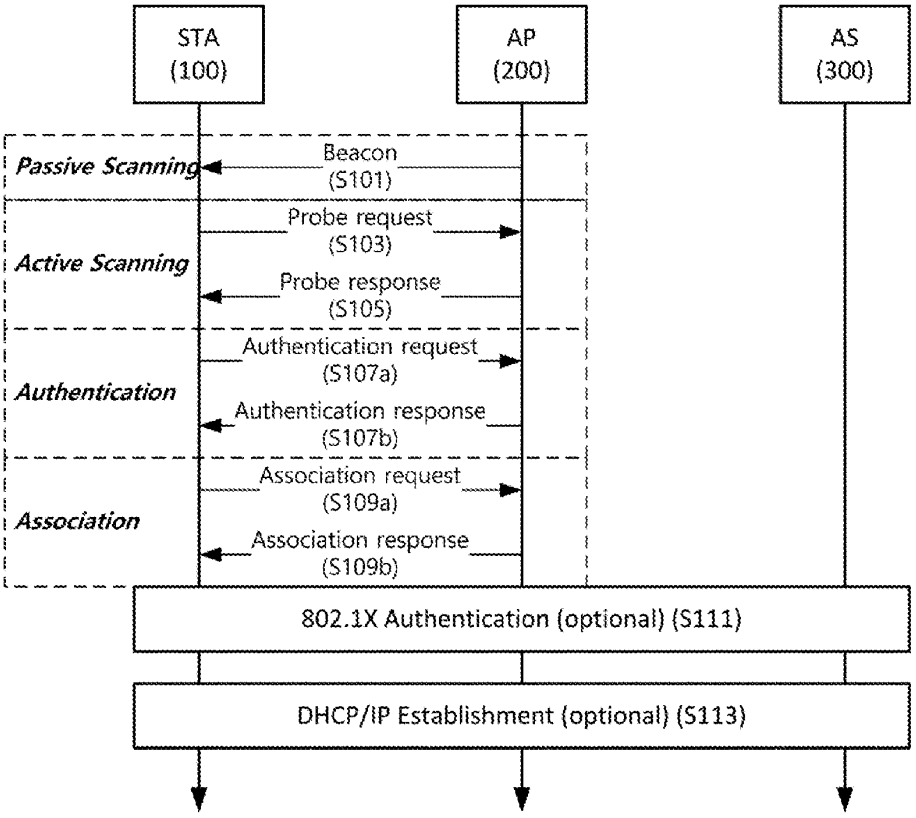

STA
(100)
AP
(200)
AS
(300)
Passive Scanning
Beacon
(S101)
Active Scanning
Probe request
(S103)
Probe response
(S105)
Authentication
Authentication request
(S107a)
Authentication response
(S107b)
Association
Association request
(S109a)
Association response
(S109b)
802.1X Authentication (optional) (S111)
DHCP/IP Establishment (optional) (S113)

FIG. 5

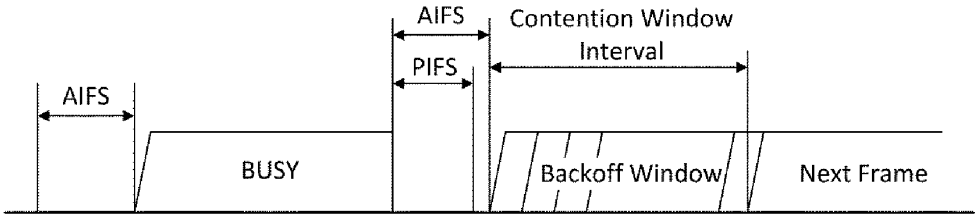


FIG. 6

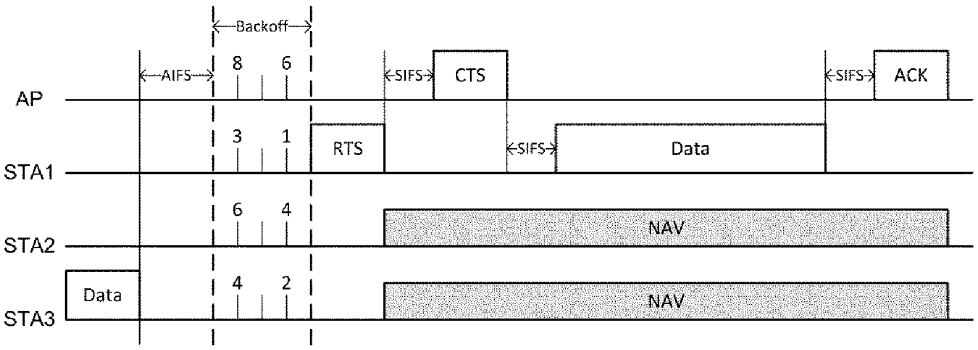


FIG. 7

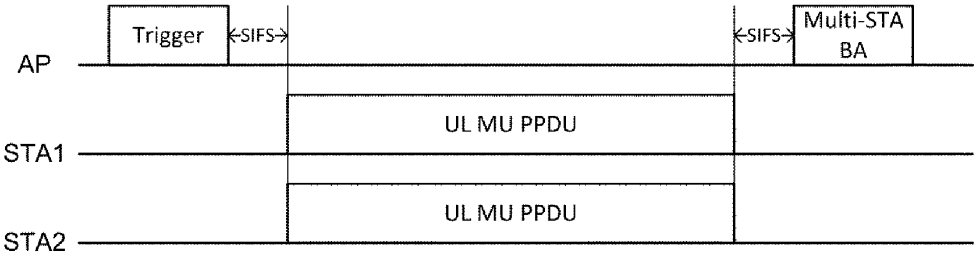


FIG. 8

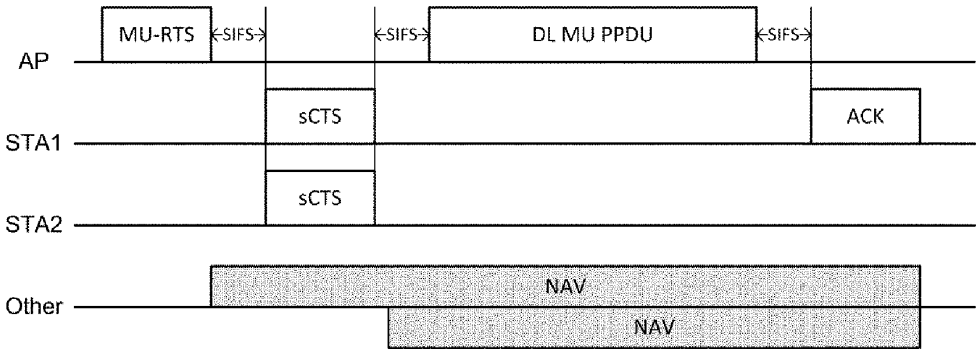

MU-RTS
SIFS
SIFS
DL MU PPDU
SIFS
AP
sCTS
ACK
STA1
sCTS
STA2
NAV
Other
NAV

FIG. 9

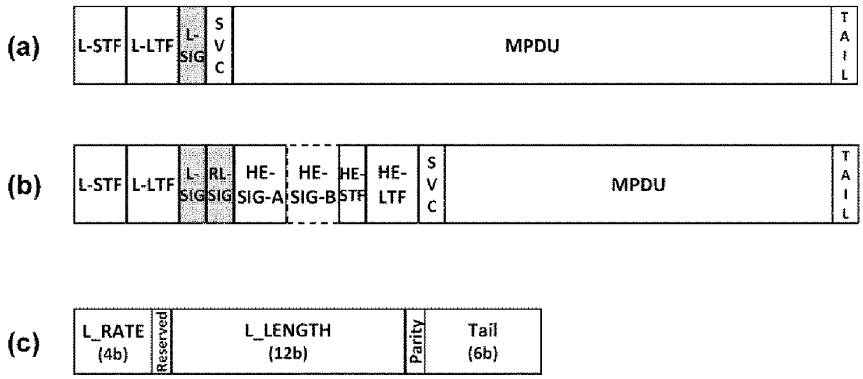

(a)
L-STF
L-LTF
L-SIG
SVC
MPDU
TAIL
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
(c)
L_RATE (4b)
Reserved
L_LENGTH (12b)
Parity
Tail (6b)

FIG. 10

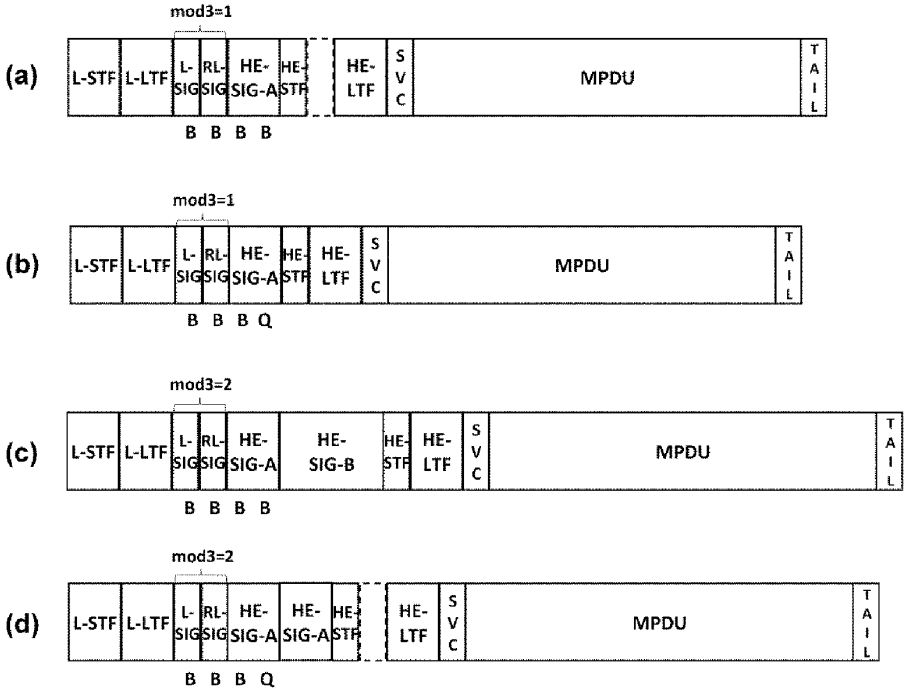
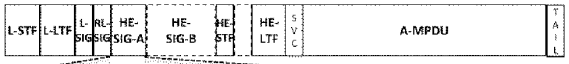

mod3=1
(a)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=1
(b)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q
mod3=2
(c)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-B
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B B
mod3=2
(d)
L-STF
L-LTF
L-SIG
RL-SIG
HE-SIG-A
HE-SIG-A
HE-STF
HE-LTF
SVC
MPDU
TAIL
B B B Q

FIG. 11



Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
Beam Change	1	
UL/DL	1	0:DL, 1:UL
MCS	4	
DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Reserved	1	
Spatial Reuse	4	TBD
Bandwidth	2	20/40/80/160(80+80)MHz
GI+LTF Size	3	1x_LTF+0.8us_GI 2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
NSTS	3	1~8 space time streams
TXOP Duration	7	
Coding	1	0:BCC, 1:LDPC
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
TxBF	1	Beamforming
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
Reserved	1	
Doppler	1	
CRC	4	
Tail	6	

(a)

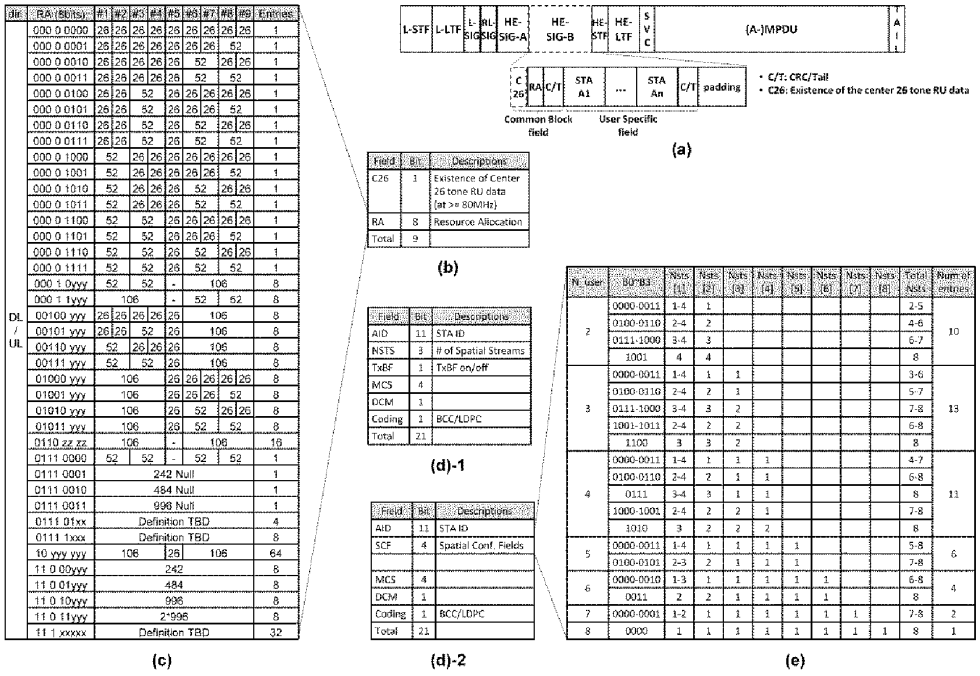
Field	Bit	Descriptions
UL/DL	1	0:DL, 1:UL
SIGB MCS	3	MCS0~MCS5
SIGB DCM	1	Dual carrier modulation
BSS Color	6	BSS identification info
Spatial Reuse	4	TBD
Bandwidth	3	(DL) 20/40/80/160(80+80), 80A, 80B, 160A, 160B (UL) 20/40/80/160(80+80), left-106tone, right-106tone, reserved
Num of SIG-B Sym	4	If SIG-B Compression is 1 (DL) Num of MU-MIMO Users (UL) Num of SIG-B Sym
SIG-B Compression	1	(DL) Set to 1 in Full BW MU-MIMO (UL) Always set to 1 to remove RU Allocation subfield
GI+LTF Size	3	2x_LTF+0.8us_GI 2x_LTF+1.6us_GI 4x_LTF+3.2us_GI
Doppler	1	
TXOP Duration	7	
Reserved	1	
Num of HE-LTF Sym	3	1, 2, 4, 6, 8
LDPC Extra Sym.	1	
STBC	1	Space Time Block Coding
Pre-FEC Padding	2	Padding Length
Padding Disam.	1	Padding Disambiguity
CRC	4	
Tail	6	

(b)

Field	Bit	Descriptions
Format	1	0: Trigger-based PPDU, 1: SU PPDU
BSS Color	6	BSS identification info
Spatial Reuse1	4	Spatial Reuse Parameter
Spatial Reuse2	4	Spatial Reuse Parameter
Spatial Reuse3	4	Spatial Reuse Parameter
Spatial Reuse4	4	Spatial Reuse Parameter
Reserved	1	
Bandwidth	2	20/40/80/160(80+80)MHz
TXOP Duration	7	
Reserved	9	
CRC	4	
Tail	6	

(c)

FIG. 12



dir.	RA-Bitmap	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
DL / UL	000 0 0000	26	26	26	26	26	26	26	26		1
	000 0 0001	26	26	26	26	26	26	26	52		1
	000 0 0010	26	26	26	26	26	52	26	26		1
	000 0 0011	26	26	26	26	26	52	52			1
	000 0 0100	26	26	52	26	26	26	26	26		1
	000 0 0101	26	26	52	26	26	26	52			1
	000 0 0110	26	26	52	26	52	26	26			1
	000 0 0111	26	26	52	26	52	52				1
	000 0 1000	52	26	26	26	26	26	26	26		1
	000 0 1001	52	26	26	26	26	26	52			1
	000 0 1010	52	26	26	26	52	26	26			1
	000 0 1011	52	26	26	26	52	52				1
	000 0 1100	52	52	26	26	26	26	26			1
	000 0 1101	52	52	26	26	26	52				1
	000 0 1110	52	52	26	52	26	26				1
	000 0 1111	52	52	26	52	52					1
	000 1 0yyy	52	52	-	106						8
	000 1 1yyy	106		-	52	52					8
	00100 yyy	26	26	26	26	106					8
	00101 yyy	26	26	52	26	106					8
	00110 yyy	52	26	26	26	106					8
	00111 yyy	52	52	26	106						8
	01000 yyy	106			26	26	26	26	26		8
	01001 yyy	106			26	26	26	52			8
	01010 yyy	106			26	52	26	26			8
	01011 yyy	106			26	52	52				8
	0110 zz xx	106			-	106					16
	0111 0000	52	52	-	52	52					1
	0111 0001	242 Null									1
	0111 0010	484 Null									1
	0111 0011	996 Null									1
	0111 01xx	Definition TBD									4
	0111 1xxx	Definition TBD									8
	10 yyy yyy	106		26	106						64
	11 0 00yyy	242									8
	11 0 01yyy	484									8
	11 0 10yyy	996									8
	11 0 11yyy	2*996									8
	11 1 xxxxx	Definition TBD									32

(c)

Field	Bit	Description
C26	1	Existence of Center 26 tone RU data (at >= 80MHz)
RA	8	Resource Allocation
Total	9	

(b)

Field	Bit	Description
AID	11	STA ID
NSTS	3	# of Spatial Streams
TxBF	1	TxBF on/off
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

(d)-1

Field	Bit	Description
AID	11	STA ID
SCF	4	Spatial Conf. Fields
MCS	4	
DCM	1	
Coding	1	BCC/LDPC
Total	21	

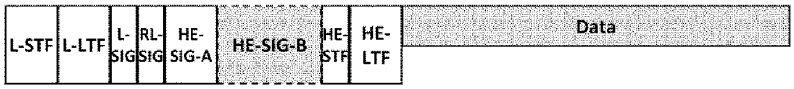
(d)-2

N_user	B0~B3	Nsts [1]	Nsts [2]	Nsts [3]	Nsts [4]	Nsts [5]	Nsts [6]	Nsts [7]	Nsts [8]	Total Nsts	Num of entries
2	0000-0011	1-4	1							2-5	10
	0100-0110	2-4	2							4-6	
	0111-1000	3-4	3							6-7	
	1001	4	4							8	
3	0000-0011	1-4	1	1						3-6	13
	0100-0110	2-4	2	1						5-7	
	0111-1000	3-4	3	2						7-8	
	1001-1011	2-4	2	2						6-8	
	1100	3	3	2						8	
4	0000-0011	1-4	1	1	1					4-7	11
	0100-0110	2-4	2	1	1					6-8	
	0111	3-4	3	1	1					8	
	1000-1001	2-4	2	2	1					7-8	
	1010	3	2	2	2					8	
5	0000-0011	1-4	1	1	1	1				5-8	6
	0100-0101	2-3	2	1	1	1				7-8	
6	0000-0010	1-3	1	1	1	1	1			6-8	4
	0011	2	2	1	1	1	1			8	
7	0000-0001	1-2	1	1	1	1	1	1		7-8	2
8	0000	1	1	1	1	1	1	1	1	8	1

(e)

FIG. 13

(a)



(b)

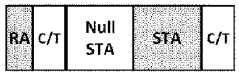
Field	Bit	Descriptions
BW	3	DL HE MU PPDU case - 20/40/80/160(80+80)MHz - 80A, 80B, 160A, 160B (Preamble Puncturing) UL HE MU PPDU case - 20/40/80/160(80+80)MHz **- 20MHz-left 106 tone** **- 20MHz-right 106 tone**



(OFDMA User Specific Info)

(c)

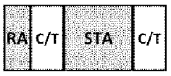
RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
0110zzzz	106				-	106				16



(OFDMA User Specific Info)

(d)

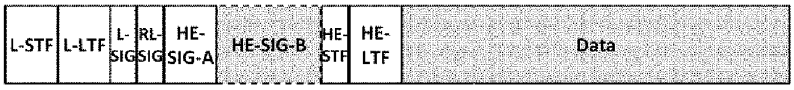
RA (8bits)	#1	#2	#3	#4	#5	#6	#7	#8	#9	Entries
others	x	x	x	x	x	x	x	x	x	x
TBD	106				-					1
TBD	-				106					1



(OFDMA User Specific Info)

FIG. 14

(a)



(b)

Field	Bit	Descriptions
SIG-B Compression	1	DL HE MU PPDU case - "0"refer RA field in SIG-B **- "1" MU-MIMO user specific info** UL HE MU PPDU case - Always set to "1" **- Use OFDMA user specific info**

FIG. 15

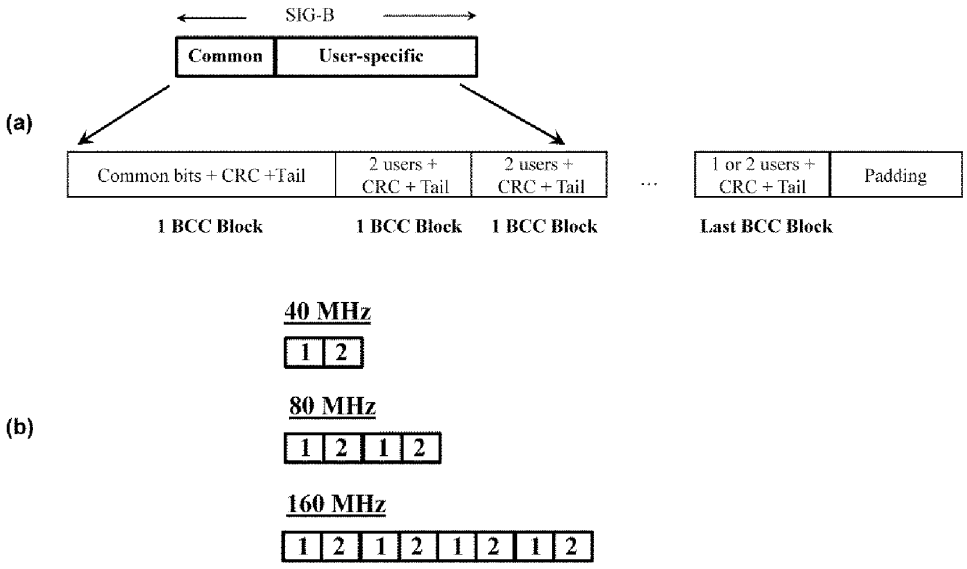

(a)
SIG-B
Common
User-specific
Common bits + CRC +Tail
2 users + CRC + Tail
2 users + CRC + Tail
1 or 2 users + CRC + Tail
Padding
1 BCC Block
1 BCC Block
1 BCC Block
Last BCC Block
(b)
40 MHz
1 2
80 MHz
1 2 1 2
160 MHz
1 2 1 2 1 2 1 2

FIG. 16

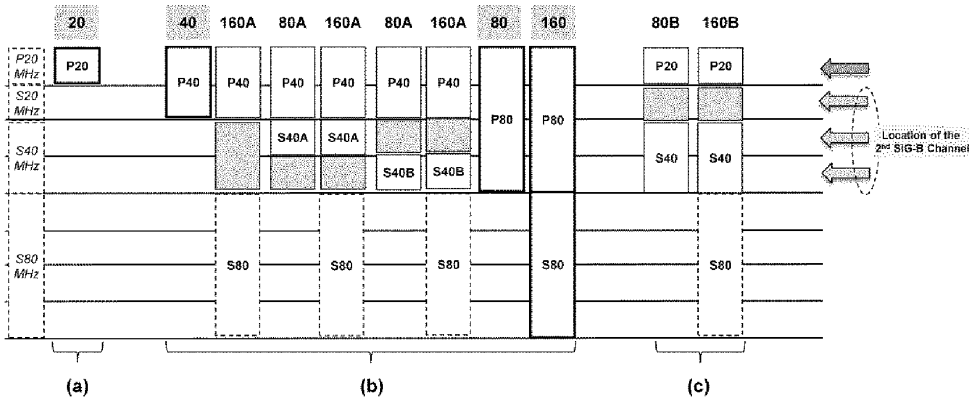

20
40
160A
80A
160A
80A
160A
80
160
80B
160B
P20 MHz
S20 MHz
S40 MHz
S80 MHz
P20
P40
S40A
S40B
P80
S80
Location of the 2nd SIG-B Channel
(a)
(b)
(c)

FIG. 17

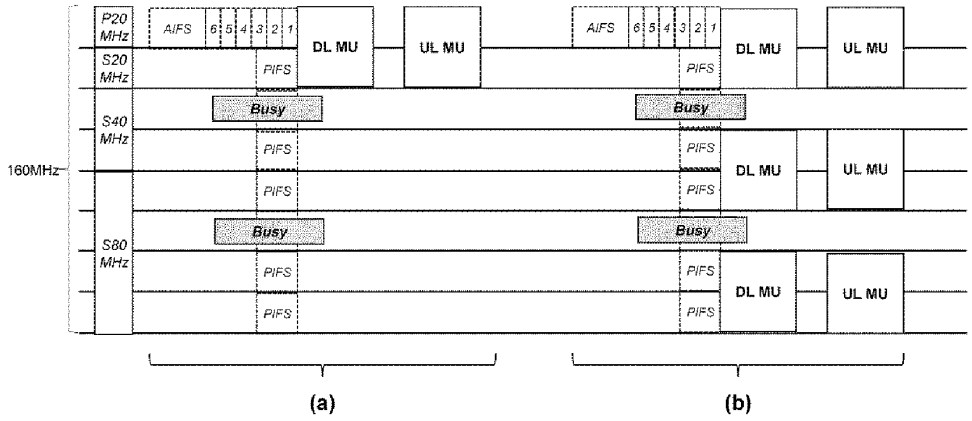

P20 MHz
S20 MHz
S40 MHz
S80 MHz
160MHz
AIFS
6 5 4 3 2 1
PIFS
Busy
DL MU
UL MU
(a)
(b)

FIG. 18

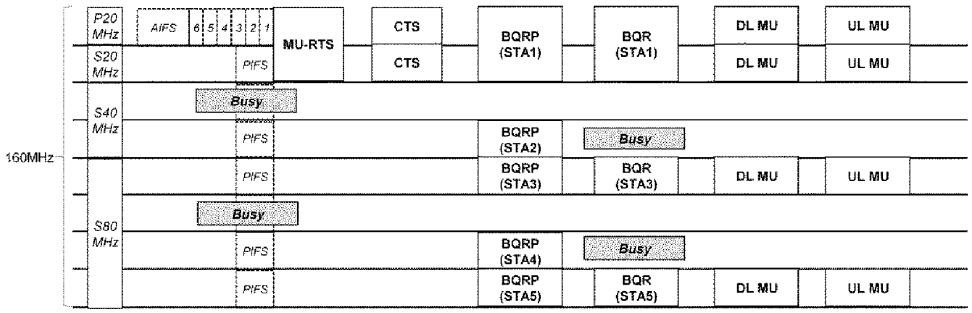

P20 MHz
S20 MHz
S40 MHz
S80 MHz
160MHz
AIFS
6 5 4 3 2 1
PIFS
Busy
MU-RTS
CTS
BQRP (STA1)
BQR (STA1)
BQRP (STA2)
BQRP (STA3)
BQR (STA3)
BQRP (STA4)
BQRP (STA5)
BQR (STA5)
DL MU
UL MU

FIG. 19

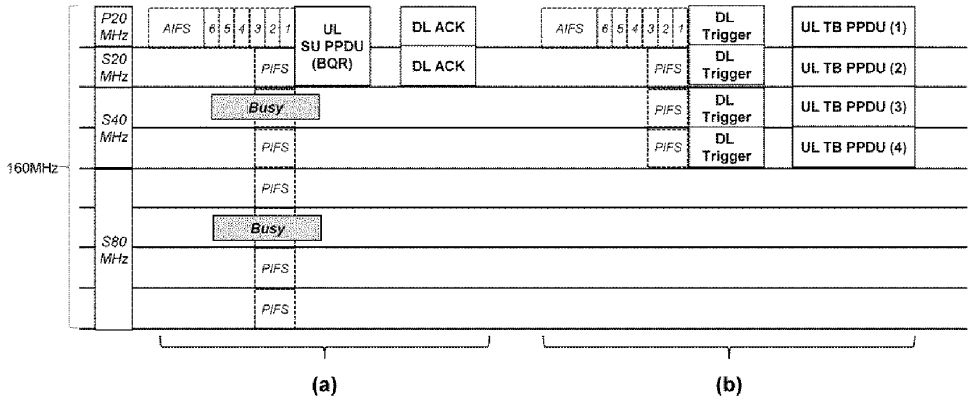
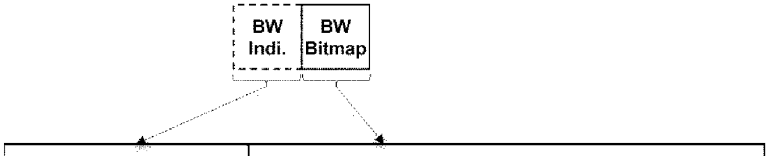


FIG. 20



BW Indication	BW Bitmap							
20MHz	Idle /Busy	-	-	-	-	-	-	-
40MHz	Idle /Busy	Idle /Busy	-	-	-	-	-	-
80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	-	-	-	-
160MHz, 80+80MHz	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy	Idle /Busy

FIG. 21

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STATEMENT UNDER 37 CFR 3.73(c)

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

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., a INSTITUTE

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

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

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

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

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

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

   SK TELECOM CO., LTD.

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

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

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

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

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

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

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

1. From: _____ To: _____

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

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

2. From: _____ To: _____

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

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

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

4. From: _____ To: _____

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

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

5. From: _____ To: _____

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

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

6. From: _____ To: _____

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

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

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

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

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

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

/Young Seok Koo 76,255/	December 30, 2019
Signature	Date
YOUNG SEOK KOO	76,255
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

Privacy Act Statement

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

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

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

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STATEMENT UNDER 37 CFR 3.73(c)

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

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET

SK TELECOM CO., LTD., a CORPORATION

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

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

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

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

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

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

   WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

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

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

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

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

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

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4. From: _____ To: _____

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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: _____

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

/Young Seok Koo 76,255/	December 30, 2019
Signature	Date
YOUNG SEOK KOO	76,255
Printed or Typed Name	Title or Registration Number

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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).
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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)).
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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.

Client Ref: WILP-180004-US
Wilus Ref: FNHEWW-180001-US
Our Ref: B-10010CON 832112-9

ASSIGNMENT

WHEREAS, I/we, Juhyung SON of Gyeonggi-do, Republic of Korea, Jinsam KWAK of Gyeonggi-do, Republic of Korea, Geonjung KO of Gyeonggi-do, Republic of Korea, and Woojin AHN of Gyeonggi-do, Republic of Korea ("Assignor"), am/are the inventor(s) of an invention entitled "WIRELESS COMMUNICATION METHOD AND WIRELESS COMMUNICATION TERMINAL FOR SIGNALING MULTI-USER PACKET" that is the subject matter of: (check all that apply)

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2017-0003147 filed on January 9, 2017,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2017-0008927 filed on January 18, 2017,

[x] an application made under the Patent Cooperation Treaty which is identifiable at WIPO by or claiming the benefit of or priority to Application No. PCT/KR2018/000443 filed on January 9, 2018,

[x] an application for Letters Patent which is identifiable in the Patent Office of US by Application No. 16/505,664 filed on July 8, 2019 ;

WHEREAS, (1) WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., an institute organized and existing under the laws of Republic of Korea, and having offices at 5F 216 Hwangsaeul-ro Bundang-gu Seongnam-si Gyeonggi-do 13595 Republic of Korea and (2) SK TELECOM CO., LTD., a corporation organized and existing under the laws of Republic of Korea ("Assignee"), and having offices at 65, Eulji-ro Jung-gu Seoul 04539, Republic of Korea, are desirous of acquiring the entire right, title and interest in and to the invention, the applications, and any and all Letters Patent or similar foreign or domestic legal protection

[x] in the United States
[ ] in all other countries or jurisdictions;

"NOW THEREFORE, for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged,

a) Assignors agree to transfer, and
b) Assignors do hereby transfer,

to Assignee, its successors and assigns, effective as of January 9, 2017, *nunc pro tunc*, Assignors' entire right, title and interest in the above-named countries and jurisdictions in and to the following including the right to sue for past infringement: the invention, the above-identified applications, all applications from which any of the above-identified applications claim priority, corresponding U.S. and non-U.S. applications, any continuation, continuation-in-part, division, renewal, or substitute for the applications, all Letters Patent for the applications, any reissue, re-examination, or similar legal protection issuing related to the Letters Patent, and all rights and benefits under any applicable treaty or convention, and Assignors authorize the Director of the United States Patent and Trademark Office or foreign equivalent to issue the Letters Patent or similar legal protection to the Assignee.

Assignors authorize the U.S. attorneys handling the above application(s) or patent(s) for the invention and the Assignee, its successors and assigns, to insert in this instrument the filing date(s), and application and patent number(s) when ascertained, for the above applications and patents and to insert any necessary missing titles. Assignors further authorize the Assignee, its successors and assigns, or anyone it may properly designate, to apply for Letters Patent or similar legal protection in its own name if desired, in the above-named countries and jurisdictions and appoint Assignee the common representative in the above-identified international application and any international application for the invention.

Assignors represent to the Assignee, its successors and assigns, that Assignors shall not execute any writing or do any act whatsoever conflicting with this Assignment. Assignors, its executors or administrators, will at any time upon request, without additional consideration, but at the reasonable expense of the Assignee, its successors and assigns, execute and deliver to Assignee or its legal representatives such additional writings and do such additional acts as the Assignee, its successors and assigns, may deem desirable to perfect its enjoyment of this grant, and render all assistance in making application for and obtaining, maintaining, and enforcing the Letters Patent or similar legal protection on the invention in any and all countries and jurisdictions, including without limitation providing testimony in any related interference, litigation or proceeding. To the extent that Assignors, its executors or administrators are unable or unavailable to execute and deliver to Assignee or its legal representatives such additional writings and do such additional acts as Assignee, its successors and assigns may deem desirable to perfect its enjoyment of this grant, and render all assistance in making application for and obtaining, maintaining, and enforcing the Letters Patent or similar legal protection on the invention in any and all countries and jurisdictions, Assignors, our executors or administrators hereby authorize Assignee, its successors and assigns to act on Assignors' behalf.

If any provision of this Assignment is held unenforceable or in conflict with the law of any jurisdiction, the validity of the remaining provisions will not be affected by such holding and the part held unenforceable in or in conflict with the law of one jurisdiction will remain in effect for other jurisdictions until held unenforceable or in conflict with the law of that jurisdiction.

Assignors and Assignee hereby irrevocably waive and agree not to assert in any suit, action, or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, that such suit, action, or proceeding is brought in an inconvenient forum or that the venue of such suit, action or proceeding is improper. Each party hereby irrevocably waives personal service of process and consents to process being served in any such suit, action or proceeding by mailing a copy thereof (certified or registered mail, return receipt requested, or any foreign equivalent of such mail service if the address in effect for notices is in a foreign country or territory) to such party at the address in effect for notices to it under this assignment and agrees that such service shall constitute good and sufficient service of process and notice thereof. Nothing contained herein shall be deemed to limit in any way any right to serve process in any manner permitted by law.

Assignors agree not to take any action, or to assist or request any third party in challenging or opposing Assignee's rights granted hereunder. Assignors further acknowledge that Assignee's patent counsel does not represent Assignors personally and acknowledge that Assignors have the right to seek independent counsel.

Juhyung SON

(Inventor / Assignor)

June 5 2019

Date

Jinsam KWAK

(Inventor / Assignor)

June 7, 2019

Date

Geonjung KO

(Inventor / Assignor)

June 5, 2019

Date

Woojin AHN

(Inventor / Assignor)

5 June 2019

Date

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.
5F 216 Hwangsaeul-ro Bundang-gu
Seongnam-si, Gyeonggi-do, 13595 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	Nov. 22, 2019
Name	JIN SAM KWAK	Telephone	82-10-8823-0623
Title	CEO		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

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Assignee Name and Address:

SK TELECOM CO., LTD.
65, Eulji-ro, Jung-gu
Seoul 04539 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	[signature]	Date	Nov. 21, 2019
Name	Bum Soo Shin	Telephone	82-2-6100-7465
Title	Director of IPR		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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