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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	09/07/2021	11116035	B-9905CON 631950-4	6210

158747 7590 08/18/2021

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):

Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;
WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., Gyeonggi-do, KOREA, REPUBLIC OF;
SK TELECOM CO., LTD., Seoul, KOREA, REPUBLIC OF;
Juhyung Son, Gyeonggi-do, KOREA, REPUBLIC OF;
Geonjung Ko, Gyeonggi-do, KOREA, REPUBLIC OF;
Jinsam Kwak, Gyeonggi-do, KOREA, REPUBLIC OF;

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

158747 7590 08/03/2021

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

EXAMINER	
RANDHAWA, MANDISH K	

ART UNIT	PAPER NUMBER
2477	

NOTIFICATION DATE	DELIVERY MODE
08/03/2021	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

Response to Rule 312 Communication	Application No.	Applicant(s)	
	16/294,883	Ahn et al.	
	Examiner	Art Unit	AIA (FITF) Status
	MANDISH RANDHAWA	2477	Yes

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

1. ☑ The amendment filed on 22 July 2021 under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

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

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

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

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	

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
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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 04/23/2021
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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.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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	07/23/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
RANDHAWA, MANDISH K	2477	370-329000

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

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

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 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)*

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature /Young Seok Koo 76,255/ Date July 22, 2021

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

Electronic Patent Application Fee Transmittal

Application Number:	16294883
Filing Date:	06-Mar-2019
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Filer:	Young Seok Koo/Lianne Herbert
Attorney Docket Number:	B-9905CON 631950-4

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:	43323769
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Lianne Herbert
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	22-JUL-2021
Filing Date:	06-MAR-2019
Time Stamp:	17:59:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E20217LI00100838
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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)	631950-IssueFee-Transmittal.pdf	91705 f376e0f987d588e4e3986e7abf48aa9e7e1c46b3	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30688 4ed041b9880acd3f557a8a19d77abdf7c5c02fa8	no	2
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: Woojin AHN	)	Examiner: Randhawa, Mandish K
	)	
Application No.: 16/294,883	)	Group: 2477
	)	
Filing Date: March 6, 2019	)	Our Ref.: B-9905CON 631950-4
	)	
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	)	Date: July 22, 2021
	)	
	)	Re: **Amendment After Notice of Allowance under 37 C.F.R. §1.312**
	)	

Mail Stop Issue Fee
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AMENDMENTS AFTER NOTICE OF ALLOWANCE UNDER 37 C.F.R. §1.312

Sir:

This paper is timely submitted in response to the Notice of Allowance mailed on April 23, 2021 for the subject application. Please amend the application as follows and consider the Remarks set forth below.

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

Remarks begin on page 6 of this paper.

All Amendments and Remarks are made without prejudice or disclaimer.

AMENDMENTS TO THE CLAIMS

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

Listing of claims

1-20. (Canceled)

21. (Previously Presented) A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:

a transceiver; and

a processor,

wherein the processor is configured to:

transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver,

switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,

when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends,

when the MPDU included in the trigger-based PPDU requests an immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received,

when the second parameter set timer expires, terminate an application of the second parameter set, and

access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.

22-25. (Canceled).

26. (Previously Presented) The wireless communication terminal of claim 21, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

27. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

28. (Previously Presented) The wireless communication terminal of claim 21, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer.

29. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value within a contention window (CW),

set a backoff timer based on the random integer value, and

access the channel based on the back off timer and a predetermined slot time,

wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

30. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value in a contention window (CW),

set a backoff timer based on the random integer value,

access the channel based on the back off timer and a predetermined slot time, and

if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.

31. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to operate a plurality of queues that are classified according to an access

category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and

when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,

wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

32. (Previously Presented) The wireless communication terminal of claim 31, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

33. (Currently Amended) An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:

transmitting a trigger-based physical layer protocol data unit (PPDU) to the base wireless communication terminal ~~using the transceiver~~;

switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal;

when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request the immediate response, setting a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends;

when the MPDU included in the trigger-based PPDU requests the immediate response, setting the second parameter set timer for the access category of the MPDU for which immediate response is received;

when the second parameter set timer expires, terminating an application of the second parameter set;

accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal and the parameter set; and

transmitting the data through the channel.

34-37. (Canceled).

38. (Previously Presented) The method of claim 33, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

39. (Previously Presented) The method of claim 33, the method further comprising:

receiving a beacon frame from the base wireless communication terminal; and

obtaining information indicating a period of the second parameter set timer from the beacon frame.

40. (Previously Presented) The method of claim 33, wherein the switching the parameter set from the first parameter set to the second parameter set comprises

setting the second parameter set timer when the switching the parameter set from the first parameter set to the second parameter set.

REMARKS

In this Amendment, claim 33 is amended for clarification purposes only. No new matter is presented as a result of these amendments. No claim is added or cancelled. Therefore, the Applicant respectfully requests approval of the amendment to claim 33.

The Commissioner is authorized to charge any additional fees which may be required or credit overpayment 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.

July 22, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76255 /

Young Seok Koo
Attorney for Applicants
Registration No. 76,255
LADAS & PARRY LLP
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Los Angeles, CA 90010
Tel No.: (323) 934-2300
Fax No.: (323) 266-0373

Electronic Acknowledgement Receipt

EFS ID:	43314722
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	22-JUL-2021
Filing Date:	06-MAR-2019
Time Stamp:	03:14:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021-07-19_631950_312Amendments.pdf	168989 3af09bce4ee878a123fe9d70e97cb8bc65a642bb	yes	6

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	6
Warnings:			
Information:			
	Total Files Size (in bytes):	168989	

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

158747 7590 07/20/2021

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LOS ANGELES, CA 90010

EXAMINER	
RANDHAWA, MANDISH K	

ART UNIT	PAPER NUMBER
2477	

NOTIFICATION DATE	DELIVERY MODE
07/20/2021	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.

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

PTOL-90A (Rev. 04/07)

Corrected ***Notice of Allowability***	**Application No.** 16/294,883	**Applicant(s)** Ahn et al.	
	Examiner MANDISH RANDHAWA	**Art Unit** 2477	**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 IDS filed on July 13, 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 21,26,27,29-33,38,39, renumbered as 1-10 . 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 _____.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

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
/M.K.R/	1.	Office Action dated June 14, 2021 for Japanese Patent Application No. 2020-125358 and its English translation provided by the Applicant's foreign counsel
/M.K.R/	2.	Office Action dated June 14, 2021 for Japanese Patent Application No. 2020-125359 and its English translation provided by the Applicant's foreign counsel
/M.K.R/	3.	Kiseon Ryu, "Ack Policy for UL MU Ack transmission", IEEE 802.11-15/1346r1, Internet URL:https://mentor.ieee.org/802.11/dcn/15/11-15-1346-01-00ax-ack-policy-for-ul-mu-ack-transmisssion.ppx, November 8, 2015
/M.K.R/	4.	Po-Kai Huang (Intel), "Comment Resolution on Trigger Frame Format – MU-RTS Variant, IEEE 802.11-16/0808r0, Internet URL:https://mentor.ieee.org/802.11/dcn/16/11-16-0808-00-00ax-comment-resolution-on-triecgr-frame-format-mu-rts-variant.docs, June 28, 2016.

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	07/15/2021

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

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

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

FOREIGN PATENT DOCUMENTS

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

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	3.	Kiseon Ryu, "Ack Policy for UL MU Ack transmission", IEEE 802.11-15/1346r1, Internet URL:https://mentor.ieee.org/802.11/dcn/15/11-15-1346-01-00ax-ack-policy-for-ul-mu-ack-transmisssion.ppx, November 8, 2015
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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. sInclude copy of this form with next communication to applicant.

Electronic Patent Application Fee Transmittal					
Application Number:	16294883				
Filing Date:	06-Mar-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME				
First Named Inventor/Applicant Name:	Woojin Ahn				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-9905CON 631950-4				
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:	43239969
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	13-JUL-2021
Filing Date:	06-MAR-2019
Time Stamp:	17:38:16
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	E20217CH38311236
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		2021-07-13_631950_IDS.pdf	155845 8fdd1f7f90fba02062b4f20b06730bb725bcf604	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	Ref1_JP2020-125358_OA_6-14-21.pdf	213298 58c64342d87639c12cf576cd5d28d27ea10c064f	no	6
Warnings:					
Information:					
3	Non Patent Literature	Ref2_802-11-15-1346r1.pdf	1345758 69b43faa10a0b398aed2c0642a8cd70c1a428b25	no	20
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
4	Other Reference-Patent/App/Search documents	Ref3_JP2020-125359_OA_6-14-2021.pdf	221033 86c0bced98785e3e5655b4caa145ace817532999	no	6
Warnings:					
Information:					
5	Non Patent Literature	Ref4_Huang_NPL.pdf	257010 685f1c6cabf80ef8e353d56f370af7711e4a8d0d	no	5

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	30689 dffe585dec61a81c8f517ecbdc6960db030248cf	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2223633	

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: Randhawa, Mandish K
Serial No.: 16/294,883	Art Unit: 2477
Filing or 371 (c) Date: March 6, 2019	Conf. No.: 6210
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: July 13, 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.

---

[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

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

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

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

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

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on March 4, 2020 and therefore are not submitted in this IDS.

[ ] Other:

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

July 13, 2021
(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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

158747 7590 07/08/2021

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

EXAMINER	
RANDHAWA, MANDISH K	

ART UNIT	PAPER NUMBER
2477	

NOTIFICATION DATE	DELIVERY MODE
07/08/2021	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

Notice of Allowability	**Application No.** 16/294,883	**Applicant(s)** Ahn et al.	
	Examiner MANDISH RANDHAWA	**Art Unit** 2477	**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 IDS filed on June 23, 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 21,26,27,29-33,38,39, renumbered as 1-10 . 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 _____.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

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
/M.K.R/	1.	Office Action dated March 22, 2021 for Korean Patent Application No. 10-2019-7006093 and its English translation provided by the Applicant's foreign counsel
/M.K.R/	2.	Notice of Allowance dated April 20, 2021 for U.S. Patent Application No. 16/596,674
/M.K.R/	3.	Office Action dated April 19, 2021 for European Patent Application No. 17 824 568.4

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	07/02/2021

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

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
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	2.	Notice of Allowance dated April 20, 2021 for U.S. Patent Application No. 16/596,674
	3.	Office Action dated April 19, 2021 for European Patent Application No. 17 824 568.4

EXAMINER	*DATE CONSIDERED*

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Electronic Patent Application Fee Transmittal					
Application Number:	16294883				
Filing Date:	06-Mar-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME				
First Named Inventor/Applicant Name:	Woojin Ahn				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-9905CON 631950-4				
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:	43060663
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	23-JUN-2021
Filing Date:	06-MAR-2019
Time Stamp:	00:57:26
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	E20216M157420631
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		2021-06-22_631950_IDS.pdf	153684 0cb16787a8c1059461f7a2a67818b04b4a94e191	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	Ref1_KR10-2019-7006093_OA_3-22-21.pdf	165415 9b349d708ad810759d04b055ae1a91aad8c04db0	no	13
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Ref2_US16596674_NOA_4-20-2021.pdf	442431 0da7a49ecb0c238e765f8e9818c4cef6ae0273c7	no	9
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	Ref3_EP178245684_OA_4-19-2021.pdf	551902 0786f4590d2065c01762ff4265d72d11fa6ce2ff	no	9
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30689 26679d6cc582ceef0fb31b127b8ad2f3ee1dd17b	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	1344121

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.

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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: RANDHAWA, MANDISH K
	Art Unit: 2477
Serial No.: 16/294,883	Conf. No.: 6210
Filing or 371 (c) Date: March 6, 2019	Our Ref: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Re: ***Information Disclosure Statement***
Date: June 22, 2021	

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

[ ] 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

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

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

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

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

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on March 4, 2020 and March 6, 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.

June 22, 2021
(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

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 04/23/2021

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

EXAMINER
RANDHAWA, MANDISH K

ART UNIT	PAPER NUMBER
2477	

DATE MAILED: 04/23/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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	07/23/2021

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 04/23/2021
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.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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	07/23/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
RANDHAWA, MANDISH K	2477	370-329000

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

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

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

158747 7590 04/23/2021

LADAS & PARRY
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SUITE 240
LOS ANGELES, CA 90010

EXAMINER	
RANDHAWA, MANDISH K	
ART UNIT	PAPER NUMBER
2477	

DATE MAILED: 04/23/2021

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. 16/294,883	Applicant(s) Ahn et al.	
	Examiner MANDISH RANDHAWA	Art Unit 2477	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 communication(s) filed on April 15, 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 21,26-27,29-33 and 38-39, as previously renumbered as 1-10 . 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 _____.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

CPC - Searched*		
Symbol	Date	Examiner
H04W80/02, H04W28/0268,H04W74/0808, H04W40/244,H04W74/08, H04L5/0055, H04W84/12, H04W74/00,H04W72/0446	12/26/2020	MR
H04W80/02, H04W28/0268,H04W74/0808, H04W40/244,H04W74/08, H04L5/0055, H04W84/12, H04W74/00,H04W72/0446	04/19/2021	MR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
Performed Inventor/Double Patenting search	06/17/2020	MR
Performed NPL (IP.com, STIC, Google), and East text search	06/18/2020	MR
Performed Inventor/Double Patenting search	12/26/2020	MR
Performed East text/CPC search	12/26/2020	MR
Performed Interference search	12/26/2020	MR
Performed Inventor/Double Patenting search	04/19/2021	MR
Performed East text/CPC search	04/19/2021	MR
Performed IP.com (Patents and NPL) search	04/19/2021	MR
Performed Interference search	04/19/2021	MR

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H04W	80/02, 28/0268,74/0808, 40/244,74/08, 84/12, 74/00, 72/0446	12/26/2020	MR
H04L	H04L	12/26/2020	MR
H04W	80/02, 28/0268,74/0808, 40/244,74/08, 84/12, 74/00, 72/0446	04/19/2021	MR
H04L	H04L	04/19/2021	MR

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

CPC						
Symbol					Type	Version
H04W	/	80	/	02	F	2013-01-01
H04W	/	74	/	00	I	2013-01-01
H04W	/	84	/	12	I	2013-01-01
H04W	/	74	/	08	I	2013-01-01
H04L	/	5	/	0055	I	2013-01-01
H04W	/	28	/	0268	I	2013-01-01
H04W	/	40	/	244	I	2013-01-01
H04W	/	72	/	0446	I	2013-01-01
H04W	/	74	/	0808	I	2013-01-01

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	19 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	28

U.S. Patent and Trademark Office — Part of Paper No.: 20210419

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	**Art Unit**
	MANDISH RANDHAWA	2477

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H04W	/	80	/	02	

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	19 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	28

U.S. Patent and Trademark Office — Part of Paper No.: 20210419

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

☐ 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	21	5	30	10	39										
-	22	6	31	-	40										
-	23	7	32												
-	24	8	33												
-	25	-	34												
2	26	-	35												
3	27	-	36												
-	28	-	37												
4	29	9	38												

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	19 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	28

U.S. Patent and Trademark Office — Part of Paper No.: 20210419

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	"20160198500"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 18:40
L3	113,977	(H04W80/02 or H04W28/0268 or H04W74/0808 or H04W40/244 or H04W74/08 or H04L5/0055 or H04W84/12 or H04W74/00 or H04W72/0446).cpc.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 18:50
L4	16	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 18:53
L5	232	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 18:53
L6	7	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 18:59
L7	624	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:02
L8	624	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:02
L9	147	3 and 7	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:03
L10	135	9 not 4 not 6	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:04
L11	19	(enhanced distribut$4 channel access or "edca" or "edcaf" or edca$2) same (back$off or parameter) near3 (timer or interval or duration or counter or countdown or time) same (immediat$4 near3 (response or ack or acknowledg$4 or feedback))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:08
L12	216	5 not 9 not 4 not 11	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:11

EAST Search History (Prior Art)

L13	18	((mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)).clm.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:27
L14	13,849	(WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY or SK TELECOM$9).as. or (Ahn near2 Woojin or Son near2 Juhyung or Ko near2 Geonjung or Kwak near2 Jinsam).in.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:28
L15	3	7 and 14	US-PGPUB; USPAT; DERWENT	NEAR	ON	2021/04/19 19:31
S1	1	"16294883"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:20
S2	6	(("20160198500") or ("20160113034") or ("20180124826")).PN.	US-PGPUB; USPAT; USOCR; DERWENT	OR	OFF	2020/06/17 12:20
S3	51	mu$2 near edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21
S4	86	mu$2 near2 edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21
S5	40	mu$2 near2 edca same parameter	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:22
S6	19	trigger$4 same edca same parameter same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 13:14
S7	187	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:49
S8	3	"20170202023"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:59
S9	3	("20170245261"|"20190098565"|"9439219").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/17 16:33
S10	218	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 16:59
S11	21	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (re$1set$4 or set$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:00

EAST Search History (Prior Art)

S12	3	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:07
S13	7	(mu$2 or multi$2 user) same trigger and (edca) same (re$1set$4 or set$4 or updat$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 22:28
S14	603	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:03
S15	502	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:04
S16	499	(contention window) and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
S17	472	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
S18	52	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value)) same (access with channel)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:06
S19	158	(access category or "ac") with (queue) same back$off with queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:26
S20	104	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:33
S21	12	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0") same (empty or "no" (data or packet)) near2 queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:43
S22	7	("20150124690"|"20160080115"|"20170257196"|"20170272138"|"20170289911"|"20170303280"|"20170310446").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/18 14:38
S23	2	("2017/0041961").URPN.	USPAT	NEAR	ON	2020/12/26 14:06
S24	36	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((enabl$4 or request$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:13

EAST Search History (Prior Art)

S25	15	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:19
S26	30	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with (parameter or edca) same ((immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:28
S27	109,764	(H04W80/02 or H04W28/0268 or H04W74/0808 or H04W40/244 or H04W74/08 or H04L5/0055 or H04W84/12 or H04W74/00 or H04W72/0446).cpc.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:30
S28	19	S26 not S25	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:30
S29	227	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:35
S30	92	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:36
S31	596	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:36
S32	140	S31 and S27	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:37
S33	3	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:50
S34	13	(enhanced distribut$4 channel access or "edca") same (back$off or parameter) near3 (timer or interval or duration or counter or countdown or time) same (immediat$4 near3 (response or ack or acknowledg$4 or feedback))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:52

EAST Search History (Prior Art)

S35	19	(enhanced distribut$4 channel access or "edca" or "edcaf") same (back$off or parameter) near3 (timer or interval or duration or counter or countdown or time) same (immediat$4 near3 (response or ack or acknowledg$4 or feedback))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:54
S36	6	S35 not S34	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:54
S37	44	(mu$2 or multi$2 user) same (parameter or edca or edcaf) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((enabl$4 or request$4 or immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:56
S38	2	("20150295680"|"20160315681").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
S39	6	("20100081393"|"20160198500"|"20170230981"|"20170245261"|"20170257887"|"20190182864").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
S40	6	("20100081393"|"20160198500"|"20170230981"|"20170245261"|"20170257887"|"20190182864").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
S41	8	S38 or S39	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:14
S42	17	((mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)).clm.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:20
S43	10	"10491355"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:20
S44	13,723	(WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY or SK TELECOM$9).as. or (Ahn near2 Woojin or Son near2 Juhyung or Ko near2 Geonjung or Kwak near2 Jinsam).in.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:30
S45	2	S31 and S44	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:31
S46	1	("20150063105").PN.	US-PGPUB; USPAT	NEAR	ON	2021/04/19 17:21

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
/M.K.R/	1.	2015/0063105	Mar. 5, 2015	LIU et al.			

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
/M.K.R/	2.	Office Action dated March 16, 2021 for Indian Patent Application No. 201927012269
/M.K.R/	3.	Jin Soo AHN et al.: "MU mode EDCA control", IEEE 802.11-16/1220r1, September 14, 2016. Yonsei University, slides 1-10

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	04/19/2021

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. sInclude copy of this form with next communication to applicant.

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2015/0063105	Mar. 5, 2015	LIU et al.			

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
	2.	Office Action dated March 16, 2021 for Indian Patent Application No. 201927012269
	3.	Jin Soo AHN et al.: "MU mode EDCA control", IEEE 802.11-16/1220r1, September 14, 2016. Yonsei University, slides 1-10

EXAMINER	*DATE CONSIDERED*

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

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	16/294,883
Filing Date	March 6, 2019
First Named Inventor	Woojin AHN
Art Unit	2477
Examiner Name	Randhawa, Mandish K
Attorney Docket Number	B-9905CON 631950-4

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 76,255/	Date	April 8, 2021
Name (Print/Type)	Young Seok Koo	Registration No.	76,255

CERTIFICATE OF MAILING OR TRANSMISSION

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

Signature	/Azatuhi Chinaryan/		
Name (Print/Type)	Azatuhi Chinaryan	Date	April 8, 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.

Electronic Patent Application Fee Transmittal					
Application Number:	16294883				
Filing Date:	06-Mar-2019				
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME				
First Named Inventor/Applicant Name:	Woojin Ahn				
Filer:	Young Seok Koo/Azatuhi Chinaryan				
Attorney Docket Number:	B-9905CON 631950-4				
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:	42408674
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	15-APR-2021
Filing Date:	06-MAR-2019
Time Stamp:	02:57:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
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Payment was successfully received in RAM	$1360
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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		2021-04-08_631950_IDS.pdf	153049 4264d0c34350b0e6216ca0edfa499b74025a05fc	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	Ref2_IN201927012269_1stOA.pdf	237564 999d03e1cf0d4da7c2109d6de9d2e30f04f2be8d	no	6
Warnings:					
Information:					
3	Non Patent Literature	Ref3_MU-Mode_NPL.pdf	624470 8ce8b696fccadd3742a0f92c55d7dcf8fb4d958e	no	10
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
4	Request for Continued Examination (RCE)	2021-04-08_631950_RCE.pdf	197115 98741bfa094be5c625e51591b8b7635db8f97508	no	2
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					

5	Fee Worksheet (SB06)	fee-info.pdf	30684 43bb0fd040d6bbdc82ff228dd859c916a8ebda9b	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1242882	

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: RANDHAWA, MANDISH K
Serial No.: 16/294,883	Art Unit: 2477
Filing or 371 (c) Date: March 6, 2019	Conf. No.: 6210
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: April 8, 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

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

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

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

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

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on March 6, 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.

April 8, 2021
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

7590 03/02/2021

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

EXAMINER	
RANDHAWA, MANDISH K	
ART UNIT	PAPER NUMBER
2477	

DATE MAILED: 03/02/2021

PRIORITY ACKNOWLEDGMENT

☒ 1. Receipt is acknowledged of priority papers submitted under 35 U.S.C. 119. The papers have been placed of record in the file.

☐ 2. Applicant's claim for priority, based on papers filed in parent Application Number _____ submitted under 35 U.S.C. 119, is acknowledged.

☐ 3. The priority papers, submitted _____, after payment of the issue fee are

- ☐ acknowledged
  While the priority claim or certified copy filed will be placed in the file record, neither will be reviewed and the patent when published will not include the priority claim.
  See 37 CFR 1.55(a)(2).
- ☐ not acknowledged since the processing fee in 37 CFR 1.17(i) has not been received.

☐ 4. For utility and plant applications filed on or after November 29, 2000, the priority claim is not entered because the claim was not presented within the time limit required by 37 CFR 1.55(a)(1). A petition to accept a delayed claim for priority under 35 U.S.C. 119(a) - (d) or (f), or 365(a) may be filed. See 37 CFR 1.55(c) and MPEP 201.14(a).

/CH/
571-272-4200 or 1-888-786-0101
FOR Application Assistance Unit
Office of Data Management

PTOL-147 (Rev. 03/08)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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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
16/294,883	03/06/2019	2477	1720	B-9905CON 631950-4	20	2

CONFIRMATION NO. 6210

CORRECTED FILING RECEIPT

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

OC000000123499314

Date Mailed: 02/22/2021

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)

Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;
Juhyung Son, Gyeonggi-do, KOREA, REPUBLIC OF;
Geonjung Ko, Gyeonggi-do, KOREA, REPUBLIC OF;
Jinsam Kwak, 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 PCT/KR2017/009841 09/07/2017

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 10-2016-0114822 09/07/2016 Access Code Provided
REPUBLIC OF KOREA 10-2016-0116877 09/10/2016 Access Code Provided
REPUBLIC OF KOREA 10-2016-0116965 09/12/2016 Access Code Provided
REPUBLIC OF KOREA 10-2016-0117898 09/13/2016 Access Code Provided
REPUBLIC OF KOREA 10-2016-0122488 09/23/2016 Access Code Provided
REPUBLIC OF KOREA 10-2016-0147189 11/06/2016 Access Code Provided
REPUBLIC OF KOREA 10-2017-0022227 02/20/2017 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: 02/18/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/294,883**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: Yes

Title

WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Preliminary Class

370

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).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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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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Document details: Country/Office: KR
Filing date: 13 Sep 2016 (13.09.2016)
Application number: 10-2016-0117898

Date of availability of document: 12 Aug 2019 (12.08.2019)

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대 한 민 국 특 허 청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

출 원 번 호 : 10-2016-0117898
Application Number

출 원 년 월 일 : 2016년 09월 13일
Filing Date Sep. 13, 2016

출 원 인 : 주식회사 윌러스표준기술연구소

Applicant(s) WILUS Institute of Standards and Technology Inc.

2021년 02월 19일

특 허 청
COMMISSIONER

재출 일자 : 2016-09-13

【서지사항】

【서류명】 특허출원서

【참조번호】 160127HEW

【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】 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 접속 파라미터 제어 방법

【발명의 영문명칭】 METHOD OF CONTROLLING TRANSMISSION FOR UPLINK MULTIUSER TRANSMISSION ACCESS PARAMETER IN WIDEBAND WIRELESS LAN NETWORKS

【발명자】

【성명】 안우진

【성명의 영문표기】 Woojin AHN

【주민등록번호】 831010-1XXXXXX

【우편번호】 122-957

【주소】 서울특별시 은평구 서오릉로13길 18-1

【국적】 KR

【발명자】

【성명】 손주형

【성명의 영문표기】 Juhyung SON

【주민등록번호】 770724-1XXXXXX

【우편번호】 437-810

【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1114동 302호

【국적】 KR

【발명자】

【성명】 곽진삼

【성명의 영문표기】 Jinsam KWAK

【주민등록번호】 740908-1XXXXXX

【우편번호】 437-810

【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1113동1704호

【국적】 KR

【발명자】

【성명】 고건중

【성명의 영문표기】 Geonjung KO

【주민등록번호】 860909-1XXXXXX

【우편번호】 443-794

【주소】 경기도 수원시 영통구 동탄원천로915번길 36, 301동 606호 (주공그린빌 3단지)

【국적】 KR

【출원언어】 국어

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 R0166-16-1030

【부처명】 미래창조과학부

【과제관리(전문)기관명】 정보통신기술진흥센터

【연구사업명】 정보통신방송표준개발지원

【연구과제명】 IEEE802.11 High Efficiency WLAN (HEW) 표준개발

【기여율】 1/1

【과제수행기관명】 (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】	33	면	0 원
【우선권주장료】	0	건	0 원
【심사청구료】	0	항	0 원
【합계】	46,000 원		

제출 일자 : 2016-09-13

【감면사유】 소기업(70%감면)[1]

【감면후 수수료】 13,800 원

【첨부서류】 1.중소기업기본법 제2조의 규정에 따른 소기업에 해당함을 증명하는 서류_1통

37-4

제출 일자 : 2016-09-13

【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 접속 파라미터 제어 방법{METHOD OF CONTROLLING TRANSMISSION FOR UPLINK MULTIUSER TRANSMISSION ACCESS PARAMETER IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 대

두되었다. 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 7은 본 발명의 일 실시예에 따른 MU EDCA parameter set의 format을 도시하고 있다.

도 8은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 format을 도시하고 있다.

도 9는 본 발명의 일 실시예에 따른 UL MU random access 실패시의 단말의 후속 동작을 도시하고 있다.

도 10은 본 발명의 일 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

도 11은 본 발명의 다른 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

도 12는 본 발명의 또다른 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

도 13은 본 발명의 일 실시예에 따른 단말의 Trigger Frame을 통한 TID 개수 조절 방법을 도시하고 있다.

도 14는 본 발명의 다른 실시예에 따른 단말의 Trigger Frame을 통한 TID 개수 조절 방법을 도시하고 있다.

【발명을 실시하기 위한 구체적인 내용】

【0011】 본 명세서에서 사용되는 용어는 본 발명에서의 기능을 고려하면서 가능한 현재 널리 사용되는 일반적인 용어를 선택하였으나, 이는 당 분야에 종사하

는 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 구성이 특정 구성요소를 "포함" 한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하" 라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만" 으로 적절하게 대체될 수 있다.

【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 명세서에서는 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. 인프라스트럭처 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 도

시한 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 규격

에 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.

【0031】 도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】 무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되

며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】 802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀 영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해 높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우, 동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】 상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 별도의 MU EDCA parameter set으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함될 수 있다. MU EDCA parameter set은

기존에 사용하고 있는 Legacy EDCA parameter set을 사용하는 단말들보다 더 낮은 확률로 채널에 접속하도록 값이 수정되어 있을 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있으며 BSS 내의 단말들에게 전달된 후 각 단말이 특정 조건을 만족할 시에 MU EDCA parameter 기반으로 동작을 시작(initiation) 하도록 할 수 있다. 또한 특정 조건에 의하여 다시 기존의 Legacy EDCA parameter set으로 돌아가도록 하는 것 역시 가능하다. 또 다른 방법으로 MU EDCA parameter set 자체가 하나의 Action 혹은 Action No Ack 프레임으로 동작되어 단말들에게 전송될 수 있다.

【0035】 도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0036】 각 단말에서 MU EDCA parameter set이 특정 조건에 의하여 initiation 된 경우, 해당 단말의 모든 AC에 대하여 EDCA parameter set이 변경될 수 있지만, 만약 특정 AC 만이 조건을 만족하는 경우에는 해당 AC에 대해서만 MU EDCA parameter set 기반으로 동작하도록 할 수도 있다. MU EDCA parameter set은 기본적으로 UL MU 전송에 스케쥴링 될 것으로 예상되는 트래픽이 대상이 되므로, 스케쥴링 예정에 없는 AC의 트래픽의 경우는 기존의 접속 확률에 따라 SU 전송을 시도하는 것이 보장되어야 한다. 이 때, 단말 내부 스케쥴링 동작 구현에 따라 현재 낮은 BO timer를 보유하고 있는 AC가 MU EDCA parameter set 기반으로 동작하는 것을 의도적으로 방지하고 큰 BO timer를 지닌 AC의 트래픽만을 UL MU 전송에 스케쥴링 되도록 유도하여 자신의 접속 확률을 상대적으로 높이려는 동작을 시도를 할

수도 있다. 이를 방지하기 위하여 단말의 특정 트래픽이 MU EDCA parameter set 동작의 대상이 되는 경우, 현재 접속 대기 시간이 가장 짧은 primary AC를 반드시 MU EDCA parameter set에 포함시키도록 하는 추가적인 규칙을 지정할 수도 있다. 이 때 primary AC를 지정하는 기준은 남아있는 BO timer와 AIFS[AC] 값의 합이 될 수 있으며 다른 방법으로 남아있는 BO timer 값이 기준이 될 수도 있다. 만약 하나 이상의 AC가 같은 접속 대기 시간으로 설정된 경우에는 해당 AC가 모두 MU EDCA parameter set를 기반으로 동작해야 한다.

【0037】도 7은 본 발명의 일 실시예에 따른 MU EDCA parameter set의 format을 도시하고 있다.

【0038】MU EDCA parameter set은 도 7과 같은 형태로 기존의 EDCA parameter set의 구성과 유사하게 구현할 수 있다. 다만 새로 정의된 element인 만큼 extension ID를 가지며, 기존의 QoS Info element가 MU QoS element로 대체되어 내부의 MU EDCA Parameter Set Update Count을 통해 단말이 MU EDCA parameter set이 총 몇 회 변경 되었는지를 알 수 있다. MU QoS info element의 나머지 필드는 기존의 QoS element와 같은 값으로 설정될 수 있다. 또한, MU EDCA parameter set에서 Legacy mode로 돌아가기 위한 timer값이 포함되며, 각 MU AC parameter record에서 각 AC 별 AIFNS, ECWmin, ECWmax 값을 받아 MU EDCA parameter set 적용시에 MIB attribute를 수정한다. 이 때, MU QoS Info element는 MU EDCA parameter set이 전송되지 않는 beacon일 경우 독립적인 element 형태 혹은 다른 (MU) QoS 관련 element 들과 함께 반드시 전송되어야 한다.

【0039】도 8은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 format을 도시하고 있다.

【0040】또다른 방법으로 도 7의 구성에서 MU QoS Info를 삭제할 수 있다. 기존의 QoS info element는 EDCA Parameter Set element 이외의 다른 QoS 관련 element들과 함께 전송될 수 있었으며, beacon에서는 상기한 element 중의 하나는 반드시 전송되기 때문에, EDCA Parameter Set element가 전송되지 않은 beacon을 받은 단말 중에서 QoS info field 내부의 EDCA Parameter Set Update counter가 자신이 보유한 counter 값과 다를 경우 자신이 정상적으로 EDCA Parameter Set을 변경하지 못하였다는 것을 판단하여 probe request를 통해 정상적인 EDCA Parameter Set 업데이트를 진행할 수 있도록 한다. 그러나 MU QoS Info field는 EDCA Parameter Set element 외에 다른 element와 함께 전송되지 않기 때문에 내부의 MU EDCA Parameter Set update counter가 기존의 QoS Info element와 같이 update counter로서의 정보를 알리는 기능을 할 수 없을 수 있다. 따라서 beacon 길이 감소를 위하여 해당 MU QoS info field가 삭제된 형태로 도 8과 같이 MU EDCA Parameter Set element를 구성할 수 있다.

【0041】도 9는 본 발명의 일 실시예에 따른 UL MU random access 실패시의 단말의 후속 동작을 도시하고 있다.

【0042】802.11ax의 UL MU Random Access (RA)에서는 AP가 Random Access Parameter Set element를 통해 Beacon, probe, (re)association, authentication 과정에서 단말에게 OCWmin, OCWmax 값을 알리면, UL MU Random Access를 최초로 실

시하는 단말은자신의 OCW 값으로 OCWmin-1를 설정하고, [0, OCW]의 범위에서 RA 시도를 위한 임의의 정수인 OBO 값을 선택한다. 이후 AP로부터 UL MU RA를 위한 TF-R을 수신하면 선택된 OBO 값에서 RA를 위하여 할당된 RU 수를 뺀 값이 0보다 작거나 같을 경우에 RA를 위하여 할당된 RU들 중에서 하나의 RU를 임의로 선택하여 전송을 시도한다. 만약 충돌 등의 상황에 의하여 RA로 송신한 데이터에 대한 ACK을 수신하지 못한 경우에는 RA를 시도하는 단말의 수가 많은 것으로 간주할 수 있으므로 기존의 OCW를 (OCW+1)*2-1로 변경하고, 확장된 구간에서 OB임의로 선택하여 차후의 RA 전송을 준비할 수 있다. 만약 OCW 값이 전송받은 OCWmax 값과 같아질 경우 이후의 연속적인 실패 상황에서 OCW는 더 이상 증가하지 않는다.

【0043】 도 10은 본 발명의 일 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

【0044】 AP로부터 수신한 TF-R에서 CS required field가 1인 경우 단말은 TF-R에 응답하는 데이터를 송신하기 전에 주변 채널에 대한 Channel Sensing을 수행해야 한다. 따라서 수신한 TF-R에 명시된 RA RU 수를 기반으로 OBO decrement를 한 단말 중에서 OBO가 0이하인 단말은 임의로 선택한 RA RU가 포함된 20MHz 채널에 대한 CS를 실시한 뒤에 그 결과가 idle인 경우에 한하여 random access를 시도할 수 있다. 만약 OBO가 0 이하인 단말들 중에서 CS결과가 busy로 판명된 단말은 해당 차수의 RA RU에 데이터를 송신할 수 없으며, 그 시점의 OBO를 유지한 뒤에 추후에 TF-R을 수신하였을 때 random access를 시도할 수 있다. 만약 OBO가 0인 상태에서 추가적인 TF-R을 수신하였다 할지라도, 선택한 RA RU에 대한 CS를 실시한 뒤에

idle 한 경우에만 최종적으로 random access를 시도할 수 있다.

【0045】 도 11은 본 발명의 다른 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

【0046】 도 10의 UL MU RA 상황과 같이 OBO가 0인 단말이 CS 조건에서 Busy로 판단되어 접속을 시도할 수 없는 경우에 OBO를 0으로 유지하는 경우 이어지는 차수의 UL MU RA 과정에서 OBO가 0인 상태로 전송이 유예된 단말과, 해당 차수에서 UL MU RA 기본 동작을 통해 OBO를 감소하여 OBO가 0에 도달한 단말이 추가되어 다수의 단말이 접속을 시도하는 상태로 대기할 수 있다. 802.11ax의 UL MU RA 접속 방식은 접속 시도 단말의 수가 증가할수록 접속 성공 확률이 감소하게 되므로, OBO 0을 유지하는 단말이 축적되는 것을 방지할 필요가 있다. 따라서 본 실시예에서는 CS 조건에 의해 RA 접속을 시도하지 않은 경우 역시 접속 실패로 간주하여 OCW doubling을 실시하고, OBO를 재선택하여 감소시키는 과정을 반복하도록 한다.

【0047】 도 12는 본 발명의 또다른 실시예에 따른 UL MU random access를 위한 TF-R 수신 시의 단말의 후속 동작을 도시하고 있다.

【0048】 도 11과 동일한 상황에서 단말은 다른 단말과의 동시 전송 상황이므로 충돌로 인한 접속 실패로 간주할 수 있지만, 실제로 전송을 시도하지는 않았으며 자신의 전송으로 인하여 다른 단말의 전송까지 방해를 미치지는 않았으므로 실패와는 다른 상황으로 간주될 수 있다. 따라서 재차 BO를 시도하도록 하지만, 기존의 실패상황과 같이 OCW를 두배로 증가시키지 않고 기존에 존재하는 OCW 에서 OBO를 재선택 하는 식의 절충안으로 적용하는 것 역시 가능하다.

【0049】 도 13은 본 발명의 일 실시예에 따른 단말의 Trigger Frame을 통한 TID 개수 조절 방법을 도시하고 있다.

【0050】 단말이 Trigger frame을 전송한 후에 그에대한 응답으로 다수의 단말이 HE TRIG PPDU을 전송할 시에 많은 수의 TID가 aggregation될 경우 수신 단말의 입장에서 reorder buffer 등의 관리에 부담이 커질 수 있으며 M-BA의 길이가 길어질 수 있기 때문에, basic TF를 보내는 단말은 user info field 내의 type dependent user info field에 TID aggregation limit field를 삽입하여 각 단말이 보낼 수 있는 최대의 TID 개수를 제한할 수 있다. 이 때 TID aggregation limit field는 0에서 7의 값을 가지며 각각 1에서 8개의 TID가 aggregation이 될 수 있음을 알릴 수 있다. 따라서 TF를 수신한 단말은 TID aggregation limit field에서 명시한 수 이하의 TID를 aggregation하여 multi TID A-MPDU를 구성할 수 있다. 추가적인 조건으로, BA agreement가 없는 TID는 위의 TID aggregation limit의 대상에서 제외될 수 있다. 또한 BA agreement가 있는 TID 중에서 MPDU delimiter 등을 통해 해당 TID의 MPDU가 단 하나만 aggregation되어 BA이 아닌 ACK의 형태로 응답을 받을 수 있음을 명시한 경우에도 TID aggregation limit의 대상에서 제외될 수 있다.

【0051】 도 14는 본 발명의 다른 실시예에 따른 단말의 Trigger Frame을 통한 TID 개수 조절 방법을 도시하고 있다.

【0052】 cascading을 통해 상향 하향 전송이 연속적으로 일어나는 경우, HE MU PPDU에 대한 응답으로 HE TRIG PPDU를 전송하는 단말들이 ACK/BA 외에 또다른

immediate response를 요구하는 데이터 등을 포함한 multi TID A-MPDU를 전송하여 전체 전송 시퀀스의 길이를 의도한 길이보다 길어지는 상황이 발생할 수 있다. 따라서 basic TF를 전송하는 단말은 HE TRIG PPDU로 응답하는 단말들이 해당 HE TRIG PPDU에 immediate response를 요구하는 MPDU를 aggregation 하지 못하게 할 수 있다. 그에 대한 구현 방법으로 도 13에 명시한 TID aggregation limit field의 해석을 달리 할 수 있다. 첫 번째 방법으로, TID 0을 어떠한 TID도 aggregation 불가능하도록 하는 지시자로 설정할 수 있다. 이에 따라 0~6의 값은 aggregation 가능한 TID의 개수를 나타내며 예외적으로 7인 경우에만 모든 TID(8)가 aggregation 가능하도록 하는 지시자로 설정할 수 있다. MMPDU 중에서 immediate response를 요구하는 Action frame의 경우, MAC 계층에서 생성되는 프레임이므로 채널 접속을 위한 AC는 할당되더라도 TID를 가지고 있지 않을 수 있다. 따라서, action frame 의 aggregation을 추가적으로 막기 위하여 TID aggregation limit field의 0의 해석을, TID를 가진 QoS Data와 action frame을 포함한, immediate response를 요구하는 MPDU의 aggregation을 허용하지 않도록 하는 지시자로 지정할 수 있다. 본 실시예 역시 추가적인 조건으로, BA agreement가 없는 TID는 위의 TID aggregation limit의 대상에서 제외될 수 있다. 또한 BA agreement가 있는 TID 중에서 MPDU delimiter 등을 통해 해당 TID의 MPDU가 단 하나만 aggregation되어 BA이 아닌 ACK의 형태로 응답을 받을 수 있음을 명시한 경우에도 TID aggregation limit의 대상에서 제외될 수 있다.

【0053】 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.

【0054】 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】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-09-13

【요약서】

【요약】

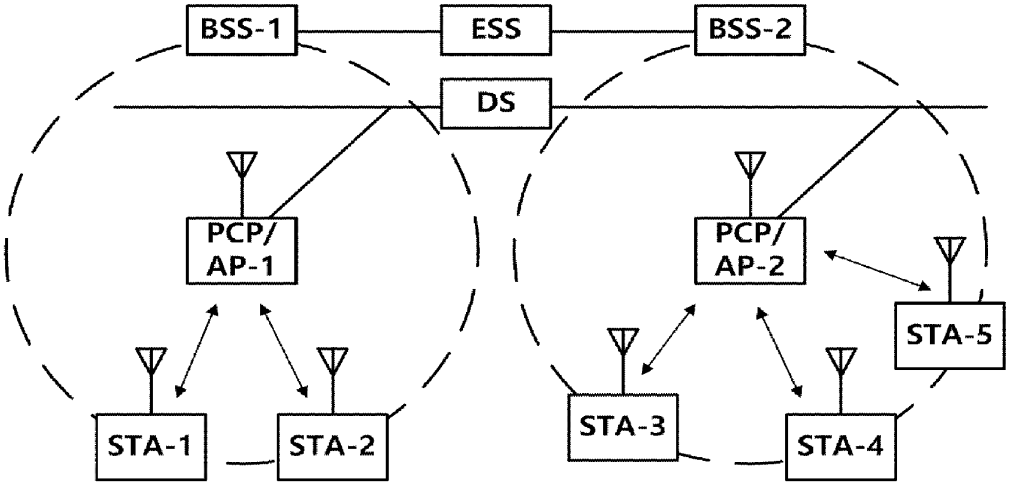
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 접속 파라미터 제어 방법이 제공될 수 있다.

【대표도】

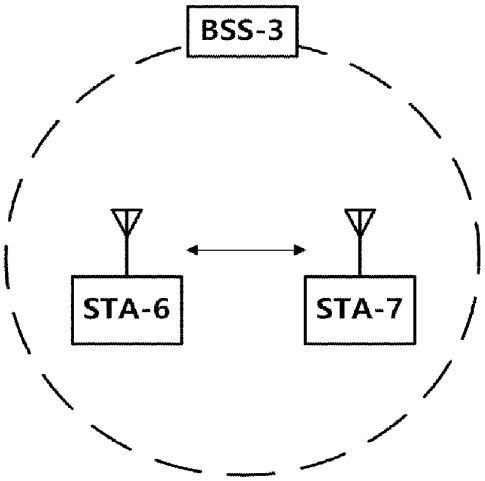
도 8

【도면】

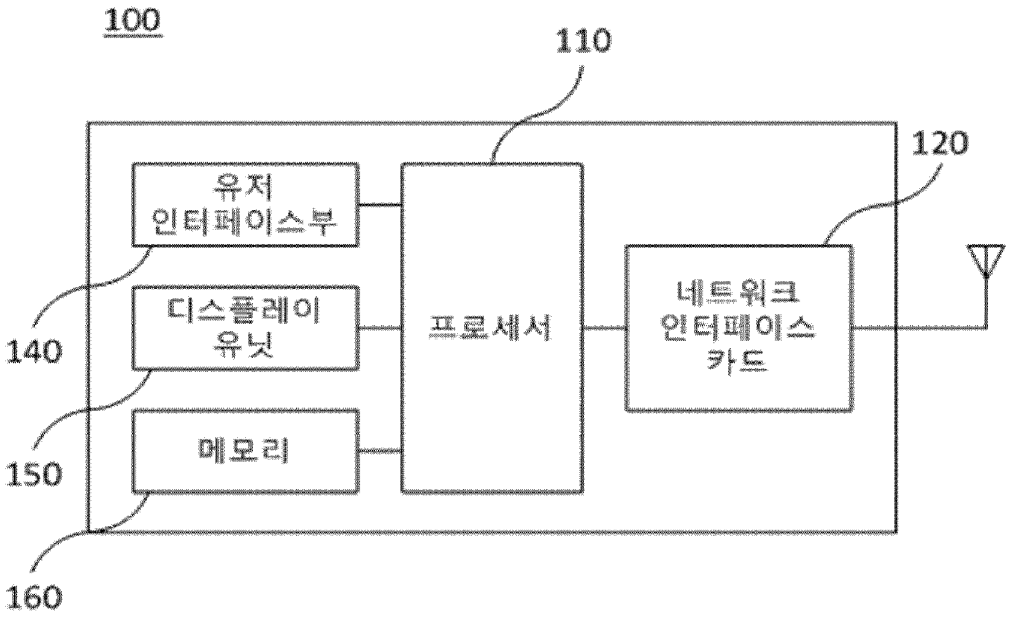
【도 1】


BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

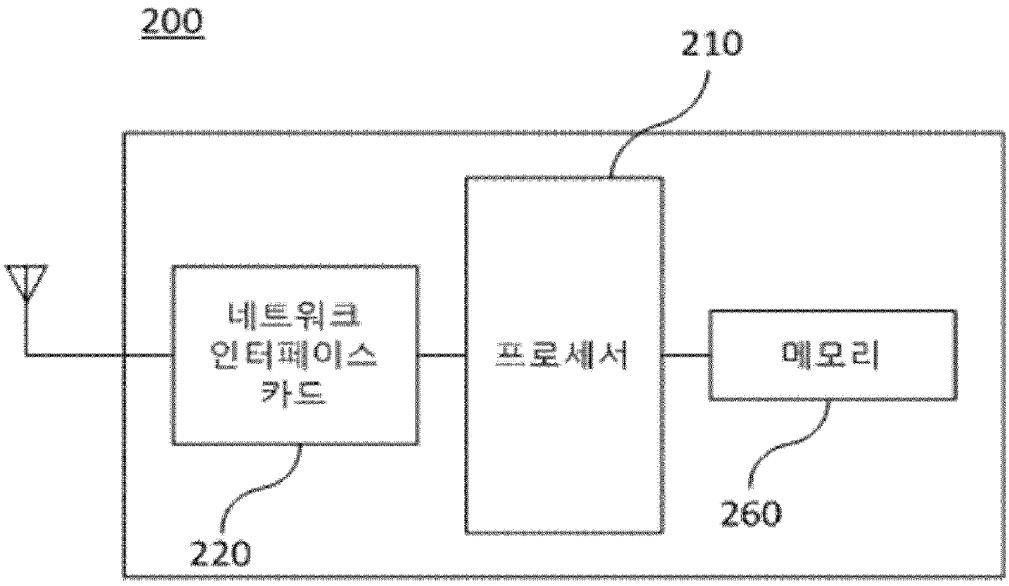
【도 2】


BSS-3
STA-6
STA-7

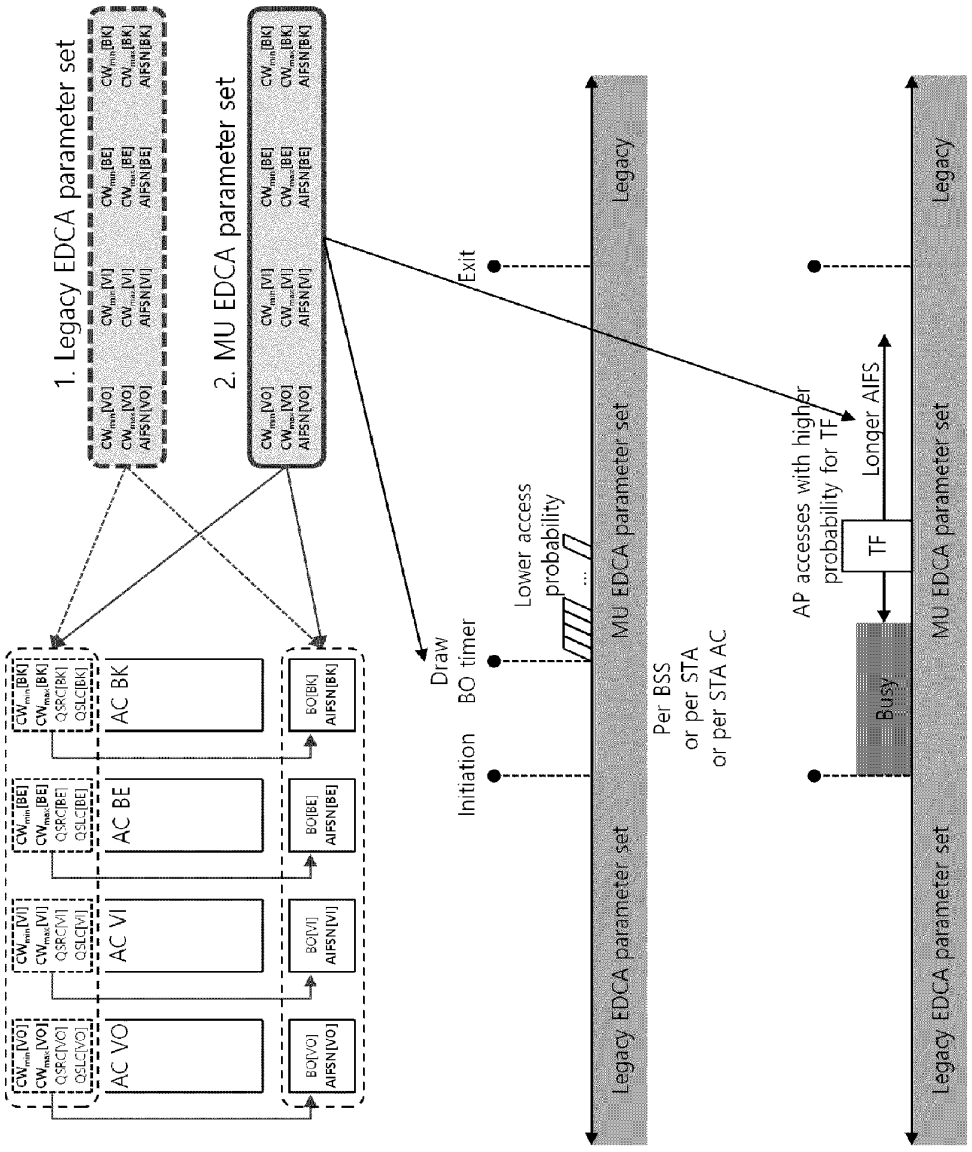
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
메모리
프로세서
네트워크
인터페이스
카드
140
150
160

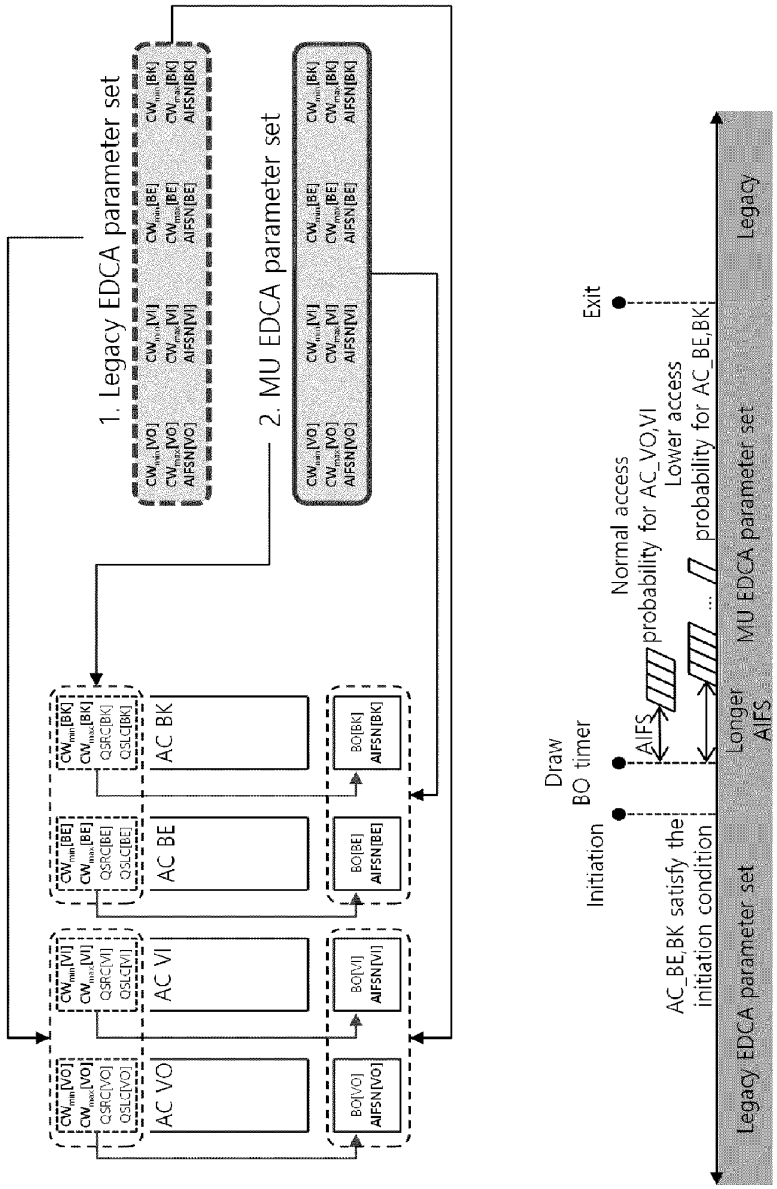
【도 4】



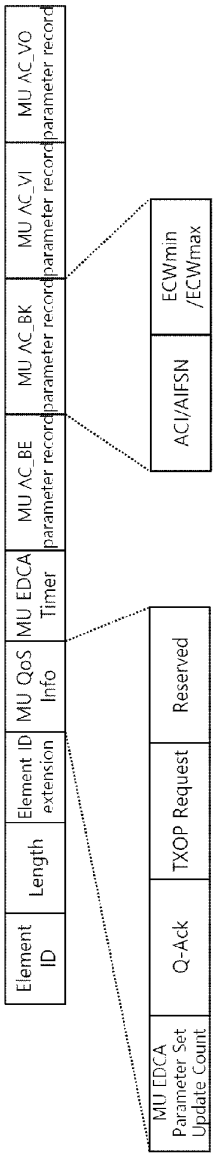
【도 5】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Draw BO timer
Initiation
Exit
Lower access probability
Per BSS or per STA or per STA AC
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
AP accesses with higher probability for TF
Longer AIFS
TF
Busy

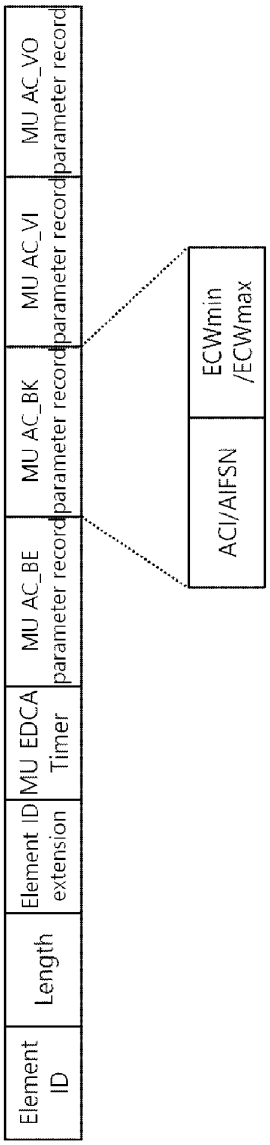
【도 6】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Exit
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
Draw BO timer
Initiation
AIFS
Longer AIFS
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

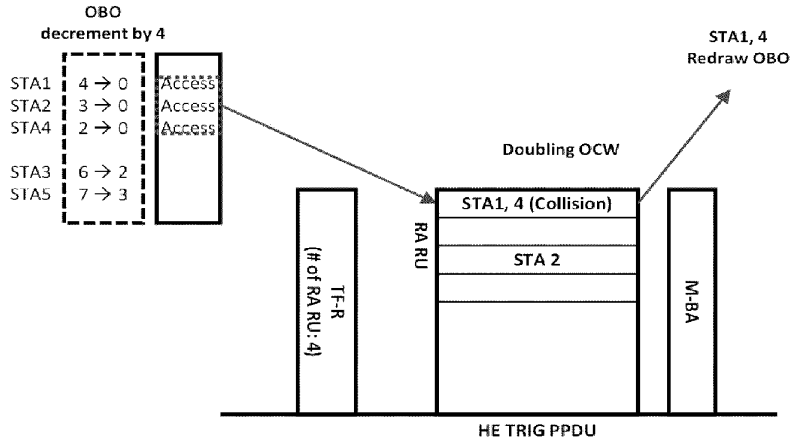
【도 7】


Element ID
Length
Element ID extension
MU QoS Info
MU EDCA Timer
MU AC_BE parameter record
MU AC_BK parameter record
MU AC_VI parameter record
MU AC_VO parameter record
MU EDCA Parameter Set Update Count
Q-Ack
TXOP Request
Reserved
ACI/AIFSN
ECWmin /ECWmax

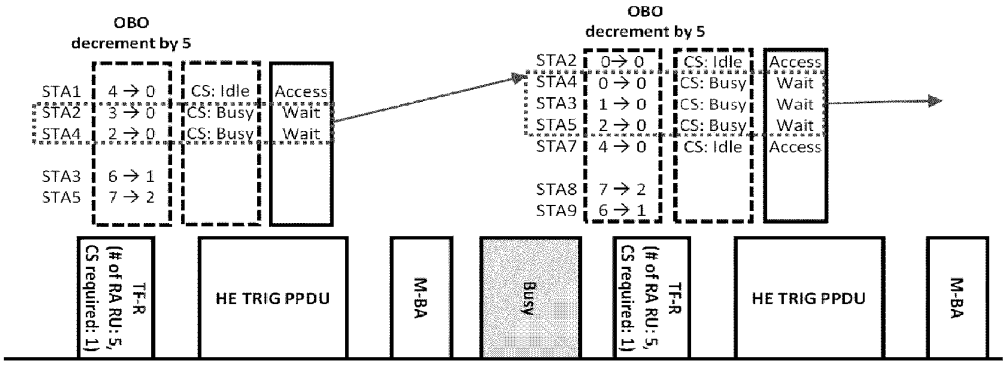
【도 8】


Element ID
Length
Element ID extension
MU EDCA Timer
MU AC_BE parameter record
MU AC_BK parameter record
MU AC_VI parameter record
MU AC_VO parameter record
ACI/AIFSN
ECWmin /ECWmax

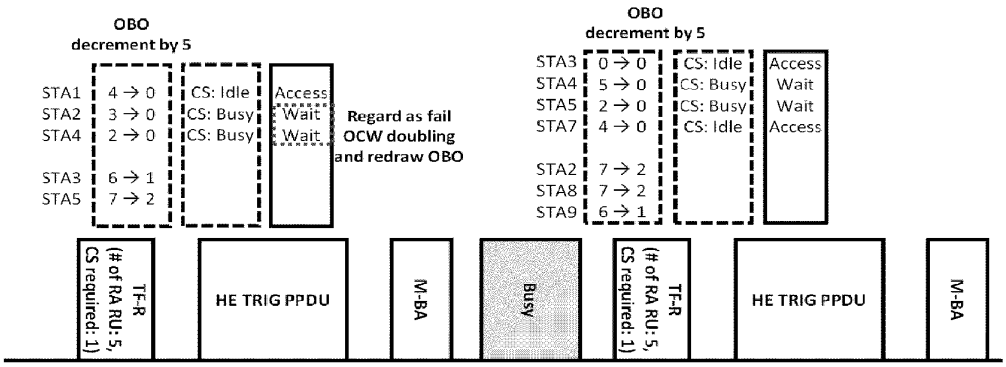
【도 9】


OBO
decrement by 4
STA1
STA2
STA4
STA3
STA5
4 → 0
3 → 0
2 → 0
6 → 2
7 → 3
Access
Access
Access
STA1, 4
Redraw OBO
Doubling OCW
STA1, 4 (Collision)
STA 2
RA RU
TF-R
(# of RA RU: 4)
M-BA
HE TRIG PPDU

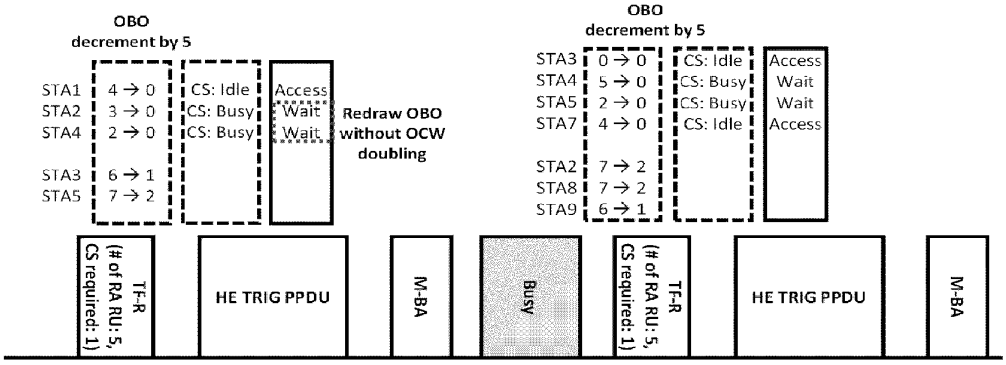
【도 10】


OBO
decrement by 5
STA1
STA2
STA4
STA3
STA5
4 → 0
3 → 0
2 → 0
6 → 1
7 → 2
CS: Idle
CS: Busy
CS: Busy
Access
Wait
Wait
OBO
decrement by 5
STA2
STA4
STA3
STA5
STA7
STA8
STA9
0 → 0
0 → 0
1 → 0
2 → 0
4 → 0
7 → 2
6 → 1
CS: Idle
CS: Busy
CS: Busy
CS: Busy
CS: Idle
Access
Wait
Wait
Access
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA
Busy
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA

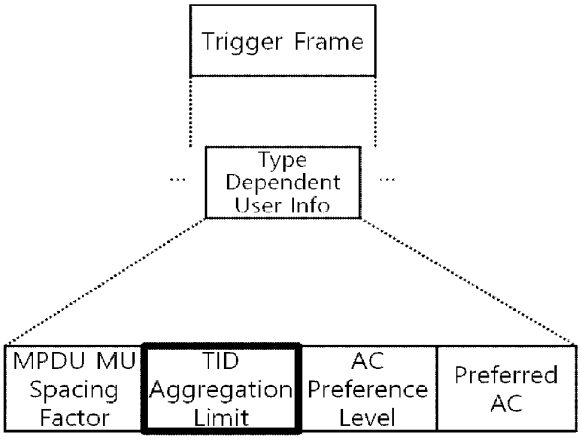
【도 11】


OBO
decrement by 5
STA1 4 → 0
STA2 3 → 0
STA4 2 → 0
STA3 6 → 1
STA5 7 → 2
CS: Idle
CS: Busy
CS: Busy
Access
Wait
Wait
Regard as fail
OCW doubling
and redraw OBO
OBO
decrement by 5
STA3 0 → 0
STA4 5 → 0
STA5 2 → 0
STA7 4 → 0
STA2 7 → 2
STA8 7 → 2
STA9 6 → 1
CS: Idle
CS: Busy
CS: Busy
CS: Idle
Access
Wait
Wait
Access
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA
Busy
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA

【도 12】

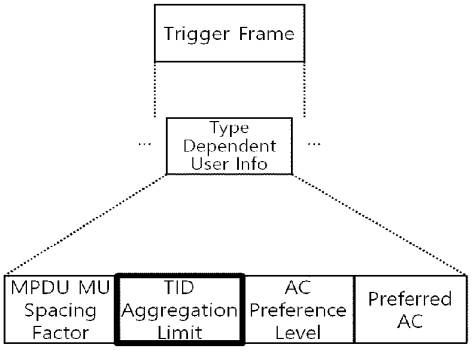

OBO
decrement by 5
STA1 4 → 0
STA2 3 → 0
STA4 2 → 0
STA3 6 → 1
STA5 7 → 2
CS: Idle
CS: Busy
CS: Busy
Access
Wait
Wait
Redraw OBO
without OCW
doubling
OBO
decrement by 5
STA3 0 → 0
STA4 5 → 0
STA5 2 → 0
STA7 4 → 0
STA2 7 → 2
STA8 7 → 2
STA9 6 → 1
CS: Idle
CS: Busy
CS: Busy
CS: Idle
Access
Wait
Wait
Access
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA
Busy
TF-R
(# of RA RU: 5,
CS required: 1)
HE TRIG PPDU
M-BA

【도 13】

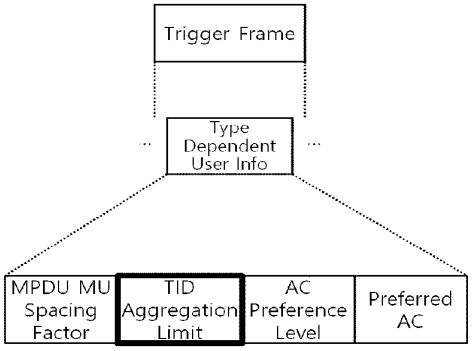


0-7: 1-8 TID is allowed to aggregate

【도 14】



0: No TID is allowed
1-6: 1-6 TID is allowed to aggregate
7: any number of TID is allowed



0: QoS data and Action frame are not allowed
1-6: 1-6 TID is allowed to aggregate
7: any number of TID is allowed

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【발명의 국문명칭】 무선랜 광대역 환경에서 단말의 MU EDCA parameter set 설정 방법

【발명의 영문명칭】 METHOD OF MU EDCA PARAMETER SET SETTING FOR STATIONS IN WIDEBAND WIRELESS LAN NETWORKS

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【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 MU EDCA parameter set 설정 방법{METHOD OF MU EDCA PARAMETER SET SETTING FOR STATIONS IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 EDCA parameter set의 변경 시점을 도시하고 있다.

도 7은 본 발명의 실시예에 따른 무선랜의 A-MPDU 구성방법을 도시하고

있다.

도 8은 본 발명의 실시예에 따른 응답 프레임을 요구하지 않는 데이터에 대한 MU EDCA parameter set 적용 방법을 도시하고 있다.

【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 구성이 특정 구성요소를 "포함" 한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하" 라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만" 으로 적절하게 대체될 수 있다.

【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 명세서에서는 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 처

리하며, 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 인

터페이스 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) 또

한 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.

【0031】도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀 영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해 높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우,

동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】 상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 별도의 MU EDCA parameter set으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함될 수 있다. MU EDCA parameter set은 기존에 사용하고 있는 Legacy EDCA parameter set을 사용하는 단말들보다 더 낮은 확률로 채널에 접속하도록 값이 수정되어 있을 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있으며 BSS 내의 단말들에게 전달된 후 각 단말이 특정 조건을 만족할 시에 MU EDCA parameter 기반으로 동작을 시작(initiation) 하도록 할 수 있다. 또한 특정 조건에 의하여 다시 기존의 Legacy EDCA parameter set으로 돌아가도록 하는 것 역시 가능하다.

【0035】 도 6은 본 발명의 실시예에 따른 EDCA parameter set의 변경 시점을 도시하고 있다.

【0036】 단말들은 기존의 Legacy EDCA parameter set을 기반으로 SU EDCA 경쟁을 할 수 있으며, 다음과 같은 조건들을 만족할 시에 MU EDCA parameter set으로 EDCA parameter set을 변경해야 한다. 1) 단말이 AP로부터 자신의 AID를 호출하는 basic variant Trigger frame을 수신하였으며, 2) 그에 응답하는 HE trigger-based PPDU에 QoS Data frame을 전송하였고, 3) AP로부터 전송한 HE trigger-based PPDU

에 대한 immediate response를 수신하는 상기한 세 가지 조건을 만족했을 시에 HE trigger-based PPDU에 포함된 AC들에 대하여 MU EDCA parameter set으로 변경한다. MU EDCA parameter set으로 변경되는 구체적인 시점은 immediate response frame의 수신 종료 시점이 될 수 있으며, 만약 M-BA 등의 immeidiate response frame이 다른 frame들과 aggregation이 되어있다면, 해당 PPDU의 수신 종료 시점으로 정할 수도 있다. 다른 방법으로, 만약 HE trigger-based PPDU를 전송한 이후에 MU cascading sequence 등으로 인하여 동일한 TXOP 상황에서 연속적인 상향 혹은 하향 전송이 이어질 경우, 해당 TXOP의 종료 시점에 MU EDCA parameter set으로 변경하는 것 역시 가능한다.

【0037】 단말은 상기한 시점들에 MU EDCA parameter set에 포함된 값을 기준으로 MU EDCA timer를 시작할 수 있다. 만약 MU EDCA timer가 만기되는 시점까지 상기한 세 가지 조건을 만족한 경우에는 MU EDCA timer를 MU EDCA parameter set에 포함된 타이머 값으로 갱신하며, 만약 조건을 만족하지 못하였을 경우에는 timer가 끝나는 시점에 모든 AC에 대하여 다시 Legacy EDCA parameter set으로 변경해야 한다.

【0038】 도 7은 본 발명의 실시예에 따른 무선랜의 A-MPDU 구성방법을 도시하고 있다.

【0039】 무선랜에서는 다양한 종류의 QoS data MPDU와 Action (No Ack) frame MPDU, control frame MPDU 등 다수의 MPDU를 하나의 PSDU로 aggregation 하여 전송하는 A-MPDU 기능을 지원한다. 그 중에서 QoS Data MPDU가 포함된 A-MPDU는

데이터가 Ack을 요구하는지 여부에 따라 Data Enabled Immediate Response (DEIR), Data Enabled No Immediate Response (DENIR)의 두 개의 context로 나눌 수 있다. 데이터가 Ack을 요청하는지의 여부는 MAC header의 QoS Control field의 Ack Policy subfield에서 지정되며, 이는 MAC의 상위 계층의 일부인 MAC Service Access Point (SAP)에서 TID 별로 service class가 QoSAck/QoSNoAck의 형태로 지정되어 내려온다. 만약 QoSNoAck service class로 지정된 TID의 경우, BA areement를 맺지 않으며, Ack Policy subfield를 No Ack으로 설정하여 전송한다.

【0040】 기존의 무선랜에서는 A-MPDU 당 하나의 TID만 전송이 가능했기 때문에, 만약 Ack을 요청하는 TID Data가 aggregation이 되면 자동적으로 DEIR context가 되며, Ack을 요청하지 않는 TID Data가 aggregationg이 되는 경우, 자동적으로 DENIR context가 된다. 따라서 기존에는 service class가 QoSAck 및 QoSNoAck인 서로 다른 TID 데이터가 하나의 A-MPDU에 전송될 수 없었다. 그러나 802.11ax 표준에서는 multi TID aggregation이 허용되었기 때문에 service class가 QoSAck 및 QoSNoAck인 서로 다른 TID 데이터가 공존하는 A-MPDU context에 대한 수정이 필요하다. service class가 QoSAck 및 QoSNoAck인 서로 다른 TID 데이터가 공존을 허용하는 경우, Ack을 요청하는 TID 데이터에 의해 immediate response가 존재하게 되므로 전체 context는 DEIR의 형태가 된다. 이 경우, Ack Policy subfield가 No Ack인 데이터는 Ack Policy subfield가 Ack(Implicit BA), MU Ack, Block Ack으로 지정된 데이터가 존재하는 경우에 한하여 optional한 형태로 존재할 수 있다. 비슷한 맥락으로 DENIR의 context에서도 Ack Pollicy subfield가 No Ack인 서로다른 다수

의 TID가 공존이 가능한 형태로 context가 수정될 수 있다.

【0041】 도 8은 본 발명의 실시예에 따른 응답 프레임을 요구하지 않는 데이터에 대한 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0042】 도 7의 실시예에서 설명한 것과 같이, QoS Data frame을 포함한 A-MPDU는 TID의 service class의 구성에 따라 immediate response를 요청할 수 있고 요청하지 않을 수도 있다. 따라서, HE trigger-based PPDU에 전송된 A-MPDU 중에서 DENIR context로 전송된 A-MPDU는 해당 A-MPDU에 대한 immediate response가 존재하지 않게 된다. 따라서 MU EDCA parameter set을 적용하기 위한 조건 중에서 전송한 HE trigger-based PPDU에 대응하는 immediate response를 수신해야한다는 조건을 만족할 수 없기 때문에 성공적으로 HE trigger-based PPDU를 전송하였음에도 불구하고 MU EDCA parameter set을 적용하지 못할 수도 있다. 상기한 문제를 해결하기 위하여, A-MPDU 내의 모든 QoS Data frame의 Ack Policy subfield가 No Ack으로 설정된 A-MPDU 혹은 DENIR context로 전송되는 A-MPDU에 포함된 QoS Data frame의 AC들에 대한 MU EDCA parameter set update 조건을 다음과 같이 변경할 수 있다. 1) 단말이 AP로부터 자신의 AID를 호출하는 basic variant Trigger frame을 수신하였으며, 2) 그에 응답하는 HE trigger-based PPDU에 QoS Data frame을 전송하였을 경우, 3) 전송한 HE trigger-based PPDU가 끝나는 시점에 MU EDCA parameter set을 적용하여, CW min, max, AIFSN, MU EDCA timer 값 등을 재 설정한다. 혹은 HE trigger-based PPDU 전송의 SIFS 이후 시점이나, 기 설정된 대표 Ack 전송 시간과 SIFS를 합한 시간 이후의 시점에 MU EDCA parameter set에 대한 update 작업을 수

행할 수 있다.

【0043】 또다른 방법으로 단말이 HE trigger-based PPDU에 자신과 함께 전송한 다른 단말에 대한 immediate response의 존재를 확인한 이후에 update하는 방법도 있다. 가령 전송한 HE trigger-based PPDU의 PHY-TXEND.confirm primitive의 이후 시점부터 aSIFSTime + aSlotTime + aRxPHYStart-Delay 이후의 시점까지 다른 단말을에 대한 immediate response가 없었을 경우에는 해당 시점에 바로 MU EDCA parameter set으로 업데이트하고 만약 immediate response가 존재하였을 경우에는 해당 PPDU의 수신 종료 시점부터 MU EDCA parameter에 대한 update를 진행할 수 있다.

【0044】 또다른 방법으로 MU EDCA parameter set 적용 시점에 대한 예외조건을 방지하기 위하여, Basic variant Trigger frame에 응답하는 HE trigger-based PPDU에 Ack policy subfield가 No Ack으로 설정된 QoS Data frame을 포함하지 않도록 하는 규칙을 지정할 수도 있다.

【0045】 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.

【0046】 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】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-11-06

【요약서】

【요약】

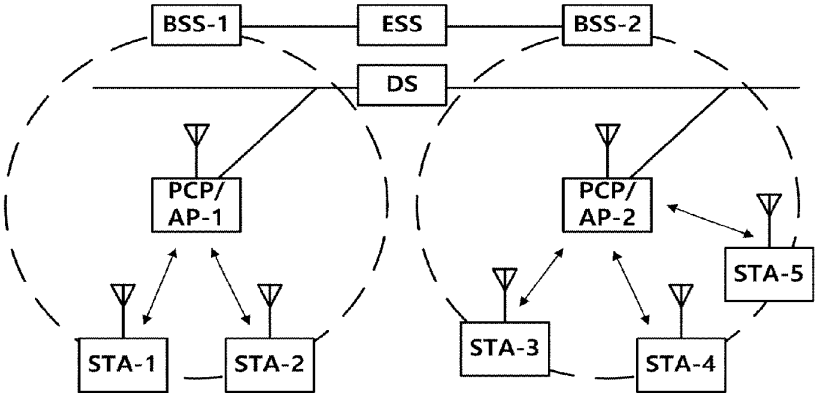
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 MU EDCA parameter set 설정 방법이 제공될 수 있다.

【대표도】

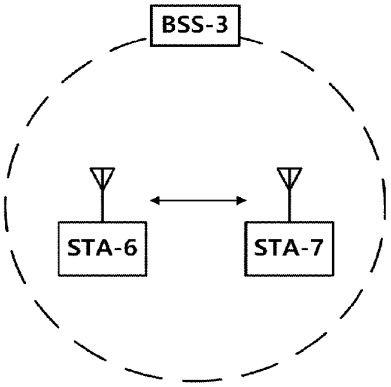
도 8

【도면】

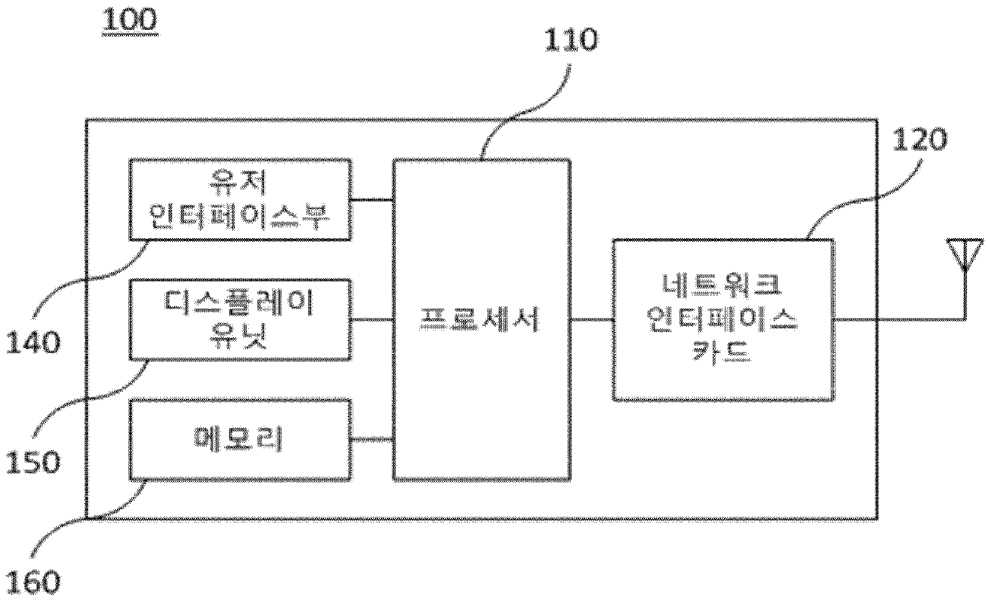
【도 1】


BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

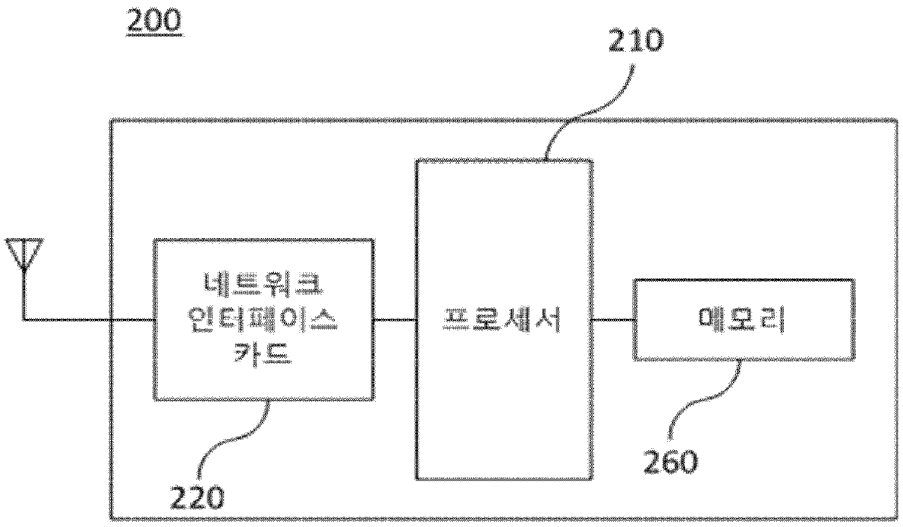
【도 2】


BSS-3
STA-6
STA-7

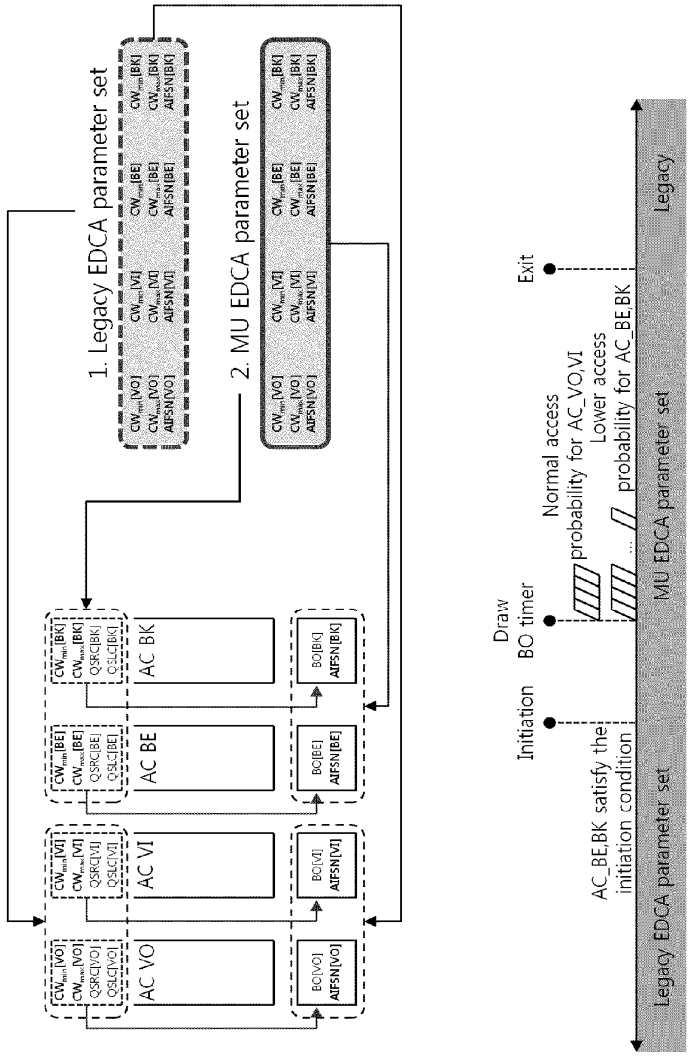
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
메모리
프로세서
네트워크
인터페이스
카드
140
150
160

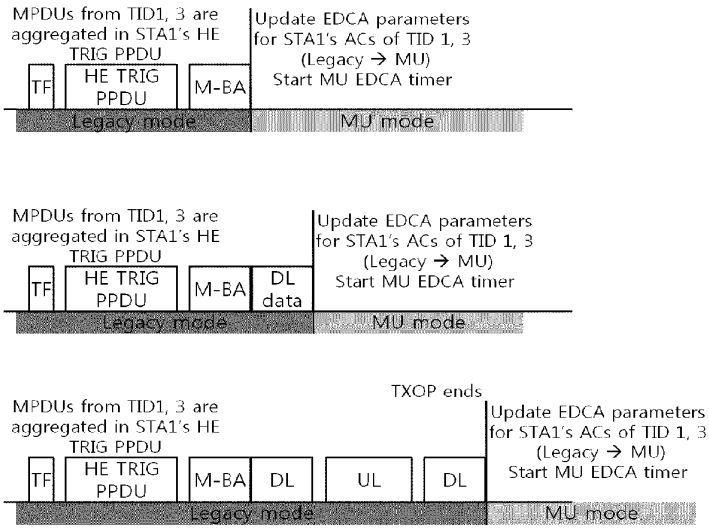
【도 4】



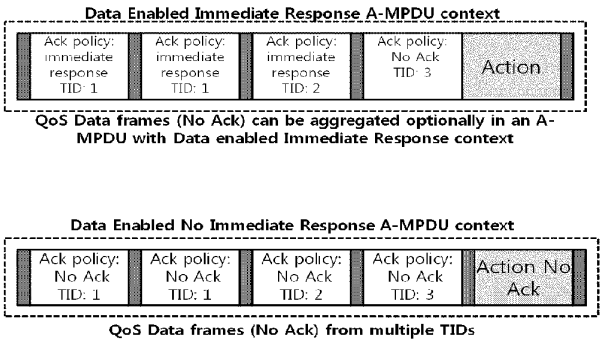
【도 5】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Initiation
Draw BO timer
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
Exit
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

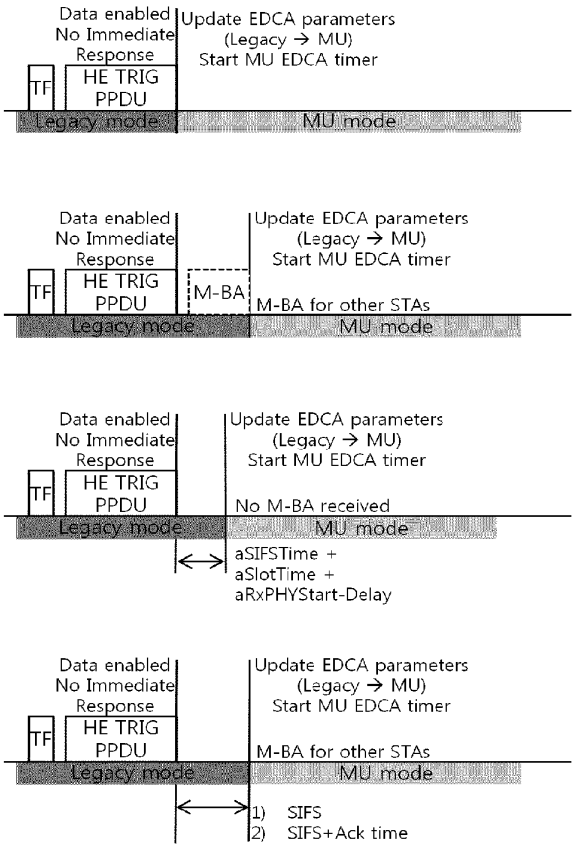
【도 6】


MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
TF
HE TRIG PPDU
M-BA
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
Legacy mode
MU mode
MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
TF
HE TRIG PPDU
M-BA
DL data
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
Legacy mode
MU mode
TXOP ends
MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
TF
HE TRIG PPDU
M-BA
DL
UL
DL
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
Legacy mode
MU mode

【도 7】


Data Enabled Immediate Response A-MPDU context
Ack policy: immediate response TID: 1
Ack policy: immediate response TID: 1
Ack policy: immediate response TID: 2
Ack policy: No Ack TID: 3
Action
QoS Data frames (No Ack) can be aggregated optionally in an A-MPDU with Data enabled Immediate Response context
Data Enabled No Immediate Response A-MPDU context
Ack policy: No Ack TID: 1
Ack policy: No Ack TID: 1
Ack policy: No Ack TID: 2
Ack policy: No Ack TID: 3
Action No Ack
QoS Data frames (No Ack) from multiple TIDs

【도 8】


Data enabled
No Immediate
Response
TF
HE TRIG
PPDU
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
Legacy mode
MU mode
Data enabled
No Immediate
Response
TF
HE TRIG
PPDU
M-BA
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
M-BA for other STAs
Legacy mode
MU mode
Data enabled
No Immediate
Response
TF
HE TRIG
PPDU
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
No M-BA received
Legacy mode
MU mode
aSIFSTime +
aSlotTime +
aRxPHYStart-Delay
Data enabled
No Immediate
Response
TF
HE TRIG
PPDU
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
M-BA for other STAs
Legacy mode
MU mode
1) SIFS
2) SIFS+Ack time

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(DAS)

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【발명의 영문명칭】 METHOD OF CONTROLING TRANSMISSION FOR UPLINK MULTIUSER ACCESS IN WIDEBAND WIRELESS LAN NETWORKS

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【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 제어 방법{METHOD OF CONTROLING TRANSMISSION FOR UPLINK MULTIUSER ACCESS IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 대

두되었다. 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 7은 본 발명의 다른 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 8은 본 발명의 일 실시예에 따른 단말의 Buffer Status Report 전송방법을 도시하고 있다.

도 9는 본 발명의 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 10은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initation 조건을 도시하고 있다.

도 11은 본 발명의 또 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 12는 본 발명의 일 실시예에 따른 MU EDCA parameter set 탈출 조건을 도시하고 있다.

도 13은 본 발명의 다른 실시예에 따른 MU EDCA parameter set 탈출 조건을 도시하고 있다.

도 14은 본 발명의 일 실시예에 따른 UL MU 전송 이후의 EDCA 동작을 도시하고 있다.

도 15는 본 발명의 다른 실시예에 따른 UL MU 전송 이후의 EDCA 동작을 도시하고 있다.

도 16은 본 발명의 일 실시예에 따른 단말의 multi-TID A-MPDU aggregation

방법을 도시하고 있다.

【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 구성이 특정 구성요소를 "포함" 한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하" 라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만" 으로 적절하게 대체될 수 있다.

【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 있

는 기기들의 집합을 나타낸다. 일반적으로 BSS는 인프라스트럭처 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭처 BSS를 나타내고 있다.

【0014】 도 1에 도시된 바와 같이 인프라스트럭처 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 명세서에서는 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.

【0031】 도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀 영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해 높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우, 동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】 상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 별도의 MU EDCA parameter set으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함될 수 있다. MU EDCA parameter set은 기존에 사용하고 있는 Legacy EDCA parameter set을 사용하는 단말들보다 더 낮은 확률로 채널에 접속하도록 값이 수정되어 있을 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있으며 BSS 내의 단말들에게 전달된 후 각 단말이 특정 조건을 만족할 시에 MU EDCA parameter 기반으로 동작을 시작(initiation) 하도록 할 수 있다. 또한 특정 조건에 의하여 다시 기존의 Legacy EDCA parameter set으로 돌아가도록 하는 것 역시 가능하다. 또 다른 방법으로 MU EDCA parameter set 자체가 하나의 Action 혹은 Action No Ack 프레임으로 동작되어 단말들에게 전송될 수 있다.

【0035】 도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0036】 각 단말에서 MU EDCA parameter set이 특정 조건에 의하여 initiation 된 경우, 해당 단말의 모든 AC에 대하여 EDCA parameter set이 변경될 수 있지만, 만약 특정 AC 만이 조건을 만족하는 경우에는 해당 AC에 대해서만 MU EDCA parameter set 기반으로 동작하도록 할 수도 있다. MU EDCA parameter set은 기본적으로 UL MU 전송에 스케쥴링 될 것으로 예상되는 트래픽이 대상이 되므로,

스케쥴링 예정에 없는 AC의 트래픽의 경우는 기존의 접속 확률에 따라 SU 전송을 시도하는 것이 보장되어야 한다. 이 때, 단말 내부 스케쥴링 동작 구현에 따라 현재 낮은 BO timer를 보유하고 있는 AC가 MU EDCA parameter set 기반으로 동작하는 것을 의도적으로 방지하고 큰 BO timer를 지닌 AC의 트래픽만을 UL MU 전송에 스케쥴링 되도록 유도하여 자신의 접속 확률을 상대적으로 높이려는 동작을 시도를 할 수도 있다. 이를 방지하기 위하여 단말의 특정 트래픽이 MU EDCA parameter set 동작의 대상이 되는 경우, 현재 접속 대기 시간이 가장 짧은 primary AC를 반드시 MU EDCA parameter set에 포함시키도록 하는 추가적인 규칙을 지정할 수도 있다. 이 때 primary AC를 지정하는 기준은 남아있는 BO timer와 AIFS[AC] 값의 합이 될 수 있으며 다른 방법으로 남아있는 BO timer 값이 기준이 될 수도 있다. 만약 하나 이상의 AC가 같은 접속 대기 시간으로 설정된 경우에는 해당 AC가 모두 MU EDCA parameter set를 기반으로 동작해야 한다.

【0037】 도 7은 본 발명의 다른 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0038】 MU EDCA parameter set에 포함될 수 있는 CWmin[AC], CWmax[AC] 값은 단말이 CW[AC], BO[AC] 값을 새로이 선택할 때 사용되는 값으로 단말이 현재 가지고 있는 BO에 직접적인 영향을 주는 것은 불가능하다. 기존의 무선랜에서는 단말이 가지고 있는 BO 값은 0이 되는 시점까지 단순 감소만 가능하므로 MU, Legacy mode로 상호 전환시에 이전에 선택하였던 BO 값이 유지되어 의도치 않은 영향을 미칠 수 있다. 가령 MU mode에 큰 CW 범위에서 선택한 BO 값이 Legacy mode 이후까지

유지되어 일반적인 SU 전송의 기회를 심각하게 저해하거나, Legacy mode에서 상대적으로 작은 CW 범위에서 선택한 BO가 MU mode 시작 이후까지 이어져서 실질적인 접속 확률 감소효과를 주지 못할 수 있다. 상기한 문제점을 해결하기 위하여 Legacy, MU 모드로의 상호 전환시에 지정된 공식에 따라 BO 값을 변환하는 방법을 이용할 수 있다. 하나의 방법으로, 기존에 유지하고 있는 BO 값에서 특정 상수 α를 곱하는 형태로 구현할 수 있다. (α는 MU EDCA parameter set의 CWmin[AC]와 Legacy EDCA parameter set의 CWmax[AC]의 비율 혹은 MU EDCA parameter set의 CWmax[AC]와 Legacy EDCA parameter set의 CWmax[AC]의 비율로 구할 수 있다.) 또 다른 방법으로 MU mode 전환 시점의 BO 값을 현재의 BO값과 MU EDCA parameter set의 CWmin[AC] 중에서 큰 값으로 선택하고, Legacy mode 전환 시점의 BO 값을 현재의 BO 값과 Legacy EDCA parameter set의 CWmax[AC] 중에서 작은 값으로 선택할 수 있다.

【0039】 마찬가지로 단말이 현재 가지고 있는 CW[AC] 값 역시 전송 성공 혹은 Retry counter에 의해 CW가 reset되는 특정 몇몇 경우에 한해서만 CWmin[AC], CWmax[AC] 값을 참조하므로 MU EDCA parameter set에서 전송된 CWmin[AC], CWmax[AC] 값들이 적용되는 시점이 매우 늦어지거나 MU mode에서 설정된 큰 CW 값이나 Legacy mode에서 설정된 작은 CW 값이 mode 전환 시에 계속 유지되어 악영향을 미칠 수 있다. 따라서 MU mode 전환 시점의 CW 값을 CWMU[BE] = max(CWmin.MU[BE],CW[BE]) 로 설정하고 Legacy mode로 전환하는 시점의 CW 값을 CW[BE] = min(CWmax[BE],CWMU[BE]) 로 설정하여 EDCA mode 전환의 효율을 높일 수

있다.

【0040】 도 8은 본 발명의 일 실시예에 따른 단말의 Buffer Status Report 전송방법을 도시하고 있다.

【0041】 MU EDCA parameter set의 적용은 단말이 자신의 트래픽이 AP로부터 스케쥴링되는 것이 예측되는 상황에서 시작되어야 한다. AP는 단말이 현재 자신이 어떠한 AC에 존재하는 트래픽의 양에 대한 정보를 Buffer Status report를 통해 얻을 수 있으므로 BSR의 적절한 활용이 MU EDCA parameter set의 initiation condition을 정의하는데 있어서 중요한 요소가 될 수 있다. 11ax에서는 단말이 QoS data MPDU의 MAC header에 존재하는 QoS control field를 통해 해당 MPDU의 TID(AC)와 관련된 저장된 트래픽 양을 알릴 수 있다. 따라서 일반적인 QoS MPDU가 전송되는 UL SU, MU 상황에 BSR이 전송될 수 있다. 또한 실질적인 data payload가 존재하지 않는 QoS Null의 형태로도 BSR을 전송할 수 있다. QoS Null의 경우 payload가 없기 때문에 수신단에서 retransmission 관련 부담이 없으므로 multi-TID aggregation limit 제한에서 자유로울 수 있다. 따라서 multi-TID A-MPDU에 자유롭게 포함될 수 있으며, TF의 변형된 형태인 BSR poll에 응답하여서도 전송이 될 수 있다. 추가적으로 DL MU 전송 상황에서 HT control field의 UL MU response scheduling에 응답하는 HE TRIG PPDU에서도 QoS Null frame에 한하여 TID 개수제한과 관계없이 PPDU 길이 한도내에서 자유롭게 BSR을 전송할 수 있다.

【0042】 도 9는 본 발명의 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0043】 도 8에서 서술한 바와 같이 11ax에서는 기존의 무선랜에 비하여 단말이 AP에게 BSR을 전송할 수 있는 조건이 매우 늘어났다. 따라서 단말이 AP에게 BSR을 전송하는 시점부터 BSR이 전송된 관련 AC 혹은 전체 AC에 대하여 AP의 스케쥴링이 있을것으로 간주하고 MU EDCA parameter set을 활성화 할 수 있다.

【0044】 또다른 방법으로 AP가 beacon 등에 해당 시점부터 UL MU 전송을 위한 스케쥴링이 있을 것임을 알리는 indication 등을 Action (No Ack) frame 혹은 beacon 등에 삽입하여 전송하고 해당 프레임이 전송된 시점을 기준으로 특정 기간 동안의 과거에 BSR을 전송한 이력이 있으면 MU EDCA parameter set을 활성화하는 조건 역시 가능할 수 있다. 상기한 방법은 AP에게 축적된 BSR을 양에 따라 AP가 선별적으로 UL MU 전송 시작 여부를 결정할 수 있고, AP의 indication 시점 이전에는 단말이 BSR을 전송하였음에도 불구하고 다른 단말들과 동등한 조건으로 SU 전송 기회를 얻을 수 있다는 점에서 효율적일 수 있다. AP의 UL MU 스케쥴링을 알리는 indication은 별도의 element의 형태이거나 HE operation element 등의 reserved bit을 이용할 수 있으며, MU EDCA parameter set이 beacon에 포함된 것 자체가 UL MU 스케쥴링이 있음을 암시적으로 알릴 수도 있다. 또한 MU EDCA parameter set 자체에 하나의 bit가 할당되어 MU EDCA parameter set이 전송이 되어도 실질적인 UL MU scheduling indication의 활성화 여부를 바탕으로 단말이 MU EDCA parameter set initation 여부를 결정할 수도 있다.

【0045】 도 10은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initation 조건을 도시하고 있다.

【0046】Beacon을 이용하여 MU EDCA parameter set을 활성화하는 또다른 방법으로 Beacon에 구체적인 스케쥴링 정보를 삽입하는 방법이 있을 수 있다. AP에게 누적된 BSR의 양이 매우 많을 경우 특정 기간 동안 모든 단말에게 실질적으로 UL MU를 스케쥴링하는 것이 불가능한 상황이 발생할 수 있으며, 이러한 상황에서 모든 BSR 전송 단말이 MU EDCA parameter set을 기반으로 동작하는 것은 비효율적일 수 있다. 따라서 AP가 해당 beacon부터 다음 beacon 전송 혹은 특정 주기 동안 scheduling을 실시할 단말의 정보를 전달함으로써 실질적으로 UL MU 전송에 참여할 단말에 한하여 MU EDCA parameter set의 활성화를 유도할 수 있다. Beacon을 통한 scheduling 정보 전달 방법으로 기존에 beacon에 존재하는 TIM element를 이용하여 11ax 단말에 한하여 TIM element에 자신의 AID가 활성화 된 것을 UL MU scheduling을 위한 TF의 하향전송이 있을 것을 알리는 용도로 해석하도록 할 수 있다. 또다른 방법으로 별도의 UL MU scheduling 관련 element를 정의할 수도 있다. 상기한 element에는 scheduling 예정인 개별 단말별로 AID와 MU EDCA parameter set으로 동작 해야할 AC 정보등이 포함될 수 있으며, 혹은 TIM element와 같이 bitmap의 형태로 scheduling 여부를 알릴 수도 있다. 위의 scheduling element에는 scheduling 단말 정보 외에도 AP의 구체적인 TF 전송 시점을 알릴 수 있는 BO timer 값이나 참여 단말의 MU EDCA parameter set 적용 AC를 일괄적으로 적용할 수 있는 AC 정보 등이 추가로 삽입될 수 있다. 상기한 부가정보는 MU EDCA parameter set 관련 element에 삽입되어 전달될 수도 있다.

【0047】 도 11은 본 발명의 또 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0048】 MU EDCA parameter set을 활성화하는 또다른 방법으로 TF 내의 user info. field에서의 스케쥴링된 단말에 대하여 MU EDCA parameter set 기반의 동작으로 하도록 유도할 수 있다. 상기한 방법은 TF가 채널에 접속한 시점부터 MU EDCA parameter set을 활성화할 수 있기 때문에 해당 시점에 처음으로 MU EDCA parameter set를 활성화하는 단말에 대해서는 채널 접속 확률 감소 효과를 즉시 얻을 수 없다는 단점을 지니고 있지만, UL MU 전송이 실질적으로 실시되는 단말에 대해서만 MU EDCA parameter set를 적용시킬 수 있고, 별도의 오버헤드를 발생시키지 않는다는 장점이 있다. 또한 실제 HE TRIG PPDU 전송을 유도하는 단말외에 다음 차수의 TF에 실질적으로 스케쥴링될 단말들에 대한 스케쥴링 정보를 user info. Field에 삽입하여 알림으로서 상기한 단점을 보완할 수 있다. 가령, 하나의 user info. field에 다음 TF에 스케쥴링될 단말의 AID와 RU indication 시그널링 방법 중에서 reserved 상태인 하나의 indication을 다음 TF 스케쥴링을 지시하는 특정 시그널링으로 지정하는 방법이 사용될 수 있다. 이 경우, RU indication은 다수의 reserved 시그널을 이용하여 MU EDCA parameter set가 활성화되는 AC를 직접적으로 알리는 방법이 사용될 수도 있으며, 실질적인 RU 위치를 알리는 용도로 쓰이지는 않는다. 이 밖에도 UL MU scheduling 관련 효율을 높일 수 있는 추가적인 정보들이 기존의 user info. field와 다른 해석의 형태로 존재할 수 있으며, 나머지 user info. field의 값들은 dummy의 형태로 해석될 수 있다. Dummy data를 줄이기 위한

또다른 방법으로 다음 차수의 TF scheduling을 알리는 특정 RU indication 시그널이 user info. field에 명시되었다면 dummy data부분이 삭제된 compressed user info. field로 해석하도록 지정할 수 있다. 상기한 방법의 형태로 다수의 user info. field가 존재할 수 있으며 호출된 단말은 MU EDCA parameter set을 활성화해야 한다. 또다른 방법으로 하나의 user info. field에 scheduling 단말을 bitmap 형태로 알려서 user info. field 반복에 의한 오버헤드를 감소시킬 수 있다. 이 경우, bitmap이 포함된 user info. field의 AID는 group AID 혹은 broadcast AID이며 특정 RU indication 시그널링이 사용될 수 있다. 또한 해당 user ifno. Field는 일반적인 user info. field와 다른 size로 구성될 수 있다.

【0049】 도 12는 본 발명의 일 실시예에 따른 MU EDCA parameter set 탈출 조건을 도시하고 있다.

【0050】 MU EDCA parameter set는 단말이 다른 단말과 동등한 조건으로 SU 전송을 위한 접속을 하는 것을 제한하기 때문에 UL MU 스케쥴링이 불확실할 경우 기존의 Legacy EDCA parameter set으로 동등하게 접속할 수 있도록 하는 탈출 조건이 필요하다. MU EDCA parameter set의 탈출 조건으로 TF에 의한 scheduling에 timer를 설정할 수 있다. 따라서 TF에 의해 UL MU에 참여한 단말은 TF 수신 시점에 timer를 시작하여 timer가 만료되는 시점까지 추가적인 TF에 의한 스케쥴링이 없었을 경우 스스로 MU EDCA parameter set를 탈출하여 SU 전송을 위한 경쟁에 참여할 수 있다. 이 때 UL MU에 참여한 단말은 HE TRIG PPDU에 BSR이 포함된 MPDU를 전송하였기 때문에 다음 TF에도 스케쥴링될 것을 기대할 수 있으나, 만약 특정 AC 혹은

BSR을 전송한 모든 AC가 empty 였던 관계로 BSR을 empty로 report 한 경우에는 이후에 추가적인 스케쥴링을 기대할 수 없으므로 해당 AC에 대하여 M-BA 수신 시점 이후에 timer 설정 없이 바로 legacy EDCA pararmeter set으로 전환할 수 있다.

【0051】 MU EDCA parameter set 탈출을 위한 timer 설정의 또다른 기준 시점으로 M-BA 수신시점이 이용될 수 있다. TF 가 기준시점으로 설정될 경우, HE TRIG PPDU의 전송이 실패했을 시에 AP의 retransmit procedure가 활성화 되는데 retransmission을 위하 TF 전송 이전 시점에 MU EDCA parameter set를 탈출하여 TF의 충돌 확률을 증가시킬 수 있다. 따라서 AP의 retransmission을 위한 TF 수신을 대기하기 위하여 M-BA 수신을 MU EDCA parameter set 탈출을 위한 timer 동작 시점으로 지정할 수 있다. 또다른 방법으로 TF 수신 시에 긴 timer를 설정한 뒤에 M-BA를 성공적으로 수신하면 짧은 timer로 갱신하는 방식으로 구현할 경우, 단말이 M-BA를 수신하지 못한 상황에서 AP가 재전송 시도를 할 것으로 오해하여 불필요하게 MU EDCA parameter set 상태로 대기하는 상황을 방지할 수 있다.

【0052】 도 13은 본 발명의 다른 실시예에 따른 MU EDCA parameter set 탈출 조건을 도시하고 있다.

【0053】 만약 단말이 TF 이외에 다른 방법에 의하여 MU EDCA parameter set의 적용이 시작되었을 경우, 시작 조건에 따라 탈출 조건도 다양하게 구성될 수 있다. 가령 BSR을 기준으로 MU EDCA parameter set이 시작되었을 경우, BSR을 전송하였어도 TF에 의하여 스케쥴링이 되지 않을 가능성이 존재하기 때문에, BSR을 기준으로 timer 가 시작되어 탈출 시퀀스가 시작될 수 있다. 이 경우, 만약 TF에 의해

스케쥴링이 실시되었다면 도 12에서 서술한 바와 같이 TF에 의한 timer로 탈출 시퀀스가 갱신될 수 있다. 또한 M-BA에 의한 탈출 조건 역시 추가적으로 적용될 수도 있다.

【0054】 만약 MU EDCA parameter set이 Beacon에 의해 시작되었을 경우, 다음 Beacon에서 추가적인 MU EDCA parameter set 시작 조건이 설정되느냐 안되느냐에 따라 즉시 MU EDCA parameter set 동작을 멈출 수 있다. 가령, AP가 UL MU indication을 비활성화 했을 경우 해당 beacon period에는 UL MU 전송을 기대할 수 없으므로 MU EDCA parameter set 동작을 멈춰야 한다. 또한 AP가 beacon에 UL MU scheduling map을 전송하는 경우 user info. 혹은 bitmap에 따라 각 단말이 자신의 스케쥴링 여부를 확인할 수 있으므로, 자신이 스케쥴링 대상이 아닌 경우 MU EDCA parameter set 동작을 멈출 수 있다.

【0055】 도 14은 본 발명의 일 실시예에 따른 UL MU 전송 이후의 EDCA 동작을 도시하고 있다.

【0056】 11ax에서는 종래의 무선랜과는 달리 UL MU 전송상황에는 데이터를 전송하는 단말이 BO timer 경쟁을 통해 채널 접속 시도를 하지 않고 AP가 TF 전송을 위한 경쟁을 한 후에 TF의 성공 여부에 따라 UL MU 전송이 시작된다. 따라서 데이터를 전송한 단말 측에서는 UL MU에 특정 AC의 데이터를 전송하였다 하더라도 해당 AC에 할당된 BO timer가 남아있을 수 있다. 이러한 상황에서 단말은 UL MU 데이터 전송의 성공 여부와 관계없이 BO timer를 재개하여 AC 큐에 남아있는 데이터 전송을 시도하는 것이 가능하다. 만약 큐에 데이터가 남아있었다면 기존 EDCA 동작

방식을 따라 BO를 decrement하고 데이터 전송 시도 후에 성공 실패 여부에 따라 CW 값을 재조정할 수 있다. 그러나 만약 UL MU 전송 후에 AC 큐에 남아있는 데이터가 존재하지 않았을 경우 EDCA 동작 방식에 따라 BO timer를 감소시킬 수 있지만 BO timer가 0에 도달할 동안 큐에 새로운 데이터가 도착하지 않는다면 해당 AC에 대해서 데이터의 성공과 실패를 가릴 수 있는 상황이 아니기 때문에 현재의 CW 값을 재조정하는 과정이 정의되어 있지 않다. 따라서 큐가 완전히 idle 한 상태가 되더라도 이전에 가지고 있던 CW 값을 그대로 유지하게 되어, 이후에 새로운 데이터가 도착한 상황에서 BO timer 값을 선택할 때 CWmin이 아닌 증가된 값의 CW를 참조하여 불필요하게 큰 값의 BO timer 값을 선택하게 되는 상황이 발생할 수 있다.

【0057】 도 15는 본 발명의 다른 실시예에 따른 UL MU 전송 이후의 EDCA 동작을 도시하고 있다.

【0058】 도 14에서 거론한 문제점을 해결하기 위하여 본 발명에서는 UL MU 전송에 의해 큐가 비워진 상태에서 특정 AC의 BO timer가 0에 도달한 후 큐가 idle 상태가 되는 상황에 CW 값을 해당 AC의 CWmin 값으로 리셋하도록 제안한다. 제안하는 동작에 따르면 UL MU 전송 이후에 큐가 idle 상태가 된 이후 시점에 데이터가 도착하였을 때 CWmin 을 기준으로 BO timer 값을 선택하여 다른 단말 및 AC에 비해 불이익을 받는 상황이 발생하지 않을 수 있다. 부가적으로 UL MU 전송 이후에 특정 AC의 큐가 비어있는 상태에서 BO timer가 0의 값에 도달하면 CW 값과 더불어 QSRC[AC]와 QLRC[AC] 값을 함께 reset 하여 AC의 동작을 초기화 상태로 변경할 수 있다. 상기한 동작은 UL MU 전송 이후의 동작 조건에만 국한되지 않고 다양한 상황

에서 AC의 큐가 비어있는 상황에서 BO timer가 0에 도달하는 경우에 적용될 수 있다.

【0059】도 16은 본 발명의 일 실시예에 따른 단말의 multi-TID A-MPDU aggregation 방법을 도시하고 있다.

【0060】11ax에서는 UL MU 상황뿐만 아니라 다양한 상황에서 단말이 multi-TID A-MPDU를 구성하여 전송하는 것이 가능하다. multi-TID A-MPDU를 구성하는 UL MU 상황에서 단말이 의도적으로 접속 시점이 빠른 AC들의 MPDU aggregation을 배제하고 접속시점이 늦은 AC의 MPDU 만을 aggregation하는 경우, 다른 단말들 (특히 Legacy 단말) 보다 높은 채널 접속 확률을 가지게 되어 네트워크 전체의 형평성을 저해할 수 있다. 상기한 문제를 해결하기 위하여, 단말이 UL MU 전송 시에 가장 접속 시점이 빠른 AC의 전체 혹은 일부를 반드시 포함시키거나, 접속 시점이 빠른 순으로 MPDU를 aggregation 하는 룰을 추가할 수 있다. 이 경우 TF가 지시하는 TID는 반드시 함께 포함 되어야 한다.

【0061】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.

【0062】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.

【부호의 설명】

【0063】100 : 스테이션

200 : 액세스 포인트

【특허청구범위】

【청구항 1】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-09-07

【요약서】

【요약】

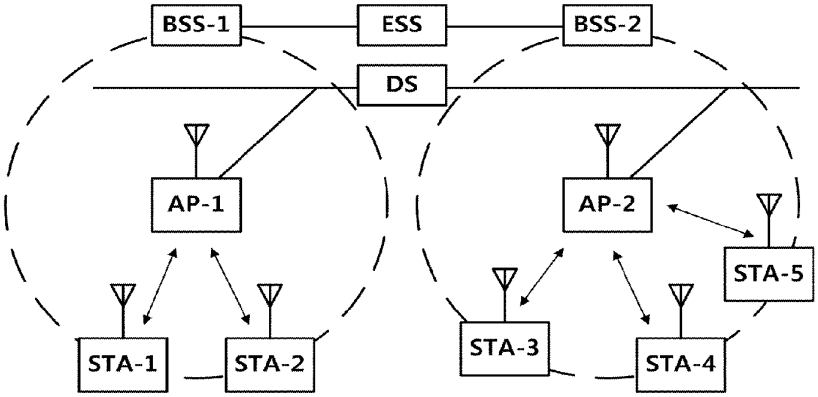
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면, 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 제어 방법이 제공될 수 있다.

【대표도】

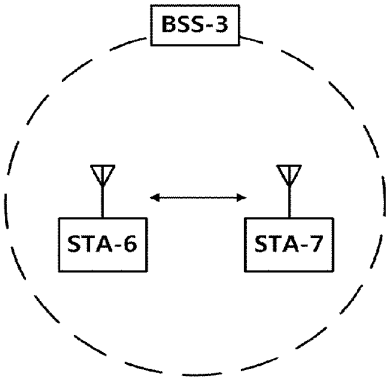
도 9

【도면】

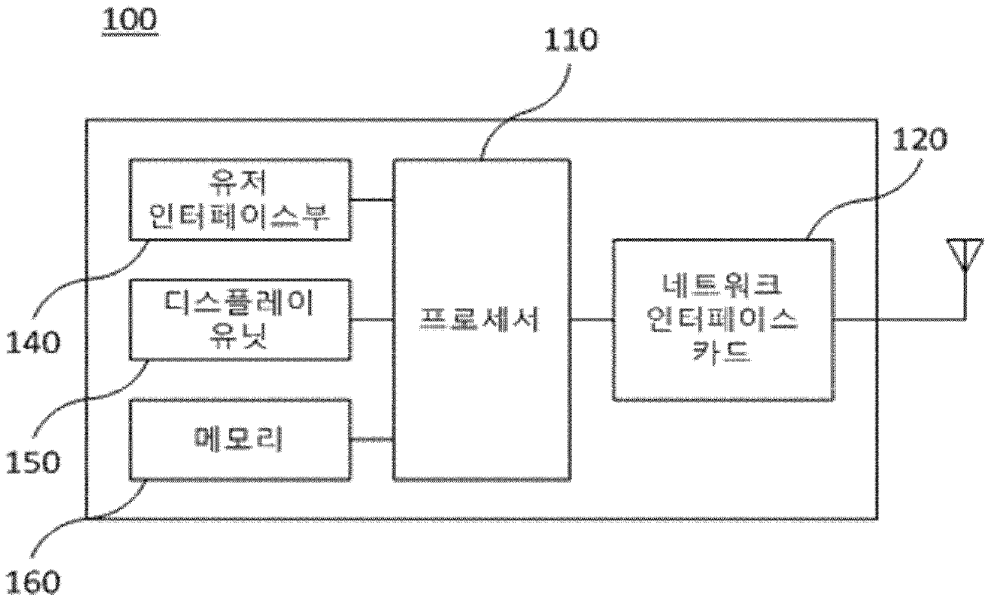
【도 1】


BSS-1
ESS
BSS-2
DS
AP-1
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

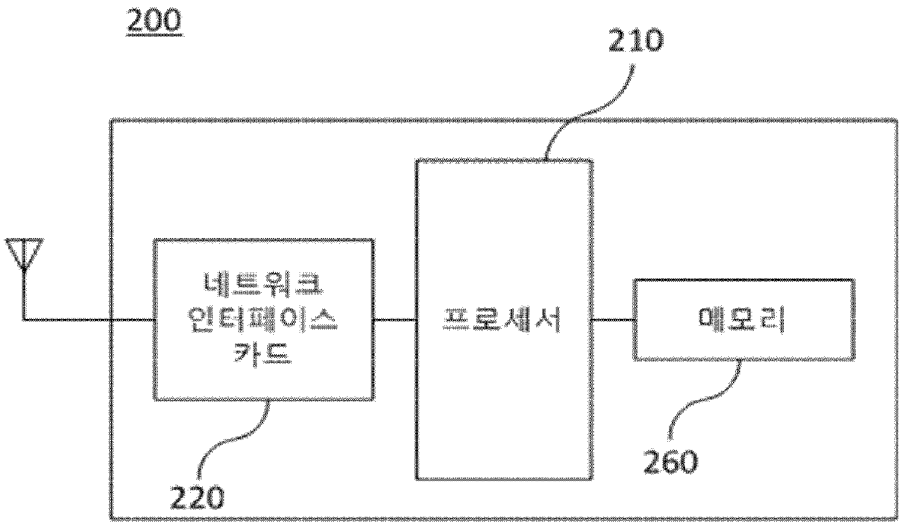
【도 2】


BSS-3
STA-6
STA-7

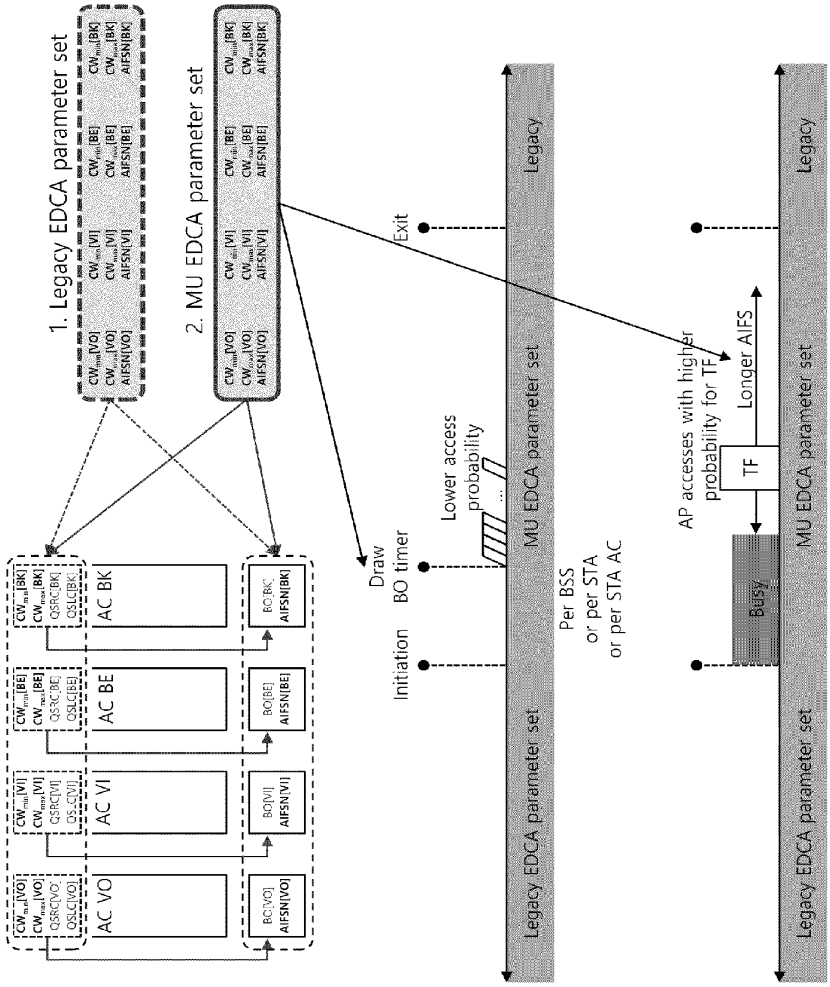
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
프로세서
네트워크
인터페이스
카드
140
150
메모리
160

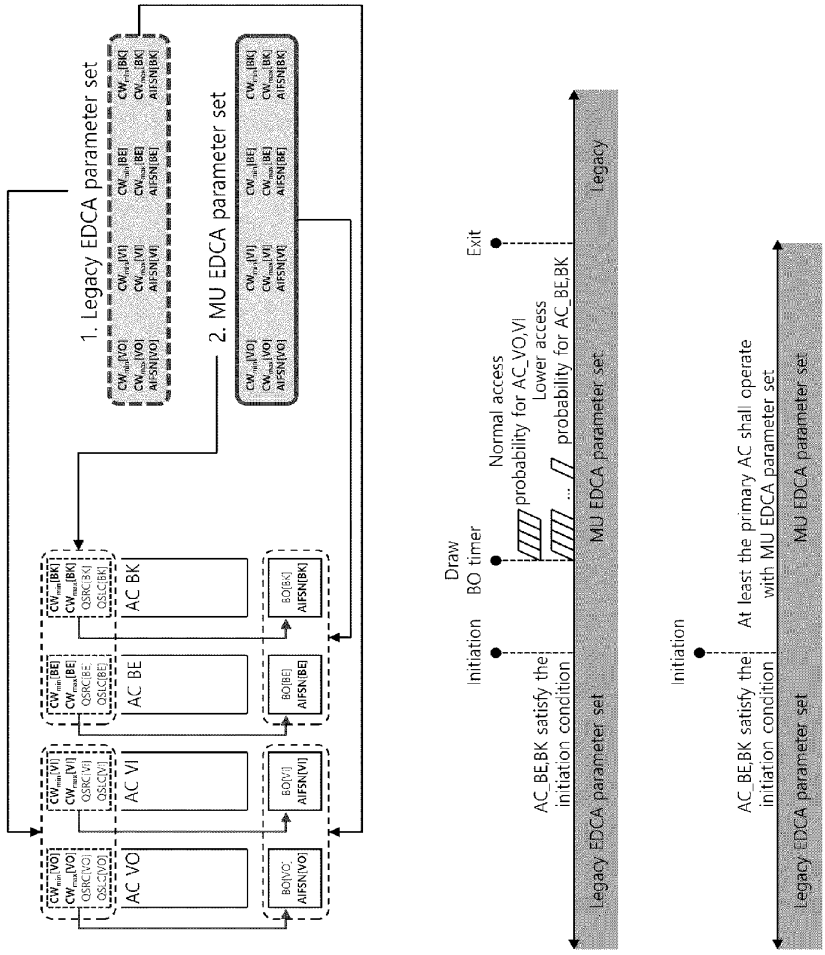
【도 4】



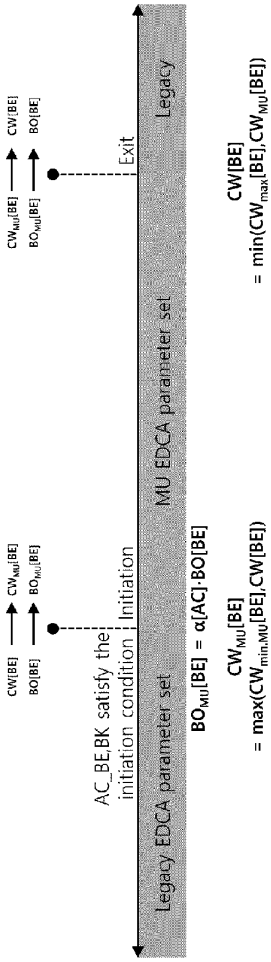
【도 5】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Draw BO timer
Initiation
Exit
Lower access probability
Per BSS or per STA or per STA AC
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
AP accesses with higher probability for TF
Longer AIFS
TF
Busy

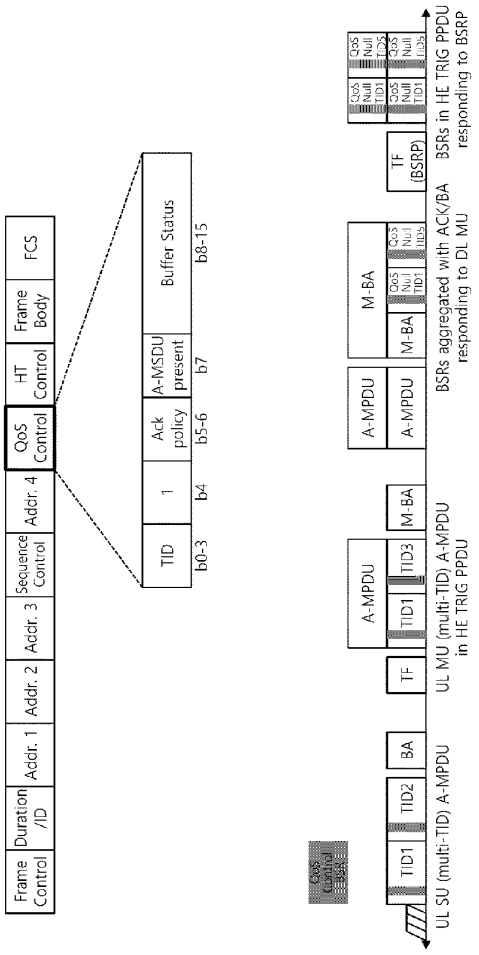
【도 6】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Initiation
Draw BO timer
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
Exit
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
Initiation
At least the primary AC shall operate with MU EDCA parameter set
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set

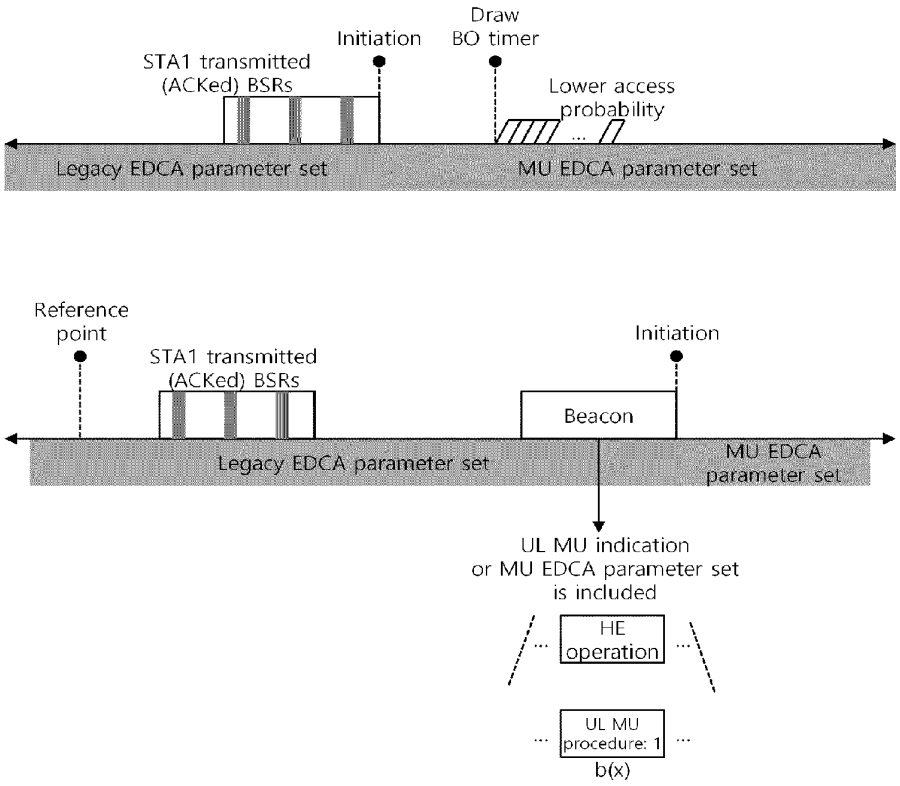
【도 7】


Legacy EDCA parameter set
MU EDCA parameter set
Legacy
Initiation
Exit
AC_BE,BK satisfy the initiation condition
CW[BE]
BO[BE]
CW_MU[BE]
BO_MU[BE]
BO_MU[BE] = α[AC]·BO[BE]
CW_MU[BE]
= max(CW_min.MU[BE],CW[BE])
CW[BE]
= min(CW_max[BE],CW_MU[BE])

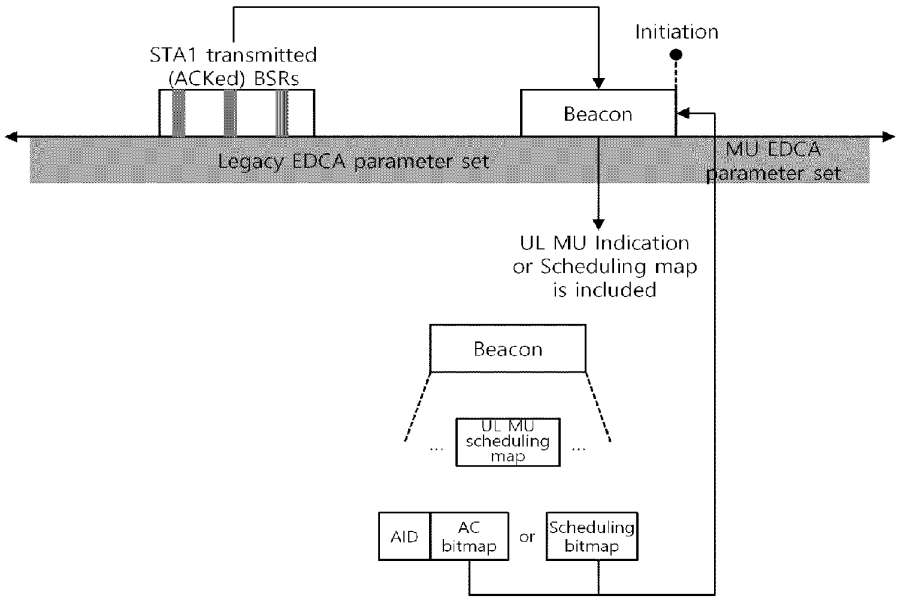
【도 8】


Frame Control
Duration /ID
Addr. 1
Addr. 2
Addr. 3
Sequence Control
Addr. 4
QoS Control
HT Control
Frame Body
FCS
TID
1
Ack policy
A-MSDU present
Buffer Status
b0-3
b4
b5-6
b7
b8-15
UL SU (multi-TID) A-MPDU
TID1
TID2
BA
TF
UL MU (multi-TID) A-MPDU in HE TRIG PPDU
A-MPDU
TID1
TID3
M-BA
A-MPDU
A-MPDU
M-BA
M-BA
BSRs aggregated with ACK/BA responding to DL MU
TF (BSRP)
BSRs in HE TRIG PPDU responding to BSRP

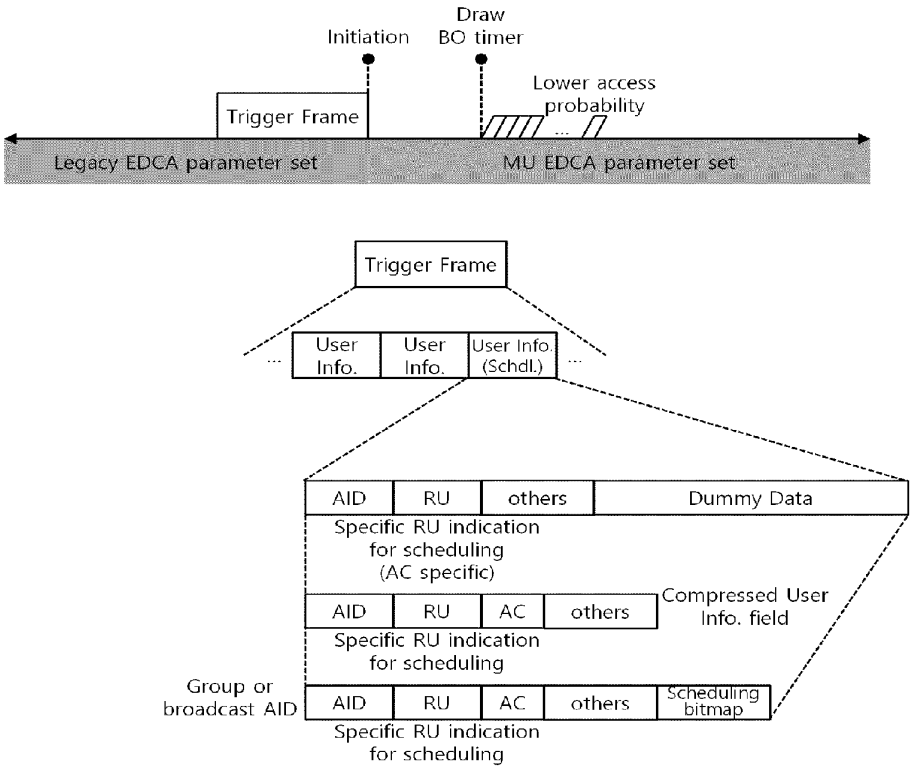
【도 9】


Draw
BO timer
Initiation
STA1 transmitted
(ACKed) BSRs
Lower access
probability
...
Legacy EDCA parameter set
MU EDCA parameter set
Reference
point
STA1 transmitted
(ACKed) BSRs
Initiation
Beacon
Legacy EDCA parameter set
MU EDCA
parameter set
UL MU indication
or MU EDCA parameter set
is included
...
HE
operation
...
...
UL MU
procedure: 1
...
b(x)

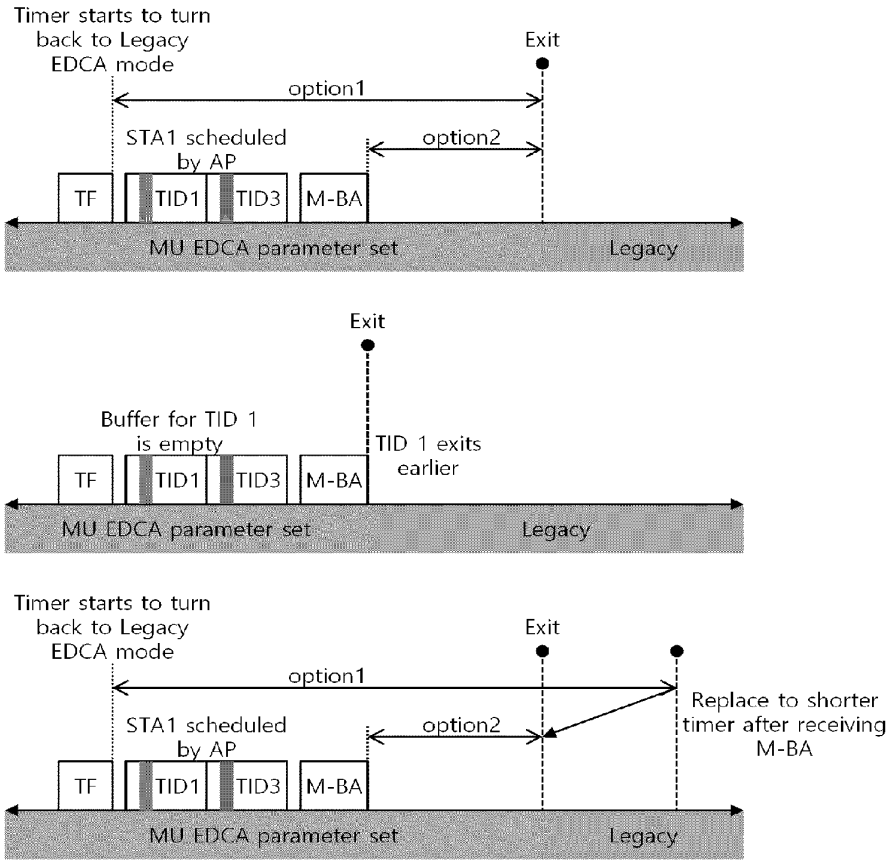
【도 10】


STA1 transmitted
(ACKed) BSRs
Initiation
Beacon
Legacy EDCA parameter set
MU EDCA
parameter set
UL MU Indication
or Scheduling map
is included
Beacon
UL MU
scheduling
map
AID
AC
bitmap
or
Scheduling
bitmap

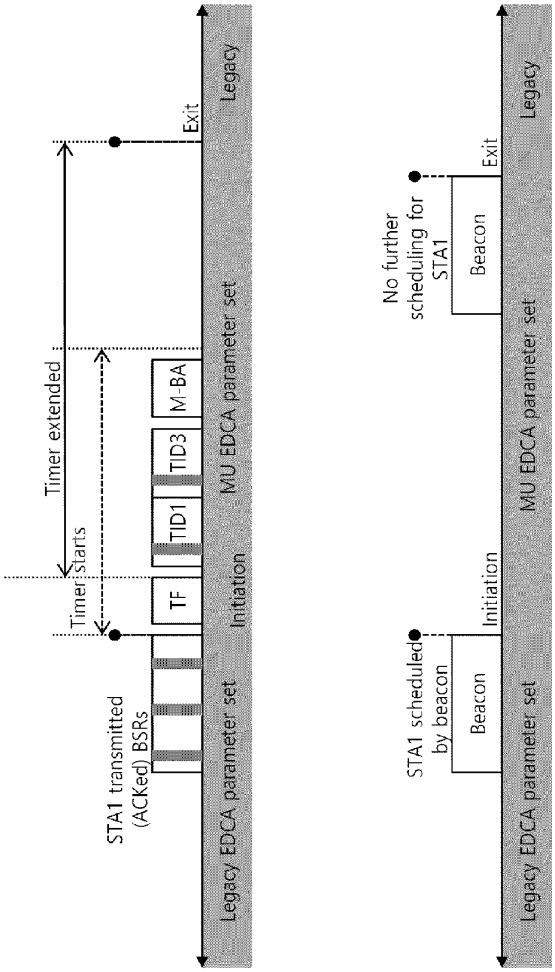
【도 11】


Initiation
Draw BO timer
Lower access probability
Trigger Frame
Legacy EDCA parameter set
MU EDCA parameter set
Trigger Frame
User Info.
User Info.
User Info. (Schdl.)
AID
RU
others
Dummy Data
Specific RU indication for scheduling (AC specific)
AID
RU
AC
others
Compressed User Info. field
Specific RU indication for scheduling
Group or broadcast AID
AID
RU
AC
others
Scheduling bitmap
Specific RU indication for scheduling

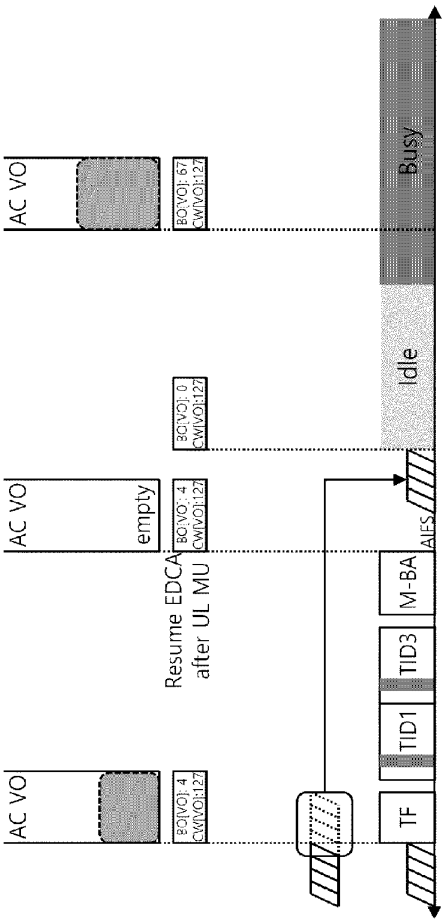
【도 12】


Timer starts to turn back to Legacy EDCA mode
Exit
option1
STA1 scheduled by AP
option2
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
Exit
Buffer for TID 1 is empty
TID 1 exits earlier
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
Timer starts to turn back to Legacy EDCA mode
Exit
option1
Replace to shorter timer after receiving M-BA
STA1 scheduled by AP
option2
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy

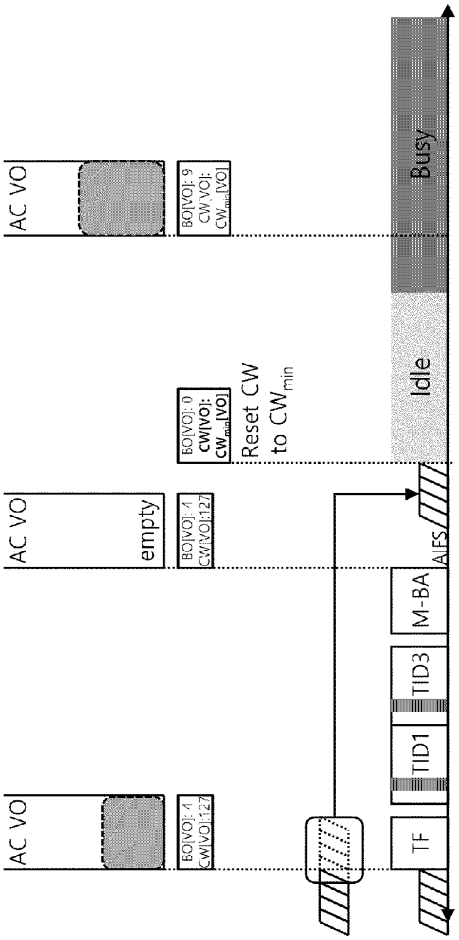
【도 13】


Legacy EDCA parameter set
STA1 transmitted (ACKed) BSRs
Initiation
TF
TID1
TID3
M-BA
MU EDCA parameter set
Timer Starts
Timer extended
Exit
Legacy
STA1 scheduled by beacon
Beacon
Initiation
No further scheduling for STA1
Beacon
Exit
MU EDCA parameter set
Legacy EDCA parameter set
Legacy

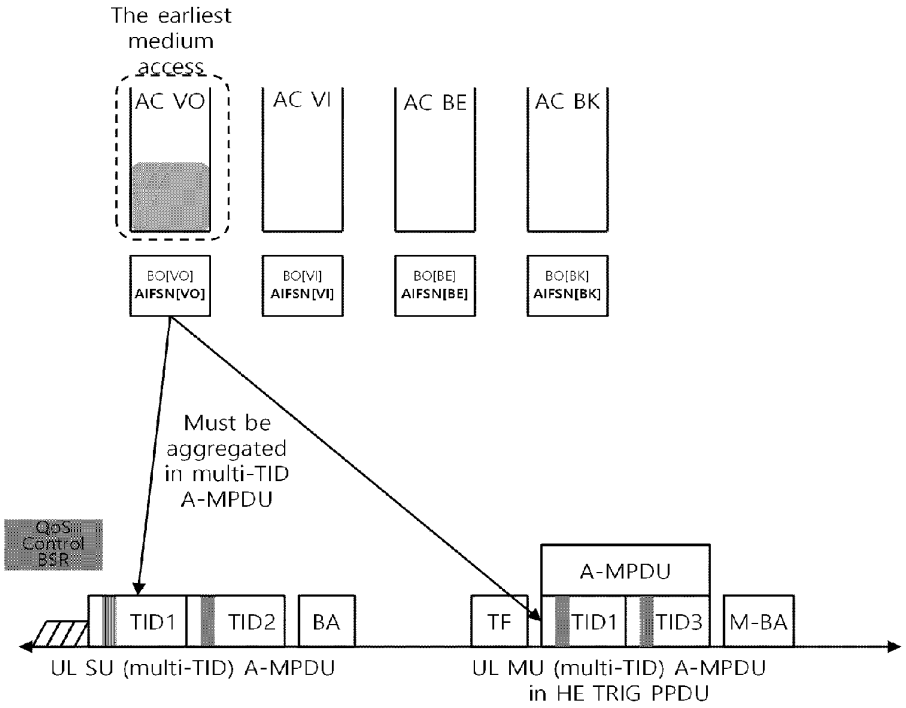
【도 14】


AC VO
BO[VO]: 4
CW[VO]:127
AC VO
empty
Resume EDCA
after UL MU
BO[VO]: 4
CW[VO]:127
BO[VO]: 0
CW[VO]:127
AC VO
BO[VO]: 67
CW[VO]:127
TF
TID1
TID3
M-BA
AIFS
Idle
Busy

【도 15】


AC VO
BO[VO]: 4
CW[VO]:127
AC VO
empty
BO[VO]: 4
CW[VO]:127
AC VO
BO[VO]: 9
CW VO]:
CWmax[VO]
BO[VO]: 0
CW[VO]:
CWmin[VO]
Reset CW
to CWmin
TF
TID1
TID3
M-BA
AIFS
Idle
Busy

【도 16】


The earliest medium access
AC VO
AC VI
AC BE
AC BK
BO[VO] AIFSN[VO]
BO[VI] AIFSN[VI]
BO[BE] AIFSN[BE]
BO[BK] AIFSN[BK]
Must be aggregated in multi-TID A-MPDU
QoS Control BSR
A-MPDU
TID1
TID2
BA
TF
TID1
TID3
M-BA
UL SU (multi-TID) A-MPDU
UL MU (multi-TID) A-MPDU in HE TRIG PPDU

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Filing Date Sep. 10, 2016

출 원 인 : 주식회사 윌러스표준기술연구소

Applicant(s) WILUS Institute of Standards and Technology Inc.

2021년 02월 19일

특 허 청

COMMISSIONER

재출 일자 : 2016-09-10

【서지사항】

【서류명】 특허출원서

【참조번호】 160123HEW

【출원구분】 특허출원

【출원인】

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【특허고객번호】 1-2013-022334-3

【대리인】

【성명】 임국일

【대리인번호】 9-2014-000874-4

【포괄위임등록번호】 2014-036557-3

【발명의 국문명칭】 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 파라미터 제어 방법

【발명의 영문명칭】 METHOD OF CONTROLLING PARAMETERS FOR UPLINK MULTIUSER TRANSMISSION IN WIDEBAND WIRELESS LAN NETWORKS

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【주민등록번호】 831010-1XXXXXX

【우편번호】 122-957

【주소】 서울특별시 은평구 서오릉로13길 18-1

【국적】 KR

【발명자】

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【성명의 영문표기】 Juhyung SON

【주민등록번호】 770724-1XXXXXX

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【국적】 KR

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【주민등록번호】 740908-1XXXXXX

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【주민등록번호】 860909-1XXXXXX

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【국적】 KR

【출원언어】 국어

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 R0166-16-1030

【부처명】 미래창조과학부

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【연구사업명】 정보통신방송표준개발지원

【연구과제명】 IEEE802.11 High Efficiency WLAN (HEW) 표준개발

【기여율】 1/1

【과제수행기관명】 (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】 27 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 : 2016-09-10

【첨부서류】 1.중소기업기본법 제2조의 규정에 따른 소기업에 해당함을 증명하는 서류_1통

32-4

제출 일자 : 2016-09-10

【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 파라미터 제어 방법 {METHOD OF CONTROLLING PARAMETERS FOR UPLINK MULTIUSER TRANSMISSION IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 대

두되었다. 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 7은 본 발명의 다른 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 8은 본 발명의 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 9는 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initation 조건을 도시하고 있다.

【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 구성이 특정 구성요소를 "포함" 한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의

미한다. 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 명세서에서는 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 인터페이스

부와 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. 네트워

크 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.

【0031】도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀 영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해

높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우, 동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】 상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 별도의 MU EDCA parameter set으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함될 수 있다. MU EDCA parameter set은 기존에 사용하고 있는 Legacy EDCA parameter set을 사용하는 단말들보다 더 낮은 확률로 채널에 접속하도록 값이 수정되어 있을 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있으며 BSS 내의 단말들에게 전달된 후 각 단말이 특정 조건을 만족할 시에 MU EDCA parameter 기반으로 동작을 시작(initiation) 하도록 할 수 있다. 또한 특정 조건에 의하여 다시 기존의 Legacy EDCA parameter set으로 돌아가도록 하는 것 역시 가능하다. 또 다른 방법으로 MU EDCA parameter set 자체가 하나의 Action 혹은 Action No Ack 프레임으로 동작되어 단말들에게 전송될 수 있다.

【0035】 도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0036】각 단말에서 MU EDCA parameter set이 특정 조건에 의하여 initiation 된 경우, 해당 단말의 모든 AC에 대하여 EDCA parameter set이 변경될 수 있지만, 만약 특정 AC 만이 조건을 만족하는 경우에는 해당 AC에 대해서만 MU EDCA parameter set 기반으로 동작하도록 할 수도 있다. MU EDCA parameter set은 기본적으로 UL MU 전송에 스케쥴링 될 것으로 예상되는 트래픽이 대상이 되므로, 스케쥴링 예정에 없는 AC의 트래픽의 경우는 기존의 접속 확률에 따라 SU 전송을 시도하는 것이 보장되어야 한다. 이 때, 단말 내부 스케쥴링 동작 구현에 따라 현재 낮은 BO timer를 보유하고 있는 AC가 MU EDCA parameter set 기반으로 동작하는 것을 의도적으로 방지하고 큰 BO timer를 지닌 AC의 트래픽만을 UL MU 전송에 스케쥴링 되도록 유도하여 자신의 접속 확률을 상대적으로 높이려는 동작을 시도를 할 수도 있다. 이를 방지하기 위하여 단말의 특정 트래픽이 MU EDCA parameter set 동작의 대상이 되는 경우, 현재 접속 대기 시간이 가장 짧은 primary AC를 반드시 MU EDCA parameter set에 포함시키도록 하는 추가적인 규칙을 지정할 수도 있다. 이 때 primary AC를 지정하는 기준은 남아있는 BO timer와 AIFS[AC] 값의 합이 될 수 있으며 다른 방법으로 남아있는 BO timer 값이 기준이 될 수도 있다. 만약 하나 이상의 AC가 같은 접속 대기 시간으로 설정된 경우에는 해당 AC가 모두 MU EDCA parameter set를 기반으로 동작해야 한다.

【0037】도 7은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0038】단말이 두 가지의 EDCA parameter set을 유지하는 경우, EDCA parameter의 일부로 데이터의 길이에 따라 각 AC 별로 데이터 재전송 회수를 특정 회수 이상 넘지 못하도록 제어하는 Long retry counter[AC]와 Short Retry Counter[AC]가 함께 포함될 수 있다. 이 retry coutner 값들은 데이터 전송이 실패했을 경우에 CW 값을 CWmin으로 reset 하는 역할을 한다. 동일한 EDCA parameter를 사용하는 도중에는 EDCAF가 지속적으로 retry limit 초과 여부를 확인하기 때문에 limit을 넘어서는 순간 CW를 reset할 수 있지만 EDCA parameter set이 변경되었고 변경된 set의 retry limit이 이전의 limit보다 작았을 경우에는 set이 바뀌는 순간 retry counter가 retry limit을 이미 초과해버린 상태일 가능성이 있다. 또한 마찬가지로 CW 값 역시 set이 변경된 시점에 바뀐 CWmax의 값을 초과해버린 상태일 가능성이 있다. 따라서 단말은 EDCA set이 변경된 이후 시점에서 최초로 BO timer를 재 선택하는 상황이 오면, set이 변경된 AC의 QSRC, QLRC 값을 변경된 short retry limit, long retry limit과 각각 비교하여, 혹시 두 값 중에 하나라도 limit을 초과하거나 같은 값이었을 경우 CW를 CWmin으로 reset하고 QSRC 및 QLRC를 0으로 reset한다. 또한 set이 변경된 AC의 CW 값을 변경된 CWmax 값과 비교하여 CWmax를 초과한 경우 CW값을 CWmax값으로 reset한다. 상기한 CW 값의 재설정은 set이 바뀌는 시점에 바로 적용되는 방식으로도 구현이 가능하다.

【0039】도 8은 본 발명의 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0040】 11ax에서는 기존의 무선랜에 비하여 단말이 AP에게 BSR을 전송할 수 있는 조건이 매우 늘어났다. 따라서 단말이 AP에게 BSR을 전송하는 시점부터 BSR이 전송된 관련 AC 혹은 전체 AC에 대하여 AP의 스케쥴링이 있을것으로 간주하고 MU EDCA parameter set을 활성화 할 수 있다.

【0041】 또다른 방법으로 AP가 beacon 등에 해당 시점부터 UL MU 전송을 위한 스케쥴링이 있을 것임을 알리는 indication 등을 Action (No Ack) frame 혹은 beacon 등에 삽입하여 전송하고 해당 프레임이 전송된 시점을 기준으로 특정 기간 동안의 과거에 BSR을 전송한 이력이 있으면 MU EDCA parameter set을 활성화하는 조건 역시 가능할 수 있다. 상기한 방법은 AP에게 축적된 BSR을 양에 따라 AP가 선별적으로 UL MU 전송 시작 여부를 결정할 수 있고, AP의 indication 시점 이전에는 단말이 BSR을 전송하였음에도 불구하고 다른 단말들과 동등한 조건으로 SU 전송 기회를 얻을 수 있다는 점에서 효율적일 수 있다. AP의 UL MU 스케쥴링을 알리는 indication은 별도의 element의 형태이거나 HE operation element 등의 reserved bit을 이용할 수 있으며, MU EDCA parameter set이 beacon에 포함된 것 자체가 UL MU 스케쥴링이 있음을 암시적으로 알릴 수도 있다. 또한 MU EDCA parameter set 자체에 하나의 bit가 할당되어 MU EDCA parameter set이 전송이 되어도 실질적인 UL MU scheduling indication의 활성화 여부를 바탕으로 단말이 MU EDCA parameter set initation 여부를 결정할 수도 있다.

【0042】 도 9는 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initation 조건을 도시하고 있다.

【0043】MU EDCA parameter set을 적용하는 또다른 방법으로 무선랜의 TWT 기능을 이용할 수 있다. 무선랜에서는 AP가 Beacon에 Target Wake Time element를 전송하여 이후 특정 시점에 Trigger frame을 포함한 service period가 있을 것임을 단말들에게 알릴 수 있다. AP는 TWT period를 시작하기 위하여 beacon에 지정된 시점부터 채널 경쟁을 거쳐 TF 등의 프레임 전송하여 TWT를 위한 TXOP을 선점해야 한다. 따라서 단말이 Beacon을 통하여 알게된 TWT period 내의 UL MU 전송에 참여한다면, AP의 TWT period 선점을 위한 채널 접속 확률을 높이기 위하여 TWT가 시점에서 사전 정의된 시간만큼의 이전 시점부터 MU EDCA parameter set으로 변경하여 채널 접속을 시도할 수 있다. 상기한 사전 정의된 시간은 TWT element나 MU EDCA parameter set element 등 beacon의 information element 중 하나를 이용해 전송되거나 고정된 값이 사용될 수 있다. TWT period가 시작된 후에는 종료시점까지 채널 접속이 제한되므로, 단말은 TWT가 시작되는 시점, 혹은 TWT period가 종료되는 시점을 기준으로 MU EDCA parameter set 적용을 마칠 수 있다.

【0044】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.

【0045】 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】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-09-10

【요약서】

【요약】

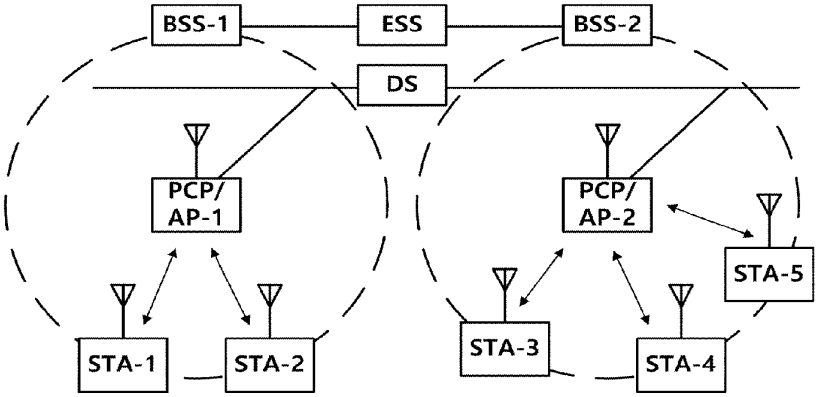
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 파라미터 제어 방법이 제공될 수 있다.

【대표도】

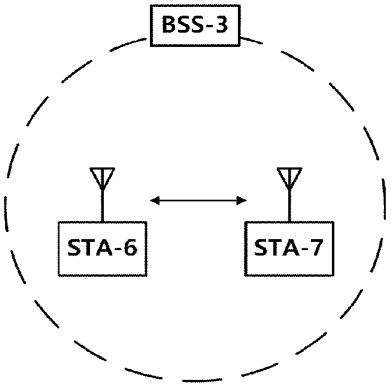
도 9

【도면】

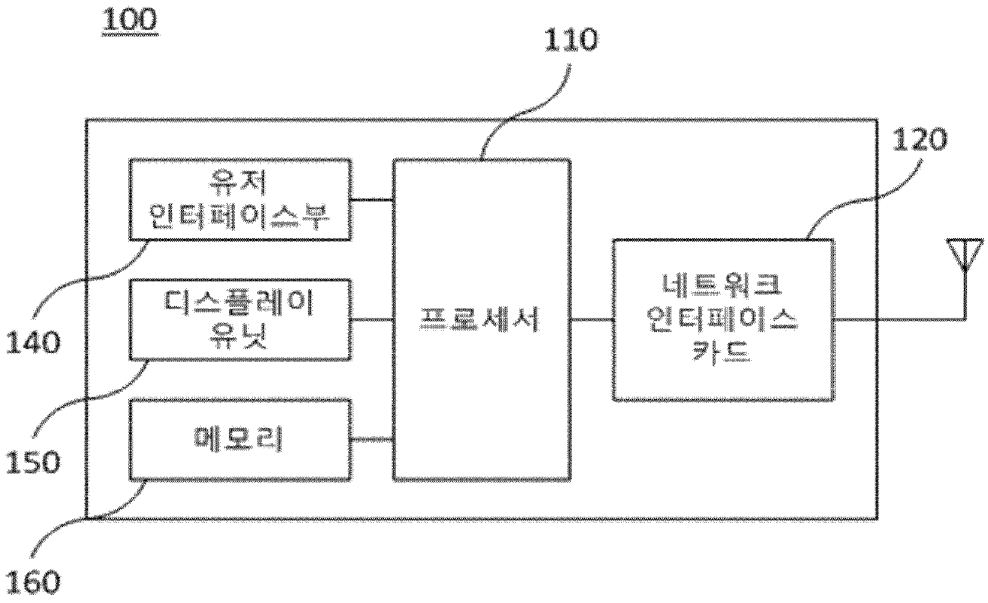
【도 1】


BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

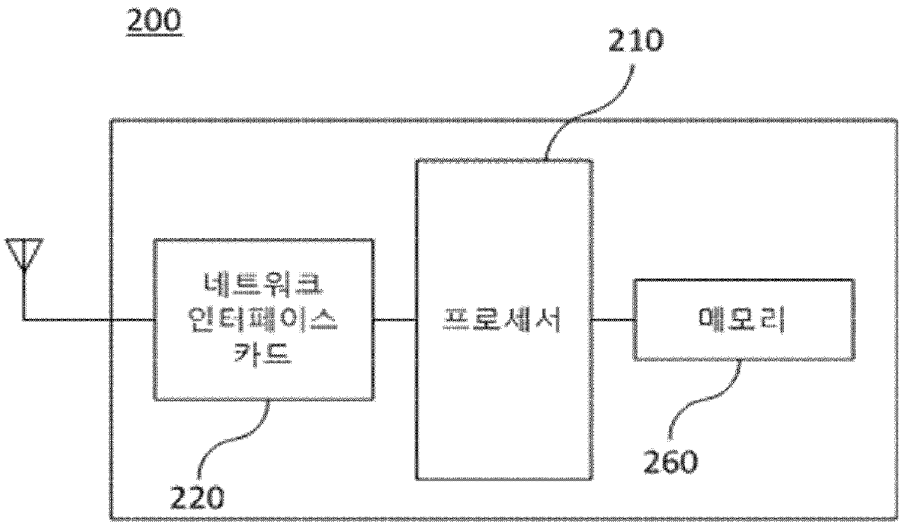
【도 2】


BSS-3
STA-6
STA-7

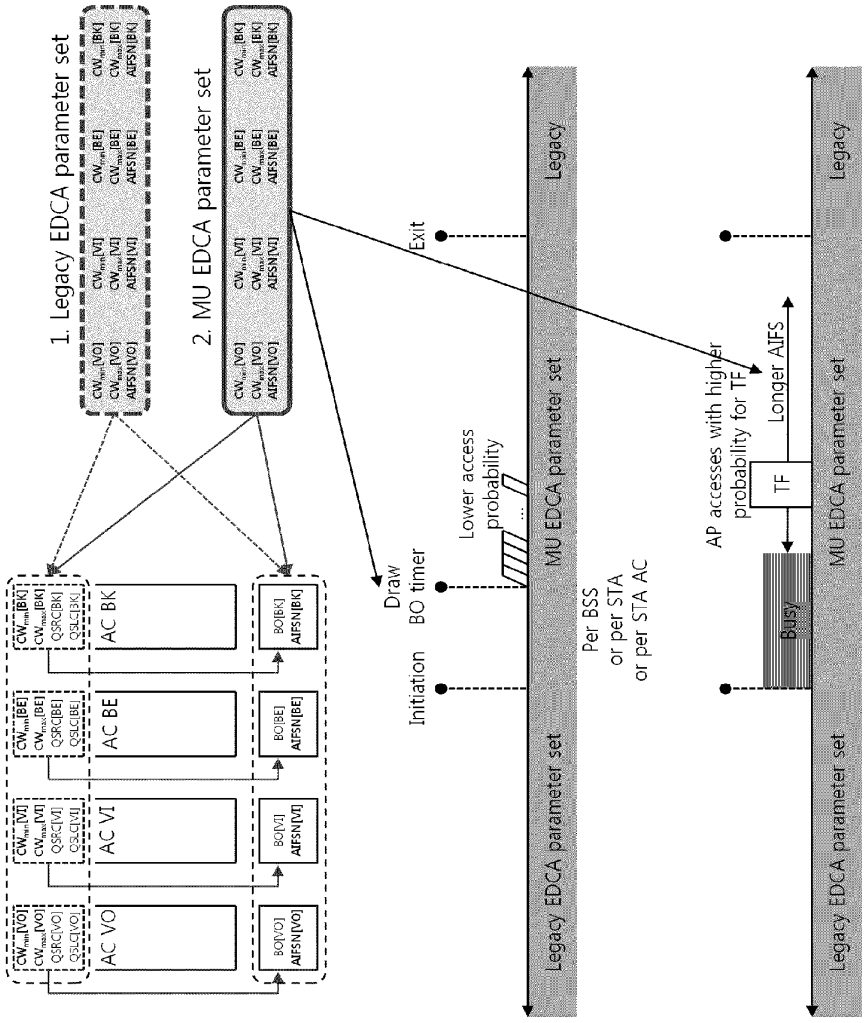
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
프로세서
네트워크
인터페이스
카드
140
150
메모리
160

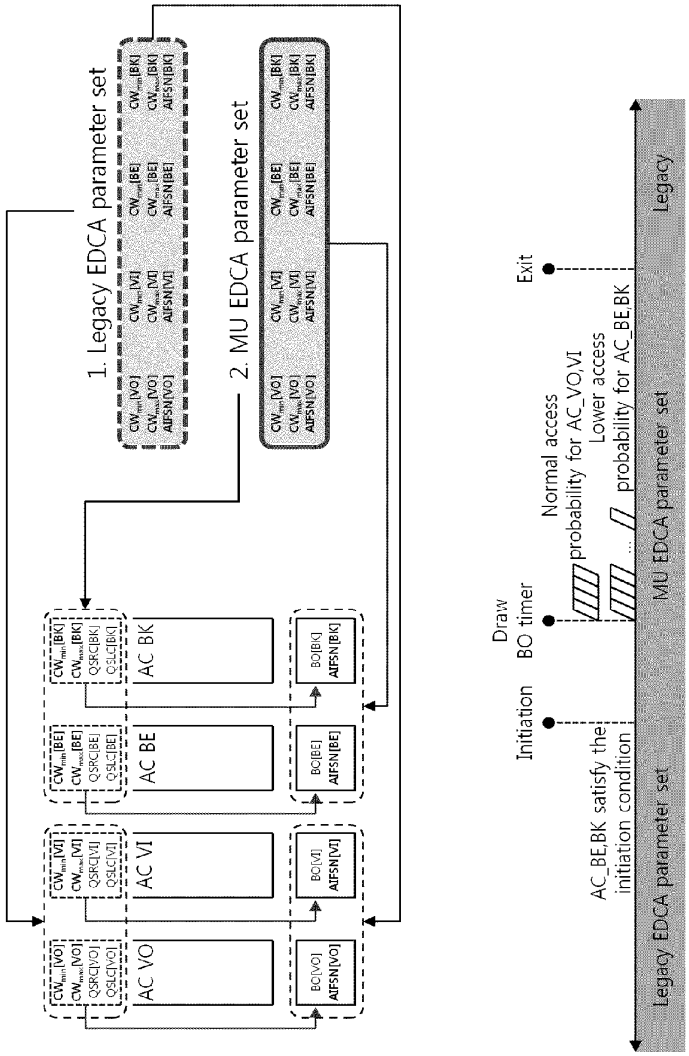
【도 4】



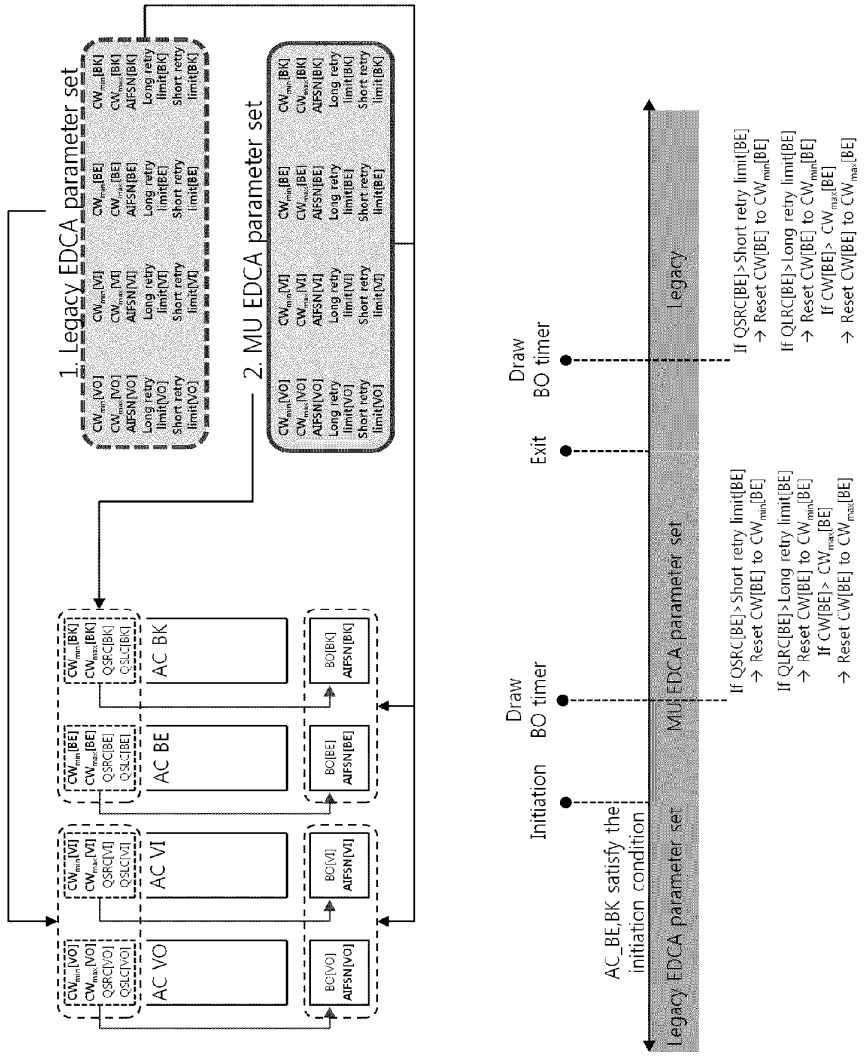
【도 5】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Exit
Draw BO timer
Initiation
Lower access probability
Per BSS or per STA or per STA AC
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
AP accesses with higher probability for TF
Longer AIFS
TF
Busy

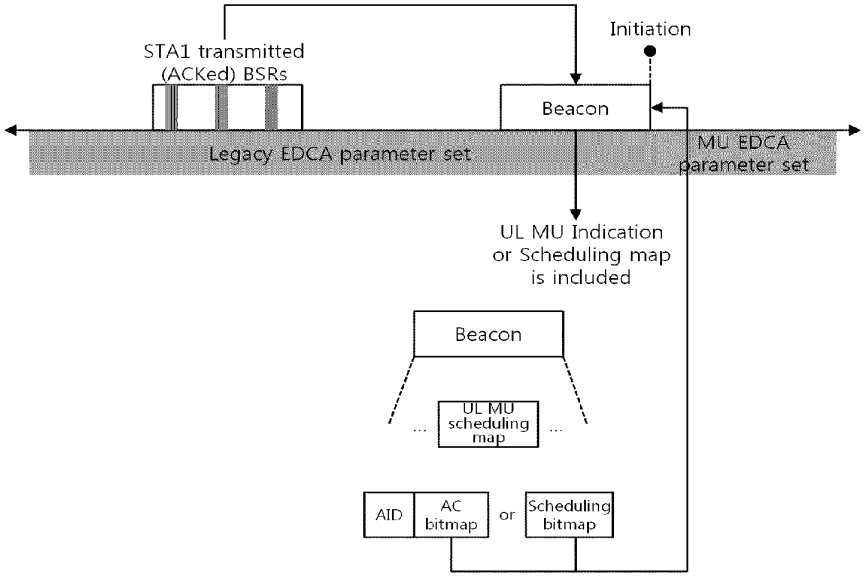
【도 6】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Initiation
Draw BO timer
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
Exit
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

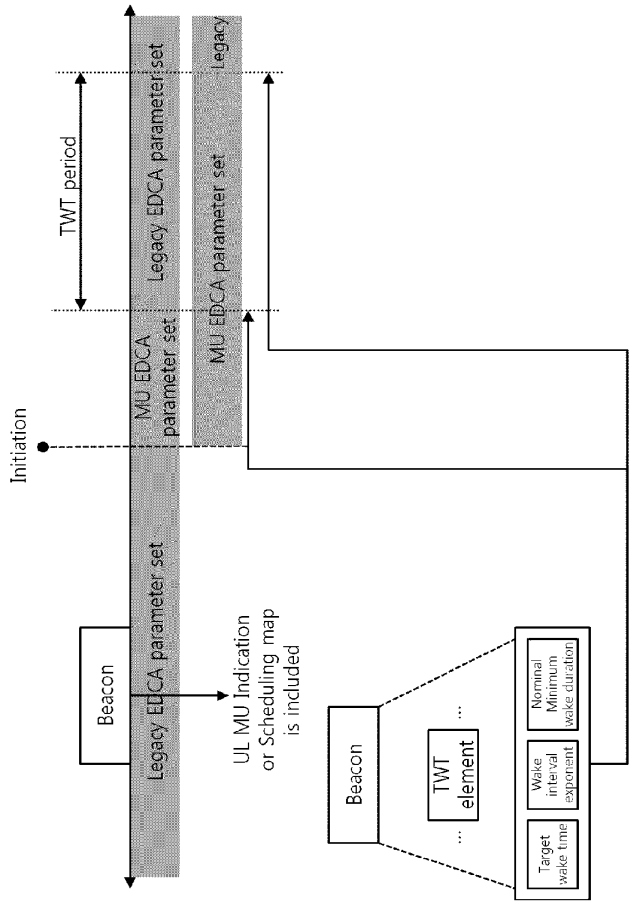
【도 7】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Initiation
Draw BO timer
Exit
Draw BO timer
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

【도 8】


Initiation
STA1 transmitted
(ACKed) BSRs
Beacon
Legacy EDCA parameter set
MU EDCA
parameter set
UL MU Indication
or Scheduling map
is included
Beacon
UL MU
scheduling
map
AID
AC
bitmap
or
Scheduling
bitmap

【도 9】


Initiation
TWT period
MU EDCA parameter set
Legacy EDCA parameter set
Legacy
Beacon
Legacy EDCA parameter set
UL MU Indication or Scheduling map is included
Beacon
TWT element
Target wake time
Wake interval exponent
Nominal Minimum wake duration

Digital Access Service
(DAS)

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출 원 인 : 주식회사 윌러스표준기술연구소

Applicant(s) WILUS Institute of Standards and Technology Inc.

2021년 02월 19일

특 허 청
COMMISSIONER

재출 일자 : 2017-02-20

【서지사항】

【서류명】 특허출원서

【참조번호】 170021HEW

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【특허고객번호】 1-2013-022334-3

【대리인】

【성명】 임국일

【대리인번호】 9-2014-000874-4

【포괄위임등록번호】 2014-036557-3

【발명의 국문명칭】 무선랜 광대역 환경에서 단말의 경쟁 윈도우 설정 방법

【발명의 영문명칭】 METHOD OF SETTING CONTENTION WINDOW VALUE OF STATIONS IN WIDEBAND WIRELESS LAN NETWORKS

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【우편번호】 03410

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【국적】 KR

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【우편번호】 16547

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【발명자】

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【성명의 영문표기】 Jinsam KWAK

【주민등록번호】 740908-1XXXXXX

【우편번호】 16021

【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1113동1704호

【국적】 KR

【출원언어】 국어

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 R0166-16-1030

【부처명】 미래창조과학부

【과제관리(전문)기관명】 정보통신기술진흥센터

【연구사업명】 정보통신방송표준개발지원

【연구과제명】 IEEE802.11 High Efficiency WLAN (HEW) 표준개발

【기여율】 1/1

【과제수행기관명】 (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】	35	면	0 원
【우선권주장료】	0	건	0 원
【심사청구료】	0	항	0 원

【합계】 46,000 원

【감면사유】 소기업(70%감면)[1]

재출 일자 : 2017-02-20

【감면후 수수료】 13,800 원

제출 일자 : 2017-02-20

【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 경쟁 윈도우 설정 방법{METHOD OF SETTING CONTENTION WINDOW VALUE OF STATIONS IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 복수의 EDCA Parameter를 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 7은 본 발명의 다른 실시예에 따른 복수의 EDCA parameter set을 이용하

는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 8은 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 9는 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 10은 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 11은 본 발명의 일 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 12는 본 발명의 다른 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

도 13은 본 발명의 또다른 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【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 구성이 특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

【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 인프라스트럭처 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭처 BSS를 나타내고 있다.

【0014】 도 1에 도시된 바와 같이 인프라스트럭처 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 명세서에서는 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, 실시

예에 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 상

기 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 인터페이

스 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.

【0031】 도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】 무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀 영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해 높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우, 동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 방법을 이용할 수 있다. 만약 단말이 과거 시점에 Buffer Status Report 등을 통해 자신의 데이터 존재 유무를 AP에게 알렸고, 특정 시점에 AP로부터 1) 자신의 AID를 지시하고 있는 User Info field를 가지고 있는 Trigger frame을 수신하였고, 2) 그에 대한 응답으로 QoS Data를 전송하였으며, 3) immediate response (e.g., M-BA) 등을 수신함으로써 전송이 성공하였다 판단하였다 가정하면, 그 단말은 UL MU 전송

으로 인한 혜택을 얻었고 또한 이후의 UL MU 전송에도 스케쥴링 될 것으로 기대할 수 있기 때문에, SU 전송을 위한 접속 확률을 낮출 수 있다. 이를 위하여, 해당 단말은 사전에 정의된 별도의 EDCA parameter set(MU EDCA parameter set)으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함할 수 있다. 따라서 MU EDCA Parameter Set Element를 수신하였고, 상기한 MU EDCA mode 조건을 충족한 단말은 immediate response frame이 포함된 PPDU의 종료시점, 혹은 (immediate response를 요청하지 않는 HE trigger-based PPDU를 전송한 경우) 전송한 HE trigger-based PPDU의 종료시점에 상기한 조건에서 전송한 QoS Data가 속한 모든 AC에 대하여 AIFSN[AC], CWmin[AC], CWmax[AC] 값을 업데이트 한다. 또한, MU EDCA를 적용한 시점부터 특정 기간 동안 추가로 성공적인 UL MU 전송을 하지 못하였을 경우에 다시 정상적인 접속 확률로 SU 전송을 하도록 할 수 있는데, 상기한 특정 기간을 지시하기 위하여 각 AC 별로 MUEDCATimer 값을 정하여 해당 타이머 값이 0이 될 경우에 해당 AC에 대해서 다시 Legacy EDCA parameter set을 이용할 수 있도록 할 수 있고, 상기한 MUEDCATimer 역시 MU EDCA Parameter Set에 포함될 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있다.

【0035】 도 6은 본 발명의 실시예에 따른 복수의 EDCA Parameter를 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0036】도 5에서 설명한 바와 같이 단말이 EDCA parameter set을 교체할 때, 현재 시점의 특정 AC의 Contention Window의 크기를 나타내는 CW[AC] 값은 변화하지 않으며, 이 후 시점에 CW를 새로 설정하는 시점에 최소 값의 기준인 CWmin[AC]와 최대 값의 기준인 CWmax[AC] 값이 새로운 EDCA parameter set에 의하여 변경된다. 따라서 변경된 CWmin[AC], CWmax[AC] 값은 EDCA parameter set이 바뀌는 즉시 영향을 미치지 않으며, 새로 CW를 변경해야하는 특정 사건이 발생하는 시점에 영향을 미친다. 본래 EDCA parameter는 하나의 set으로 운용되었기 때문에 CW 값이 변화할 시에 CWmin[AC] 값보다 같거나 크고, CWmax[AC] 값보다 작거나 같은 범위에서만 설정되도록 설계되었다. 그러나 두 개의 EDCA parameter set을 사용하게 됨에 따라 특정 상황에서 CW 값을 변화시킨 후에 그 값이 현재의 CWmin[AC] 보다 작거나 CWmax[AC] 보다 큰 상황들이 발생하게 되었다. 아래에 그 예시를 설명한다

【0037】현재의 CW 설정 규칙에 따르면:

【0038】1) Transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC,

【0039】2) Transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time,

【0040】 3) Transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive

【0041】 위의 세 가지 상황이 발생하였을 시에:

【0042】 a) If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].

【0043】 b) If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC]

【0044】 c) Otherwise,

【0045】 c-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0046】 c-2) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0047】 의 형태로 정의하고 있다. 1), 2), 3) 조건은 모두 전송 실패 및 내부 경쟁 실패 등 해당 EDCAF가 전송을 재시도 해야 하는 상황을 기술하고 있다. 또한 해당 조건 하에서 a), b)의 상황은 EDCAF 자체의 재전송 시도 회수 초과에 따른

CW 리셋 동작이며, c)는 그렇지 않은 상황에서 CW 값을 재설정하는 상황을 기술하고 있다.

【0048】 만약, 특정 AC의 CW 값이 CWmin(e.g., CWmin.old = 3)과 같은 값이었고, 새로운 EDCA parameter set으로 바뀐 뒤에(CWmin.new = 15) 상기한 1, 2, 3)의 조건에 의하여 c-1) 동작이 실행되면, 7의 CW 값을 갖게 된다. 이 경우 새로 설정된 CW 값이 현재의 CWmin 값보다 작은 상황이 발생한다. 또다른 예로, 현재의 CW 값이 CWmax (CWmax.old = 31) 값과 같았고, 새로운 EDCA parameter set으로 바뀌었으며(CWmax.new = 15), 상기한 1, 2, 3)의 조건에 의하여 c) 동작이 실행되면 현재의 CW 값이 새로운 CWmax를 초과하는 값이기 때문에 현재의 c-1), c-2) 규칙에 따르면 CW 값을 재설정할 수 있는 조건이 정의되어있지 않아서 정상적으로 동작하지 않을 수 있다.

【0049】 현재 MU EDCA 및 Legacy EDCA parameter set의 설정값에 대한 규칙을 지정하고 있지 않으므로 위에서 설명한 예시들은 MU EDCA parameter set에서 Legacy EDCA parameter set으로 변환되거나, Legacy EDCA parameter set에서 MU EDCA parameter set으로 변환되는 두 가지 상황에서 모두 발생할 수 있다.

【0050】 도 7은 본 발명의 다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0051】 도 6에서 설명한 부적절한 CW 값 설정 및 오동작을 방지하기 위하여 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다.

【0052】 c-1) For a non-HE STA, if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0053】 c-2) For an HE STA, if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 - 1).

【0054】 c-3) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0055】 c-4) For an HE STA, if CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0056】 CWmax를 초과하거나 CWmin 미만의 CW 값을 갖는 상황은 복수 개의 EDCA parameter set을 사용하는 HE 단말에게서 발생할 수 있으므로, 기존의 non-HE 단말들에 미치는 영향을 최소화하기 위하여 조건을 분리할 수 있다. 또한 본 실시예의 c-2)의 동작에 따라 HE 단말은 현재의 CW가 CWmin보다 작으면 CWmin으로 설정되고, CWmin보다 크고 CWmax보다 작으면 지속적으로 증가한다. 또한 max() 함수의 사용으로 CWmin 미만 및 이상 조건을 별도로 나눌 필요 없이 하나의 조건문으로 처리 가능하다. 또다른 조건으로 본 실시예의 c-3)의 동작에 의해 현재의 CW가 CWmax와 같을 경우, HE 및 non-HE 단말 모두 CWmax와 같은 값으로 유지되고, c-4)의 조건에 의해 HE 단말에 한하여 현재의 CW 값이 CWmax보다 클 경우에 CWmax 값으로 재설정될 수 있다.

【0057】 도 8은 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0058】 또다른 방법으로 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다. 도 8의 실시예는 도 7의 실시예와 같은 결과를 도출하지만 다른 표현 방식을 제안한다.

【0059】 c-1) For a non-HE STA,

【0060】 c-1-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0061】 c-1-2) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0062】 c-2) For an HE STA,

【0063】 c-2-1) If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].

【0064】 c-2-2) if CW[AC] is equal to or greater than CWmin[AC] and less than CWmax[AC], CW[AC] shall be set to (CW[AC] + 1) × 2 - 1.

【0065】 c-2-3) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0066】 c-2-4) If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0067】 도 9는 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0068】 또다른 방법으로 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다. 도 9의 실시예는 도 7의 실시예와 같은 결과를 도출하지만 다른 표현 방식을 제안한다.

【0069】 c-1) For a non-HE STA,

【0070】 c-1-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0071】 c-1-2) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0072】 c-2) For an HE STA,

【0073】 c-2-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 - 1).

【0074】 c-2-2) If CW[AC] is equal to or greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0075】 본 실시예에서 제안하는 방식의 경우, HE 단말과 legacy 단말인 non-HE 단말의 동작을 명확하게 구분할 수 있으며, 또한 두 분류의 단말이 같은 분기 조건을 가짐으로써 구현의 용이성을 추가로 얻을 수 있다.

【0076】 도 10은 본 발명의 또다른 실시예에 따른 복수의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0077】 또다른 방법으로 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다. 도 10의 실시예는 도 7의 실시예와 같은 결과를 도출하지만 다른 표현 방식을 제안한다.

【0078】 c-1) For a non-HE STA,

【0079】 c-1-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0080】 c-1-2) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0081】 c-2) For an HE STA,

【0082】 c-2-1) if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 - 1).

【0083】 c-2-2) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0084】 c-2-3) If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0085】 본 실시예에 따르면 도 9의 실시예보다 조건문이 한 가지 더 추가되지만, HE 단말의 CW 값이 CWmax와 같은 경우, 추가적인 연산을 하지 않고 CWmax 값

에 머무르도록 할 수 있으므로 연산량을 줄일 수 있다는 장점이 있다.

【0086】 도 11은 본 발명의 일 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0087】 복수의 EDCA parameter set을 사용하지 않는 기존의 무선랜에서도 매우 간헐적으로 AP에 의해 EDCA parameter set의 내부 값이 변경될 수 있으며, 기존 값과 새로 설정되는 값의 차이에 따라 도 6에서 설명한 문제가 동일하게 발생할 수 있다. 따라서 도 7에서 도 11에 걸쳐 HE 단말에게 적용되는 규칙이 HE, non-HE 단말의 구분 없이 적용되게 함으로써 비정상적인 CW 설정 문제를 해결할 수 있다. 따라서 도 6의 c) 조건에서의 동작을 아래와 같이 수정할 수 있다.

【0088】 c) Otherwise,

【0089】 c-1) If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].

【0090】 c-2) if CW[AC] is greater than CWmin[AC] and equal or less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0091】 c-3) If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0092】 따라서 c-1)부터 c-3)의 동작에 따라 EDCA parameter set이 변경된 이후 시점에 모든 단말은 현재의 CW가 CWmin보다 작으면 CWmin으로 설정되고, CWmin보다 크고 CWmax보다 작으면 지속적으로 증가한다. 또한, 현재의 CW가 CWmax

와 같을 경우 CWmax와 같은 값으로 유지되고, 현재의 CW 값이 CWmax보다 클 경우에 CWmax 값으로 재설정될 수 있다.

【0093】 도 12는 본 발명의 다른 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0094】 또다른 방법으로 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다. 도 12의 실시예는 도 11의 실시예와 같은 결과를 도출하지만 다른 표현 방식을 제안한다.

【0095】 c) Otherwise,

【0096】 c-1) If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].

【0097】 c-2) if CW[AC] is greater than CWmin[AC] and equal or less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 - 1.

【0098】 c-3) If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

【0099】 c-4) If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0100】 도 13은 본 발명의 또다른 실시예에 따른 하나의 EDCA parameter set을 이용하는 상황에서의 Contention Window 설정 방법을 도시하고 있다.

【0101】 또다른 방법으로 c) 상황의 CW 설정 규칙을 다음과 같이 바꿀 수 있다. 도 13의 실시예는 도 11의 실시예와 같은 결과를 도출하지만 다른 표현 방식을 제안한다.

【0102】 c) Otherwise,

【0103】 c-1) If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 - 1).

【0104】 c-2) If CW[AC] is equal to or greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【0105】 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.

【0106】 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】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2017-02-20

【요약서】

【요약】

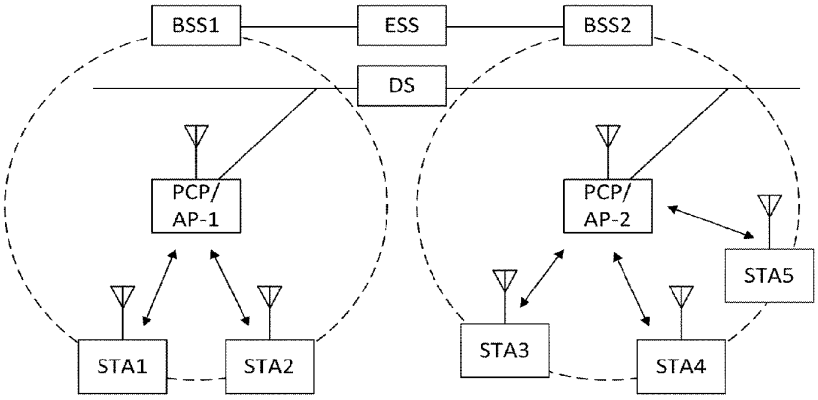
무선랜을 위한 장치, 시스템 및 무선랜 통신 방법이 게시된다. 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 경쟁 윈도우 설정 방법{METHOD OF SETTING CONTENTION WINDOW VALUE OF STATIONS IN WIDEBAND WIRELESS LAN NETWORKS}이 제공될 수 있다.

【대표도】

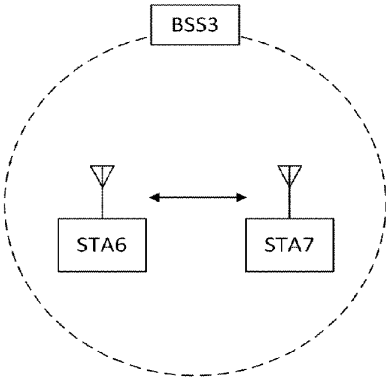
도 9

【도면】

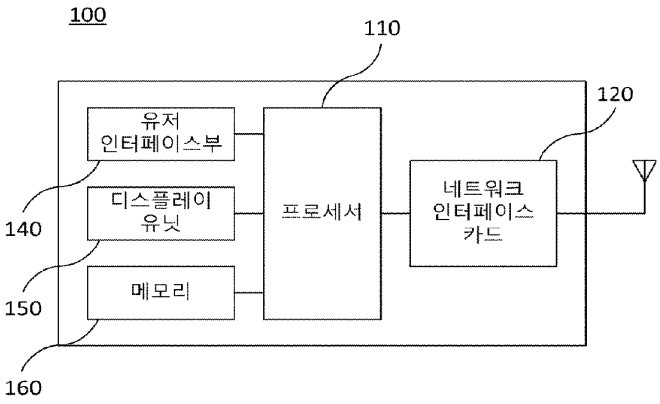
【도 1】


BSS1
ESS
BSS2
DS
PCP/
AP-1
PCP/
AP-2
STA5
STA1
STA2
STA3
STA4

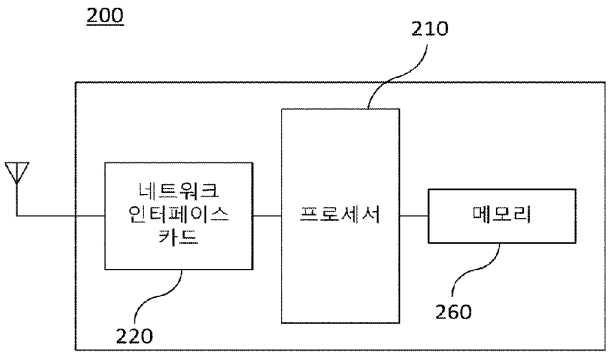
【도 2】


BSS3
STA6
STA7

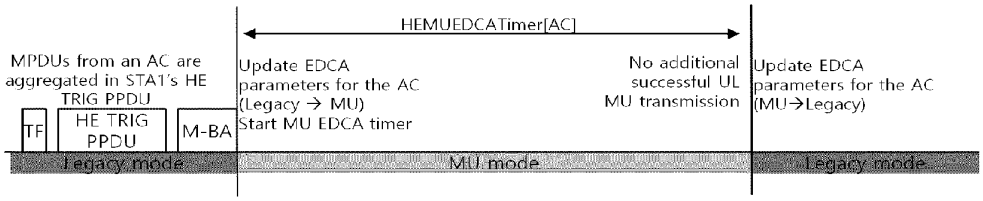
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
메모리
프로세서
네트워크
인터페이스
카드
140
150
160

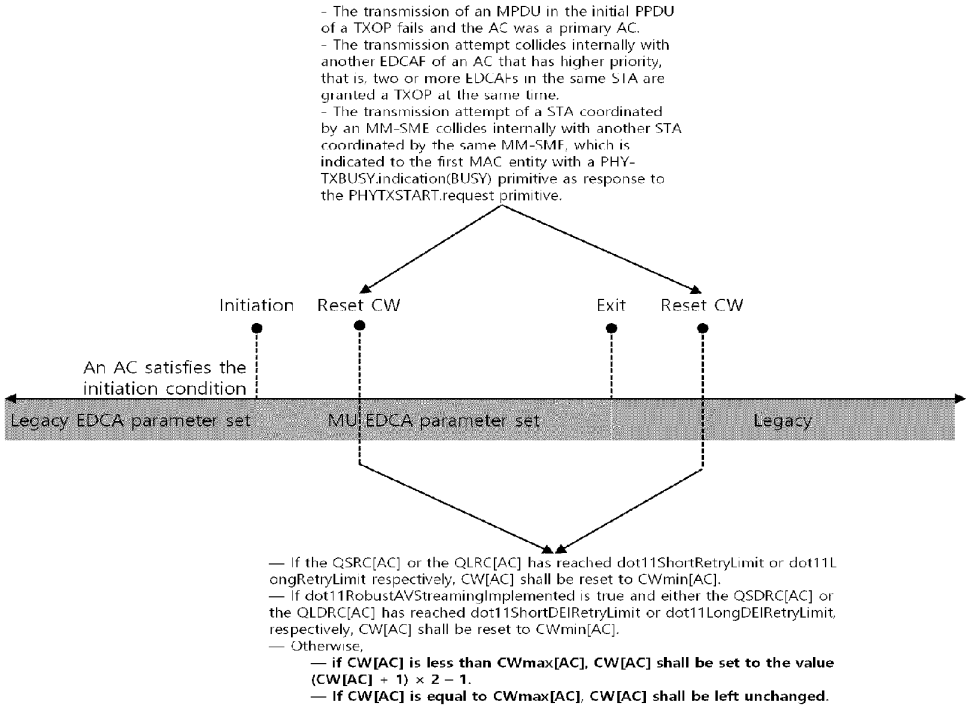
【도 4】


200
210
네트워크
인터페이스
카드
프로세서
메모리
220
260

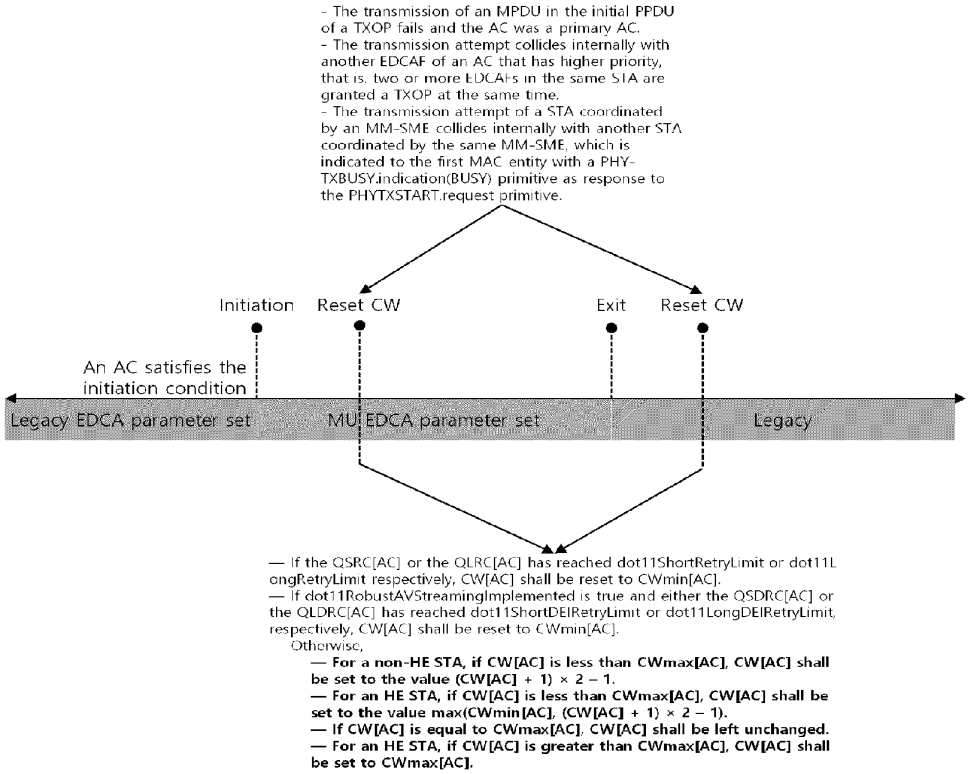
【도 5】


HEMUEDCATimer[AC]
MPDUs from an AC are aggregated in STA1's HE TRIG PPDU
Update EDCA parameters for the AC (Legacy → MU) Start MU EDCA timer
No additional successful UL MU transmission
Update EDCA parameters for the AC (MU→Legacy)
TF
HE TRIG PPDU
M-BA
Legacy mode
MU mode
Legacy mode

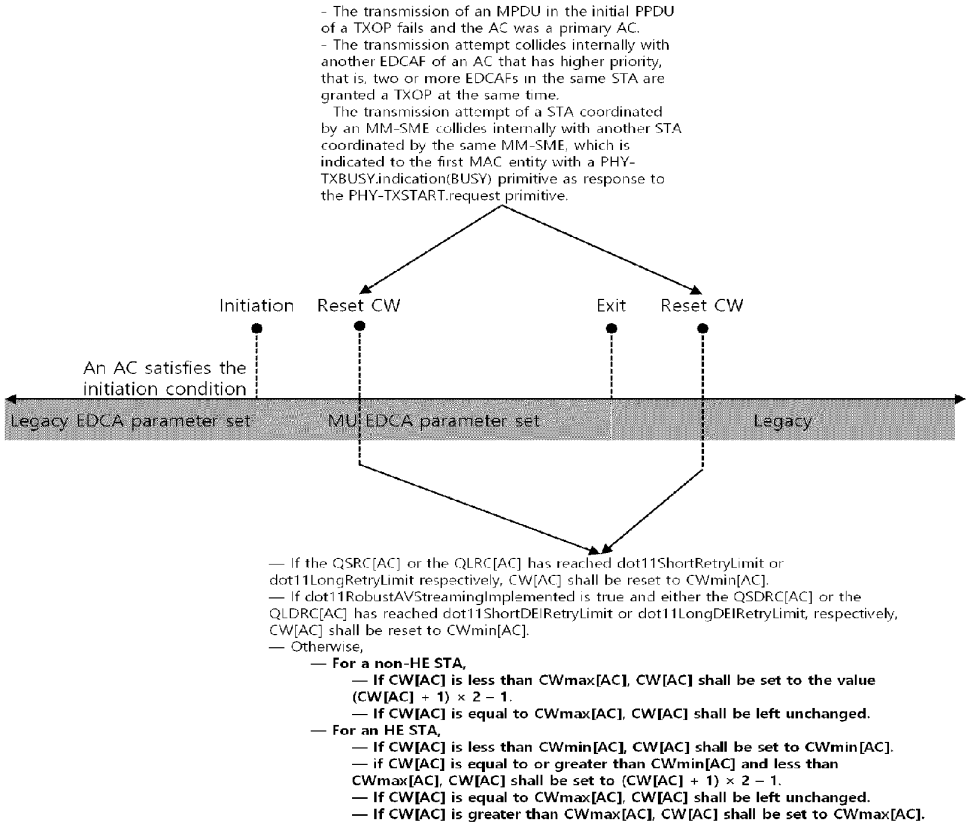
【도 6】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive.
Initiation
Reset CW
Exit
Reset CW
An AC satisfies the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDELRetryLimit or dot11LongDELRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.

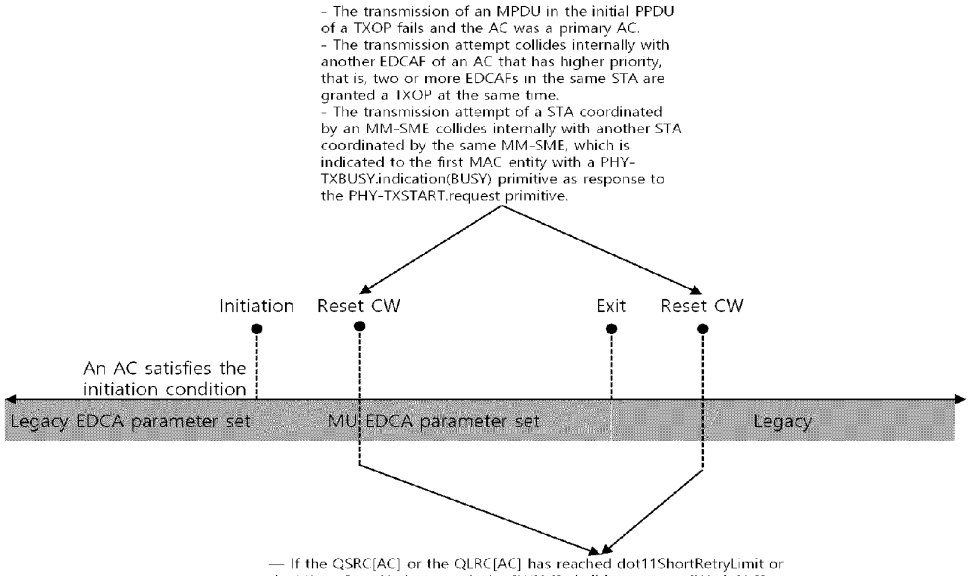
【도 7】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive.
Initiation
Reset CW
Exit
Reset CW
An AC satisfies the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDElRetryLimit or dot11LongDElRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
Otherwise,
— For a non-HE STA, if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— For an HE STA, if CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 − 1).
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— For an HE STA, if CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

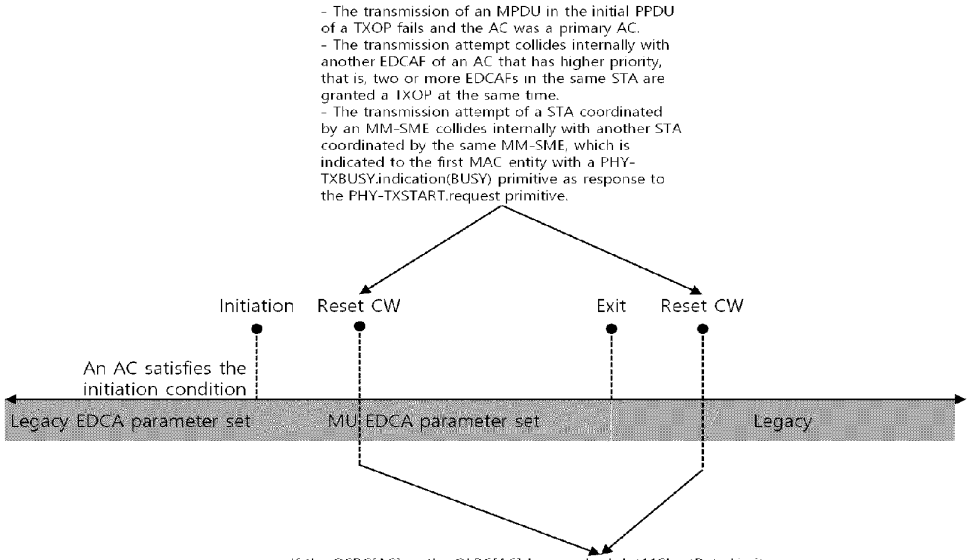
【도 8】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHY-TXSTART.request primitive.
Initiation
Reset CW
Exit
Reset CW
An AC satisfies the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— For a non-HE STA,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— For an HE STA,
— If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].
— if CW[AC] is equal to or greater than CWmin[AC] and less than CWmax[AC], CW[AC] shall be set to (CW[AC] + 1) × 2 − 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

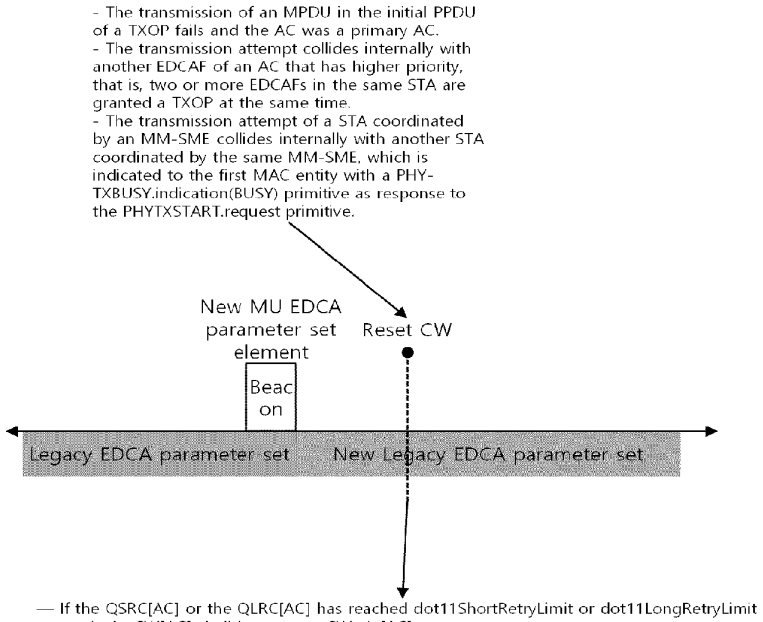
【도 9】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHY-TXSTART.request primitive.
Initiation
Reset CW
Exit
Reset CW
An AC satisfies the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— For a non-HE STA,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— For an HE STA,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 − 1).
— If CW[AC] is equal to or greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

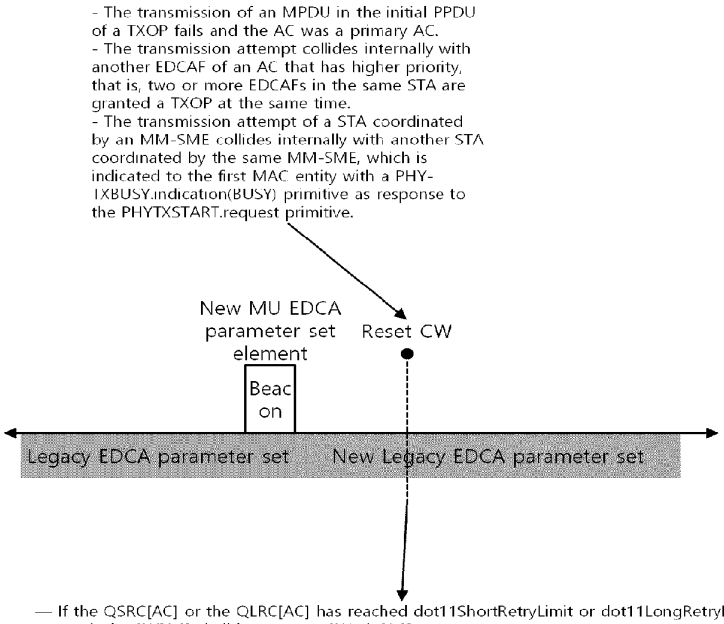
【도 10】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHY-TXSTART.request primitive.
Initiation
Reset CW
Exit
Reset CW
An AC satisfies the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— For a non-HE STA,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— For an HE STA,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 − 1).
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

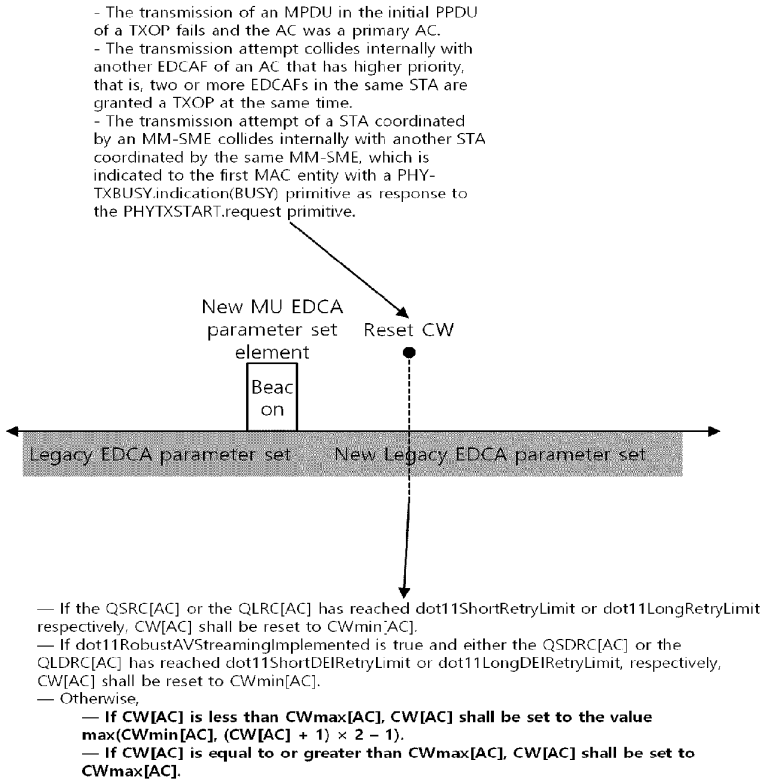
【도 11】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive.
New MU EDCA parameter set element
Reset CW
Beacon
Legacy EDCA parameter set
New Legacy EDCA parameter set
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].
— if CW[AC] is greater than CWmin[AC] and equal or less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1) × 2 − 1.
— If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【도 12】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive.
New MU EDCA parameter set element
Reset CW
Beacon
Legacy EDCA parameter set
New Legacy EDCA parameter set
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDELRetryLimit or dot11LongDELRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— If CW[AC] is less than CWmin[AC], CW[AC] shall be set to CWmin[AC].
— if CW[AC] is equal to or greater than CWmin[AC] and less than CWmax[AC], CW[AC] shall be set to (CW[AC] + 1) × 2 – 1.
— If CW[AC] is equal to CWmax[AC], CW[AC] shall be left unchanged.
— If CW[AC] is greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

【도 13】


- The transmission of an MPDU in the initial PPDU of a TXOP fails and the AC was a primary AC.
- The transmission attempt collides internally with another EDCAF of an AC that has higher priority, that is, two or more EDCAFs in the same STA are granted a TXOP at the same time.
- The transmission attempt of a STA coordinated by an MM-SME collides internally with another STA coordinated by the same MM-SME, which is indicated to the first MAC entity with a PHY-TXBUSY.indication(BUSY) primitive as response to the PHYTXSTART.request primitive.
New MU EDCA parameter set element
Reset CW
Beacon
Legacy EDCA parameter set
New Legacy EDCA parameter set
— If the QSRC[AC] or the QLRC[AC] has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].
— If dot11RobustAVStreamingImplemented is true and either the QSDRC[AC] or the QLDRC[AC] has reached dot11ShortDELRetryLimit or dot11LongDELRetryLimit, respectively, CW[AC] shall be reset to CWmin[AC].
— Otherwise,
— If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value max(CWmin[AC], (CW[AC] + 1) × 2 – 1).
— If CW[AC] is equal to or greater than CWmax[AC], CW[AC] shall be set to CWmax[AC].

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출 원 번 호 : 10-2016-0122488
Application Number

출 원 년 월 일 : 2016년 09월 23일
Filing Date Sep. 23, 2016

출 원 인 : 주식회사 윌러스표준기술연구소

Applicant(s) WILUS Institute of Standards and Technology Inc.

2021년 02월 19일

특 허 청
COMMISSIONER

재출 일자 : 2016-09-23

【서지사항】

【서류명】 특허출원서

【참조번호】 160129HEW

【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】 무선랜 광대역 환경에서 단말의 다중 사용자 전송 제어 방법

【발명의 영문명칭】 METHOD OF CONTROLLING MULTIUSER TRANSMISSION FOR STATIONS IN WIDEBAND WIRELESS LAN NETWORKS

【발명자】

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【성명의 영문표기】 Woojin AHN

【주민등록번호】 831010-1XXXXXX

【우편번호】 03410

【주소】 서울특별시 은평구 서오릉로13길 18-1

【국적】 KR

【발명자】

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【성명의 영문표기】 Juhyung SON

【주민등록번호】 770724-1XXXXXX

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【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1114동 302호

【국적】 KR

【발명자】

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【성명의 영문표기】 Jinsam KWAK

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【우편번호】 16021

【주소】 경기도 의왕시 내손중앙로 11 의왕내손이편한세상 1113동1704호

【국적】 KR

【발명자】

【성명】 고건중

【성명의 영문표기】 Geonjung KO

【주민등록번호】 860909-1XXXXXX

【우편번호】 16547

【주소】 경기도 수원시 영통구 동탄원천로915번길 36, 301동 606호 (주공그린빌 3단지)

【국적】 KR

【출원언어】 국어

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 R0166-16-1030

【부처명】 미래창조과학부

【과제관리(전문)기관명】 정보통신기술진흥센터

【연구사업명】 정보통신방송표준개발지원

【연구과제명】 IEEE802.11 High Efficiency WLAN (HEW) 표준개발

【기여율】 1/1

【과제수행기관명】 (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】 32 면 0 원

【우선권주장료】 0 건 0 원

【심사청구료】 0 항 0 원

【합계】 46,000 원

【감면사유】 소기업(70%감면)[1]

제출 일자 : 2016-09-23

【감면후 수수료】 13,800 원

재출 일자 : 2016-09-23

【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 다중 사용자 전송 제어 방법{METHOD OF CONTROLLING MULTIUSER TRANSMISSION FOR STATIONS IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 대

두되었다. 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 실시예에 따른 무선랜의 Enhanced Distributed Channel Access Function (EDCAF)의 동작을 도시하고 있다.

도 6은 본 발명의 다른 실시예에 따른 EDCAF의 동작 상황을 도시하고 있다.

도 7은 본 발명의 또다른 실시예에 따른 EDCAF의 동작 상황을 도시하고

있다.

도 8는 본 발명의 일 실시예에 따른 UL MU 전송 제어 방법을 도시하고 있다.

도 9는 본 발명의 일 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

도 10은 본 발명의 다른 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

도 11은 본 발명의 또다른 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

【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 구성이 특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한

다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

【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 인프라스트럭처 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭처 BSS를 나타내고 있다.

【0014】도 1에 도시된 바와 같이 인프라스트럭처 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 명세서에서는 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 인

터페이스 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 프로그램

이 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.

【0031】도 5는 본 발명의 실시예에 따른 무선랜의 Enhanced Distributed Channel Access Function (EDCAF)의 동작을 도시하고 있다.

【0032】무선랜에서는 데이터들의 서로다른 Quality of Service (QoS)에 따라 차등적인 전송 기회를 주기 위하여 네 개의 Access Class (AC) 별로 독립적인 EDCAF를 운영한다. EDCAF는 각기 할당된 AC 큐에서 데이터가 어느 시점에 채널 접속을 시도할지, 채널 접속 성공 시에 얼마만큼의 길이로 채널을 점유할지를 결정한다. AP가 Beacon 등을 통해 전송하는 EDCA Parameter Set element에 각 AC 별로 ECWmin, ECWmax, AIFSN, TXOP Limit 값을 전송하며 단말의 EDCAF는 해당 값들을 기반으로 동작한다.

【0033】 기본적으로 무선랜에서는 AC 큐에 데이터가 도착하면 각 EDCAF는 AC 별로 서로 다른 값을 가지는 AIFS[AC] (AIFSN[AC] x aSlotTime + aSIFSTime)의 시간을 대기한 후에 채널이 idle 한 경우에 접속을 시도할 수 있으나, 만약 전송에 실패하거나 데이터가 큐에 도착한 시점에 채널이 busy 하였을 경우에는 BackOff

(BO) Procedure를 호출하여 추가적인 대기시간을 더 거친 후에 접속을 시도할 수 있다. BO procedure가 호출되면 각 EDCAF가 현재 가지고 있는 Contention Window ([0, CW[AC]])의 범위에서 임의의 정수를 선택한 뒤에 선택한 backoff value[AC] x aSlotTime 만큼의 BO timer를 설정하여 대기한다. AC의 큐가 비어있고, 채널이 busy한 상태에서 데이터가 도착하여 BO value를 선택하는 상황에는 기존의 CW[AC] 값을 유지한 상태로 선택하지만, 만약 단말이 TXOP holder로서 데이터 전송을 성공한 시점에 primary AC에 대하여 BO value를 선택할 시에는 CW[AC] 값을 CWmin[AC] 값으로 reset 하며, 데이터 전송을 실패한 시점에 primary AC의 BO 값을 선택하거나, 동일 단말의 EDCAF 간 경쟁에서 internal collision이 발생한 경우에는 (CW[AC] + 1) x 2 -1 의 값으로 증가시킨다. 증가시킨 CW[AC]의 값이 단말이 현재 가지고 있는 CWmax[AC]보다 크거나 같을 경우에는 CWmax[AC] 값으로 유지해야 한다.

【0034】 각 EDCAF는 채널이 idle한 경우 BO timer를 slot 단위로 감소시키며 매 slot마다 채널 상태를 확인한다 (Clear Channel Assessment, CCA). 만약 slot 중간의 CCA 과정에서 다른 단말의 전송이 감지되었을 경우에는 EDCAF의 모든 동작을 중지하고 대기하고 다시 채널이 idle 해지면 AIFS[AC]를 대기한 후에 BO timer 감소를 재개한다. 반면에, CCA를 마친 각 slot의 boundary에서는 EDCAF가 수행할 수 있는 동작은 현재 네 가지로 정의되어 있으며, 네 가지 중 반드시 하나를 선택하여 수행해야 한다. 각 slot의 boundary에서, 1) BO timer가 0이 아니었을 경우에는 추가적인 한 slot 감소를 수행한다. 2) EDCAF 내부에 데이터가 존재하고, BO

timer가 0이며, 동일 단말 내의 더 높은 User Prioirty (UP) 를 갖는 다른 EDCAF가 데이터 전송을 시도 하지 않을 경우에는 전송 시퀀스를 개시한다. 3) EDCAF 내부에 데이터가 존재하고 BO timer가 0이며, 더 높은 UP의 EDCAF가 전송을 시도하는 경우에는 internal collision으로 정의되며 그에 따른 후속 시퀀스를 따른다. 4) 혹은, 정의되지 않은 조건에서 아무 동작을 수행하지 않을 수 있다.

【0035】현재 무선랜의 표준에서는 BO timer가 0이며 EDCAF에 데이터가 존재하지 않는 상황에서의 EDCAF의 slot boundary 동작을 정의하지 않고 있다. 해당 상황은 primary AC가 EDCAF 내에 있는 모든 데이터의 전송에 성공하였고, 그 시점에 선택한 BO timer (post BO)가 0에 도달하는 시점까지 상위 계층으로부터 추가적인 데이터의 도착이 없었을 경우에 발생할 수 있다. 또한 MU-MIMO 혹은 DL OFDMA를 이용한 DL MU 전송 상황에서 AP가 primary AC로 채널을 점유한 상황에서 primary AC 외의 다른 AC의 데이터를 함께 aggregation할 수 있다. 이 때, 함께 aggregation된 AC는 primary AC가 아니므로 BO timer가 남아있지만 EDCAF 내의 모든 데이터가 aggregation 되었을 경우, 빈 큐에 대해서 BO timer를 갖게 되며 남아있는 BO timer가 모두 소진 되는 시점까지 상위 계층으로부터 추가적인 데이터의 도착이 없었을 경우 해당 시점의 slot boundary 역시 BO timer가 0이지만 EDCAF에 데이터가 존재하지 않는 상황이 발생할 수 있다. 또한 UL OFDMA를 이용한 UL MU 상황에서는 UL 전송 단말 입장에서 primary AC가 존재하지 않으므로 HE trigger-based PPDU에 전송되는 모든 AC의 EDCAF가 위의 상황에 처할 수 있다. 또한, BA agreement가 있는 AC 중에서 하나의 (A-)MSDU가 남아있고 그것의 lifetime이 expired 되어서

discard된 경우에도 명시한 상황이 발생할 수 있다. 상기한 상황이 발생한 EDCAF에서 추가적인 BO procedure를 호출할 수행할 데이터가 없으므로 EDCAF 내의 모든 state variable을 현 상태로 유지하고 아무 동작을 수행하지 않는 것을 규칙으로 정의할 수 있다.

【0036】 도 6은 본 발명의 다른 실시예에 따른 EDCAF의 동작 상황을 도시하고 있다.

【0037】 도 5에서 서술한 상황에서 실시할 수 있는 또다른 동작 예로 EDCAF에 데이터가 없고 BO timer가 0에 도달한 경우에 또다시 BO procedure를 호출하도록 수 있다. 기존에 무선랜에서 정의되어있는, BO timer가 0인 slot boundary의 EDCAF 내부 동작 중의 하나로 BO procedure를 호출하는 것이 이미 정의되어 있으나, 그것은 internal collision에 의한 전송 실패 상황만을 가정하고 있기 때문에 BO valuc를 선택하기 직전에 CW를 doubling 하도록 정의되어있다. 그러나 본 실시예에서는 전송 실패에 의한 BO procedure 호출이 아니므로, BO procedure를 호출하되 CW value는 기존의 값을 그대로 유지하도록 할 수 있다. 본 실시예에 서술한 방법대로 BO procedure를 호출한 후에 새로 선택된 BO timer가 0에 도달하기까지 새로운 데이터의 도착이 없었을 경우에는 본 실시예의 동작을 다시 반복할 수 있다.

【0038】 도 7은 본 발명의 또다른 실시예에 따른 EDCAF의 동작 상황을 도시하고 있다.

【0039】 도 5에서 서술한 BO timer가 0이며 EDCAF에 데이터가 존재하지 않는

상태를 발생시킬 수 있는 상황들 중에서 post BO에 의해 발생하는 상황에서는 전송 성공에 의하여 CW[AC] 및 short retry counter (QSRC[AC]), long retry counter (QLRC[AC])가 reset되기 때문에 EDCAF의 초기 상태와 같은 조건에서 동작을 멈추고 새로운 데이터가 도착하였을 때 동작을 시작할 수 있다. 그러나 post BO가 아닌 UL/DL MU와 같은 다른 상황은 11ax에서 발생할 가능성이 높고 기존의 무선랜에서는 희박하게 발생하는 상황이었기 때문에 EDCAF 내부 파라미터들에 대한 설정 규칙이 정의되지 않았다. 따라서 명시한 상황에서 기존에 큰 값의 CW 값을 가지고 있었을 경우, 데이터가 없는 상태로 일정 시간을 유휴상태로 보냈음에도 불구하고 새로운 데이터가 EDCAF에 도착하였을 때 큰 값의 BO timer를 뽑을 가능성이 높아짐에 따라 다른 단말 및 EDCAF와의 경쟁에서 손해를 볼 수 있다. 따라서 위의 문제를 보완하기 위하여 EDCAF에 데이터가 없고 BO timer가 0에 도달한 경우에 EDCAF를 initialize하라는 규칙을 지정할 수 있다. EDCAF의 initialization은 EDCAF의 내부 파라미터들을 초기값으로 되돌리는 것을 의미하므로 CW를 초기값인 CWmin으로 설정하는 것을 의미한다. 추가적으로 QSRC, QLRC 역시 초기값인 0으로 설정할 수 있다. EDCAF가 초기화 된 후에는 아무 동작을 하지 않고 멈출 수 있지만, 구현의 방법 중의 하나로 도 7에서 명시한 것과 같이 새로 BO procedure를 호출할 수 있다. 그러나 이 상황 역시 internal collision에 의한 실패 상황이 아니므로 CW를 doubling하지않고 초기화된 상태 그대로 BO procedure를 호출해야 한다. 또한 도 7의 실시예와 같이 또다시 같은 상황이 반복될 경우 반복적으로 BO procedure를 호출할 수도 있다. 다만, 채널이 idle하고 새로운 데이터가 EDCA에 도착하지 않는 시간이 길

어질 경우, EDCAF 내부 파라미터가 이미 초기화된 상태에서 BO timer가 0에 도달할 때마다 불필요하게 반복적으로 EDCAF 초기화 명령을 내릴 수 있으므로, EDCAF 내부 파라미터가 초기값이 아닌 경우에만 초기화를 진행한다는 조건을 추가할 수 있다. 만약 본 EDCAF가 초기화 상태이며 BO timer가 0이고, EDCAF에 데이터가 존재하지 않을 경우에는 도 6의 실시예와 같은 조건으로 BO procedure를 호출할 수 있다. 이 경우에도, 도 6의 실시예와 같이 CW는 기존에 남아있는 값을 그대로 이용해야 한다.

【0040】 도 8는 본 발명의 일 실시예에 따른 UL MU 전송 제어 방법을 도시하고 있다.

【0041】 11ax에서는 단말이 자신의 물리적인 송/수신 파라미터를 조절할 수 있고 수신 단말 측에서의 효과적인 동작을 위하여 자신의 송/수신 파라미터 변경 상황을 알리는 방법을 정의하고 있다. 11ax 단말은 MAC 헤더 중에서 HT-control field의 HE variant의 일종인 Operation Mode Indication(OMI) element를 통해 자신의 송/수신 파라미터를 알린다. OMI를 전송한 OMI initiator는 OMI의 수신 대상인 OMI responder로부터 immediate response를 수신한 뒤에 송/수신 파라미터를 변경할 수 있다. OMI의 subfield 중에서 UL MU disable subfield가 있고 이 subfield가 활성화 되었을 경우, OMI initiator는 UL MU disable subfield가 비활성화된 OMI를 전송하기 전까지는 UL MU 전송에 참여하지 않는다. OMI responder 단말은 UL MU disable subfield가 비활성화된 OMI를 송신한 OMI initiator 단말을 UL MU 전송에 스케줄링 하여서는 안된다. 또한, UL MU disable subfield가 활성화된 OMI를 전

송한 단말은 DL MU 상황의 HE MU PPDU 안에 자신을 수신자로 하는 MPDU가 MMPDU이거나 QoS Control field의 Ack policy subfield가 MU ACK 등으로 설정된 MPDU인 경우 UL MU 형태의 immediate response를 전송할 수 없다. 따라서 OMI responder 단말은 UL MU disable subfield가 활성화된 OMI를 전송한 OMI initiator에게 HE MU PPDU를 이용하여 DL MU 전송을 할 시에, 해당 단말에게 전송되는 A-MPDU에 Action frame, trigger frame, UL MU response scheduling이 포함된 MPDU, QoS control field의 Ack policy field가 MU Ack으로 설정된 MPDU 등 UL MU 형태의 response를 요구하는 MPDU를 aggregation 하여서는 안된다.

【0042】 도 9는 본 발명의 일 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

【0043】 현재 11ax에서는 UL MU로 전송된 HE TRIG PPDU가 immediate response를 요구할 시에 HE MU PPDU 형태로 다수의 단말에게 BA을 전송하는 것을 허용하고 있다. 또한 11ax에서 정의된 M-BA는 하나의 MAC 프레임에 다수의 단말에 대한 ACK정보를 포함할 수 있기 때문에 하나의 HE MU PPDU 안에 group addressed M-BA와 individually addressed M-BA가 혼재할 수 있다. 따라서, group addressed M-BA가 할당된 RU에 대해서는 HE MU PPDU의 프리앰블의 HE SIG-B field에 broadcast AID를 기재하고, individually addressed M-BA가 할당된 RU에 대해서는 각 단말의 AID를 삽입하여야 한다. 만약, 두 개 이상의 서로 다른 group addressed M-BA가 하나의 HE MU PPDU에 전송될 경우, 서로 다른 RU에 대하여 두 개 이상의 broadcast AID 정보가 프리앰블의 HE SIG-B에 기재되게 되고, Ack을 수신하여야 하

는 UL MU 참여 단말은 자신의 AID가 HE SIG-B에 존재하지 않는 경우, 두 개 이상의 broadcast AID 가리키는 RU 중에서 자신의 Ack 정보가 어디에 속하는지를 알 수 없다. 따라서, 위와 같은 문제점을 해결하기 위하여, 하나의 HE MU PPDU에 두 개 이상의 서로 다른 M-BA가 전송되는 경우, group addressed M-BA는 반드시 하나만 존재해야 한다. 또한 각 M-BA들은 M-BA의 대상이 되는 UL MU 참여 단말들이 HE TRIG PPDU를 전송한 RU가 포함된 20MHz 채널에 M-BA를 전송하여야 한다.

【0044】 도 10은 본 발명의 다른 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

【0045】 만약 11ax에서 정의하고 있는 MU cascading의 형태로 연속적인 전송을 하는 경우, HE MU PPDU 안에 group addressed M-BA가 전송된다면 broadcast AID가 이미 하나의 RU에 할당되었기 때문에, 다른 RU에 group addressed A-MPDU를 전송하는 것이 불가능하다. 만약 다른 RU에 group addressed Trigger Frame 등을 전송할 수 있을 경우, MU cascading 전송의 효율을 더욱 높일 수 있으므로, 상기한 문제점을 해결하기 위하여 group addressed response를 위한 broadcast AID를 별도로 지정할 수 있다. HE MU PPDU를 수신하는 단말은 두 개 이상의 RU에서 자신을 대상으로 하는 A-MPDU를 수신할 수 없도록 정의되어 있기 때문에, 상기한 방법을 이용할 경우, HE MU PPDU로부터 response를 수신하여야 하는 단말은 HE-SIG-B field에서 자신의 AID 혹은 group addressed response를 위하여 지정된 AID가 할당된 RU를 통하여 Ack 정보를 수신할 수 있다. 만약 HE MU PPDU에서 Ack 수신이 예정되어 있지 않은 단말들은 HE-SIG-B field에서 자신의 AID 혹은 일반 broadcast AID를 찾

아서 해당되는 RU에서 자신의 data 혹은 group addressed trigger frame 등을 수신하는 것이 가능하다.

【0046】 도 11은 본 발명의 또다른 실시예에 따른 HE MU PPDU 구성 방법을 도시하고 있다.

【0047】 하나의 HE MU PPDU에서 group addressed M-BA와 M-BA가 아닌 다른 group addressed A-MPDU를 수신하기 위한 다른 방법으로 RU allocation의 index 순서를 이용할 수 있다. 현재 11ax의 HE-SIG-B의 RU allocation signaling은 다양한 크기의 RU들의 조합 패턴마다 고유한 signaling 번호를 부여하고, 호출된 signaling의 패턴에서 명시하고 있는 RU의 순서대로 AID 값이 할당된다. 가령, HE MU PPDU HE-SIG-B 안에 두 개의 broadcast AID가 있는 경우, HE-SIG-B에 우선적으로 기재되어있는 broadcast AID를 group addressed M-BA를 위한 RU로 설정하고, 후에 기재되어있는 broadcast AID를 M-BA가 아닌 group addressed 데이터로 암시적으로 지정하는 방식으로 이용하거나, 반대의 순서로 이용할 수 있다. 만약, 두 개의 broadcast addressed AID가 서로 다른 20MHz 채널에 할당되었을 경우에는 무선랜의 channel bonding 규칙의 순서를 우선으로 한다.

【0048】 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.

【0049】 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】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-09-23

【요약서】

【요약】

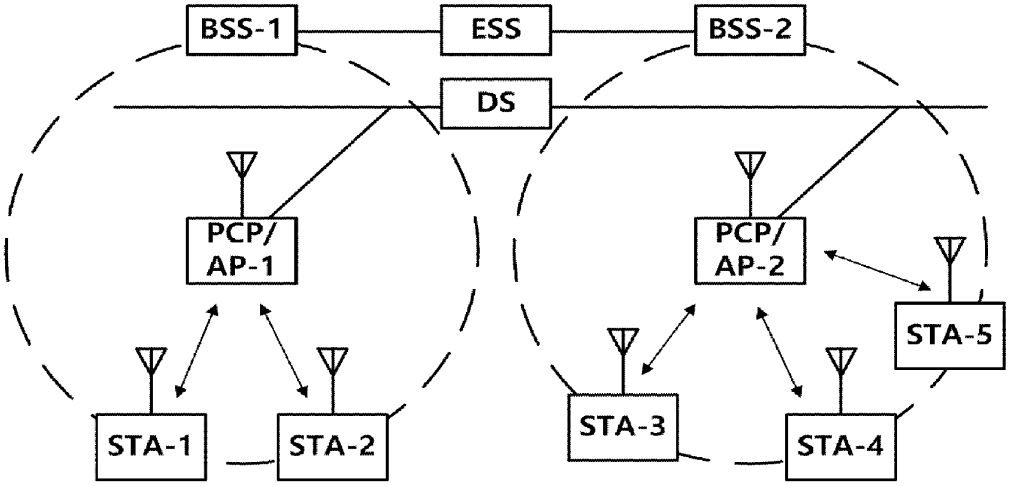
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 다중 사용자 전송 제어 방법이 제공될 수 있다.

【대표도】

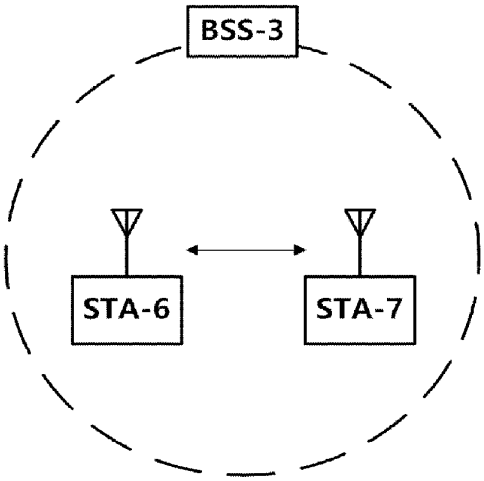
도 7

【도면】

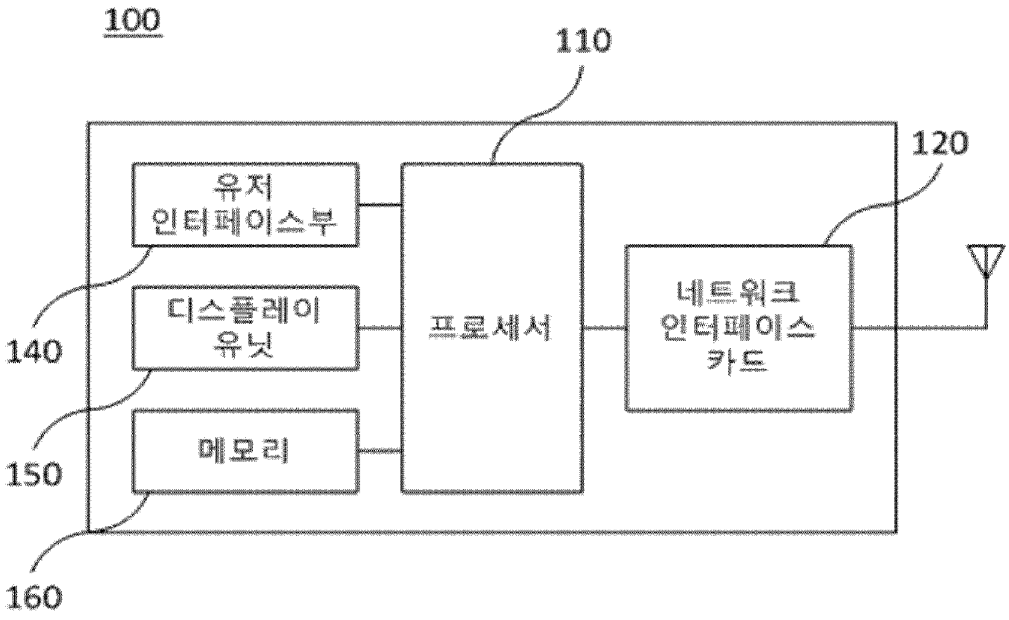
【도 1】


BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

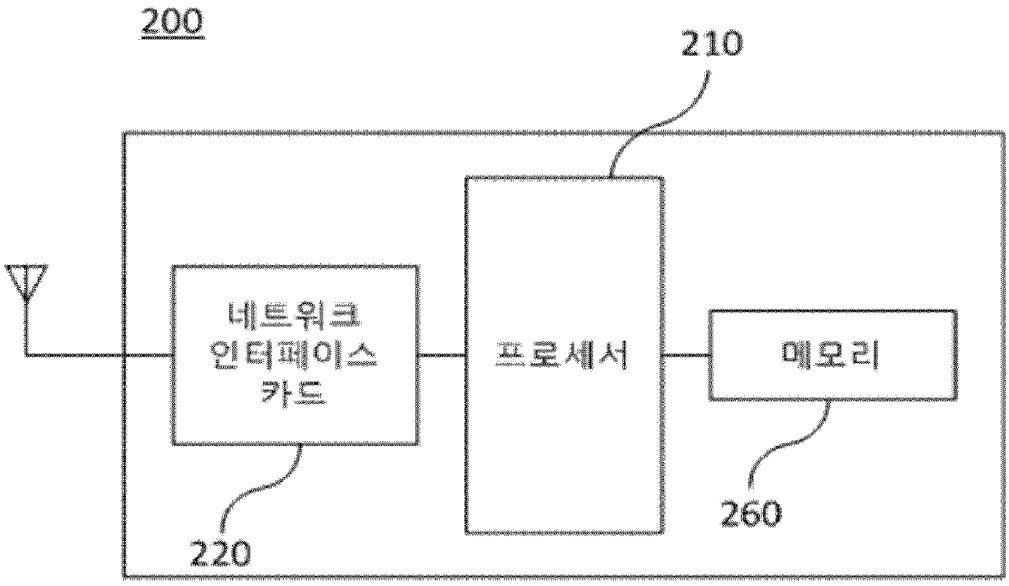
【도 2】


BSS-3
STA-6
STA-7

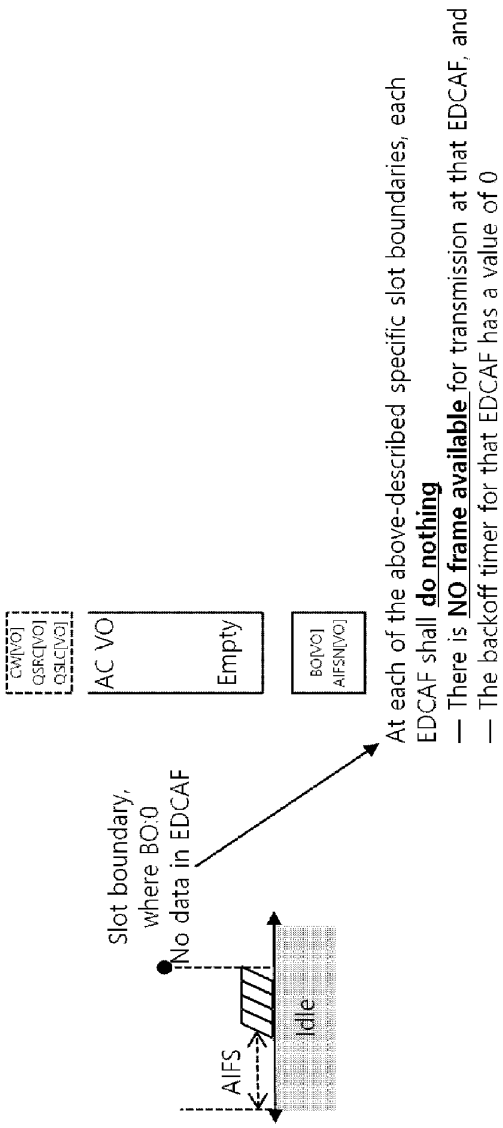
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
메모리
프로세서
네트워크
인터페이스
카드
140
150
160

【도 4】



【도 5】


CW[VO]
QSRC[VO]
QSLC[VO]
AC VO
Empty
BO[VO]
AIFSN[VO]
Slot boundary,
where BO:0
No data in EDCAF
AIFS
Idle
At each of the above-described specific slot boundaries, each EDCAF shall do nothing
— There is NO frame available for transmission at that EDCAF, and
— The backoff timer for that EDCAF has a value of 0

41-31

【도 6】

2) At each of the above-described specific slot boundaries, each EDCAF shall **invoke backoff procedure**

— There is **NO frame available** for transmission at that EDCAF, and

— The backoff timer for that EDCAF has a value of 0

If the backoff procedure is invoked for reason 2) above, the value of CW[AC] shall be left unchanged.

41-33

【도 7】

3) At each of the above-described specific slot boundaries, each EDCAF shall **initialize EDCAF**

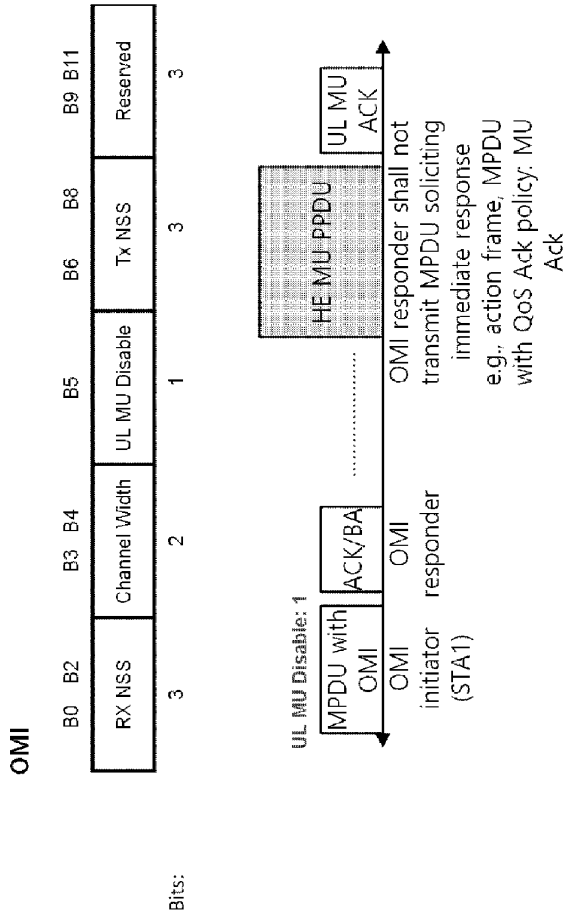
— There is **NO frame available** for transmission at that EDCAF, and

— The backoff timer for that EDCAF has a value of 0

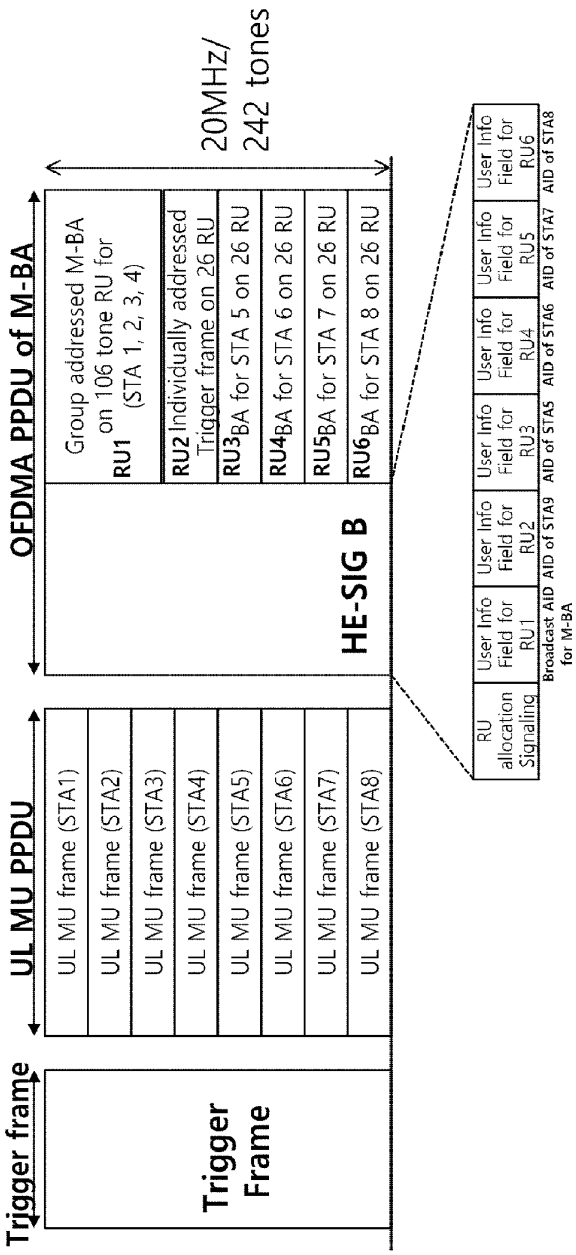
Note: If the EDCAF is initialized for reason 3) above, the EDCAF may(shall) invoke BO procedure

→ If the backoff procedure is invoked for reason 3) above, the value of CW[AC] shall be left unchanged.

【도 8】

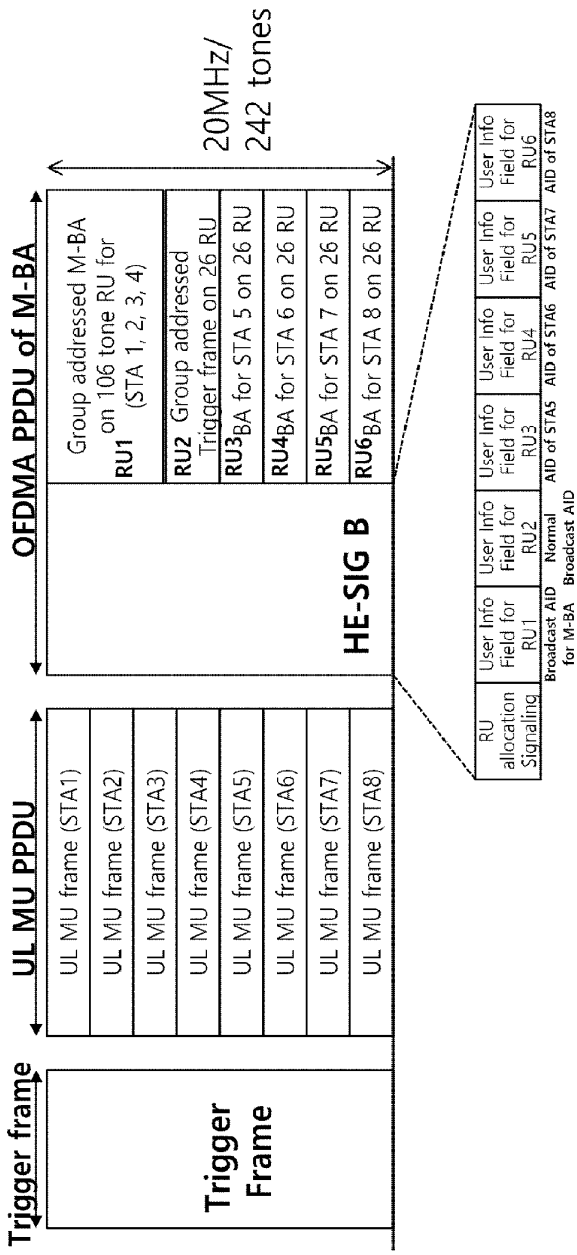

OMI
B0 B2
B3 B4
B5
B6 B8
B9 B11
RX NSS
Channel Width
UL MU Disable
Tx NSS
Reserved
Bits:
3
2
1
3
3
UL MU Disable: 1
MPDU with OMI
ACK/BA
HE MU PPDU
UL MU ACK
OMI initiator (STA1)
OMI responder
OMI responder shall not transmit MPDU soliciting immediate response e.g., action frame, MPDU with QoS Ack policy: MU Ack

【도 9】


Trigger frame
Trigger Frame
UL MU PPDU
UL MU frame (STA1)
UL MU frame (STA2)
UL MU frame (STA3)
UL MU frame (STA4)
UL MU frame (STA5)
UL MU frame (STA6)
UL MU frame (STA7)
UL MU frame (STA8)
OFDMA PPDU of M-BA
HE-SIG B
Group addressed M-BA on 106 tone RU for RU1 (STA 1, 2, 3, 4)
RU2 Individually addressed Trigger frame on 26 RU
RU3 BA for STA 5 on 26 RU
RU4 BA for STA 6 on 26 RU
RU5 BA for STA 7 on 26 RU
RU6 BA for STA 8 on 26 RU
20MHz/ 242 tones
RU allocation Signalling
User Info Field for RU1
User Info Field for RU2
User Info Field for RU3
User Info Field for RU4
User Info Field for RU5
User Info Field for RU6
Broadcast AID for M-BA
AID of STA9
AID of STA5
AID of STA6
AID of STA7
AID of STA8

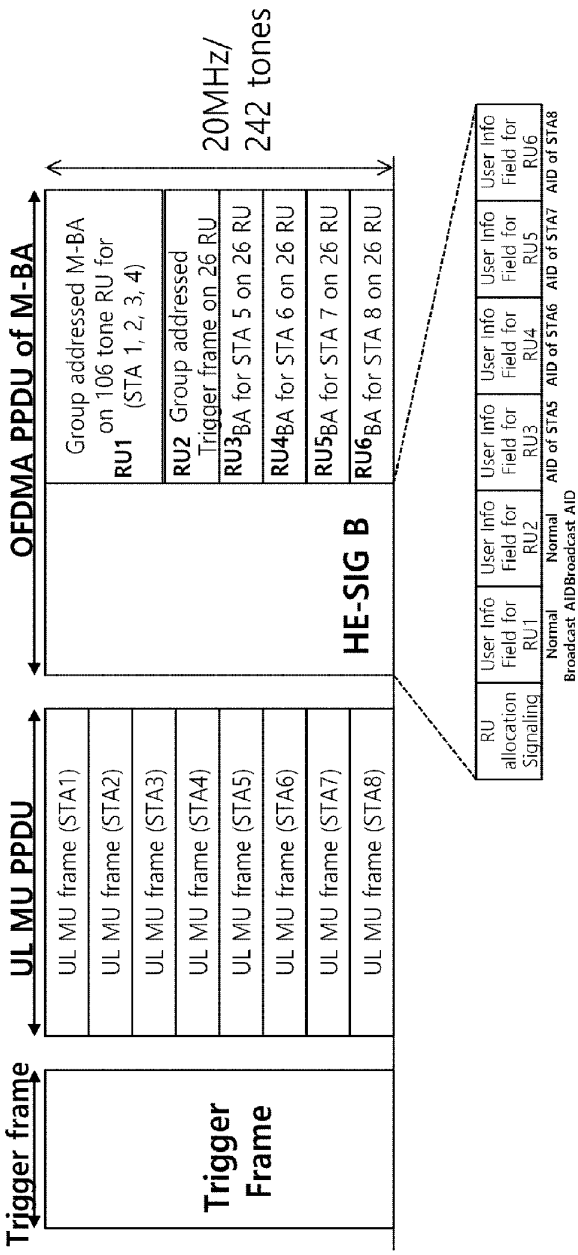
41-37

【도 10】


Trigger frame
UL MU PPDU
OFDMA PPDU of M-BA
20MHz/
242 tones
Trigger Frame
UL MU frame (STA1)
UL MU frame (STA2)
UL MU frame (STA3)
UL MU frame (STA4)
UL MU frame (STA5)
UL MU frame (STA6)
UL MU frame (STA7)
UL MU frame (STA8)
HE-SIG B
Group addressed M-BA on 106 tone RU for (STA 1, 2, 3, 4)
RU1
RU2 Group addressed Trigger frame on 26 RU
RU3BA for STA 5 on 26 RU
RU4BA for STA 6 on 26 RU
RU5BA for STA 7 on 26 RU
RU6BA for STA 8 on 26 RU
RU allocation Signalling
User Info Field for RU1
User Info Field for RU2
User Info Field for RU3
User Info Field for RU4
User Info Field for RU5
User Info Field for RU6
Broadcast AID
Normal
AID of STA5
AID of STA6
AID of STA7
AID of STA8
for M-BA
Broadcast AID

41-39

【도 11】



Preceding broadcast AID is for M-BA

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(DAS)

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【발명의 영문명칭】 METHOD OF CONTROLLING TRANSMISSION FOR UPLINK MULTIUSER TRANSMISSION ACCESS IN WIDEBAND WIRELESS LAN NETWORKS

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【발명의 설명】

【발명의 명칭】

무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 접속 제어 방법 {METHOD OF CONTROLLING TRANSMISSION FOR UPLINK MULTIUSER TRANSMISSION ACCESS IN WIDEBAND WIRELESS LAN NETWORKS}

【기술분야】

【0001】 본 발명은 전송 효율을 향상시키기 위한 방법으로서, 더욱 상세하게는 무선랜에서 향상된 채널 접속 방법을 제안하여 전송 효율을 향상시키는 다양한 방법, 장치 및 시스템에 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 대

두되었다. 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 발명의 실시예에 따르면, 전송 효율을 향상시킬 수 있는 방법을 제공한다. 본 발명은 무선랜을 이용하는 스테이션 내지 액세스 포인트, 셀룰러 통신을 이용하는 스테이션 내지 기지국 등 다양한 통신 디바이스에 사용 가능하다.

【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 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

도 7은 본 발명의 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 8은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 9는 본 발명의 또 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

도 10은 본 발명의 일 실시예에 따른 MU EDCA parameter set의 탈출 조건을 도시하고 있다.

【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 구성이

특정 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다. 이에 더하여, 특정 임계값을 기준으로 "이상" 또는 "이하"라는 한정 사항은 실시예에 따라 각각 "초과" 또는 "미만"으로 적절하게 대체될 수 있다.

【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 인프라스트럭처 BSS(infrastructure BSS)와 독립 BSS(Independent BSS, IBSS)로 구분될 수 있으며, 도 1은 이 중 인프라스트럭처 BSS를 나타내고 있다.

【0014】도 1에 도시된 바와 같이 인프라스트럭처 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 명세서에서는 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 인터페

이스 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 프

로그램을 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.

【0031】도 5는 본 발명의 일 실시예에 따른 다중 사용자 상향 전송시의 EDCA parameter 제어방법을 도시하고 있다.

【0032】무선랜에서는 각 단말에 전송할 데이터가 있을 경우 바로 전송을 시도하지 않고 각 트래픽이 속한 AC 별로 지정된 대기 시간 (AIFS[AC])을 거친 후에 전송을 시도한다. 또한, 만약 채널이 busy 상태였다가 idle로 전환이 되었을 때에는 지정된 대기시간에 추가적으로 Backoff timer (BO) 값을 설정하여 timer 만큼 더 대기 하였다가 전송을 시도한다. 상기한 BO 값 역시 AC 별로 독립적으로 관리되며, 각 AC 별로 서로 다른 Contention Window (CW[AC])의 범위에서 임의의 값으로 선택된다.

【0033】802.11ax에서는 OFDMA를 이용한 다중 사용자 상향 전송 (UL MU)이 채택되었으며, 기존의 전송기법과 다르게 다중 사용자 상향 전송에서는 데이터를 전송하는 각 단말이 아닌 AP가 Trigger Frame을 전송함으로써 전체 전송과정이 시작된다. 다중 사용자 상향 전송을 위한 전송시도를 AP가 함에따라 UL MU에 참여하는 단말들은 UL MU 전송과 무관하게 기존의 동작대로 전송을 위한 경쟁을 시도하며, AP의 TF를 수신하게되면 경쟁 동작을 멈추고 AP의 지시에 따라 UL MU 전송을 시작한다. 11ax의 동작에 따르면 UL MU 전송이 각 단말들의 경쟁 동작에 전혀

영향을 미치지 않기 때문에 단말들은 동일한 트래픽에 대해서 각자의 SU 전송 시도와 AP의 TF 전송 시도의 중복된 전송 기회를 갖게되어 기존의 무선랜 단말에 비해 높은 경쟁 우위를 점할 수 있다는 문제가 발생할 수 있다. 또한 AP가 특정 단말의 트래픽을 UL MU를 위해 UL MU 전송에 스케쥴링 한 뒤에 TF 전송을 시도하는 경우, 동일한 트래픽에 대해 AP와 단말이 동시에 경쟁을 하는 상황이 발생하여 결과적으로 채널 상에서 충돌이 발생하는 확률을 증가시킬 수 있다.

【0034】상기한 두 가지 문제점을 해결하기 위한 방법으로 UL MU 전송에 참여하는 단말이 기존 상황보다 더 낮은 확률로 채널에 접속을 시도하도록 하는 별도의 MU EDCA parameter set으로 경쟁에 참여하도록 할 수 있다. MU EDCA parameter set에는 각 AC 별로 AIFS[AC]의 길이를 결정하는 AIFSN[AC] 값과 CW[AC] 범위를 결정하는 CWmin[AC], CWmax[AC] 값 등이 포함될 수 있다. MU EDCA parameter set은 기존에 사용하고 있는 Legacy EDCA parameter set을 사용하는 단말들보다 더 낮은 확률로 채널에 접속하도록 값이 수정되어 있을 수 있다. MU EDCA parameter set은 Information element의 형태로 Beacon 등에 포함되어 전송될 수 있으며 BSS 내의 단말들에게 전달된 후 각 단말이 특정 조건을 만족할 시에 MU EDCA parameter 기반으로 동작을 시작(initiation) 하도록 할 수 있다. 또한 특정 조건에 의하여 다시 기존의 Legacy EDCA parameter set으로 돌아가도록 하는 것 역시 가능하다. 또 다른 방법으로 MU EDCA parameter set 자체가 하나의 Action 혹은 Action No Ack 프레임으로 동작되어 단말들에게 전송될 수 있다.

【0035】 도 6은 본 발명의 실시예에 따른 MU EDCA parameter set 적용 방법을 도시하고 있다.

【0036】 각 단말에서 MU EDCA parameter set이 특정 조건에 의하여 initiation 된 경우, 해당 단말의 모든 AC에 대하여 EDCA parameter set이 변경될 수 있지만, 만약 특정 AC 만이 조건을 만족하는 경우에는 해당 AC에 대해서만 MU EDCA parameter set 기반으로 동작하도록 할 수도 있다. MU EDCA parameter set은 기본적으로 UL MU 전송에 스케쥴링 될 것으로 예상되는 트래픽이 대상이 되므로, 스케쥴링 예정에 없는 AC의 트래픽의 경우는 기존의 접속 확률에 따라 SU 전송을 시도하는 것이 보장되어야 한다. 이 때, 단말 내부 스케쥴링 동작 구현에 따라 현재 낮은 BO timer를 보유하고 있는 AC가 MU EDCA parameter set 기반으로 동작하는 것을 의도적으로 방지하고 큰 BO timer를 지닌 AC의 트래픽만을 UL MU 전송에 스케쥴링 되도록 유도하여 자신의 접속 확률을 상대적으로 높이려는 동작을 시도를 할 수도 있다. 이를 방지하기 위하여 단말의 특정 트래픽이 MU EDCA parameter set 동작의 대상이 되는 경우, 현재 접속 대기 시간이 가장 짧은 primary AC를 반드시 MU EDCA parameter set에 포함시키도록 하는 추가적인 규칙을 지정할 수도 있다. 이 때 primary AC를 지정하는 기준은 남아있는 BO timer와 AIFS[AC] 값의 합이 될 수 있으며 다른 방법으로 남아있는 BO timer 값이 기준이 될 수도 있다. 만약 하나 이상의 AC가 같은 접속 대기 시간으로 설정된 경우에는 해당 AC가 모두 MU EDCA parameter set를 기반으로 동작해야 한다.

【0037】도 7은 본 발명의 일 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0038】MU EDCA parameter set을 활성화하는 또다른 방법으로 basic TF 내의 user info. field에서의 스케쥴링된 단말에 대하여 MU EDCA parameter set 기반의 동작으로 하도록 유도할 수 있다. 상기한 방법은 TF가 채널에 접속한 시점부터 MU EDCA parameter set을 활성화할 수 있기 때문에 해당 시점에 처음으로 MU EDCA parameter set를 활성화하는 단말에 대해서는 채널 접속 확률 감소 효과를 즉시 얻을 수 없다는 단점을 지니고 있지만, UL MU 전송이 실질적으로 실시되는 단말에 대해서만 MU EDCA parameter set를 적용시킬 수 있고, 별도의 오버헤드를 발생시키지 않는다는 장점이 있다. 또한 실제 HE TRIG PPDU 전송을 유도하는 단말외에 다음 차수의 TF에 실질적으로 스케쥴링될 단말들에 대한 스케쥴링 정보를 user info. Field에 삽입하여 알림으로서 상기한 단점을 보완할 수 있다. 가령, 하나의 user info. field에 다음 TF에 스케쥴링될 단말의 AID와 RU indication 시그널링 방법 중에서 reserved 상태인 하나의 indication을 다음 TF 스케쥴링을 지시하는 특정 시그널링으로 지정하는 방법이 사용될 수 있다. 이 경우, RU indication은 다수의 reserved 시그널을 이용하여 MU EDCA parameter set가 활성화되는 AC를 직접적으로 알리는 방법이 사용될 수도 있으며, 실질적인 RU 위치를 알리는 용도로 쓰이지는 않는다. 이 밖에도 UL MU scheduling 관련 효율을 높일 수 있는 추가적인 정보들이 기존의 user info. field와 다른 해석의 형태로 존재할 수 있으며, 나머지 user info. field의 값들은 dummy의 형태로 해석될 수 있다. Dummy data를 줄이기 위한

또다른 방법으로 다음 차수의 TF scheduling을 알리는 특정 RU indication 시그널이 user info. field에 명시되었다면 dummy data부분이 삭제된 compressed user info. field로 해석하도록 지정할 수 있다. 상기한 방법의 형태로 다수의 user info. field가 존재할 수 있으며 호출된 단말은 MU EDCA parameter set을 활성화해야 한다. 또다른 방법으로 하나의 user info. field에 scheduling 단말을 bitmap 형태로 알려서 user info. field 반복에 의한 오버헤드를 감소시킬 수 있다. 이 경우, bitmap이 포함된 user info. field의 AID는 group AID 혹은 broadcast AID이며 특정 RU indication 시그널링이 사용될 수 있다. 또한 해당 user ifno. Field는 일반적인 user info. field와 다른 size로 구성될 수 있다. User info. field가 MU EDCA parameter set의 시작 조건이 되는 경우, 데이터의 전달 여부가 MU EDCA parameter set 시작을 위하 추가적인 조건이 될 수 있다. 따라서, TF에 의해서 HE TRIG PPDU를 전송한 후에 그에 응답하는 AP의 M-BA의 전송이 존재하는 경우에 한하여 MU EDCA parameter set 적용을 시작할 수 있다. M-BA를 받은 후에 HE TRIG PPDU에 포함하여 전송한 모든 AC에 대하여 MU EDCA parameter set을 적용할 수 있지만, 만약 데이터 전송이 실패했을 경우 각 단말의 추가적인 SU 전송이 보장되어야 하므로, HE TRIG PPDU에 전송된 AC 중에서 특정 AC가 M-BA에서 BA/ACK 정보를 수신하였다면 그 AC를 제외하고 MU EDCA parameter set 적용을 시작하는 것도 가능하다. 추가적인 조건으로 만약 HE TRIG PPDU에 포함된 특정 단말의 QoS data가 QoS control field에서 해당 AC의 queue 안에 더 이상 데이터가 없음을 report 하였다면 더 이상 UL MU에 스케쥴링 될 가능성이 없으므로 MU EDCA parameter set 적용에서 제외

할 수도 있다.

【0039】 도 8은 본 발명의 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0040】 basic TF 외에도, BSR poll과 같은 TF-variant나 HE-variant HT-control field의 UL MU response scheduling에 의해서 HE TRIG PPDU가 전송되는 경우에 해당 PPDU 안에 특정 단말의 QoS Data 혹은 QoS Null 등이 전송된 경우, 해당 AC에 대하여 MU EDCA parameter set 적용을 시작하는 것 역시 가능하다. 이 때 TF variant에 의한 HE TRIG PPDU에는 ACK/BA가 뒤따르지 않기 때문에, M-BA의 수신 여부가 적용조건에 포함되지 않으며, MU EDCA parameter set 적용 시작 시점 역시 HE TRIG PPDU 송신 직후 시점이 될 수 있다.

【0041】 도 9는 본 발명의 또 다른 실시예에 따른 MU EDCA parameter set의 initiation 조건을 도시하고 있다.

【0042】 TF에서는 user info. field 에서 AID 필드에 AID 0을 명시함으로써 할당된 RU에 임의의 단말의 random access를 지시할 수 있다. 해당 random access RU에 특정 단말이 경쟁을 성공하여 UL MU 전송에 참여하고 M-BA를 수신하였을 경우, 해당 단말은 UL MU를 위한 resource를 부여받았으며 HE TRIG PPDU에서 추가적인 scheduling을 위한 BSR을 전송하였다고 판단할 수 있으므로 MU EDCA parameter set의 적용을 시작하도록 할 수 있다. Random access에 성공한 단말 역시 HE TRIG PPDU에 전송 성공한 AC 혹은 M-BA를 성공적으로 전송받은 AC에 한하여 MU EDCA parameter set를 적용하도록 할 수 있다. Random access의 경우 M-BA에 해

당 단말에 대한 per AID TID field가 하나도 존재하지 않을 경우, HE TRIG PPDU가 손상된 것인지, random access 충돌이 일어난 것인지 판단할 수 없으므로 MU EDCA parameter set 적용을 시작하지 않을 수 있다.

【0043】 도 10은 본 발명의 일 실시예에 따른 MU EDCA parameter set 탈출 조건을 도시하고 있다.

【0044】 MU EDCA parameter set는 단말이 다른 단말과 동등한 조건으로 SU 전송을 위한 접속을 하는 것을 제한하기 때문에 UL MU 스케쥴링이 불확실할 경우 기존의 Legacy EDCA parameter set으로 동등하게 접속할 수 있도록 하는 탈출 조건이 필요하다. MU EDCA parameter set의 탈출 조건으로 TF에 의한 scheduling에 timer를 설정할 수 있다. (timer 값은 MU EDCA parameter set element안에 포함되어 단말에게 전송될 수 있다.) 따라서 TF에 의해 UL MU에 참여한 단말은 M-BA 수신 완료 시점에 timer를 시작하여 timer가 만료되는 시점까지 추가적인 TF에 의한 스케쥴링이 없었을 경우 스스로 MU EDCA parameter set를 탈출하여 SU 전송을 위한 경쟁에 참여할 수 있다. 이 때 UL MU에 참여한 단말은 HE TRIG PPDU에 BSR이 포함된 MPDU를 전송하였기 때문에 다음 TF에도 스케쥴링될 것을 기대할 수 있으나, 만약 특정 AC 혹은 BSR을 전송한 모든 AC가 empty 였던 관계로 BSR을 empty로 report 한 경우에는 이후에 추가적인 스케쥴링을 기대할 수 없으므로 해당 AC에 대하여 M-BA 수신 시점 이후에 timer 설정 없이 바로 legacy EDCA pararmeter set으로 전환할 수 있다. 만약 M-BA를 수신하지 않는 non basic variant TF에 의한 UL MU 전송이었을 경우에는 HE TRIG PPDU 송신 완료 시점부터 MU EDCA parameter set 탈출을

위한 timer를 시작할 수 있다.

【0045】 만약 M-BA가 수신되지 않았을 경우에는 M-BA timeout을 지정하여 해당 시점을 기준으로 MU EDCA parameter set 탈출 타이머를 시작할 수 있다. M-BA timeout은 ME-TRIG PPDU 송신 이후에 (aSIFSTime) + aRxPHYStartDelay + (2x aSlotTime) 등의 시간이 자난 시점으로 지정할 수 있다.

【0046】 전송 M-BA 수신 및 non-basic variant TF에 의한 탈출 timer 값과 M-BA를 수신하지 못한 상황에서의 탈출 timer의 값은 서로 다를 수 있다. 만약 M-BA를 수신하지 못한 상황에서의 timer값이 다르게 설정되는 경우, 그 타이머의 값은 MU EDCA parameter set에 전송되는 timer의 값에서 고정된 상수배가 곱해진 형태로 설정될 수 있다.

【0047】 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.

【0048】 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 해석되

어야 한다.

【특허청구범위】

【청구항 1】

무선랜을 위한 방법, 장치 및 시스템.

재출 일자 : 2016-09-12

【요약서】

【요약】

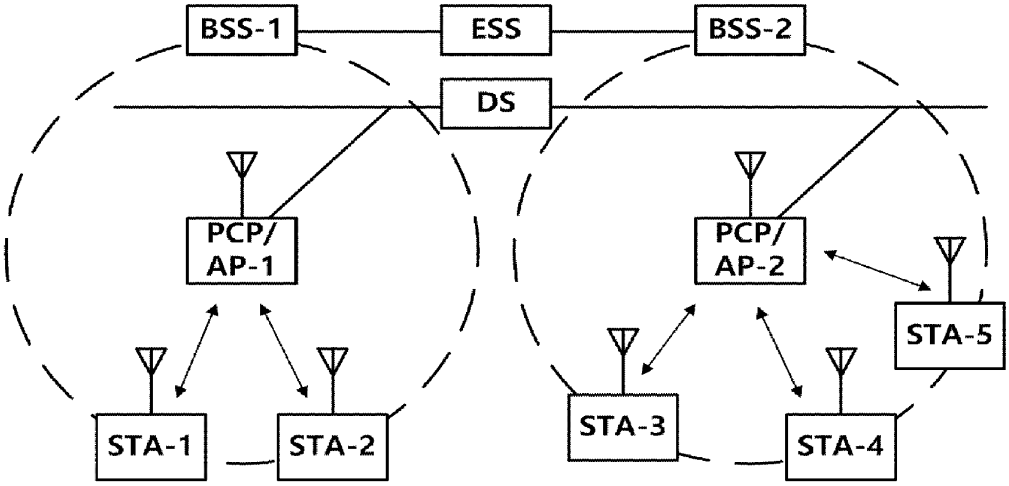
본 발명은 무선랜을 위한 장치, 시스템 및 무선랜 통신 방법에 관한 것으로, 본 발명의 실시예에 따르면 무선랜 광대역 환경에서 단말의 다중 사용자 상향 전송 접속 제어 방법이 제공될 수 있다.

【대표도】

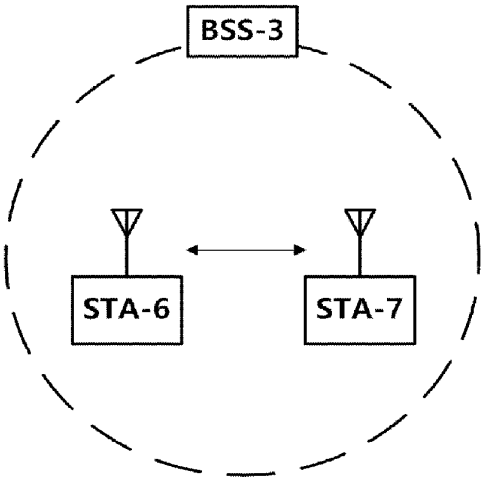
도 7

【도면】

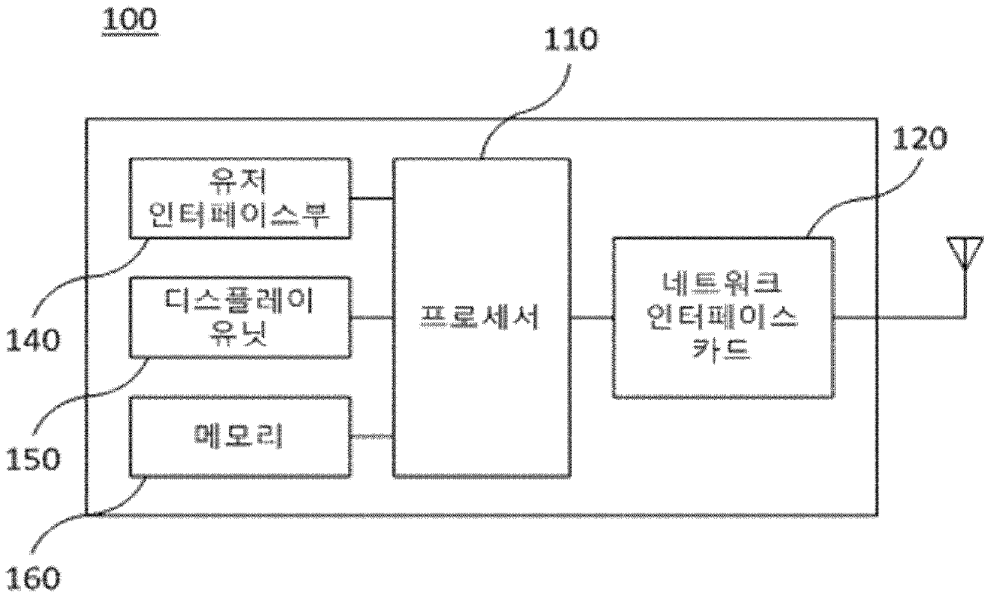
【도 1】


BSS-1
ESS
BSS-2
DS
PCP/
AP-1
PCP/
AP-2
STA-5
STA-1
STA-2
STA-3
STA-4

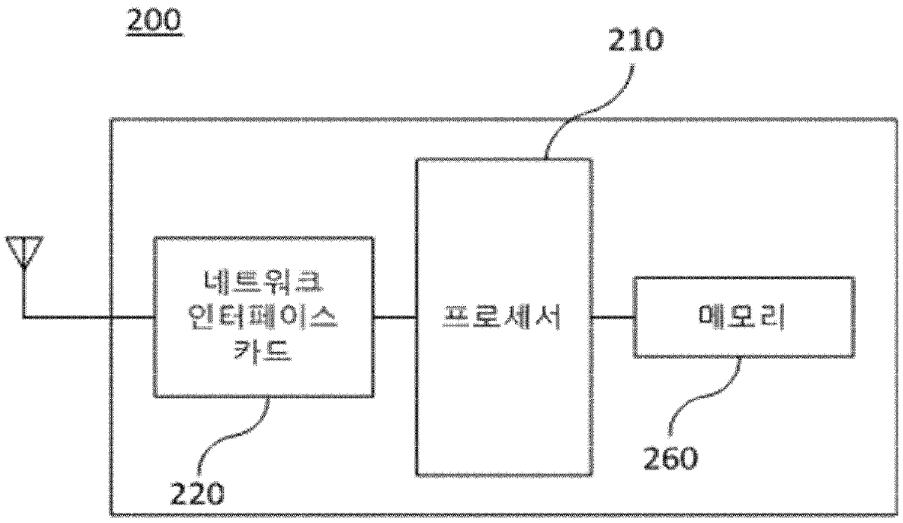
【도 2】


BSS-3
STA-6
STA-7

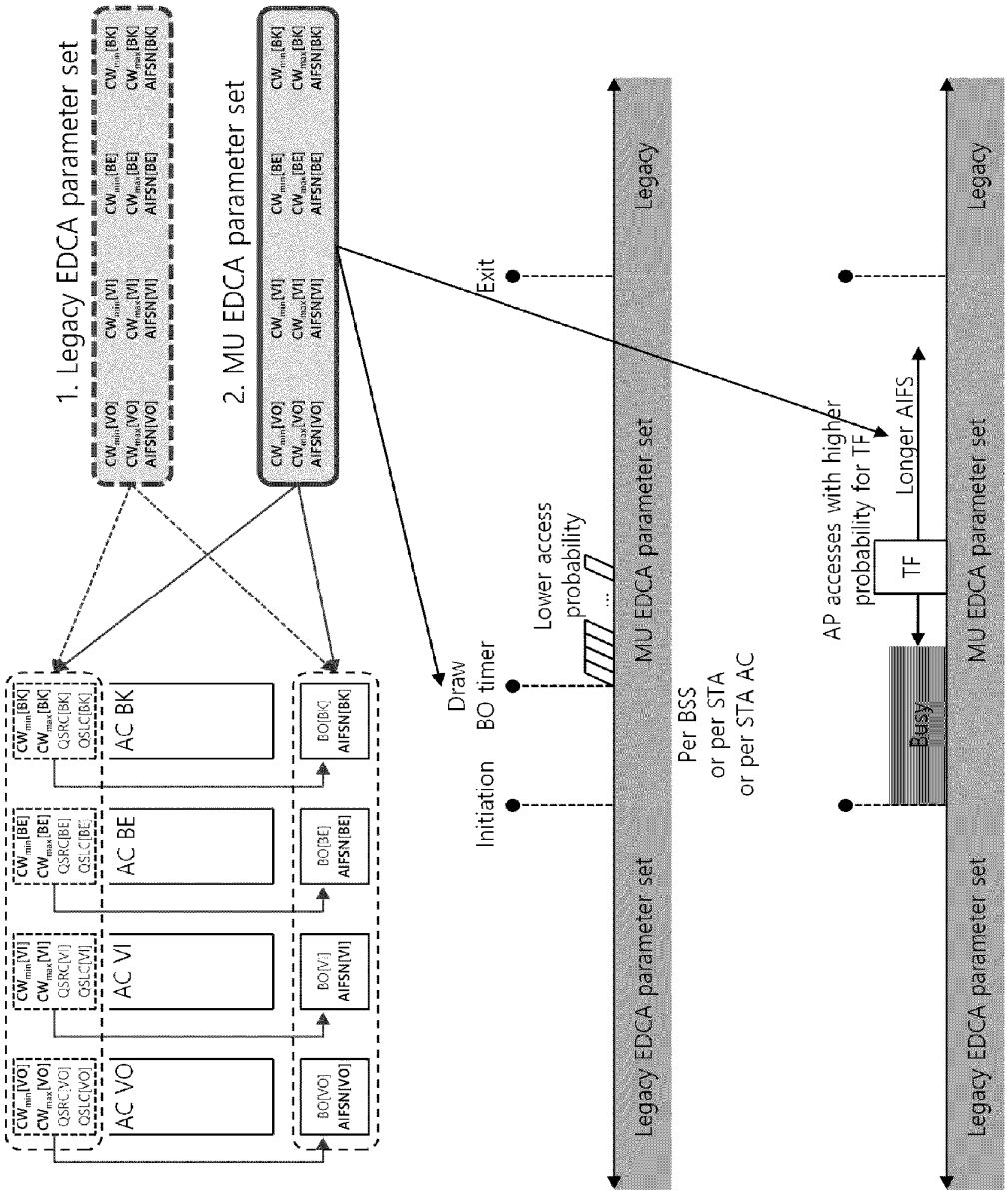
【도 3】


100
110
120
유저
인터페이스부
디스플레이
유닛
프로세서
네트워크
인터페이스
카드
140
150
메모리
160

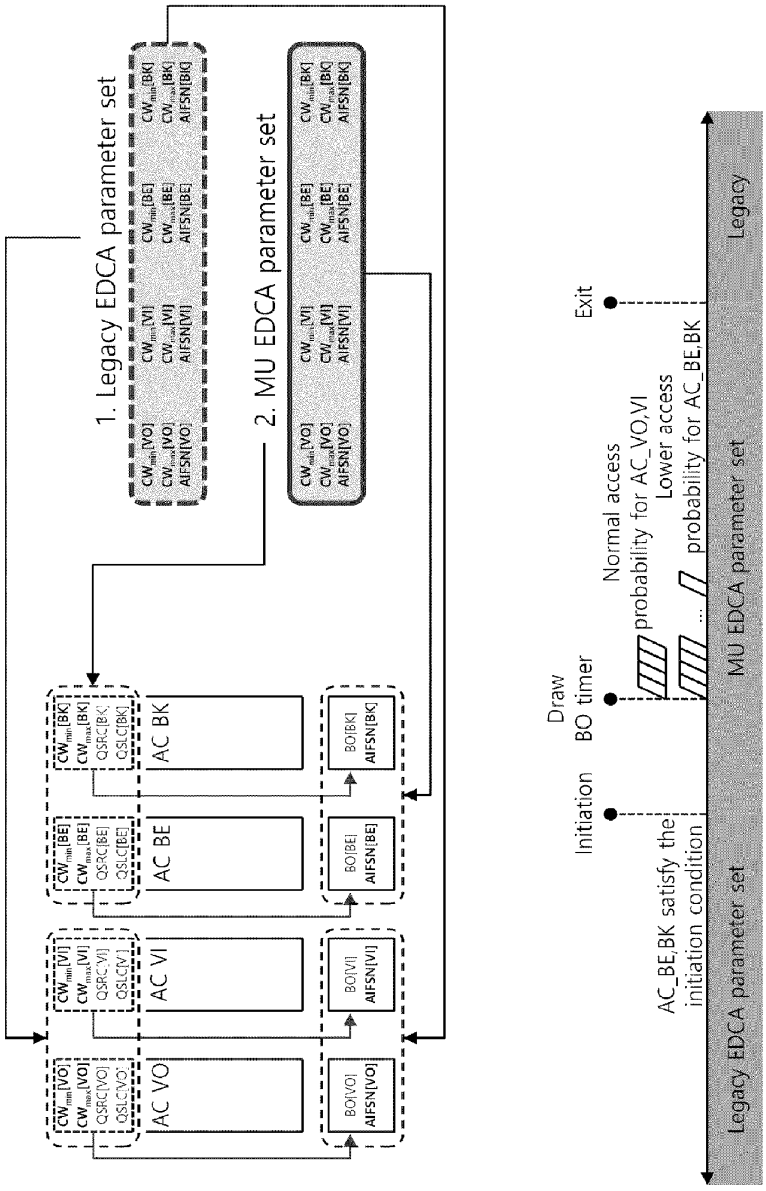
【도 4】



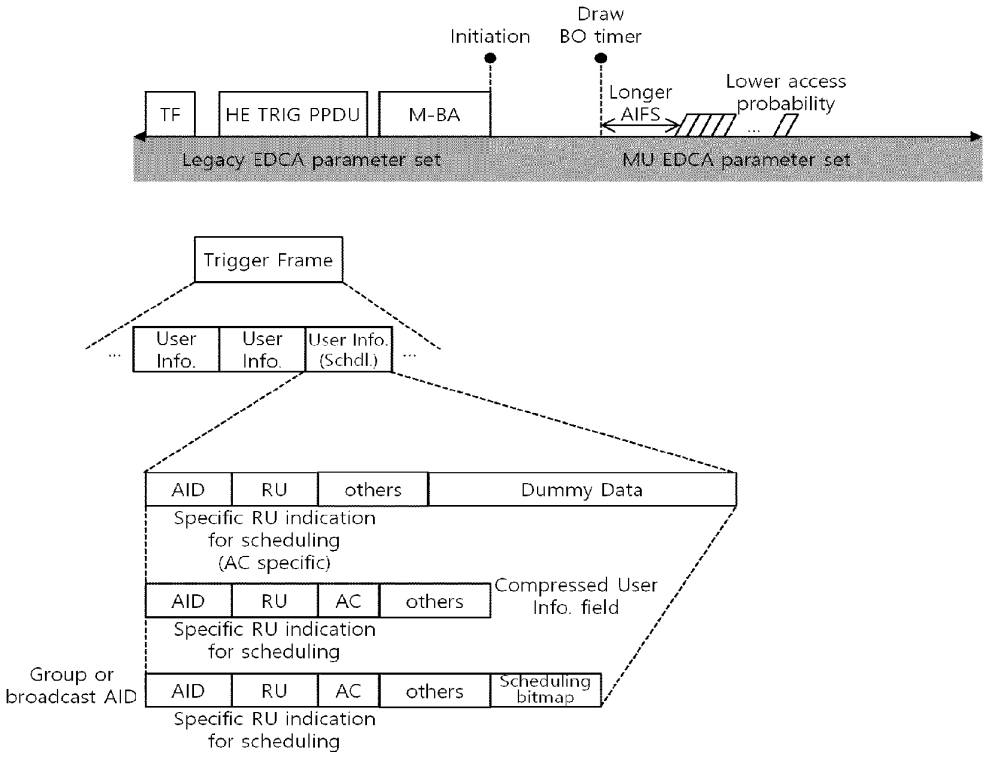
【도 5】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Draw
BO timer
Initiation
Lower access probability
Per BSS
or per STA
or per STA AC
Exit
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
AP accesses with higher probability for TF
Longer AIFS
TF
Busy

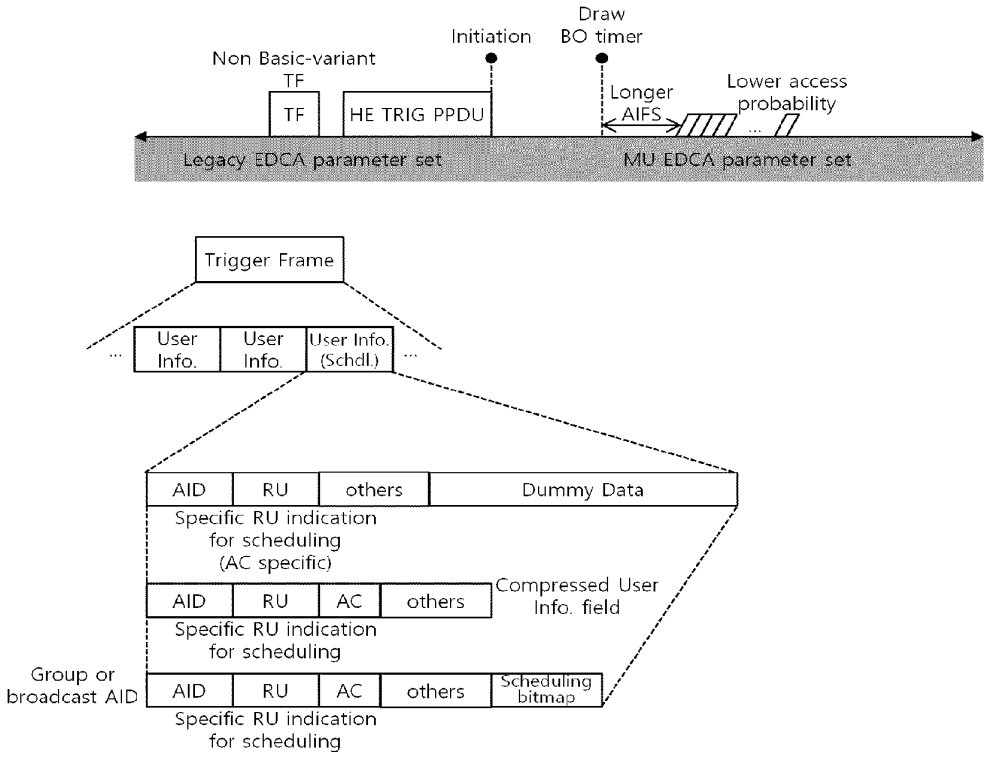
【도 6】


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Draw BO timer
Initiation
AC_BE,BK satisfy the initiation condition
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
Exit
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

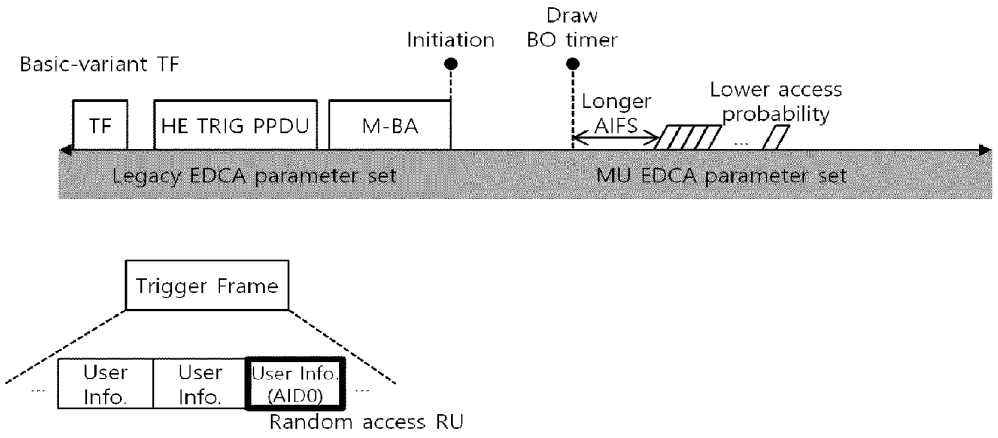
【도 7】


Initiation
Draw
BO timer
TF
HE TRIG PPDU
M-BA
Longer
AIFS
Lower access
probability
Legacy EDCA parameter set
MU EDCA parameter set
Trigger Frame
User
Info.
User
Info.
User Info.
(Schdl.)
AID
RU
others
Dummy Data
Specific RU indication
for scheduling
(AC specific)
AID
RU
AC
others
Compressed User
Info. field
Specific RU indication
for scheduling
Group or
broadcast AID
AID
RU
AC
others
Scheduling
bitmap
Specific RU indication
for scheduling

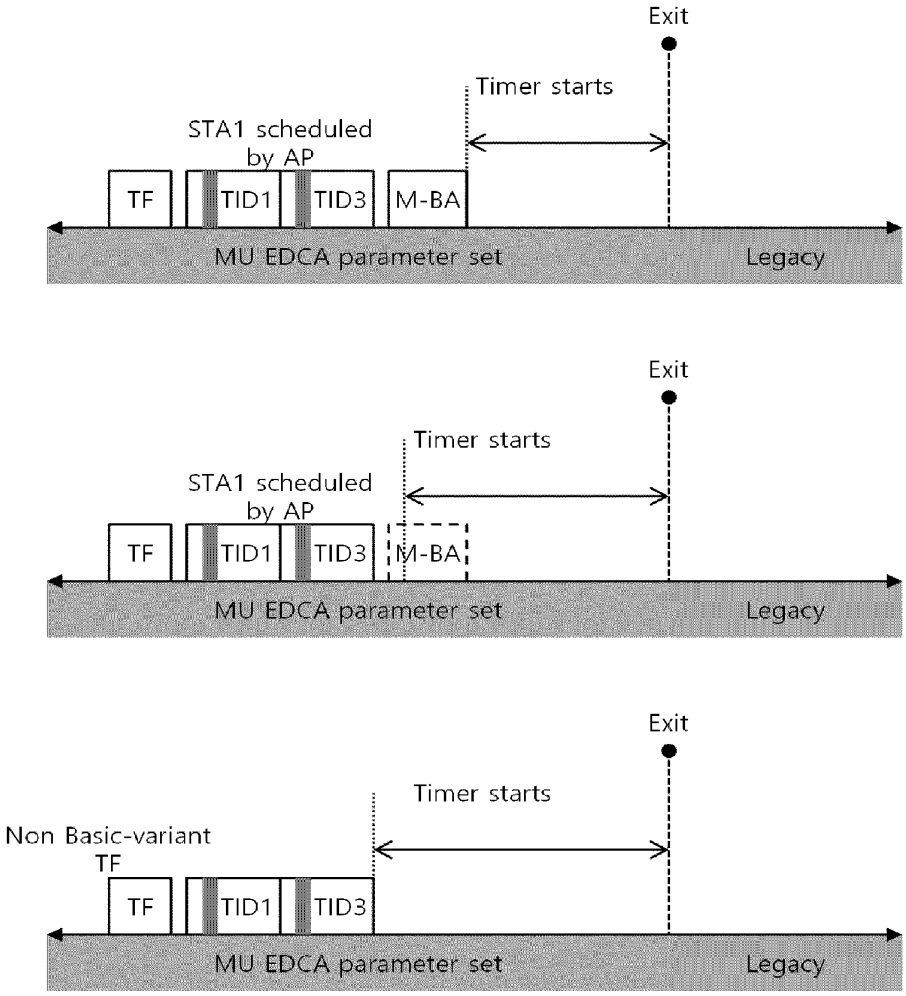
【도 8】


Draw
BO timer
Initiation
Non Basic-variant
TF
TF
HE TRIG PPDU
Longer
AIFS
Lower access
probability
Legacy EDCA parameter set
MU EDCA parameter set
Trigger Frame
User
Info.
User
Info.
User Info.
(Schdl.)
AID
RU
others
Dummy Data
Specific RU indication
for scheduling
(AC specific)
AID
RU
AC
others
Compressed User
Info. field
Specific RU indication
for scheduling
Group or
broadcast AID
AID
RU
AC
others
Scheduling
bitmap
Specific RU indication
for scheduling

【도 9】


Draw
BO timer
Initiation
Basic-variant TF
Longer
AIFS
Lower access
probability
TF
HE TRIG PPDU
M-BA
Legacy EDCA parameter set
MU EDCA parameter set
Trigger Frame
User
Info.
User
Info.
User Info.
(AID0)
Random access RU

【도 10】


Exit
Timer starts
STA1 scheduled by AP
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
Exit
Timer starts
STA1 scheduled by AP
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
Exit
Timer starts
Non Basic-variant TF
TF
TID1
TID3
MU EDCA parameter set
Legacy

Document Description: Application Data Sheet to update/correct info
Doc Code: ADS.CORR

CORRECTED ADS FORM

Application Number	16294883
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Inventor Information

****If no data is shown, no data has been corrected****

	Data of Record	Updated Data
Order Number		
Name		
Residence Information		
Residency		
City		
State		
Country of Residence		
Mailing Address of Inventor		
Address 1		
Address 2		
City,State/Province, Postal Code		
Country		

Corrected ADS 1.0

Document Description: Application Data Sheet to update/correct info
Doc Code: ADS.CORR

Application Information

	Data of Record	Updated Data
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	
Attorney Docket Number	B-9905CON 631950-4	
Entity Type	Regular Undiscounted	

Domestic Benefit/National Stage Information

****If no data is shown, no data has been corrected****

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121,365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S. C. 119(e) or 120, and 37 CFR 1.78(a).

		Data of Record	Updated Data
	Prior Application Status		
	Application Number		
	Continuity Type		
	Prior Application Number		
	Filing Date (YYYY-MM-DD)		
	Patent Number		
	Issue Date (YYYY-MM-DD)		

Foreign Priority Information

Document Description: Application Data Sheet to update/correct info
Doc Code: ADS.CORR

****If no data is shown, no data has been corrected****

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

		Data of Record	Updated Data
	Application Number	10-2016-0114822	
	Country	KR	
	Filing Date	2016-09-07	
	Access Code		FB73
		Data of Record	Updated Data
	Application Number	10-2016-0116877	
	Country	KR	
	Filing Date	2016-09-10	
	Access Code		DA4F
		Data of Record	Updated Data
	Application Number	10-2016-0116965	
	Country	KR	
	Filing Date	2016-09-12	
	Access Code		255B

Corrected ADS 1.0

		Data of Record	Updated Data
	Application Number	10-2016-0117898	
	Country	KR	
	Filing Date	2016-09-13	
	Access Code		690A

		Data of Record	Updated Data
	Application Number	10-2016-0122488	
	Country	KR	
	Filing Date	2016-09-23	
	Access Code		CF5E

		Data of Record	Updated Data
	Application Number	10-2016-0147189	
	Country	KR	
	Filing Date	2016-11-06	
	Access Code		A22D

		Data of Record	Updated Data
	Application Number	10-2017-0022227	
	Country	KR	
	Filing Date	2017-02-20	
	Access Code		7DB2

Applicant Information

****If no data is shown, no data has been corrected****
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.

	Data of Record	Updated Data

Corrected ADS 1.0

Document Description: Application Data Sheet to update/correct info
Doc Code: ADS.CORR

Applicant Type		
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		
Applicant is an Organization		
Name		
Organization Name		
Address 1		
Address 2		
City,State/Province,Postal Code		
Country		
Phone Number		
Fax Number		
Email Address		

Assignee Information including Non-Applicant Assignee Information

****If no data is shown, no data has been corrected****
Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office

	Data of Record	Updated Data
Order		
Applicant is an Organization		
Name		

Corrected ADS 1.0

Organization Name		

Mailing Address

Address 1		
Address 2		
City,State/Province,Postal Code		
Country		
Phone Number		
Fax Number		
Email Address		

Signature

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b).

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 76,255/	Registration Number	76255
First Name	Young Seok	Last Name	Koo

Electronic Acknowledgement Receipt

EFS ID:	41951749
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	18-FEB-2021
Filing Date:	06-MAR-2019
Time Stamp:	00:43:58
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	Application Data Sheet to update/ correct info	CorrectedADS.pdf	85045 6a12f9b908c30b0bf9d19ae247f7186f4be8cd58	no	6

Warnings:

Information:	
Total Files Size (in bytes):	85045

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 01/19/2021

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

EXAMINER
RANDHAWA, MANDISH K

ART UNIT	PAPER NUMBER
2477	

DATE MAILED: 01/19/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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	04/19/2021

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 01/19/2021
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.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

TITLE OF INVENTION: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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	04/19/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
RANDHAWA, MANDISH K	2477	370-329000

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

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

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 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.
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4	6210

158747 7590 01/19/2021

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

EXAMINER	
RANDHAWA, MANDISH K	
ART UNIT	PAPER NUMBER
2477	

DATE MAILED: 01/19/2021

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. 16/294,883	Applicant(s) Ahn et al.	
	Examiner MANDISH RANDHAWA	Art Unit 2477	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 communication(s) filed on September 22, 2020.
   ☐ 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, 26, 27, 29-33,38, 39, renumbered as 1-10 . 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. 12/30/20.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

EXAMINER'S AMENDMENT

2. 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.

Authorization for this examiner's amendment was given in an interview with Young Seok Koo on December 30, 2020.

3. Claims 28 and 40 have been amended as follows:

Claim 28 (Cancelled).

Claim 40 (Cancelled).

Allowable Subject Matter

4. Claims 21, 26, 27, 29-33, 38, 39, renumbered as 1-10, are allowed.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MANDISH RANDHAWA whose telephone number is (571)270-5650. The examiner can normally be reached on Monday-Thursday (7 AM-4 PM).

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, Ayaz Sheikh can be reached on (571) 272-3795. 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.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

Applicant-Initiated Interview Summary	**Application No.** 16/294,883	**Applicant(s)** Ahn et al.	
	Examiner MANDISH RANDHAWA	**Art Unit** 2477	**AIA (FITF) Status** Yes

All participants (applicant, applicants representative, PTO personnel):

(1) MANDISH RANDHAWA. (3) _____.

(2) YOUNG SEOK KOO. (4) _____.

Date of Interview: 30 December 2020.

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

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☑112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 28 and 40.

Identification of prior art discussed: _____.

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

Applicant's representative authorized examiner's amendment to avoid potential rejection under 112 (d). For details, see examiner's amendment..

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

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

☐ Attachment

/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

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

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

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

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

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

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

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

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

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

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

Examiner to Check for Accuracy

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

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	**Art Unit**
	MANDISH RANDHAWA	2477

CPC							
Symbol						**Type**	**Version**
H04W	/	80	/	02		F	2013-01-01
H04W	/	74	/	00		I	2013-01-01
H04W	/	84	/	12		I	2013-01-01
H04W	/	74	/	08		I	2013-01-01
H04L	/	5	/	0055		I	2013-01-01
H04W	/	28	/	0268		I	2013-01-01
H04W	/	40	/	244		I	2013-01-01
H04W	/	72	/	0446		I	2013-01-01
H04W	/	74	/	0808		I	2013-01-01

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	26 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	28

U.S. Patent and Trademark Office — Part of Paper No.: 20201226

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	**Art Unit**
	MANDISH RANDHAWA	2477

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04W	/	80	/	02

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477	26 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	28

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	**Art Unit**
	MANDISH RANDHAWA	2477

☐ 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	21	5	30	10	39										
-	22	6	31	-	40										
-	23	7	32												
-	24	8	33												
-	25	-	34												
2	26	-	35												
3	27	-	36												
-	28	-	37												
4	29	9	38												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 10	
/MANDISH K RANDHAWA/ Examiner, Art Unit 2477 (Primary Examiner)	26 December 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 28

U.S. Patent and Trademark Office — Part of Paper No.: 20201226

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

CPC - Searched*		
Symbol	Date	Examiner
H04W80/02, H04W28/0268,H04W74/0808, H04W40/244,H04W74/08, H04L5/0055, H04W84/12, H04W74/00,H04W72/0446	12/26/2020	MR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
Performed Inventor/Double Patenting search	06/17/2020	MR
Performed NPL (IP.com, STIC, Google), and East text search	06/18/2020	MR
Performed Inventor/Double Patenting search	12/26/2020	MR
Performed East text/CPC search	12/26/2020	MR
Performed Interference search	12/26/2020	MR

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04W	80/02, 28/0268,74/0808, 40/244,74/08, 84/12, 74/00, 72/0446	12/26/2020	MR
H04L	L5/0055	12/26/2020	MR

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0230981	Aug. 10, 2017	RYU et al.			
	2.	2017/0257887	Sep. 7, 2017	Ghosh et al.			
	3.	2019/0182864	Jun. 13, 2019	HUANG et al.			
	4.	2017/0245261	Aug. 24, 2017	Cariou et al.			
	5.	2016/0198500	Jul. 7, 2016	MERLIN et al.			
	6.	2010/0081393	Apr. 1, 2010	Huang			

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
	7.	Office Action dated April 16, 2020 for U.S. Patent Application No. 16/188,274
	8.	Office Action dated May 14, 2020 for U.S. Patent Application No. 16/361,283
	9.	Laurent Cariou et al.: "Proposed spec text for MU EDCA parameters", Resolution for CID 9058 and 90751, IEEE P802.11, Wireless LANs, September 1, 2016. See pp. 1-7
	10.	Notice of Allowance dated June 18, 2020 for Korean Patent Application No. 10-2020-7002361 and its English translation provided by the Applicant's foreign counsel
	11.	Extended European Search Report dated May 12, 2020 for European Patent Application No. 17849113.0
	12.	Notice of Allowance dated June 22, 2020 for Japanese Patent Application No. 2019-500497 and its English translation provided by the Applicant's foreign counsel

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	12/26/2020

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. sInclude copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.K.R/

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L11	2	("2017/0041961").URPN.	USPAT	NEAR	ON	2020/12/26 14:06
L12	36	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((enabl$4 or request$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:13
L13	15	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:19
L14	30	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with (parameter or edca) same ((immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:28
L15	109,764	(H04W80/02 or H04W28/0268 or H04W74/0808 or H04W40/244 or H04W74/08 or H04L5/0055 or H04W84/12 or H04W74/00 or H04W72/0446).cpc.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:30
L16	19	14 not 13	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:30
L17	227	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:35
L18	92	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:36
L19	596	(mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:36
L20	140	19 and 15	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:37

EAST Search History (Prior Art)

L21	3	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:50
L22	13	(enhanced distribut$4 channel access or "edca") same (back$off or parameter) near3 (timer or interval or duration or counter or countdown or time) same (immediat$4 near3 (response or ack or acknowledg$4 or feedback))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:52
L23	19	(enhanced distribut$4 channel access or "edca" or "edcaf") same (back$off or parameter) near3 (timer or interval or duration or counter or countdown or time) same (immediat$4 near3 (response or ack or acknowledg$4 or feedback))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:54
L24	6	23 not 22	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:54
L25	44	(mu$2 or multi$2 user) same (parameter or edca or edcaf) same (timer or time$out or count$4 or count$down or reset$4 or set$4) with ((enabl$4 or request$4 or immediat$4) near3 (respons or feedback or ack or acknowledg$5) or enabl$4 immediat$4 response or "deid" or enabl$4 ("not" or "no") immediat$4 response or "denir")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 14:56
L26	2	("20150295680"|"20160315681").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
L27	6	("20100081393"|"20160198500"|"20170230981"|"20170245261"|"20170257887"|"20190182864").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
L28	6	("20100081393"|"20160198500"|"20170230981"|"20170245261"|"20170257887"|"20190182864").PN.	US-PGPUB; USPAT	NEAR	ON	2020/12/26 15:13
L29	8	26 or 27	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:14
L31	17	((mu$2 or multi$2 user) with (parameter or edca) same (timer or time$out or counter or countdown or set$4 or re$1set$4) with (respons or feedback or ack or acknowledg$5)).clm.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:20
L32	10	"10491355"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:20
L33	13,723	(WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY or SK TELECOM$9).as. or (Ahn near2 Woojin or Son near2 Juhyung or Ko near2 Geonjung or Kwak near2 Jinsam).in.	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:30

EAST Search History (Prior Art)

L34	2	19 and 33	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/12/26 15:31
S1	1	"16294883"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:20
S2	6	(("20160198500") or ("20160113034") or ("20180124826")).PN.	US-PGPUB; USPAT; USOCR; DERWENT	OR	OFF	2020/06/17 12:20
S3	51	mu$2 near edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21
S4	86	mu$2 near2 edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21
S5	40	mu$2 near2 edca same parameter	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:22
S6	19	trigger$4 same edca same parameter same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 13:14
S7	187	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:49
S8	3	"20170202023"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:59
S9	3	("20170245261"|"20190098565"|"9439219").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/17 16:33
S10	218	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 16:59
S11	21	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (re$1set$4 or set$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:00
S12	3	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:07
S13	7	(mu$2 or multi$2 user) same trigger and (edca) same (re$1set$4 or set$4 or updat$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 22:28
S14	603	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:03

EAST Search History (Prior Art)

S15	502	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:04
S16	499	(contention window) and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
S17	472	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
S18	52	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value)) same (access with channel)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:06
S19	158	(access category or "ac") with (queue) same back$off with queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:26
S20	104	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:33
S21	12	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0") same (empty or "no" (data or packet)) near2 queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:43
S22	7	("20150124690"|"20160080115"|"20170257196"|"20170272138"|"20170289911"|"20170303280"|"20170310446").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/18 14:38

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2015/0295680	Oct. 15, 2015	Othman et al.			
	2.	2016/0315681	Oct. 27, 2016	MOON et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	3.	2015/199306	Dec. 30, 2015	WO			Espacenet
	4.	2016/123403	Aug. 4, 2016	WO			
	5.	201847021036	Jun. 15, 2018	IN			Complete Specification

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	6.	Office Action dated June 29, 2020 for Japanese Patent Application No. 2019-534619 and its English translation provided by Applicant's foreign counsel
	7.	Office Action dated July 28, 2020 for U.S. Patent Application No. 16/596,674
	8.	Notice of Allowance dated August 18, 2020 for U.S. Patent Application No. 16/188,274
	9.	Notice of Allowance dated September 15, 2020 for Korean Patent Application No. 10-2020-7026125 and its English translation provided by Applicant's foreign counsel
	10.	Office Action dated September 3, 2020 for Korean Patent Application No. 10-2018-7033463 and its English translation provided by Applicant's foreign counsel
	11.	Evgeny Khorov et al., "Considerations on Trigger Frame for Random Access Procedure", doc. IEEE 802.11-16/0399r1, March 2016, slides 1-11
	12.	Office Action dated September 9, 2020 for Indian Patent Application No. 201927007972

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	12/26/2020

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. /M.K.R/

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

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	4.	2016/123403	Aug. 4, 2016	WO			
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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.

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: 29 September, 2020

Sungjin HONG
Patent Attorney
QUS INT'L PATENT & LAW GROUP
5Fl., 216 Hwangsaeul-ro,
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Electronic Acknowledgement Receipt

EFS ID:	40696117
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	29-SEP-2020
Filing Date:	06-MAR-2019
Time Stamp:	00:02:05
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		2020-09-28_631950_IDS.pdf	266454 02fb13a0010f95eb8128147f7e85b9f1f3e794a9	yes	5

	Multipart Description/PDF files in .zip description			
	Document Description	**Start**	**End**	
	Transmittal Letter	1	3	
	Information Disclosure Statement (IDS) Form (SB08)	4	4	
	Transmittal Letter	5	5	

Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	Ref1_JP2019-534619_OA.pdf	188126 68afeda6a8713f201291b51cce75c022f83b6a33	no	7
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Ref2_US16596674_1stOA.pdf	716147 8243f693bd110ee63e033921aca0d5ddfe69f012	no	19
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	Ref5_US16188274_NOA.pdf	610878 99582aace5941eb2492a81c1e0492636e07e94c2	no	16
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	Ref6_KR10-2020-7026125_NOA.pdf	143713 20a7b675a60fb1d12dbb6c08e0d296400f830f6e	no	4
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	Ref7_KR10-2018-7033463_1stOA.pdf	221330 5a4a284ecfce8bff36b7993011e2763a94548e4c	no	10
Warnings:					
Information:					

7	Non Patent Literature	Ref8_IEEE_802-11-16_0399r1.pdf	249268 498606ab964129902c13c78f1d3a2b5c55499c19	no	11
Warnings:					
Information:					
8	Foreign Reference	Ref9_WO2015-199306.pdf	1758749 48a0e4be0f10261b8ae710a9ff1b3fdb616931f5	no	153
Warnings:					
Information:					
9	Other Reference-Patent/App/Search documents	Ref10_IN201927007972_1stOA.pdf	242709 255c1274ef3178536de37ba1cf115df822ff0250	no	6
Warnings:					
Information:					
10	Foreign Reference	Ref11_WO2016-123403.pdf	1094920 583c8cc452bca9ae22b5f7fba823860accae5eab	no	119
Warnings:					
Information:					
11	Foreign Reference	Ref12_IN201847021036_Complete_specification.pdf	685941 9b25242dfbd3c5d4ae37123344fea45e74e934a3	no	39
Warnings:					
Information:					
		Total Files Size (in bytes):	6178235		

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: Randhawa, Mandish K
Serial No.: 16/294,883	Art Unit: 2477
Filing or 371 (c) Date: March 6, 2019	Conf. No.: 6210
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: September 28, 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.

[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 March 6, 2019 and March 4, 2020 and therefore are not submitted in this IDS.

[x] Other: copy of the statement as set forth under 37 C.F.R. 1.97(e)(1).

I hereby certify that this document is being transmitted to the 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 /

Young Seok Koo
Attorney for Applicant
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(323) 934-2300 voice

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 16/294,883	Filing Date 03/06/2019	☐ 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	09/22/2020	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".	/SHANDA E ROSS/
*** 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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Woojin AHN	) Examiner:	Randhawa, Mandish K
Application No.:	16/294,883	) Confirmation No.:	6210
Filing Date:	March 6, 2019	) Group Art Unit:	2477
Title:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	) Attorney Docket:	B-9905CON 631950-4
		) Date:	September 22, 2020
		) Re:	**Response to Non-Final Office Action of June 23, 2020**

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

RESPONSE TO OFFICE ACTION

Sir:

This paper is timely submitted in response to the non-Final Office Action mailed on June 23, 2020 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 6 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 that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:

a transceiver; and

a processor,

wherein the processor is configured to:

transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver,

switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,

when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends,

when the MPDU included in the trigger-based PPDU requests the immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received,

~~set a second parameter set timer based on whether a response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received,~~

when the second parameter set timer expires, terminate an application of the second parameter set, and

access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.

22-25. (Canceled).

26. (Previously Presented) The wireless communication terminal of claim 21, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

27. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

28. (Previously Presented) The wireless communication terminal of claim 21, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer.

29. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value within a contention window (CW),

set a backoff timer based on the random integer value, and

access the channel based on the back off timer and a predetermined slot time,

wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

30. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value in a contention window (CW),

set a backoff timer based on the random integer value,

access the channel based on the back off timer and a predetermined slot time, and

if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.

31. (Previously Presented) The wireless communication terminal of claim 21, wherein the processor is configured to operate a plurality of queues that are classified according to an access

category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and

when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,

wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

32. (Previously Presented) The wireless communication terminal of claim 31, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

33. (Currently Amended) An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:

transmitting a trigger-based physical layer protocol data unit (PPDU) to the base wireless communication terminal using the transceiver;

switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal;

when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, setting a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends;

when the MPDU included in the trigger-based PPDU requests the immediate response, setting the second parameter set timer for the access category of the MPDU for which immediate response is received;

~~setting a second parameter set timer based on whether the response to the MPDU included in the trigger-based PPDU is received;~~

when the second parameter set timer expires, terminating an application of the second parameter set;

accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal and the parameter set; and

transmitting the data through the channel.

34-37. (Canceled).

38. (Previously Presented) The method of claim 33, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

39. (Previously Presented) The method of claim 33, the method further comprising:

receiving a beacon frame from the base wireless communication terminal; and

obtaining information indicating a period of the second parameter set timer from the beacon frame.

40. (Previously Presented) The method of claim 33, wherein the switching the parameter set from the first parameter set to the second parameter set comprises

setting the second parameter set timer when the switching the parameter set from the first parameter set to the second parameter set.

REMARKS/ARGUMENTS

The following Remarks/Arguments are in response to the non-Final Office Action mailed on June 23, 2020 (hereinafter "Office Action") for the subject application. Pending in the application are claims 21-40.

In the Office Action, claims 21-23, 26-28, 33-35 and 38-40 stand rejected under 35 U.S.C. §103 as allegedly being obvious over U.S. Patent Application Publication No. 2017/0325264 (hereinafter "Cherian") in view of IEEE 802.11-16/1180r (hereinafter "IEEE"). Claims 21, 22, 24, 25, 33, 34, 36 and 37 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of U.S. Patent Application Publication No. 2017/0202023 (hereinafter "Zhou"). Claims 29 and 30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of IEEE and U.S. Patent Application Publication No. 2016/0066257 (hereinafter "Liu"). Claims 31 and 32 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of IEEE and U.S. Patent Application Publication No. 2019/0313453 (hereinafter "Baron").

In this response, claims 21 and 33 are amended. No new matter is presented as a result of these amendments. Claims 22-25 and 34-37 are canceled. No new claim is added. Claims 1-20 were previously canceled. Accordingly, the claims pending in this application after entry of this response are claims 21, 26-33 and 38-40.

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 21-23, 26-28, 33-35 and 38-40 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of IEEE (See Office Action: item 6 at page 3). Claims 21, 22, 24, 25, 33, 34, 36 and 37 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of Zhou (See Office Action: item 7 at page 8). Claims 29 and 30 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of IEEE and Liu (See Office Action: item 8 at page 11). Claims 31 and 32 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Cherian in view of IEEE and Baron (See

Office Action: item 9 at page 13). These rejections are hereby traversed, and reconsideration and withdrawal are respectfully requested.

Claim 21

Claim 21 recites:

> *A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:*
> *a transceiver; and*
> *a processor,*
> *wherein the processor is configured to:*
> *transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver,*
> *switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,*
> *when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends,*
> *when the MPDU included in the trigger-based PPDU requests the immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received,*
> *when the second parameter set timer expires, terminate an application of the second parameter set, and*
> *access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.*

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 add "*when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, when the MPDU included in the trigger-based PPDU requests the immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received*".

References Cherian in view of IEEE

The Applicant cannot find any disclosure, teaching or suggestion in Cherian or IEEE that "*the processor is configured to … when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] when the MPDU included in the trigger-based PPDU requests the immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added). Therefore, it is respectfully submitted that claim 21 is not obvious over Cherian in view of IEEE, and requests reconsideration and withdrawal of the §103 rejection of claim 21.

References Cherian in view of Zhou

Cherian and Zhou fail to disclose, teach or suggest that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added).

The Office Action acknowledges that "Cherian does not explicitly teach, wherein the processor is configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU" (Office Action: page 11). Accordingly, Cherian does not disclose, teach or suggest that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added).

Further, Zhou fails to make up the deficiency of Cherian with respect to the limitation of claim 21 that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added). In the Office Action, the Examiner indicates that "Zhou teaches the wireless communication terminal may set second parameter timer after the wireless communication terminal transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message (Provisional application No. 62/278,268: ¶[0081])" (Office Action: page 11). Paragraph [0081] of Provisional Application No. 62/278,268 of Zhou states that "the STA 106 may reset timer/counter to zero after the STA 106 transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message" (emphasis added). However, "reset[ting] timer/counter to zero after the STA 106 transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message" in Zhou is not a disclosure, teaching or suggestion that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added). Further, the "scheduled UL transmission" referred in paragraph [0081] of Provisional Application No. 62/278,268 of Zhou does not indicate a type of response, but indicates an initiation type of the UL transmission. Additionally, nowhere does Zhou mention the "***immediate response***" recited in claim 21 (emphasis added). Hence, Zhou does not cure Cherian's failure of teaching that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the*

second parameter set timer for the access category of the MPDU for which immediate response is received" as recited in claim 21 (emphasis added).

For at least the foregoing reasons, the Applicant respectfully submits that claim 21 is not obvious over Cherian in view of Zhou, and requests reconsideration and withdrawal of the §103 rejection of claim 21.

* * *

For completeness of reasoning, neither Liu nor Baron discloses, teaches or suggests that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" as recited in claim 21 (emphasis added). Hence, Liu and Baron do not make up the deficiency of the combination of Cherian and IEEE with respect to the limitation of claim 21 that "*the processor is configured to … **when** a MAC protocol data unit (MPDU) included in the trigger-based PPDU does **not request** an **immediate response**, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends, [and] **when** the MPDU included in the trigger-based PPDU **requests** the **immediate response**, set the second parameter set timer for the access category of the MPDU for which immediate response is received*" (emphasis added). Accordingly, the Applicant respectfully submits that claim 21 is not obvious over obvious over Cherian in view of IEEE and Liu or over Cherian in view of IEEE and Baron.

Claim 33

The Applicant respectfully submits that arguments similar to the arguments set forth for claim 21 can be used, *mutatis mutandis*, to show that claim 33 is patentable under 35 U.S.C. §103, and requests reconsideration and withdrawal of the §103 rejection of claim 33.

Claims 26-32 and 38-40

"If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). As discussed above, claims 21 and 33 are patentable under 35 U.S.C. §103. Claims 26-32 and 38-40 depend from claim 21 or 33. Therefore, the Applicant respectfully submits that claims 26-32 and 38-40 are patentable under 35 U.S.C. §103 at least by way of their dependencies on claims 21 and 33, and requests reconsideration and withdrawal of the §103 rejections of claims 26-32 and 38-40.

Claims 22-25 and 34-37

Although the Applicant respectfully disagrees with the Examiner, solely to expedite prosecution of the present application and allowance of the claims, claims 22-25 and 34-37 are canceled, rendering the rejections moot.

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 22, 2020
(Date of Transmission)

Young Seok Koo
(Name of Person Transmitting)

/ Young Seok Koo /
(Signature)

Respectfully submitted,

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Electronic Acknowledgement Receipt	
EFS ID:	40634613
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo
Filer Authorized By:	
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	22-SEP-2020
Filing Date:	06-MAR-2019
Time Stamp:	18:33:00
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		ResponseToOA06_23_2020_631950_4US.pdf	92218 6b55ae54c984ecded79a8b4a2ace62fe55d1b99c	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	12
Warnings:			
Information:			
	Total Files Size (in bytes):	92218	

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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.

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0230981	Aug. 10, 2017	RYU et al.			
	2.	2017/0257887	Sep. 7, 2017	Ghosh et al.			
	3.	2019/0182864	Jun. 13, 2019	HUANG et al.			
	4.	2017/0245261	Aug. 24, 2017	Cariou et al.			
	5.	2016/0198500	Jul. 7, 2016	MERLIN et al.			
	6.	2010/0081393	Apr. 1, 2010	Huang			

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
	7.	Office Action dated April 16, 2020 for U.S. Patent Application No. 16/188,274
	8.	Office Action dated May 14, 2020 for U.S. Patent Application No. 16/361,283
	9.	Laurent Cariou et al.: "Proposed spec text for MU EDCA parameters", Resolution for CID 9058 and 90751, IEEE P802.11, Wireless LANs, September 1, 2016. See pp. 1-7
	10.	Notice of Allowance dated June 18, 2020 for Korean Patent Application No. 10-2020-7002361 and its English translation provided by the Applicant's foreign counsel
	11.	Extended European Search Report dated May 12, 2020 for European Patent Application No. 17849113.0
	12.	Notice of Allowance dated June 22, 2020 for Japanese Patent Application No. 2019-500497 and its English translation provided by the 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. sInclude 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: 15 July, 2020

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Electronic Acknowledgement Receipt

EFS ID:	40015114
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	16-JUL-2020
Filing Date:	06-MAR-2019
Time Stamp:	21:07:58
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	Other Reference-Patent/App/Search documents	Ref1_US16188274_1stOA.pdf	280566 b5f140d8e6352d3c61c0c860f568459256ba746a	no	9
Warnings:					

Information:					
2	Other Reference-Patent/App/Search documents	Ref5_US16361283_1stOA.pdf	653008 7d91cb355213a5a0c1ff0f0ab72683f41d3e56d1	no	17
Warnings:					
Information:					
3	Non Patent Literature	Ref9_IEEE_P802-11_Proposed_spec_text.pdf	719623 2d38dc5a656cb0bad5084007d94c87c104372bf3	no	7
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	Ref10_KR10-2020-7002361_NOA.pdf	502583 dcbc0dcc78904cac032232f7f43316af259aad42	no	7
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	Ref11_EP178491130_EESR.pdf	470079 022b4ad4e4e53874165a36bf20519067f31a4d88	no	7
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	Ref12_JP2019-500497_NOA.pdf	136703 fb70edce15d2c9a3cc61397133a6252e6cc7464e	no	6
Warnings:					
Information:					
7		2020-07-15_631950_IDS.pdf	188560 8f21883f6f3beabb8c1ad64deacb09db8caaa2af	yes	5

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Transmittal Letter	1	3
Information Disclosure Statement (IDS) Form (SB08)	4	4
Transmittal Letter	5	5

Warnings:	
Information:	
Total Files Size (in bytes):	2951122

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	Examiner: RANDHAWA, MANDISH K
	Art Unit: 2477
Serial No.: 16/294,883	Conf. No.: 6210
Filing or 371 (c) Date: March 6, 2019	Our Ref: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Re: ***Information Disclosure Statement***
Date: July 16, 2020	

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.

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[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.

[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 March 4, 2020 and March 6, 2019 and therefore are not submitted in this IDS.

[x] Other: copy of the statement as set forth under 37 C.F.R. 1.97(e)(1).

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

July 16, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

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EXAMINER	
RANDHAWA, MANDISH K	

ART UNIT	PAPER NUMBER
2477	

NOTIFICATION DATE	DELIVERY MODE
06/23/2020	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
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Office Action Summary	Application No. 16/294,883	Applicant(s) Ahn et al.	
	Examiner MANDISH RANDHAWA	Art Unit 2477	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 3/6/19.

☐ 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) 21-40 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) 21-40 is/are rejected.

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

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

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

Application Papers

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

11)☐ The drawing(s) filed on _____ 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 3/6/19, 9/10/19, 3/4/20.

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

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

Claim Rejections - 35 USC § 103

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

3. 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.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

6. Claims 21-23, 26-28, 33-35 and 38-40 are rejected under 35 U.S.C. 103 as being unpatentable over Cherian et al. (US 2017/0325264 A1, hereinafter "Cherian") in view of IEEE 802.11-16/1180r0 ("Proposed spec text for MU EDCA parameters").

Regarding claims 21, 22, 33 and 34, Cherian teaches a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising: a transceiver; and a processor (**figs. 1 and 2**), wherein the processor is configured to: transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver (**Provisional application No. 62/333745: figs. 3, 4, ¶ [0047], Once the STA receives a trigger frame scheduling UL resources, the STA may switch to the MU mode and transmit data packets using the scheduled resources, ¶ [0049], ¶ [0065]**); switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal (**Provisional application No. 62/333745: ¶ [0052]-¶ [0054], ¶ [0058], One or more of the STAs may be operating in a default SU**

mode before receiving the trigger frame from the AP. In response to receiving the trigger frame at 402, the STAs 1-3 transition to the MU mode and, simultaneously transmit packets on the UL on resources scheduled by the trigger frame received at 402., Fig. 5, ¶ [0061], The most recent MU EDCA Parameter Set element received by a STA may be used to update the appropriate MIB values. ¶ [0065] A High Efficiently (HE) non-AP STA that receives a trigger frame (e.g., Basic variant Trigger frame) that contains a Per User Info field with the AID of the STA may update its EDCA parameters, for example, dotIIEDCATableCWmin, dotI IEDCATableCWmax, dotIIEDCATableAIFSN, and dotI IHEMUEDCATimer to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated. In an aspect, the dotI IHEMUEDCATimer may uniformly count down to 0 when its value is nonzero.); set a second parameter set timer; when the second parameter set timer expires, terminate an application of the second parameter set (**Provisional application No. 62/333745: Fig. 5, ¶ [0063], where The MU EDCA Timer indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid after reception of a Trigger frame, ¶ [0065] An HE non-AP STA that receives a trigger frame (e.g., Basic variant Trigger frame) that contains a Per User Info field with the AID of the STA may update its EDCA parameters sent by the AP to which the STA is associated. In an aspect, the dotI IHEMUEDCATimer may uniformly count down to 0 when its value is nonzero, ¶ [0067], ¶ [0069]**), access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set; and transmitting the data through the channel (**Provisional application No. 62/333745: figs.3- 5, ¶ [0042]**).

Cherian does not explicitly teach set a second parameter set timer based on whether a response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received.

IEEE teaches set a second parameter set timer based on whether a response to an MPDU included in the trigger-based PPDU is received; wherein the processor is configured to set the second parameter set timer when the response reception ends (**Pages 5-6, The STA operating with MU EDCA parameters can switch back to the legacy EDCA parameters: if the STA has not been scheduled after a pre-defined TimeOut after the last time the STA was scheduled by Basic variant Trigger frame in UL MU. Timeout starts from end of basic variant Trigger. The MU EDCA Timer indicates the duration of time, in units of 8TUs, for which the provided MU EDCA parameters are used by an HE STA after reception of a basic variant Trigger frame. Page 7: An HE non-AP UL MU capable STA that receives a Basic variant Trigger frame that contains a Per User Info field with the AID of the STA, and that receives an immediate response from the AP for the transmitted Trigger-based PPDU, shall: ...Update its HEMUEDCATimer state variable to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated. The HEMUEDCATimer shall uniformly count down to 0 when its value is nonzero**).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to set a second parameter set timer based on whether a response to an MPDU included in the trigger-based PPDU is received in the system of Cherian to comply with the IEEE standard requirements.

Regarding claims 23 and 35, Cherian in view of IEEE teaches the wireless communication terminal of claim 21.

Cherian does not explicitly teach wherein the processor is configured to set the second parameter set timer for an access category of an MPDU for which the response is received.

IEEE teaches wherein the processor is configured to set the second parameter set timer for an access category of an MPDU for which the response is received (**Page 7: An HE non-AP UL MU capable STA that receives a Basic variant Trigger frame that contains a Per User Info field with the AID of the STA, and that receives an immediate response from the AP for the transmitted Trigger-based PPDU, shall: update its CWmin[AC], CWmax[AC], AIFSN[AC], state variables to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated, for all the ACs from which QoS Data frames were transmitted in the trigger-based PPDU. Update its HEMUEDCATimer state variable to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated**).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to configured to set the second parameter set timer for an access category of an MPDU for which the response is received in the system of Cherian in view of IEEE to comply with the IEEE standard requirements.

Regarding claims 26 and 38, Cherian in view of IEEE teaches the wireless communication terminal of claim 21, wherein the MPDU included in the trigger-based PPDU is a QoS data frame (**Provisional application No. 62/333745: ¶ [0042] and ¶ [0060]. IEEE: Pages 5-7, An HE non-AP UL MU capable STA that receives a Basic**

variant Trigger frame that contains a Per User Info field with the AID of the STA, and that receives an immediate response from the AP for the transmitted Trigger-based PPDU, shall: update its CWmin[AC], CWmax[AC], AIFSN[AC], state variables to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated, for all the ACs from which QoS Data frames were transmitted in the trigger-based PPDU.).

Regarding claims 27 and 39, Cherian in view of IEEE teaches the wireless communication terminal of claim 21.

Cherian does not explicitly teach wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

IEEE teaches wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame (**Pages 6-7, The QoS AP shall announce the EDCA parameters in selected Beacon frames**).
Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame in the system of Cherian in view of IEEE to comply with the IEEE standard requirements.

Regarding claims 28 and 40, Cherian in view of IEEE teaches the wireless communication terminal of claim 21, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer (**Provisional application No. 62/333745: ¶ [0058], One or**

more of the STAs may be operating in a default SU mode before receiving the trigger frame from the AP. In response to receiving the trigger frame at 402, the STAs 1-3 transition to the MU mode and, simultaneously transmit packets on the UL on resources scheduled by the trigger frame received at 402., Fig. 5, ¶ [0061], The most recent MU EDCA Parameter Set element received by a STA may be used to update the appropriate MIB values. ¶ [0065] A High Efficiently (HE) non-AP STA that receives a trigger frame (e.g., Basic variant Trigger frame) that contains a Per User Info field with the AID of the STA may update its EDCA parameters, for example, dotIIEDCATableCWmin, dotIIEDCATableCWmax, dotIIEDCATableAIFSN, and dotIIHEMUEDCATimer to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated. IEEE: Pages 6-7, The MU EDCA Timer indicates the duration of time, in units of 8TUs, for which the provided MU EDCA parameters are used by an HE STA after reception of a basic variant Trigger frame).

7. Claims 21, 22, 24, 25, 33, 34, 36 and 37 are rejected under 35 U.S.C. 103 as being unpatentable over Cherian in view of Zhou et al. (US 2017/0202023 A1, hereinafter "Zhou").

Regarding claims 21, 22, 33 and 34, Cherian teaches a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising: a transceiver; and a processor (**figs. 1 and 2**), wherein the processor is configured to: transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver (**Provisional application No. 62/333745: figs. 3, 4, ¶ [0047], Once the STA receives a trigger frame scheduling UL resources, the STA may switch to the MU mode and**

transmit data packets using the scheduled resources, ¶ [0049], ¶ [0065]); switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal (**Provisional application No. 62/333745: ¶ [0052]-¶ [0054], ¶ [0058], One or more of the STAs may be operating in a default SU mode before receiving the trigger frame from the AP. In response to receiving the trigger frame at 402, the STAs 1-3 transition to the MU mode and, simultaneously transmit packets on the UL on resources scheduled by the trigger frame received at 402., Fig. 5, ¶ [0061], The most recent MU EDCA Parameter Set element received by a STA may be used to update the appropriate MIB values. ¶ [0065] A High Efficiently (HE) non-AP STA that receives a trigger frame (e.g., Basic variant Trigger frame) that contains a Per User Info field with the AID of the STA may update its EDCA parameters, for example, dotIIEDCATableCWmin, dotI IEDCATableCWmax, dotIIEDCATableAIFSN, and dotI IHEMUEDCATimer to the values contained in the most recently received MU EDCA Parameter Set element sent by the AP to which the STA is associated. In an aspect, the dotI IHEMUEDCATimer may uniformly count down to 0 when its value is nonzero.**); set a second parameter set timer; when the second parameter set timer expires, terminate an application of the second parameter set (**Provisional application No. 62/333745: Fig. 5, ¶ [0063], where The MU EDCA Timer indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid after reception of a Trigger frame, ¶ [0065] An HE non-AP STA that receives a trigger frame (e.g., Basic variant Trigger frame) that contains a Per User Info field with the AID of the STA may update its EDCA parameters sent by the**

AP to which the STA is associated. In an aspect, the dotIIHEMUEDCATimer may uniformly count down to 0 when its value is nonzero, ¶ [0067], ¶ [0069]), access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set; and transmitting the data through the channel (**Provisional application No. 62/333745: figs.3- 5, ¶ [0042]**).

Cherian does not explicitly teach set a second parameter set timer based on whether a response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received.

Zhou teaches set a second parameter set timer based on whether a response to an MPDU included in the trigger-based PPDU is received; wherein the processor is configured to set the second parameter set timer when the response reception ends (**Provisional application No. 62/278,268: ¶ [0081], the STA 106 may reset timer/counter to zero after the STA 106 transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message. In other aspects, the STA 106 may reset timer/counter to zero after the STA 106 transmits a non-scheduled UL transmission, or transmits a non-scheduled UL transmission and gets an ACK message**).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to set a second parameter set timer based on whether a response to an MPDU included in the trigger-based PPDU is received in the system of Cherian to further improve the system (**¶ [0005] of Zhou**).

Regarding claims 24, 25, 36 and 37, Cherian in view of Zhou teaches the wireless communication terminal of claim 21.

Cherian does not explicitly teach, wherein the processor is configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

However, Zhou teaches the wireless communication terminal may set second parameter timer after the wireless communication terminal transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message (**Provisional application No. 62/278,268: ¶ [0081]**).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU (i.e., determine to set the second parameter set timer when the transmission of the trigger-based PPDU ends when the ACK is not requested or to set the second parameter set timer after an ACK is received when the ACK is requested) in the system of Cherian in view of Zhou. The motivation for doing this is a matter of design choice.

8. Claims 29 and 30 are rejected under 35 U.S.C. 103 as being unpatentable over Cherian in view of IEEE as applied to claim 21 above, and further in view of Liu et al. (US 2016/0066257 A1, hereinafter "Liu").

Regarding claim 29, Cherian in view of IEEE teaches the wireless communication terminal of claim 21, wherein the parameter set comprises a minimum value (CWmin) of the Contention Window (CW) and a maximum value (CWmax) of the CW (**Cherian: ¶ [0064] and ¶ [0065]. IEEE: pages 5 and 7**).

Cherian in view of IEEE does not explicitly teach wherein the processor is configured to calculate a random integer value within a CW, set a backoff timer based

on the random integer value, and access the channel based on the back off timer and a predetermined slot time.

However, it is well known in the art to calculate a random integer value within a CW, set a backoff timer based on the random integer value, and access the channel based on the back off timer and a predetermined slot time, wherein the parameter set comprises a CWmin and CWmax of the CW, as evidenced by **¶ [0031]** of Liu.

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to calculate a random integer value within a CW, set a backoff timer based on the random integer value, and access the channel based on the back off timer and a predetermined slot time in the system of Cherian in view of IEEE to comply with EDCA protocol in IEEE 802.11 WLAN (**¶ [0031] of Liu**).

Regarding claim 30, Cherian in view of IEEE teaches the wireless communication terminal of claim 21, wherein the parameter set comprises a minimum value (CWmin) of the Contention Window (CW) and a maximum value (CWmax) of the CW (**Cherian: ¶ [0064] and ¶ [0065]. IEEE: pages 5 and 7**).

Cherian in view of IEEE does not explicitly wherein the processor is configured to calculate a random integer value in a CW, set a backoff timer based on the random integer value, access the channel based on the back off timer and a predetermined slot time, and if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.

However, it is well known in the art to calculate a random integer value in a CW, set a backoff timer based on the random integer value, access the channel based on

the back off timer and a predetermined slot time, and if a value of the CW is greater than the CWmax of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax, as evidenced by **¶ [0030] and ¶ [0031]** of Liu.

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to calculate a random integer value in a CW, set a backoff timer based on the random integer value, access the channel based on the back off timer and a predetermined slot time, and if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax in the system of Cherian in view of IEEE to comply with EDCA protocol in IEEE 802.11 WLAN (**¶ [0031] of Liu**).

9. Claims 31 and 32 are rejected under 35 U.S.C. 103 as being unpatentable over Cherian in view of IEEE as applied to claim 21 above, and further in view of Baron et al (US 2019/0313453 A1, hereinafter "Baron").

Regarding claims 31 and 32, Cherian in view of IEEE teaches the wireless communication terminal of claim 21.

Cherian in view of IEEE does not explicitly teach wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer, wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a

predetermined slot time, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

Baron teaches wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer, wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to clear the backoff timer (**¶ [0159], ¶ [0160], each AC (and corresponding buffer) acts as an independent DCF contending entity including its respective queue backoff engine, ¶ [0107], the queue backoff value associated with a non-empty traffic queue being decreased by the node over time to access the communication channel upon reaching zero. Of course, this operation may be made for each traffic queue that becomes empty after the step of transmitting data. clearing a queue backoff value corresponding to a traffic queue when no more data to be transmitted to the access point, ¶ [0262], [0262] The node then computes the queue backoff value as being equal to a random value selected in range [0, CW]+AIFS, where CW is the current value of the CW for the Access Category**).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was filed to operate a plurality of queues that are classified according to

an access category of data stored in a queue and perform backoff procedure of accessing a channel based on a time corresponding to a backoff timer, set based on a random integer value calculated in a contention window (CW), and reduced when the channel is idle for a predetermined slot time, in each of the plurality of queues, and perform no operation at a slot boundary of the backoff timer and to maintain the backoff timer to be 0 when there is no data stored in the queue and the backoff timer corresponding to the queue is 0 in the system of Cherian in view of IEEE to provide improved and fairer communication method/device (**¶ [0042] of Baron**).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MANDISH RANDHAWA whose telephone number is (571)270-5650. The examiner can normally be reached on Monday-Thursday (7 AM-4 PM).

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, Ayaz Sheikh can be reached on (571) 272-3795. 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.

/MANDISH K RANDHAWA/
Examiner, Art Unit 2477

Notice of References Cited	Application/Control No. 16/294,883	Applicant(s)/Patent Under Reexamination Ahn et al.	
	Examiner MANDISH RANDHAWA	Art Unit 2477	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-20170325264-A1	11-2017	CHERIAN; George	H04W74/0816	1/1
*	B	US-20170202023-A1	07-2017	Zhou; Yan	H04W72/12	1/1
*	C	US-20160066257-A1	03-2016	Liu; Jianhan	H04L5/006	370/329
*	D	US-20190313453-A1	10-2019	BARON; Stephane	H04W74/0816	1/1
	E					
	F					
	G					
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	K					
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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	IEEE 802.11-16/1180r0 (“Proposed spec text for MU EDCA parameters”), September 2016. (Year: 2016)
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	**Art Unit**
	MANDISH RANDHAWA	2477

✓	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	06/18/2020								
	21	✓								
	22	✓								
	23	✓								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								
	29	✓								
	30	✓								
	31	✓								
	32	✓								
	33	✓								
	34	✓								
	35	✓								
	36	✓								
	37	✓								
	38	✓								
	39	✓								
	40	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/294,883	Ahn et al.
	Examiner	Art Unit
	MANDISH RANDHAWA	2477

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
Performed Inventor/Double Patenting search	06/17/2020	MR
Performed NPL (IP.com, STIC, Google), and East text search	06/18/2020	MR

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

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

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
	1.	2018-509024	Mar. 29, 2018	JP			Espacenet
	2.	2016/007770	Jan. 14, 2016	WO			
	3.	2016/068572	May 6, 2016	WO			Espacenet

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EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	4.	Office Action dated December 16, 2019 for Japanese Patent Application No. 2019-534619 and its English translation provided by the Applicant's foreign counsel
	5.	Office Action dated February 3, 2020 for Japanese Patent Application No. 2019-500497 and its English translation provided by the Applicant's foreign counsel
	6.	Extended European Search Report dated February 10, 2020 for European Patent Application No. 17824568.4
	7.	Laurent Cariou et al. "2 Sets of EDCA Parameters", IEEE 802.11-16/0998r0, IEEE, July 2016, Search Date December 5, 2019, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0998-00-00ax-rules-for-2-edcaparameters.pptx >. Slides 1-21
	8.	Robert Stacey, "Specification Framework for TGax", IEEE 802.11-15/0132r17, IEE P802.11. Internet URL: https://mentor.ieee.org/802.11/dcn/15/11-15-0132-17-00ax-spec-framework.docx>, May 25, 2016, pp. 33-34
	9.	Chittabrata Ghosh (INTEL): "Signaling of Multi-TID Aggregation Limit", IEEE 802.11-16/0667r0, Draft: 11-16-0667-00-00AX-SIGNALING-OF-MULTI-TID-AGGREGATION-LIMIT, IEEE-SA MENTOR, Piscataway, NJ USA, vol. 802.11ax, May 16, 2016, pages 1-16, XP068119549, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0667-00-00ax-signaling-of-multi-tid-aggregation-limit.pptx (retrieved on 05/16/2016)
	10.	Chittabrata Ghosh (INTEL): "Multi-TID Aggregation Limit", IEEE 802.11-16/0362r1, Draft: 11-16-0362-01-00AX-MULTI-TID-AGGREGATION-LIMIT, IEEE-SA MENTOR, Piscataway, NJ USA, vol. 802.11ax, No. 1, May 15, 2016, pages 1-26, XP068105245, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0667-00-00ax-signaling-of-multi-tid-aggregation-limit.pptx (retrieved on 03/15/2016)

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	11.	LAN/MAN STANDARDS COMMITTEE OF THE IEEE COMPUTER SOCIETY; "Draft Standard for Information technology-tele-communications and information exchange between systems Local and metropolitan area networks- Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for high efficiency in frequency bands between 1 GHz and 6Ghz", IEEE Draft; Draft P802.11ax_D0.2, IEEE-SA, Piscataway, NJ USA, vol. 802.11ax drafts, no. D0.2, June 8, 2016. Pages 1-227, XP068137424, Retrieved from the Internet: URL: www.ieee802.org/11/private/Draft_Standards/11ax/Draft P802.11ax_D0.2.pdf (Retrieved on June 8, 2016)

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	06/18/2020

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. sInclude copy of this form with next communication to applicant.

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Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
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 March 6, 2019
		GROUP NO. ~~2464~~ 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0257196	Sept. 7, 2017	Ghosh et al.			
	2.	2017/0310446	Oct. 26, 2017	ASTERJADHI et al.			
	3.	2016/0080115	Mar. 17, 2016	Joshiam et al.			
	4.	2015/0124690	May 7, 2015	MERLIN et al.			
	5.	2017/0272138	Sep. 21, 2017	CHUN et al.			
	6.	2017/0303280	Oct. 19, 2017	CHUN et al.			
	7.	2017/0289911	Oct. 5, 2017	KIM et al.			

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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
	8.	International Preliminary Report on Patentability (Chapter I) issued on March 12, 2019 for PCT/KR2017/009841 and its English translation from WIPO
	9.	Notice of Allowance dated July 10, 2019 for U.S. Patent Application No. 16/233,078
	10.	Non-Final Office Action dated March 18, 2019 for U.S. Patent Application No. 16/233,078

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	06/18/2020

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EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	603	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:03
L2	502	(CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:04
L3	499	(contention window) and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
L4	472	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value))	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:05
L5	52	(contention window with "cw") and (CW$1min or (minimum or min) near CW) same ((maximum or max) cw or CW$1max) same (back$off with random with (integer or value)) same (access with channel)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 12:06
L6	158	(access category or "ac") with (queue) same back$off with queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:26
L7	104	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0")	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:33
L8	12	(access category or "ac") with (queue) same back$off with queue and back$off with (zero or "0") same (empty or "no" (data or packet)) near2 queue	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/18 13:43
L10	7	("20150124690"|"20160080115"|"20170257196"|"20170272138"|"20170289911"|"20170303280"|"20170310446").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/18 14:38
S1	1	"16294883"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:20
S2	6	(("20160198500") or ("20160113034") or ("20180124826")).PN.	US-PGPUB; USPAT; USOCR; DERWENT	OR	OFF	2020/06/17 12:20
S3	51	mu$2 near edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21

EAST Search History (Prior Art)

S4	86	mu$2 near2 edca	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:21
S5	40	mu$2 near2 edca same parameter	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 12:22
S6	19	trigger$4 same edca same parameter same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 13:14
S7	187	(mu$2 or multi$2 user) same (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:49
S8	3	"20170202023"	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 14:59
S9	3	("20170245261"|"20190098565"|"9439219").PN.	US-PGPUB; USPAT	NEAR	ON	2020/06/17 16:33
S10	218	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 16:59
S11	21	(mu$2 or multi$2 user) same trigger and (parameter or edca) same (re$1set$4 or set$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:00
S12	3	("802.11ax" or "802.11" ax) same edca same timer	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 17:07
S13	7	(mu$2 or multi$2 user) same trigger and (edca) same (re$1set$4 or set$4 or updat$4) near4 (timer or time$out) with (respons or feedback or ack or acknowledg$5)	US-PGPUB; USPAT; DERWENT	NEAR	ON	2020/06/17 22:28

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. ~~N/A~~ 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	FILING DATE ~~Concurrently~~ Herewith 3/6/19
		GROUP NO. ~~N/A~~ 2477

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2016/0057657	Feb. 25, 2016	SEOK			
	2.	2010/0150116	Jun. 17, 2010	Ji et al.			

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EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	3.	10-2015-0073165	Jun. 30, 2015	KR			KIPRIS
	4.	2016/112146	Jul. 14, 2016	WO			
	5.	10-2016-0045023	Apr. 26, 2016	KR			KIPRIS
	6.	2018/048229	Mar. 15, 2018	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	7.	International Search Report for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation from WIPO (now published as WO 2018/048229)
	8.	Written Opinion of the International Searching Authority for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation by Google Translate (now published as WO 2018/048229)
	9.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r0, July 2016, Slides 1-21 created on created on July 25, 2016
	10.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r1, July 2016, Slides 1-33 created on July 25, 2016
	11.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r2, July 2016, Slides 1-32 created on September 12, 2016
	12.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r3, July 2016, Slides 1-32 created on September 12, 2016

EXAMINER	*DATE CONSIDERED*
/MANDISH K RANDHAWA/	06/18/2020

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.K.R/

Bibliographic Data

Application No: 16/294,883

Foreign Priority claimed: ◉ Yes ○ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /MANDISH K RANDHAWA/ Examiner's Signature | Initials

Title: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/06/2019	370	2477	B-9905CON 631950-4
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

Jinsam Kwak Gyeonggi-do, KOREA, REPUBLIC OF

CONTINUING DATA

This application is a CON of PCT/KR2017/009841 09/07/2017

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2016-0114822 09/07/2016

KOREA, REPUBLIC OF 10-2016-0116877 09/10/2016

KOREA, REPUBLIC OF 10-2016-0116965 09/12/2016

KOREA, REPUBLIC OF 10-2016-0117898 09/13/2016

KOREA, REPUBLIC OF 10-2016-0122488 09/23/2016

KOREA, REPUBLIC OF 10-2016-0147189 11/06/2016

KOREA, REPUBLIC OF 10-2017-0022227 02/20/2017

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$1,720

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2477

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	7.	Laurent Cariou et al. "2 Sets of EDCA Parameters", IEEE 802.11-16/0998r0, IEEE, July 2016, Search Date December 5, 2019, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0998-00-00ax-rules-for-2-edcaparameters.pptx >. Slides 1-21
	8.	Robert Stacey, "Specification Framework for TGax", IEEE 802.11-15/0132r17, IEE P802.11. Internet URL: https://mentor.ieee.org/802.11/dcn/15/11-15-0132-17-00ax-spec-framework.docx>, May 25, 2016, pp. 33-34
	9.	Chittabrata Ghosh (INTEL): "Signaling of Multi-TID Aggregation Limit", IEEE 802.11-16/0667r0, Draft: 11-16-0667-00-00AX-SIGNALING-OF-MULTI-TID-AGGREGATION-LIMIT, IEEE-SA MENTOR, Piscataway, NJ USA, vol. 802.11ax, May 16, 2016, pages 1-16, XP068119549, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0667-00-00ax-signaling-of-multi-tid-aggregation-limit.pptx (retrieved on 05/16/2016)
	10.	Chittabrata Ghosh (INTEL): "Multi-TID Aggregation Limit", IEEE 802.11-16/0362r1, Draft: 11-16-0362-01-00AX-MULTI-TID-AGGREGATION-LIMIT, IEEE-SA MENTOR, Piscataway, NJ USA, vol. 802.11ax, No. 1, May 15, 2016, pages 1-26, XP068105245, Internet URL: https://mentor.ieee.org/802.11/dcn/16/11-16-0667-00-00ax-signaling-of-multi-tid-aggregation-limit.pptx (retrieved on 03/15/2016)

	11.	LAN/MAN STANDARDS COMMITTEE OF THE IEEE COMPUTER SOCIETY; "Draft Standard for Information technology-tele-communications and information exchange between systems Local and metropolitan area networks- Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for high efficiency in frequency bands between 1 GHz and 6Ghz", IEEE Draft; Draft P802.11ax_D0.2, IEEE-SA, Piscataway, NJ USA, vol. 802.11ax drafts, no. D0.2, June 8, 2016. Pages 1-227, XP068137424, Retrieved from the Internet: URL: www.ieee802.org/11/private/Draft_Standards/11ax/Draft P802.11ax_D0.2.pdf (Retrieved on June 8, 2016)

EXAMINER	*DATE CONSIDERED*

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Electronic Acknowledgement Receipt

EFS ID:	38773846
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo
Filer Authorized By:	
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	04-MAR-2020
Filing Date:	06-MAR-2019
Time Stamp:	23:11:25
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		2020-03-04_631950_IDS.pdf	164530 9ffb7b2207b9d5856dce33c9c2aeddd16e5ea2f6	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	Foreign Reference	Ref4_JP2018-509024.pdf	888383 e8d14a0174063739 2a07d68de6fb6722ca46fe66	no	46
Warnings:					
Information:					
3	Foreign Reference	Ref6_WO2016-007770.pdf	5625277 ca9891445458 25da67e6e0f0f6ba50d31c321b66	no	65
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Information:					
4	Foreign Reference	Ref8_WO2016-068572.pdf	1768745 01df775433ed95c1bd211ad0dc61773b1588cf50	no	60
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	Ref1_JP2019-534619_1stOA.pdf	322495 0b2bf48ed1c5047888081 42e3ca208ce60d4c27d	no	11
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	Ref5_JP2019-500497_1stOA.pdf	267160 1cd18297ae5f48f96e5dc93ffcf30b7d2ac68557	no	6
Warnings:					
Information:					
7	Other Reference-Patent/App/Search documents	Ref13_EP178245684_EESR.pdf	1038557 96dbadd1d872fd2e38027f2470db577d04ef73f7	no	10
Warnings:					

Information:					
8	Non Patent Literature	Ref2_IEEE802-11-16_0998r0.pdf	1256567 ae6072078fef15363d7eecf7d035a92df5ce56b6	no	21
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
9	Non Patent Literature	Ref7_IEEE802-11-15_0132r17.pdf	2131661 4af6d24b066fccd5b3f906f5d465ae0324bade8d	no	61
Warnings:					
Information:					
10	Non Patent Literature	Ref14_IEEE802-11-16_0667r0.pdf	2114601 a08921487b7c15a5ad5e4434d690b43d805b488a	no	16
Warnings:					
Information:					
11	Non Patent Literature	Ref15_IEEE802-11-16_0362r1.pdf	3410003 62af62fb78d3d510eda32caf71650c404f6f0c08	no	26
Warnings:					
Information:					
12	Non Patent Literature	Ref16_IEEEP802-11axTM_D02.pdf	22998749 a1d19f8c266fc72e2b2dd3d2e544d9fd92484db6	no	227
Warnings:					
Information:					
			Total Files Size (in bytes):	41986728	

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: BANDHAWA, MANDISH K
	Art Unit: 2477
Serial No.: 16/294,883	Conf. No.: 6210
Filing or 371 (c) Date: March 6, 2019	Our Ref: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Re: ***Information Disclosure Statement***
Date: March 4, 2020	

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

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

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

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

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

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

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

Items Disclosed

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

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

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

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

Additional Information

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

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

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

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

[ ] 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.

March 4, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

Young Seok Koo
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Los Angeles, CA 90010
(323) 934-2300 voice

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

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	)	***Re.: Preliminary Amendment***
	)	Group: 2464
USSN: 16/294,883	)	Examiner: NGO, RICKY QUOC
Filing Date: March 6, 2019	)	Our Ref.: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	)	Date: September 30, 2019

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 Claims begin on page 2 of this paper

Remarks begin on page 7 of this paper.

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. (New) A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:

a transceiver; and

a processor,

wherein the processor is configured to:

transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver,

switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,

set a second parameter set timer based on whether a response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received,

when the second parameter set timer expires, terminate an application of the second parameter set, and

access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.

22. (New) The wireless communication terminal of claim 21, wherein the processor is configured to set the second parameter set timer when the response reception ends.

23. (New) The wireless communication terminal of claim 21, wherein the processor is configured to set the second parameter set timer for an access category of an MPDU for which the response is received.

24. (New) The wireless communication terminal of claim 21, wherein the processor is configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

25. (New) The wireless communication terminal of claim 24, wherein when the MPDU included in the trigger-based PPDU does not request an ACK, the processor is configured to set the second parameter set timer when the transmission of the trigger-based PPDU ends.

26. (New) The wireless communication terminal of claim 21, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

27. (New) The wireless communication terminal of claim 21, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

28. (New) The wireless communication terminal of claim 21, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer.

29. (New) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value within a contention window (CW),

set a backoff timer based on the random integer value, and

access the channel based on the back off timer and a predetermined slot time,

wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

30. (New) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value in a contention window (CW),

set a backoff timer based on the random integer value,

access the channel based on the back off timer and a predetermined slot time, and

if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.

31. (New) The wireless communication terminal of claim 21, wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and

when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,

wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

32. (New) The wireless communication terminal of claim 31, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

33. (New) An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:

transmitting a trigger-based physical layer protocol data unit (PPDU) to the base wireless communication terminal using the transceiver;

switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal;

setting a second parameter set timer based on whether the response to the MPDU included in the trigger-based PPDU is received;

when the second parameter set timer expires, terminating an application of the second parameter set;

accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal and the parameter set; and

transmitting the data through the channel.

34. (New) The method of claim 33, wherein the setting of the second parameter set timer comprises setting the second parameter set timer when the response reception ends.

35. (New) The method of claim 33, wherein the setting of the second parameter set timer comprises setting the second parameter set timer for an access category of an MPDU for which the response is received.

36. (New) The method of claim 33, wherein the setting the second parameter set timer comprises determining when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

37. (New) The method of claim 36, wherein the determining when to set the second parameter set timer comprises setting the second parameter set timer when the transmission of the trigger-based PPDU ends when the MPDU included in the trigger-based PPDU does not request an ACK.

38. (New) The method of claim 33, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

39. (New) The method of claim 33, the method further comprising:

receiving a beacon frame from the base wireless communication terminal; and

obtaining information indicating a period of the second parameter set timer from the beacon frame.

40. (New) The method of claim 33, wherein the switching the parameter set from the first parameter set to the second parameter set comprises

setting the second parameter set timer when the switching the parameter set from the first parameter set to the second parameter set.

REMARKS

In this Preliminary Amendment, claims 1-20 are cancelled and new claims 21-40 are added. No new matter is presented as a result of these amendments.

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.

September 30, 2019
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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4525 Wilshire Blvd., Suite 240
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(323) 934-2300 voice

Electronic Acknowledgement Receipt

EFS ID:	37326335
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	30-SEP-2019
Filing Date:	06-MAR-2019
Time Stamp:	22:35:11
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		2019-09-30_631950_Preliminary_Amendments.pdf	109437 7acb3d6d98fcaf99d7d10dda4ff857bdd2bfb5ab	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	7
Warnings:			
Information:			
	Total Files Size (in bytes):	109437	

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

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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 16/294,883	Filing Date 03/06/2019	☐ 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	09/30/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	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".	/SHARON M WEST/
*** 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-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
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 March 6, 2019
		GROUP NO. 2464

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0257196	Sept. 7, 2017	Ghosh et al.			
	2.	2017/0310446	Oct. 26, 2017	ASTERJADHI et al.			
	3.	2016/0080115	Mar. 17, 2016	Joshiam et al.			
	4.	2015/0124690	May 7, 2015	MERLIN et al.			
	5.	2017/0272138	Sep. 21, 2017	CHUN et al.			
	6.	2017/0303280	Oct. 19, 2017	CHUN et al.			
	7.	2017/0289911	Oct. 5, 2017	KIM et al.			

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
	8.	International Preliminary Report on Patentability (Chapter I) issued on March 12, 2019 for PCT/KR2017/009841 and its English translation from WIPO
	9.	Notice of Allowance dated July 10, 2019 for U.S. Patent Application No. 16/233,078
	10.	Non-Final Office Action dated March 18, 2019 for U.S. Patent Application No. 16/233,078

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.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference WILP170086WO	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/KR2017/009841	International filing date *(day/month/year)* 07 September 2017 (07.09.2017)	Priority date *(day/month/year)* 07 September 2016 (07.09.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 12 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 12 March 2019 (12.03.2019)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Kihwan Moon e-mail: pct.team1@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	09.01.2018
Applicant's or agent's file reference: WILP170086WO	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/KR2017/009841	07.09.2017	07.09.2016

International Patent Classification (IPC) or both national classification and IPC
H04W74/08(2009.01)i, H04W84/12(2009.01)i, H04W74/00(2009.01)i

Applicant
WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☒ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Reference is made to the following documents:

D1: KR 10-2015-0073165 A (LG ELECTRONICS INC.) 30 June 2015

D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 14 July 2016

D3: KR 10-2016-0045023 A (NEWRACOM, INC.) 26 April 2016

D4: US 2016-0057657 A1 (NEWRACOM, INC.) 25 February 2016

D5: US 2010-0150116 A1 (JI, Lusheng et al.) 17 June 2010

2.1 Novelty and Inventive Step

2.1.1 Claims 1-14

Document D1, which is the most relevant prior art to the invention as set forth in claim 1, discloses a wireless communication terminal including the feature wherein a wireless device (1900) comprises a processor (1920), a memory (1940), and a radio frequency (RF) unit (1960), and the RF unit (1960) is connected to the processor (1920) to transmit/receive a wireless signal (see D1, paragraphs [0205] and [0206] and figure 19).

Claim 1 only differs from document D1 in that document D1 does not clearly disclose the feature, in claim 1, of

"accessing a channel according to the priority of data that a wireless communication terminal will transmit to a base communication terminal", but said difference could be readily derived by a person skilled in the art from the technical feature, in document D1, of defining traffic categories which are transmission priorities and accessing a channel on the basis of the defined traffic categories (see D1, paragraph [0110]). Therefore, the invention as set forth in claim 1 lacks an inventive step in light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 2 is not disclosed in document D1 but could be readily derived from the feature, in document D2, wherein, when a device is not configured to communicate with an AP through multi-user (MU) communication, a first set of EDCA parameters is adjusted, and the first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium (see D2, claims 3 and 6). Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and thus the invention as set forth in claim 2 lacks an inventive step (PCT Article 33(3)).

The additional technical features in claims 3-6 are not disclosed in documents D1 and D2 but could be readily derived from the features, in document D3, wherein: when an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering), the AP considers that a frame exchange starting by the UL MU polling (or UL MU

triggering) is successful (see D3, paragraph [0184]); when a terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period (for example, SIFS + data frame + SIFS + ACK frame) for continuous transmission thereafter, by using duration information included in the CTS frame (see D3, paragraph [0058]); response frames transmitted in a UL MU random access scheme by random STAs which have received a frame which triggers a UL MU random access include a buffer state of a responding STA, an attribute (for example, access category) of UL data, the UL data, or the like (see D3, paragraph [0221]); and an access category-based UL MU random access is performed (see D3, paragraphs [0232] to [0236]). Therefore, it would be obvious to a person skilled in the art to combine the inventions disclosed in documents D1 and D2 and the features disclosed in document D3, and thus the invention as set forth in claims 3-6 lacks an inventive step (PCT Article 33(3)).

The additional technical feature in claim 7 is not disclosed in the cited documents, but "setting a second parameter set timer when transmission of a trigger-based PPDU ends if an MPDU included in the trigger-based PPDU does not request ACK" is merely a simple application of the well-known and commonly used feature, and thus the invention as set forth in claim 7 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 8 could be readily derived from the features, in document D3,

wherein: an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering) (see D3, paragraph [0184]); and a quality of service (QoS) STA performs backoff after an arbitration IFS (AIFS) for an access category (AC) to which a frame belongs elapses, and then transmits the frame (see D3, paragraph [0052]). Therefore, the invention as set forth in claim 8 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 9 could be readily derived from the feature, in document D3, wherein, to support a UL MU random access of a TIM STA, an AP broadcasts, to TIM STAs, a frame (for example, UL MU poll request frame) which triggers a UL MU random access (see D3, paragraph [0224]). Therefore, the invention as set forth in claim 9 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 10 could be readily derived from the feature, in document D2, wherein a first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium when a device is not configured to communicate with an AP through MU communication, and the first set of EDCA parameters is adjusted (see D2, claims 3 and 6) and the feature, in document D3, wherein, when the terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period for continuous transmission thereafter, by using duration information

included in the CTS frame (see D3, paragraph [0058]). Therefore, the invention as set forth in claim 10 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 11 could be readily derived from the features, in document D1, wherein: an STA determines a contention window (CW) size by using a random backoff algorithm and performs a backoff procedure (see D1, paragraph [0095]); and the STA can calculate a backoff time for performing the backoff procedure, on the basis of following mathematical formula 6, and with reference to mathematical formula 6, the CW is a value selected between the minimum value of a passive scanning-specific CW and aCWMax (see D1, paragraphs [0160] to [0162]). Therefore, the invention as set forth in claim 11 lacks an inventive step from the combination of documents D1 and D2 (PCT Article 33(3)).

The additional technical feature in claim 12 could be readily derived from the features, in document D1, wherein: an STA determines a CW size by using a random backoff algorithm and performs a backoff procedure (see D1, paragraph [0095]); and the STA can calculate a backoff time for performing the backoff procedure on the basis of the following mathematical formula 6, and with reference to mathematical formula 6, the CW is a value selected between the minimum value of a passive scanning-specific CW and aCWMax (see D1, paragraphs [0160] to [0162]). Therefore, the invention as set forth in claim 12 lacks an inventive step in light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 13 could be readily derived from the feature, in document D1, wherein a four ACs-based transmission queue defined in 802.11e MAC can act as an individual EDCA contention entity for a wireless medium access in one STA, and one AC maintains an independent backoff counter with an own AIFS value (see D1, paragraph [0124] and figure 11). Therefore, the invention as set forth in claim 13 lacks an inventive step in light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 14 is not disclosed in the cited documents, but "maintaining a backoff timer corresponding to a queue as 0 when no data is stored in the queue and the backoff timer is 0" is merely a simple application of the well-known and commonly used feature, and thus the invention as set forth in claim 14 lacks an inventive step in light of document D1 (PCT Article 33(3)).

2.1.2 Claims 15-20

Document D1, which is the most relevant prior art to the invention as set forth in claim 15, discloses a method comprising a step of transmitting traffic data through a channel access (see D1, paragraphs [0006] and [0110]). Claim 15 only differs from document D1 in that document D1 does not clearly disclose the feature, in claim 15, of "accessing a channel according to the priority of data to be transmitted to a base wireless communication terminal", but said difference could be readily derived by a person skilled in the art from the technical feature, in document D1, of defining traffic categories

which are transmission priorities and accessing a channel on the basis of the defined traffic categories (see D1, paragraph [0110]). Therefore, the invention as set forth in claim 15 lacks an inventive step in the light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 16 is not disclosed in document D1 but could be readily derived from the feature, in document D1, of defining traffic categories which are transmission priorities to determine the priority for accessing a channel on the basis of the defined traffic categories and transmitting traffic data (see D1, paragraph [0110]) and the feature, in document D2, wherein, when a device is not configured to communicate with an AP through MU communication, a first set of EDCA parameters is adjusted, and the first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium (see D2, claims 3 and 6). Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and thus the invention as set forth in claim 16 lacks an inventive step (PCT Article 33(3)).

The additional technical features in claims 17-20 are not disclosed in documents D1 and D2 but could be readily derived from the features, in document D3, wherein: when an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering), the AP considers that a frame exchange starting by the UL MU polling (or UL MU triggering) is successful (see D3, paragraph [0184]);

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

when the terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period (for example, SIFS + data frame + SIFS + ACK frame) for continuous transmission thereafter, by using duration information included in the CTS frame (see D3, paragraph [0058]); response frames transmitted in a UL MU random access scheme by random STAs which have received a frame which triggers a UL MU random access include a buffer state of a responding STA, an attribute (for example, access category) of UL data, the UL data, or the like (see D3, paragraph [0221]); and an access category-based UL MU random access is performed (see D3, paragraphs [0232] to [0236]). Therefore, it would be obvious to a person skilled in the art to combine the inventions disclosed in documents D1 and D2 and the features disclosed in document D3, and thus the invention as set forth in claims 17-20 lacks an inventive step (PCT Article 33(3)).

2.2 Industrial Applicability

The invention as set forth in claims 1-20 is industrially applicable (PCT Article 33(4)).

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. The wording "the base communication terminal" in claims 1 and 16 is unclear since said wording is not previously defined, and thus claims 1 and 16 do not meet the requirement of PCT Article 6.
(Note: The present international search report and written opinion have been established on the basis of the assumption that "the base communication terminal" is "the base wireless communication terminal".)

2. The wording "the traffic priority" in claim 12 is unclear since said wording is not previously defined, and thus claim 12 does not meet the requirement of PCT Article 6.

3. The wording "the transmission and reception unit" in claim 17 is unclear since said wording is not previously defined, and thus claim 17 does not meet the requirement of PCT Article 6.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference WILP170086WO	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/KR2017/009841	International filing date *(day/month/year)* 07 September 2017 (07.09.2017)	Priority date *(day/month/year)* 07 September 2016 (07.09.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 12 March 2019 (12.03.2019)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Kihwan Moon e-mail: pct.team1@wipo.int

Form PCT/IB/373 (January 2004)

특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 06776 서울시 서초구 마방로 48, 2층

PCT

국제조사기관의 견해서

(PCT규칙 43의2.1)

발송일 *(일/월/년)*	2018년 01월 09일 (09.01.2018)
출원인 또는 대리인의 서류참조기호 WILP170086WO	**추가적인 조치** 아래 2를 참조

국제출원번호	국제출원일 *(일/월/년)*	우선일 *(일/월/년)*
PCT/KR2017/009841	2017년 09월 07일 (07.09.2017)	2016년 09월 07일 (07.09.2016)

국제특허분류(IPC)
H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 74/00(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 01월 09일 (09.01.2018)	진상범 전화번호 +82-42-481-8398

서식 PCT/ISA/237 (표지) (2015년 1월)

국제조사기관의 견해서

국제출원번호
PCT/KR2017/009841

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/KR2017/009841

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	없음	있음
	청구항	1-20	없음
산업상 이용가능성 (IA)	청구항	1-20	있음
	청구항	없음	없음

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: KR 10-2015-0073165 A (엘지전자 주식회사) 2015.06.30
D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 2016.07.14
D3: KR 10-2016-0045023 A (뉴라컴 인코포레이티드) 2016.04.26
D4: US 2016-0057657 A1 (NEWRACOM, INC.) 2016.02.25
D5: US 2010-0150116 A1 (LUSHENG JI 등) 2010.06.17

2.1 신규성 및 진보성

2.1.1 청구항 제1항-제14항

청구항 제1항에 기재된 발명과 가장 근접한 인용문헌 D1에는 무선장치(1900)가 프로세서(1920), 메모리(1940) 및 RF부(radio frequency unit, 1960)를 포함하고, 상기 RF부(1960)는 프로세서(1920)와 연결하여 무선신호를 송신/수신하는 것(D1: 단락 [0205]-[0206]; 및 도면 19 참조)을 포함하는 무선 통신 단말이 제시되어 있습니다.

다만, 청구항 제1항의 특징인 '무선 통신 단말이 베이스 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제1항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제2항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와는 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은

추가 기재란에 계속

국제조사기관의 견해서

국제출원번호
PCT/KR2017/009841

제8기재란 국제출원에 관한 의견

청구범위, 발명의설명 및 도면의 명료성에 관하여 또는 청구범위가 발명의설명에 의하여 충분히 뒷받침되고 있는지에 관하여 다음과 같은 의견을 제시합니다.

1. 청구항 제1항 및 제16항의 '상기 베이스 통신 단말'은 이전에 정의되어 있지 않아 불명확하므로, 청구항 제1항 및 제16항은 PCT 제6조의 요건을 충족시키지 않습니다.
(Note: 본 국제조사 보고서 및 견해서에서는 '상기 베이스 통신 단말'이 '상기 베이스 무선 통신 단말'인 것으로 가정하여 작성되었습니다.)

2. 청구항 제12항의 '상기 트래픽의 우선도'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제12항은 PCT 제6조의 요건을 충족시키지 않습니다.

3. 청구항 제17항의 '상기 송수신부'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제17항은 PCT 제6조의 요건을 충족시키지 않습니다.

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
제5 기재란의 연속

통상의 지식을 가진자에게 자명하므로, 청구항 제2항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제3항-제6항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로 간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제3항-제6항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제7항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '트리거 기반 PPDU가 포함하는 MPDU가 ACK을 요청하지 않는 경우, 트리거 기반 PPDU의 전송을 종료한 때 제2 파라미터 셋 타이머를 설정하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제7항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제8항에 추가된 기술적 특징은 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신하는 것(D3: 단락 [0184] 참조)과 QoS(Quality of Service) STA은 프레임이 속하는 액세스 카테고리(access category, AC)를 위한 AIFS(arbitration IFS) 경과 후 백오프를 수행한 다음 프레임을 전송하는 것(D3: 단락 [0052] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제8항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제9항에 추가된 기술적 특징은 인용문헌 D3의 TIM STA의 UL MU 랜덤 액세스를

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추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

지원하기 위해서, AP는 TIM STA들을 대상으로 UL MU 랜덤 액세스를 트리거하는 프레임(예를 들어, UL MU 폴 요청 프레임)을 브로드캐스트하는 것(D3: 단락 [0224] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제9항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제10항에 추가된 기술적 특징은 인용문헌 D2의 제 1 세트의 EDCA 파라미터는 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제 2 세트와 다르며, 상기 제1 세트의 EDCA 파라미터로 조정하는 것(D2: 청구항 3, 6 참조)과, 인용문헌 D3의 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제10항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제11항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제11항에 기재된 발명은 인용문헌 D1 및 D2의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제12항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있고으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제12항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제13항에 추가된 기술적 특징은 인용문헌 D1의 802.11e MAC에 정의된 4개의 AC 별 전송 큐는 하나의 STA 내에서 무선 매체 액세스를 위해 개별적인 EDCA 경쟁 개체로서 역할을 수행할 수 있고, 하나의 AC는 자신의 AIFS 값을 가지고 독립된 백오프 카운터를 유지하는 것(D1: 단락 [0124]; 및 도면 11 참조)으로부터 용이하게 도출할 수 있습니다.

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추가 기재란

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이전 기재란의 연속

따라서 청구항 제13항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제14항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '큐에 저장된 데이터가 없고, 상기 큐에 해당하는 백오프 타이머가 0인 경우, 상기 백오프 타이머를 0으로 유지하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제14항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

2.1.2 청구항 제15항-제20항
청구항 제15항에 기재된 발명과 가장 근접한 인용문헌 D1에는 채널 액세스를 통해 트래픽 데이터를 전송하는 단계(D1: 단락 [0006], [0110] 참조)를 포함하는 방법이 제시되어 있습니다.
다만, 청구항 제15항의 특징인 '베이스 무선 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제15항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제16항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 우선 순위를 결정하고, 트래픽 데이터를 전송하는 것(D1: 단락 [0110] 참조)과 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제16항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제17항-제20항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로

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추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진 자에게 자명하므로, 청구항 제17항-제20항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

2.2 산업상 이용가능성

청구항 제1항-제20항에 기재된 발명은 산업상 이용가능합니다(PCT 제33조(4)).

Electronic Acknowledgement Receipt

EFS ID:	37125470
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	10-SEP-2019
Filing Date:	06-MAR-2019
Time Stamp:	22:06:06
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		2019-09-10_631950_IDS.pdf	151459 04fba930ad82781b5a2471b3d9053dbb8b5dcc82	yes	4

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	Ref1_US16233078_1stOA_3-18-19.pdf	564087 e537362eb06e3d47cd58a1ba9e0c24fe82684c93	no	15
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Ref7_US16233078_NOA_7-10-19.pdf	597064 4022943628829bbb3c01332ed6ab6b5b3af1faee	no	13
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	Ref10_PCTKR2017009841_IPRP.pdf	804907 10307c77252bf75ddc28d04d0729e1e773b535ff	no	21
Warnings:					
Information:					
		Total Files Size (in bytes):	2117517		

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. and SK TELECOM CO., LTD.	Examiner: NGO, RICKY QUOC
	Art Unit: 2464
Serial No.: 16/294,883	Conf. No.: 6210
Filing or 371 (c) Date: March 6, 2019	Our Ref: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Re: ***Information Disclosure Statement***
Date: September 10, 2019	

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir/Madam:

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

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

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

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

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

Timing and Fees

This IDS is being filed:

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

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

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

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

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

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

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

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

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

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

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

Items Disclosed

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

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

Notice of Allowance dated July 10, 2019 and Non-Final Office Action dated March 18, 2019 for U.S. Patent Application No. 16/233,078

[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 Preliminary Report on Patentability (Chapter I) issued on March 12, 2019 for PCT/KR2017/009841

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.

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

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

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

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on March 6, 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.

September 10, 2019
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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Attorney for Applicant
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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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4

CONFIRMATION NO. 6210

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

PUBLICATION NOTICE



Title:WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Publication No.US-2019-0208571-A1
Publication Date:07/04/2019

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

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/294,883

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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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
16/294,883	03/06/2019	2642	1720	B-9905CON 631950-4	20	2

CONFIRMATION NO. 6210

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LOS ANGELES, CA 90036-5679

FILING RECEIPT

OC000000106786571

Date Mailed: 03/25/2019

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Inventor(s)

Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;
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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 PCT/KR2017/009841 09/07/2017

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 10-2016-0114822 09/07/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0116877 09/10/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0116965 09/12/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0117898 09/13/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0122488 09/23/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0147189 11/06/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2017-0022227 02/20/2017 No 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.

If Required, Foreign Filing License Granted: 03/21/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/294,883**
Projected Publication Date: 07/04/2019
Non-Publication Request: No
Early Publication Request: Yes
Title

WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Preliminary Class

455

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).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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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.

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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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PTO/SB/80 (11-08)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.
5F 216 Hwangsaeul-ro Bundang-gu
Seongnam-si, Gyeonggi-do, 13595 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	Nov. 22, 2019
Name	JIN SAM KWAK	Telephone	+82-10-8623
Title	CEO		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/SB/80 (11-05)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

SK TELECOM CO., LTD.
65, Eulji-ro, Jung-gu
Seoul 04539 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	[signature]	Date	Nov. 21, 2019
Name	Bum Soo Shin	Telephone	82-2-6100-7465
Title	Director of IPR		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(c)

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

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

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

4. From: _____ To: _____

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

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

5. From: _____ To: _____

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

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

6. From: _____ To: _____

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

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

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

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

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

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

/Young Seok Koo 76,255/	March 6, 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 USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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.

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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:

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2. From: _____ To: _____

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3. From: _____ To: _____

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

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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☑ 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/	March 6, 2019
Signature	Date
YOUNG SEOK KOO	76,255
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

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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).
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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)).
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.
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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-170086-US
Wilus Ref: FNHEWW-170023-US
Our Ref: B-9905CON 631950-4

ASSIGNMENT

WHEREAS, I/we, Woojin AHN of Gyeonggi-do, Republic of Korea, Juhyung SON of Gyeonggi-do, Republic of Korea, Geonjung KO of Gyeonggi-do, Republic of Korea, and Jinsam KWAK of Gyeonggi-do, Republic of Korea ("Assignor"), am/are the inventor(s) of an invention entitled "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME" 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. 10-2016-0114822 filed on September 7, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0116877 filed on September 10, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0116965 filed on September 12, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0117898 filed on September 13, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0122488 filed on September 23, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0147189 filed on November 6, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2017-0022227 filed on February 20, 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/KR2017/009841 filed on September 7, 2017,

[x] an application for Letters Patent which is identifiable in the Patent Office of _____ by Application No. _____ filed on _____;

WHEREAS, (1) WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., an institute organized and existing under the laws of Republic of Korea ("Assignee"), 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 September 7, 2016, *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.

Woojin AHN

(Inventor / Assignor)

Feb. 20. 2019

Date

Juhyung SON

(Inventor / Assignor)

Feb 20 2019

Date

Geonjung KO

(Inventor / Assignor)

Feb 20, 2019

Date

Jinsam KWAK

(Inventor / Assignor)

Feb. 20. 2019

Date

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	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.	2016/0057657	Feb. 25, 2016	SEOK			
	2.	2010/0150116	Jun. 17, 2010	Ji et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	3.	10-2015-0073165	Jun. 30, 2015	KR			KIPRIS
	4.	2016/112146	Jul. 14, 2016	WO			
	5.	10-2016-0045023	Apr. 26, 2016	KR			KIPRIS
	6.	2018/048229	Mar. 15, 2018	WO			Espacenet

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

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	7.	International Search Report for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation from WIPO (now published as WO 2018/048229)
	8.	Written Opinion of the International Searching Authority for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation by Google Translate (now published as WO 2018/048229)
	9.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r0, July 2016, Slides 1-21 created on created on July 25, 2016
	10.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r1, July 2016, Slides 1-33 created on July 25, 2016
	11.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r2, July 2016, Slides 1-32 created on September 12, 2016
	12.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r3, July 2016, Slides 1-32 created on September 12, 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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/009841

A. CLASSIFICATION OF SUBJECT MATTER

H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 74/00(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 74/08; H04W 74/00; H04L 5/00; H04W 28/06; H04W 84/12

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: EDCA(Enhanced Distribution Channel Access), AP, UE, PPDU, priority, AC(Access Category), timer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2015-0073165 A (LG ELECTRONICS INC.) 30 June 2015 See paragraphs [0006], [0095], [0110], [0124], [0160]-[0162], [0205]-[0206], and figures 11, 19.	1,12-15
Y		2-11,16-20
Y	WO 2016-112146 A1 (QUALCOMM INCORPORATED) 14 July 2016 See claims 3, 6.	2-11,16-20
Y	KR 10-2016-0045023 A (NEWRACOM, INC.) 26 April 2016 See paragraphs [0052], [0058], [0184], [0221], [0224], [0232]-[0236].	3-10,17-20
A	US 2016-0057657 A1 (NEWRACOM, INC.) 25 February 2016 See paragraphs [0043]-[0051]; and figure 1.	1-20
A	US 2010-0150116 A1 (JI, Lusheng et al.) 17 June 2010 See paragraphs [0020]-[0028]; and figures 1-2.	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
09 JANUARY 2018 (09.01.2018)	**09 JANUARY 2018 (09.01.2018)**
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/KR2017/009841

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2015-0073165 A	30/06/2015	US 2015-0245382 A1	27/08/2015
		US 9380602 B2	28/06/2016
		WO 2014-061992 A1	24/04/2014
WO 2016-112146 A1	14/07/2016	AU 2016-205258 A1	15/06/2017
		CN 107113887 A	29/08/2017
		KR 10-2017-0103777 A	13/09/2017
		TW 201632026 A	01/09/2016
		US 2016-0198500 A1	07/07/2016
KR 10-2016-0045023 A	26/04/2016	US 2016-113034 A1	21/04/2016
US 2016-0057657 A1	25/02/2016	KR 10-2016-0022790 A	02/03/2016
US 2010-0150116 A1	17/06/2010	US 8125969 B2	28/02/2012

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 WILP170086WO	추가적인 조치	서식 PCT/ISA/220 및 아래 5.(해당하는경우) 참조
국제출원번호 **PCT/KR2017/009841**	국제출원일 *(일/월/년)* 2017년 09월 07일 (07.09.2017)	(최) 우선일 *(일/월/년)* 2016년 09월 07일 (07.09.2016)
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 28 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/KR2017/009841

A. 발명이 속하는 기술분류(국제특허분류(IPC))

H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 74/00(2009.01)i

B. 조사된 분야

조사된 최소문헌(국제특허분류를 기재)
H04W 74/08; H04W 74/00; H04L 5/00; H04W 28/06; H04W 84/12

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: EDCA(Enhanced Distribution Channel Access), AP, UE, PPDU, priority, AC(Access Category), timer

C. 관련 문헌

카테고리*	인용문헌명 및 관련 구절(해당하는 경우)의 기재	관련 청구항
X	KR 10-2015-0073165 A (엘지전자 주식회사) 2015.06.30 단락 [0006], [0095], [0110], [0124], [0160]-[0162], [0205]-[0206]; 및 도면 11, 19 참조.	1,12-15
Y		2-11,16-20
Y	WO 2016-112146 A1 (QUALCOMM INCORPORATED) 2016.07.14 청구항 3, 6 참조.	2-11,16-20
Y	KR 10-2016-0045023 A (뉴라컴 인코포레이티드) 2016.04.26 단락 [0052], [0058], [0184], [0221], [0224], [0232]-[0236] 참조.	3-10,17-20
A	US 2016-0057657 A1 (NEWRACOM, INC.) 2016.02.25 단락 [0043]-[0051]; 및 도면 1 참조.	1-20
A	US 2010-0150116 A1 (LUSHENG JI 등) 2010.06.17 단락 [0020]-[0028]; 및 도면 1-2 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 01월 09일 (09.01.2018)	2018년 01월 09일 (09.01.2018)

ISA/KR의 명칭 및 우편주소
대한민국 특허청
(35208) 대전광역시 서구 청사로 189,
4동 (둔산동, 정부대전청사)
팩스 번호 +82-42-481-8578

심사관
진상범
전화번호 +82-42-481-8398

서식 PCT/ISA/210 (두 번째 용지) (2015년 1월)

국 제 조 사 보 고 서
대응특허에 관한 정보

국제출원번호
PCT/KR2017/009841

국제조사보고서에서 인용된 특허문헌	공개일	대응특허문헌	공개일
KR 10-2015-0073165 A	2015/06/30	US 2015-0245382 A1	2015/08/27
		US 9380602 B2	2016/06/28
		WO 2014-061992 A1	2014/04/24
WO 2016-112146 A1	2016/07/14	AU 2016-205258 A1	2017/06/15
		CN 107113887 A	2017/08/29
		KR 10-2017-0103777 A	2017/09/13
		TW 201632026 A	2016/09/01
		US 2016-0198500 A1	2016/07/07
KR 10-2016-0045023 A	2016/04/26	US 2016-113034 A1	2016/04/21
US 2016-0057657 A1	2016/02/25	KR 10-2016-0022790 A	2016/03/02
US 2010-0150116 A1	2010/06/17	US 8125969 B2	2012/02/28

특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 06776 서울시 서초구 마방로 48, 2층

PCT

국제조사기관의 견해서

(PCT규칙 43의2.1)

발송일 *(일/월/년)*	2018년 01월 09일 (09.01.2018)
출원인 또는 대리인의 서류참조기호 WILP170086WO	**추가적인 조치** 아래 2를 참조

국제출원번호	국제출원일 *(일/월/년)*	우선일 *(일/월/년)*
PCT/KR2017/009841	2017년 09월 07일 (07.09.2017)	2016년 09월 07일 (07.09.2016)

국제특허분류(IPC)
H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 74/00(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 01월 09일 (09.01.2018)	진상범 전화번호 +82-42-481-8398

서식 PCT/ISA/237 (표지) (2015년 1월)

국제조사기관의 견해서

국제출원번호
PCT/KR2017/009841

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/KR2017/009841

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	없음	있음
	청구항	1-20	없음
산업상 이용가능성 (IA)	청구항	1-20	있음
	청구항	없음	없음

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: KR 10-2015-0073165 A (엘지전자 주식회사) 2015.06.30
D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 2016.07.14
D3: KR 10-2016-0045023 A (뉴라컴 인코포레이티드) 2016.04.26
D4: US 2016-0057657 A1 (NEWRACOM, INC.) 2016.02.25
D5: US 2010-0150116 A1 (LUSHENG JI 등) 2010.06.17

2.1 신규성 및 진보성

2.1.1 청구항 제1항-제14항

청구항 제1항에 기재된 발명과 가장 근접한 인용문헌 D1에는 무선장치(1900)가 프로세서(1920), 메모리(1940) 및 RF부(radio frequency unit, 1960)를 포함하고, 상기 RF부(1960)는 프로세서(1920)와 연결하여 무선신호를 송신/수신하는 것(D1: 단락 [0205]-[0206]; 및 도면 19 참조)을 포함하는 무선 통신 단말이 제시되어 있습니다.

다만, 청구항 제1항의 특징인 '무선 통신 단말이 베이스 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제1항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제2항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와는 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은

추가 기재란에 계속

국제출원번호

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국제조사기관의 견해서

제8기재란 국제출원에 관한 의견

청구범위, 발명의설명 및 도면의 명료성에 관하여 또는 청구범위가 발명의설명에 의하여 충분히 뒷받침되고 있는지에 관하여 다음과 같은 의견을 제시합니다.

1. 청구항 제1항 및 제16항의 '상기 베이스 통신 단말'은 이전에 정의되어 있지 않아 불명확하므로, 청구항 제1항 및 제16항은 PCT 제6조의 요건을 충족시키지 않습니다.
(Note: 본 국제조사 보고서 및 견해서에서는 '상기 베이스 통신 단말'이 '상기 베이스 무선 통신 단말'인 것으로 가정하여 작성되었습니다.)

2. 청구항 제12항의 '상기 트래픽의 우선도'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제12항은 PCT 제6조의 요건을 충족시키지 않습니다.

3. 청구항 제17항의 '상기 송수신부'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제17항은 PCT 제6조의 요건을 충족시키지 않습니다.

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
제5 기재란의 연속

통상의 지식을 가진자에게 자명하므로, 청구항 제2항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제3항-제6항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로 간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제3항-제6항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제7항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '트리거 기반 PPDU가 포함하는 MPDU가 ACK을 요청하지 않는 경우, 트리거 기반 PPDU의 전송을 종료한 때 제2 파라미터 셋 타이머를 설정하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제7항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제8항에 추가된 기술적 특징은 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신하는 것(D3: 단락 [0184] 참조)과 QoS(Quality of Service) STA은 프레임이 속하는 액세스 카테고리(access category, AC)를 위한 AIFS(arbitration IFS) 경과 후 백오프를 수행한 다음 프레임을 전송하는 것(D3: 단락 [0052] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제8항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제9항에 추가된 기술적 특징은 인용문헌 D3의 TIM STA의 UL MU 랜덤 액세스를

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

지원하기 위해서, AP는 TIM STA들을 대상으로 UL MU 랜덤 액세스를 트리거하는 프레임(예를 들어, UL MU 폴 요청 프레임)을 브로드캐스트하는 것(D3: 단락 [0224] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제9항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제10항에 추가된 기술적 특징은 인용문헌 D2의 제 1 세트의 EDCA 파라미터는 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제 2 세트와 다르며, 상기 제1 세트의 EDCA 파라미터로 조정하는 것(D2: 청구항 3, 6 참조)과, 인용문헌 D3의 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제10항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제11항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제11항에 기재된 발명은 인용문헌 D1 및 D2의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제12항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있고으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제12항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제13항에 추가된 기술적 특징은 인용문헌 D1의 802.11e MAC에 정의된 4개의 AC 별 전송 큐는 하나의 STA 내에서 무선 매체 액세스를 위해 개별적인 EDCA 경쟁 개체로서 역할을 수행할 수 있고, 하나의 AC는 자신의 AIFS 값을 가지고 독립된 백오프 카운터를 유지하는 것(D1: 단락 [0124]; 및 도면 11 참조)으로부터 용이하게 도출할 수 있습니다.

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

따라서 청구항 제13항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제14항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '큐에 저장된 데이터가 없고, 상기 큐에 해당하는 백오프 타이머가 0인 경우, 상기 백오프 타이머를 0으로 유지하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제14항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

2.1.2 청구항 제15항-제20항
청구항 제15항에 기재된 발명과 가장 근접한 인용문헌 D1에는 채널 액세스를 통해 트래픽 데이터를 전송하는 단계(D1: 단락 [0006], [0110] 참조)를 포함하는 방법이 제시되어 있습니다.
다만, 청구항 제15항의 특징인 '베이스 무선 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제15항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제16항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 우선 순위를 결정하고, 트래픽 데이터를 전송하는 것(D1: 단락 [0110] 참조)과 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제16항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제17항-제20항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진 자에게 자명하므로, 청구항 제17항-제20항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

2.2 산업상 이용가능성

청구항 제1항-제20항에 기재된 발명은 산업상 이용가능합니다(PCT 제33조(4)).

Patent Cooperation Treaty
International Research Organization
repair·
Moth
2nd floor of Mabangro 48, Seocho-gu, Seoul, Korea 06776
References to documents filed or written by Daerian
WILPl 70086WO
Shipping Earl
(Days / Will / year)
Additional action
Defense of international application
PCT / KR2017 / 009841
I International Application
Sep 07, 2017 Earl (07.09.2017)
International Patent Classification (IPC)
H04W 74108 (2009.01) i, H04W 84112 (2009.01) i, H04W 74100 (2009.01) i
Filed
Willrus Standard Technology Laboratory Co., Ltd.
l 'Include information on the following fields,
~ The basis of the opinion
Ordinance 2
PCT / KR2017 / 009841
PCT
Opinion of the International Searching Authority
(2 1 of PCT Regulation 43)
2018 Jan 09 (09.01.2018)
See below 2
First of all,
Sep 07, 2016 Earl (07.09.2016)
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
Comment 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 01/09 (09.01.2010)
Examiner
Jin Sang Bum
Phone number +82 82 42 481 8398

Defense of international application
The International Searching Authority
PCT / KR2017 / 009841
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 authorized 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)

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PCT / KR2017 / 009841
Article 571 (a) (i) of PCT Rule 43: (a) (i) of the PCT Rule 43 novelty, inventive step or industrial applicability,
Explanations and explanations supporting this
l 'opinion
Novelty (N) claim 1 20
Claim
Progressive (IS) Claim
Claim 1
Acid availability (IA) Claim 1 20
Claim
2. Disclaimers and Explanations'
The following is a cited document.

Dl: KR 10-2015-0073165 A (LG Electronics Co., Ltd.) 2015.06.30
D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 2016.07.14
D3: KR 10-2016-0045023 A (Nyuracom INCORPORATED) 2016.04.26
D4: US 2016-0057657 Al (NEWRACOM, INC.) 2016.02.25
D5: US 2010-0150116 Al (LUSHENG JI etc) 2010.06.17

2.1 Preliminary and Advancement
2.1.1 Claims Clauses 1 to 14
.), Lambda 1 p
.), Λ1 D
.), Λ1 D
In the cited document D1 closest to the invention described in claim 1,
(1960), a memory (1940), and an R part (radio fr, εquεncy unit, 1960), and the R part (1960)
(Dl: Paragraph [0205] - and Figure 19
) Is shown in Fig.
However, in the case where the data of the data to be transmitted to the wireless copper terminal,
Access to the channel according to priority & quot; is explicitly described in the above cited document D1
However, the difference is that the above-mentioned cited documents
The traffic category (traffic catεgoriεs), which is the transmission priority of the DL, is defined,
(Dl: see paragraph [O 11 O]), it is easy to derive from the technical specification
It is possible. Therefore, the invention described in claim 1 is not inventive by the reference document D1.
(PCT Article 33 (3)).
The technical specifications added to claim 2 are not presented in the reference D1,
If the device in D2 is not configured to route to the AP through a multi-user (MU) copper line,
& Lt; / RTI & gt; of the EDCA parameter, which is used for access to the medium,
(D2: see claims 3 and 6) which is different from the second set.
Therefore, combining the above-described specifications described in the reference document D1 with the above-

Continue to add additional fields
Format PCT/ISA, 237 (Article 571) (2015 l Will)
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Article 871 Comments on International Application
As to the clarity of the claims, the description of the invention and the drawings, or whether the claims are fully supported by the description of the invention
W We give the following comments
1. Claim 1 and Base 1116 1. Since the base communication terminal 1 has not been previously defined and is unclear,
And 16 do not meet the requirements of PCT Article VI.
(Note: In this international search report and the written statement 1, the base communication terminal 1
It was created by assuming.)
1, the base wireless communication terminal 1
2. Priority 1 of the traffic according to claim 12 is unclear because it has not been previously defined,
Section 12 does not meet the requirements of Article 6 of the PCT.
3. Since the transmitter / receiver 1 of claim 17 is not previously defined and is unclear,
PCT does not meet the requirements of Article 6.
Format PCT / ISA / 237 (Article 8) (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
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PCT / KR2017 / 009841
The invention described in claim 2 is not inventive since it is self-evident to a person with ordinary knowledge
(PCT Article 33 (3)).
The technical specifications added to claims 3 to 6 are not given in the references D1 and D2
, The AP of the cited document D3 instructs it by polling for UL MU transmission (or UL MU triggering)
(E.g., an MPDU) from at least one STA that has been received,
If the frame exchange initiated by UL MU polling (or UL MU triggering) is successful
(See D3: paragraph [0184]), the terminal STA3 transmits the CTS frame
A frame transmission period (for example,
For example, setting a NAV timer for a SIPS + data frame + a SIPS + ACK frame)
(See D3: paragraph [0058]), an arbitrary STA that has repaired a frame triggering the UL MU random access
The response frame transmitted by the UL MU random access method includes the buffer state of the responding STA
(For example, an access category), UL data, etc.
(See D3: paragraph [0221]), performing access category based UL MU random access (D3:
Can be easily derived from the rock (see [0232] - [0236]). Therefore, the cited documents D1

and D2
To combine the above-described specification described in the reference document D3 with the invention described in
, The invention described in claims 3 to 6 is not inventive (see PCT Article 33
(3)).
The technical specification added in claim 7 is not included in the above cited documents,
If the MPDU included in the initiator-based PPDU does not request an ACK,
Before PPDU
Setting the second parameter set timer at the end of a song 'is a simple
The invention described in claim 7 is not limited to the application of any of the references D1, D2 and D3
There is no progressivity by sum (PCT Article 33 (3)).
The technical specification added in claim 8 is that the AP of the reference D3 polls for UL MU transmission
(E.g., UL MU triggering) from at least one STA,
(D3: see paragraph [0184]) and QoS (Quality of Service)
AIFS (arbitration IFS) for the access category (aceɛss catɛgory, AC)
Off & lt; / RTI & gt; and then transmitting the frame (see D3: paragraph [0052]).
You can. Therefore, the invention according to claim 8 is based on the combination of the reference documents D1 D2 and D3
(PCT Article 33 (3)).
The technical specification added to claim 9 is the UL MU Random Access of the TIM STA of the reference D3
Continued on next page

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Additional fields
If there is not enough space in the previous section,
Continuation of the
Defense of international application
PCT / KR2017 / 009841
To support, the AP sends a frame to the TIM STAs to trigger a UL MU random access
(E.g., UL MU poll request frame) (D3: see paragraph [0224]),
It is easy to draw. Therefore, the invention described in claim 9 is based on the documents Dl, D2
And D3 (PCT Article 33 (3)).
The technical specification added to claim 10 is that the EDCA parameter of the first set of reference D2 is a chapter
If the device is not configured to route to the AP through a multi-user (MU) copper line,
Which is different from the second set of EDCA parameters used for the first set of EDCA parameters,
(D2: refer to claims 3 and 6), and the terminal STA3 of the reference document D3 transmits the CTS frame
It is possible to transmit continuously afterwards using the duration information included in the CTS frame
(See D3: paragraph [0058]) for the NAV timer for the next frame transfer period

It can be easily derived. Therefore, the invention described in claim 10 is related to the documents D1, D2
And D3 (PCT Article 33 (3)).
The technical specification added to claim 11 is that the STA of the reference D1 is a random back-
(CW) size is determined by a random backoff algorithm, and a backoff
(See Dl: paragraph [0095]) and the STA performs a backoff procedure to perform the backoff procedure
The time can be calculated based on the following Equation (6), and with reference to Equation (6), cw =
Scanning is the value selected between the minimum value of a specific competing window and aCWMax (Dl: Paragraph
[O 160] - [0162]). Therefore, in the present invention,
The invention is not inventive by virtue of the combination of the references D1 and D2 (PCT Article 33 (3)).
The technical specification added to claim 12 is that the STA of the reference D1 is a random back-
(CW) size is determined by a random backoff algorithm, and a backoff
(See Dl: paragraph [0095]) and the STA performs a backoff procedure to perform the backoff procedure
The time can be calculated based on the following Equation 6, and with reference to Equation 6, Sheve Scanning is the value selected between the minimum value of a specific competing window and aCWMax (Dl: Paragraph
[O 160] - [0162]). Thus, in accordance with claim 12,
The invention is not inventive by reference D1 (PCT Article 33 (3)).
The technical specification added to claim 13 is based on the four AC
A star transmission queue is a separate EDCA competitive entity for accessing the medium within a single STA
And one AC can have an AIFS value of charity and an independent backoff counter
(See Dl: paragraph [0124]; see Figure 11).
Continued on next page

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Additional fields
If there is not enough space in the previous section,
Continuation of the
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PCT /KR2017 / 009841
Therefore, the invention described in claim 13 has no inventive step due to the reference document D1 (PCT
33 (3)).
The technical specification added to claim 14 is not included in the above cited documents,
If there is no stored data and the backoff timer corresponding to the queue is 0,
Keeping a zero at zero is merely a simple application of widely-used tolerance techniques,
The invention according to Clause 14 is not inventive by reference D1. (PCT Article 33 (3)).
2.1.2 Claims Clause 15 - Clause 20

In the cited document D1 closest to the invention of claim 15,
(Dl: see paragraphs [0006], [0110]) for transmitting the data.
All
However, according to the priority of the data to be transmitted to the base-mobility mobile terminal,
Quot; accessing & lt; RTI ID = 0.0 & gt; a & lt; / RTI & gt; channel is not explicitly described in the above cited document D1
The difference, however, is that the transfer of the cited document D1 to a person of ordinary knowledge
Define priority traffic category (traffic catɛgoriɛs) to access the channel based on it
(Dl: see paragraph [O 11 O]).
Therefore, the invention described in claim 15 is not inventive by the reference document D1 (PCT No. 33
(3)).
The technical specification added to claim 16 is not presented in the document D1,
The traffic category (traffic catɛgoriɛs), which is the transmission priority of the DL, is defined,
To determine the priority to perform access, and to transmit the traffic data (Dl: Paragraph
[O 11 O]) and the device of the reference document D2 are connected to the AP through the MU (multi-user)
If this is not the case, adjust with the first set of EDCA parameters,
From the second set of EDCA parameters used (D2: see claims 3 and 6)
You can derive. Therefore, in the invention described in the reference document D1 and the invention described in the reference document D2
It will be apparent to one of ordinary skill in the art how to combine specific features,
The name is not inventive (PCT Article 33 (3)).
The technical features added to claims 17 - 20 are not presented in the references D1 and D2
However, if the AP in the cited document D3 is polled by UL MU transmission (or UL MU triggering)
When the indicated data unit (e.g., an MPDU) is recovered from at least one STA,
If the frame exchange initiated by UL MU polling (or UL MU triggering) is successful
Continued on next page

The International Searching Authority
Additional fields
If there is not enough space in the previous section,
Continuation of the
Defense of international application
PCT / KR2017 / 009841
(See D3: paragraph [0184]), the terminal STA3 transmits the CTS frame
A frame transmission period (for example,
For example, setting a NAV timer for a SIPS + data frame + a SIPS + ACK frame)
(See D3: paragraph [0058]), an arbitrary STA that has repaired a frame triggering the UL MU random access
The response frame transmitted by the UL MU random access method includes the buffer state of the responding STA
(For example, an access category), UL data, etc.

(See D3: paragraph [0221]), performing access category based UL MU random access (D3:
Can be easily derived from the rock (see [0232] - [0236]). Therefore, the cited documents D1 and D2
To combine the above-described specification described in the reference document D3 with the invention described in
The inventions claimed in claims 17 to 20 are not inventive (see PCT Article 33 (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)).
Format PCT / ISA / 237 (Additional Resources) (2015 l Will)

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin AHN
Filer:	Young Seok Koo/Azatuhi Chinaryan
Attorney Docket Number:	B-9905CON 631950-4

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:	35346691
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin AHN
Customer Number:	158747
Filer:	Young Seok Koo
Filer Authorized By:	
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	06-MAR-2019
Filing Date:	
Time Stamp:	22:06:41
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	030719INTEFSW22073300
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	631950_ADS_PDF.pdf	112751 f548c6404a87b9036363b22fb92a112fdbaa7c9f	no	10
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2		631950_EngSpecDrawings.pdf	858407 41c0d6db733a285ec9dfde2d70412c774e62b33c	yes	103

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	71
Claims	72	76
Abstract	77	77
Drawings-other than black and white line drawings	78	103

Warnings:					
Information:					
3	Oath or Declaration filed	631950_Declaration_Signed.pdf	60026 ed3df8bebcc74c4ee3712cf65bd9c0ef572d8da0	no	2
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
4	Power of Attorney	631950_POA_All.pdf	893983 f0970a40298b1a98526c235dd5045a25b25e50c1	no	2
Warnings:					

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Information:					
5	Assignee showing of ownership per 37 CFR 3.73	631950_Statement373c.pdf	511617 2af2e7a6416004ebb6d163ca187891ae1eee59b2	no	10
Warnings:					
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Information:					
6		631950_Preliminary_Amendments.pdf	93961 49540194c63a379f68a827c62f9f0fec9bea088d	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Specification	2	2
	Applicant Arguments/Remarks Made in an Amendment	3	3

Warnings:					
Information:					
7		631950_IDS_ver2.pdf	151217 51d492e40a0792d55f87567cfb0a880b156cef9c	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:					
8	Foreign Reference	Ref1_KR10-2015-0073165.pdf	6823807 ba03105e588bfefcc7a9bd452b1f36e0ea4e248f	no	71
Warnings:					
Information:					

9	Foreign Reference	Ref2_WO2016-112146.pdf	2385445 1e8b7a38e2953a92253660c900484306d745ee49	no	54
Warnings:					
Information:					
10	Foreign Reference	Ref3_KR10-2016-0045023.pdf	11691468 541cbfa91b82617f5caf872d9dabd9a9e1e52910	no	122
Warnings:					
Information:					
11	Other Reference-Patent/App/Search documents	Ref_PCTKR2017009841_ISR.pdf	235012 f8b6b9203d623ba41177ef6061e614a9736c26d7	no	5
Warnings:					
Information:					
12	Other Reference-Patent/App/Search documents	Ref_PCTKR2017009841_WROP.pdf	403992 573459b89c00f50001d42706861e38adf91adb71	no	16
Warnings:					
Information:					
13	Foreign Reference	Ref_WO2018-048229.pdf	7886636 895bff9f10f1b3176036913f122b4a7308ed3d40	no	155
Warnings:					
Information:					
14	Non Patent Literature	Ref6_11-16-0998-00-00ax-rules-for2_NPL.pdf	1263470 c3cc06f4c516c7263b2f01235edc043a6c1596c1	no	21
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
15	Non Patent Literature	Ref7_11-16-0998-01-00ax-rules-for2_NPL.pdf	1967232 e420d3a868a378826bd59c8ffbb83d3c7a44ca84	no	33
Warnings:					
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Image File Wrapper and may affect subsequent processing					
Information:					
16	Non Patent Literature	Ref8_11-16-0998-02-00ax-rules-for2_NPL.pdf	1906721 e12c9bf66aa65ea626c80f15b8de948fabe81b40	no	32
Warnings:					
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Information:					
17	Non Patent Literature	Ref9_11-16-0998-03-00ax-rules-for2_NPL.pdf	1919781 08ffd60aedac7155da1c0f6fff8cb12bfe44f8a1	no	32
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
18	Fee Worksheet (SB06)	fee-info.pdf	35145 b447513751ae7cbd34a95333781e988825eaf6af	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	39200671	

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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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
	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

Inventor 2 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 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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		
Address 2	915beon-gil Yeongtong-gu Suwon-si		
City	Gyeonggi-do	State/Province	
Postal Code	16547	Country [i]	KR

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	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:

Address 1	1113-1704, 11 Naesonjungang-ro Uiwang-si		
Address 2			
City	Gyeonggi-do	State/Province	
Postal Code	16021	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-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

Application Information:

Title of the Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME		
Attorney Docket Number	B-9905CON 631950-4	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	26	**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-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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	PCT/KR2017/009841	2017-09-07

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)
10-2016-0114822	KR	2016-09-07	
Remove			
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2016-0116877	KR	2016-09-10	
Remove			
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2016-0116965	KR	2016-09-12	
Remove			
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2016-0117898	KR	2016-09-13	
Remove			
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2016-0122488	KR	2016-09-23	
Remove			
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2016-0147189	KR	2016-11-06	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0022227	KR	2017-02-20	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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:

Address 1	65, Eulji-ro Jung-gu		
Address 2			
City	Seoul	**State/Province**	
Country	KR	Postal Code	04539
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	B-9905CON 631950-4
	Application Number	
Title of Invention	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

Organization Name	

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Young Seok Koo 76255/			Date (YYYY-MM-DD)	2019-03-06
First Name	Young Seok	Last Name	Koo	Registration Number	76,255

Additional Signature may be generated within this form by selecting the Add button.

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

[DESCRIPTION]

[Invention Title]

WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

[Technical Field]

The present invention relates to wireless communication method and a wireless communication terminal using enhanced distributed channel access.

[Background Art]

In recent years, with supply expansion of mobile apparatuses, a wireless communication technology that can provide a rapid wireless Internet service to the mobile apparatuses has been significantly spotlighted. The wireless communication 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.

One of most famous wireless communication technology is wireless LAN technology. 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 Orthogonal Frequency Division Multiplexing (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 communication technology standards after the 802.11ac and 802.11ad, discussion for providing a high-efficiency and high-performance wireless communication technology in a high-density environment is continuously performed. That is, in a next-generation wireless communication technology environment, communication having high frequency efficiency needs to be provided indoors/outdoors under the presence of high-density terminals and base terminals and various technologies for implementing the communication are required.

Especially, as the number of devices using a wireless communication technology increases, it is necessary to efficiently use a predetermined channel. Therefore, required is a technology capable of efficiently using bandwidths by simultaneously transmitting data between a plurality of terminals and base terminals.

[Disclosure]

[Technical Problem]

An object of an embodiment of the present invention is to provide a wireless communication terminal using enhanced distributed channel access.

[Technical Solution]

According to an embodiment of the present invention, a wireless communication terminal that wirelessly communicates with a base wireless communication terminal includes: a transceiver; and a processor for processing a radio signal received through the transceiver or a radio signal to be transmitted through the transceiver. The processor is configured to access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal.

The processor may be configured to switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal.

The processor may be configured to transmit the trigger-based physical layer

protocol data unit (PPDU) to the base wireless communication terminal using the transceiver, set a second parameter set timer according to an immediate response reception based on whether an immediate response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received, and when the second parameter set timer expires, terminate the application of the second parameter set.

The processor may be configured to set the second parameter set timer when the immediate response reception ends.

The processor may be configured to set the second parameter set timer for an access category of an MPDU for which the immediate response is received.

The processor may be configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

When the MPDU included in the trigger-based PPDU does not request an ACK, the processor may be configured to set the second parameter set timer when the transmission of the trigger-based PPDU ends.

The MPDU included in the trigger-based PPDU may be a QoS data frame.

The processor may be configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

When switching the parameter set from the first parameter set to the second parameter set, the processor may be configured to set the second parameter set timer.

The processor may be configured to calculate a random integer value in a contention window (CW), set a backoff timer based on the random integer value, and access a channel based on the back off timer and a predetermined slot time, wherein the

parameter set may include a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

The processor may be configured to calculate a random integer value in a contention window (CW), set a backoff timer based on the random integer value, access a channel based on the back off timer and a predetermined slot time, and when a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the traffic, set the value of the CW to the CWmax.

The processor may be configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and perform a backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer, wherein the backoff timer may be set based on a random integer value calculated within a contention window (CW), and may be reduced when the channel is idle for a predetermined slot time.

When there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor may be configured to maintain the backoff timer to be 0.

According to an embodiment of the present invention, an operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal includes: accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal; and transmitting the data through the channel.

The accessing of the channel may include: switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter

set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal; and accessing a channel using a second set of parameters based on a priority of the traffic to be transmitted to the base communication terminal by the wireless communication terminal.

The method may further include transmitting a trigger-based PPDU to the base wireless communication terminal using the transceiver, wherein the switching from the first parameter set to the second parameter set may include: setting a second parameter set timer according to an immediate response reception based on whether an immediate response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received, and when the second parameter set timer expires, terminating the application of the second parameter set.

The setting of the second parameter set timer may include setting the second parameter set timer when the immediate response reception ends.

The setting of the second parameter set timer may include setting the second parameter set timer for an access category of an MPDU for which the immediate response is received.

The setting of the second parameter set timer may determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

The setting of the second parameter set timer may include setting the second parameter set timer when transmission of the trigger based PPDU ends when the MPDU included in the trigger based PPDU does not request an ACK.

[Advantageous Effects]

An embodiment of the present invention provides a wireless communication

method using enhanced distributed channel access and a wireless communication terminal using the same..

[Description of Drawings]

FIG. 1 shows a wireless LAN system according to an embodiment of the present invention.

FIG. 2 shows a wireless LAN system according to another embodiment of the present invention.

FIG. 3 shows a block diagram illustrating a configuration of a station according to an embodiment of the inventive concept.

FIG. 4 shows a block diagram illustrating a configuration of an access point according to an embodiment of the present invention.

FIG. 5 shows a process that a station sets an access point and a link according to an embodiment of the present invention.

FIG. 6 shows that a wireless communication terminal according to an embodiment of the present invention adjusts EDCA parameters according to UL MU transmission.

FIG. 7 shows a method of applying an MU EDCA parameter set by a wireless communication terminal according to an embodiment of the present invention.

FIG. 8 shows a method of aggregating multi-TID A-MPDUs by a wireless communication terminal according to an embodiment of the present invention.

FIG. 9 shows an operation in which a wireless communication terminal according to an embodiment of the present invention receives information on an MU EDCA parameter set from a base wireless communication terminal and applies the information on an MU EDCA parameter set.

FIG. 10 describes an operation in which a base wireless communication terminal according to an embodiment of the present invention transmits a BSR through a QoS Control field.

FIG. 11 shows an operation in which a wireless communication terminal according to another embodiment of the present invention receives information on an MU EDCA parameter set from a base wireless communication terminal and applies the information on an MU EDCA parameter set.

FIG. 12 shows an operation in which a wireless communication terminal according to another embodiment of the present invention obtains information on an MU EDCA parameter set from a trigger frame and applies the information on an MU EDCA parameter set.

FIG. 13 shows an operation in which a wireless communication terminal according to another embodiment of the present invention obtains information on an MU EDCA parameter set from a target wake time element and applies the information on an MU EDCA parameter set.

FIG. 14 shows an operation in which a wireless communication terminal according to an embodiment of the present invention terminates the MU EDCA parameter application.

FIG. 15 shows an operation in which a wireless communication terminal according to another embodiment of the present invention terminates the MU EDCA parameter application.

FIG. 16 shows an operation in which a wireless communication terminal according to another embodiment of the present invention applies an MU EDCA parameter.

FIG. 17 shows an A-MPDU generated by a wireless communication terminal according to an embodiment of the present invention and a type of responding for a corresponding A-MPDU.

FIG. 18 shows an operation in which a wireless communication terminal according to another embodiment of the present invention applies an MU EDCA parameter.

FIG. 19 shows an operation in which a wireless communication terminal according to an embodiment of the present invention applies an MU EDCA parameter set.

FIG. 20 shows an operation of changing a CW value while a wireless communication terminal according to an embodiment of the present invention changes an EDCA parameter set.

FIG. 21 shows an operation of changing a CW value while a wireless communication terminal according to an embodiment of the present invention changes an EDCA parameter set.

FIG. 22 shows a specific format of an MU EDCA parameter set element according

to an embodiment of the present invention.

FIG. 23 shows a specific format of an MU EDCA parameter set element according to another embodiment of the present invention.

FIG. 24 shows an EDCA operation after UL MU transmission of a wireless communication terminal according to an embodiment of the present invention.

FIG. 25 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to the embodiment of the present invention is empty and the backoff timer is 0.

FIG. 26 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to another embodiment of the present invention is empty and the backoff timer is 0.

FIG. 27 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to another embodiment of the present invention is empty and the backoff timer is 0.

FIG. 28 shows the operation of a wireless communication terminal according to an embodiment of the present invention.

[Mode for Carrying out the Invention]

Preferred embodiments of the present invention will be described below in more detail with reference to the accompanying drawings. The present invention may, however, be embodied in different forms and should not be constructed as limited to the embodiments set forth herein. Parts not relating to description are omitted in the drawings in order to clearly describe the present invention and like reference numerals refer to like elements throughout.

Furthermore, when it is described that one comprises (or includes or has) some elements, it should be understood that it may comprise (or include or has) only those elements, or it may comprise (or include or have) other elements as well as those elements if there is no specific limitation.

This application claims priority to and the benefit of Korean Patent Application Nos. 10-2016-0114822 (2016.09.07), Nos. 10-2016-0116877 (2016.09.10), Nos. 10-2016-

0116965 (2016.09.12), Nos. 10-2016-0117898 (2016.09.13), Nos. 10-2016-0122488 (2016.09.23), Nos. 10-2016-0147189 (2016.11.06), and Nos. 10-2017-0022227 (2017.02.20) filed in the Korean Intellectual Property Office and the embodiments and mentioned items described in the respective applications are included in the Detailed Description of the present application.

FIG. 1 is a diagram illustrating a wireless communication system according to an embodiment of the present invention. For convenience of description, an embodiment of the present invention is described through the wireless LAN system. 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 concept including a wireless LAN communication device such as non-AP STA, or an AP, or both terms. A station for wireless communication includes a processor and a transceiver 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 transceiver is functionally connected with the processor and transmits and receives frames through the wireless network for the station.

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.

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 communication system according to another embodiment of the present invention. For convenience of description, another embodiment of the present invention is described through the wireless LAN system. 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 transceiver 120, a user interface unit 140, a display unit 150, and a memory 160.

First, the transceiver 120 transmits and receives a wireless signal such as a wireless LAN physical layer frame, or the like and may be embedded in the station 100 or provided as an exterior. According to the embodiment, the transceiver 120 may include at least one transmit and receive module using different frequency bands. For example, the transceiver 120 may include transmit and receive 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 transmit and receive module using a frequency band of 6 GHz or more and a transmit and receive module using a frequency band of 6 GHz or less. The respective transmit and receive 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 transmit and receive module. The transceiver 120 may operate only one transmit and receive module at a time or simultaneously operate multiple transmit and receive modules together according to the performance and requirements of the station 100. When the station 100 includes a plurality of transmit and receive modules, each transmit and receive module may be implemented by independent elements or a plurality of modules may be integrated into one chip.

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 transceiver 120, and the like. The processor 110 may be a modulator and/or demodulator which modulates wireless signal transmitted to the transceiver 120 and demodulates wireless signal received from the transceiver 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 transceiver 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 transceiver 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 transceiver 220 for operating the BSS in at least one frequency band. As described in the embodiment of FIG. 3, the transceiver 220 of the AP 200 may also include a plurality of transmit and receive modules using different frequency bands. That is, the AP 200 according to the embodiment of the present invention may include two or more transmit and receive modules among different frequency bands, for example, 2.4 GHz, 5 GHz, and 60 GHz together. Preferably, the AP 200 may include a transmit and receive module using a frequency band of 6 GHz or more and a transmit and receive module using a frequency

band of 6 GHz or less. The respective transmit and receive modules may perform wireless communication with the station according to a wireless LAN standard of a frequency band supported by the corresponding transmit and receive module. The transceiver 220 may operate only one transmit and receive module at a time or simultaneously operate multiple transmit and receive modules together according to the performance and requirements of the AP 200.

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. The processor 210 may be a modulator and/or demodulator which modulates wireless signal transmitted to the transceiver 220 and demodulates wireless signal received from the transceiver 220. The processor 210 controls various operations such as radio 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).

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.

In a specific embodiment, the AP 200 may be a wireless communication terminal that allocates a communication medium resource and performs scheduling in an independent network, such as an ad-hoc network, which is not connected to an external distribution service. In addition, the AP 200 may be at least one of a base station, an eNB, and a transmission point TP. The AP 200 may also be referred to as a base wireless communication terminal.

In a frequency band commonly used by various wireless communication devices, such as an unlicensed band, a wireless communication terminal may access the channel through a contention procedure. Specifically, if the channel to be accessed by the wireless communication terminal is idle for a predetermined time, the wireless communication terminal starts the backoff procedure. In the backoff procedure, the wireless communication terminal obtains a random integer value in a contention window (CW) and sets the random integer value as a backoff timer. If the corresponding channel is idle during a predetermined slot time, the wireless communication terminal decreases the backoff

timer. If the value of the backoff timer is 0, the wireless communication terminal accesses the corresponding channel. At this time, if the corresponding channel is busy, the wireless communication terminal stops the backoff procedure. If the channel to be accessed by the wireless communication terminal is idle for a predetermined time, the wireless communication terminal resumes the backoff procedure again.

Further, the wireless communication terminal may access the channel according to the priority of the data to be transmitted. Specifically, the wireless communication terminal may use the CW determined according to the priority of the data to be transmitted. At this time, the minimum value CWmin and the maximum value CWmax of CW are determined according to the priority of data to be transmitted by the wireless communication terminal. In addition, the predetermined time at which the wireless communication terminal waits to start the backoff procedure is determined according to the priority of the data to be transmitted by the wireless communication terminal. Also, the wireless communication terminal may wait for a designated time according to the priority of the data to be transmitted, and then start the backoff procedure. The designated time according to the priority is referred to as arbitration interframe space (AIFS). This operation is referred to as enhanced distributed channel access (EDCA). In addition, the priority of data may be determined according to an access category (AC).

The base wireless communication terminal may trigger uplink transmission of one or more wireless communication terminals to the base wireless communication terminal. At this time, one or more wireless communication terminals may perform uplink transmission to a base wireless communication terminal using Orthogonal Frequency-Division Multiple Access (OFDMA). Further, the base wireless communication terminal transmits trigger information to one or more wireless communication terminals through a

trigger frame or a MAC header to trigger uplink transmissions for the base wireless communication terminal of one or more wireless communication terminals. At this time, the base wireless communication terminal accesses the channel for uplink transmission of one or more wireless communication terminals. In addition, one or more wireless communication terminals access the channel for uplink transmission of each of the one or more wireless communication terminals. Therefore, when the uplink transmission of one or more wireless communication terminals is scheduled for uplink transmission by the base wireless communication terminal, the uplink transmission of one or more wireless communication terminals has a higher priority than transmission of other wireless communication terminals that transmit data having the same priority. In addition, since the base wireless communication terminal and one or more wireless communication terminals simultaneously access the channel for the same transmission, the channel access efficiency may decrease. Therefore, when the uplink multi-user (UL-MU) transmission is scheduled, it is necessary to adjust the EDCA parameter value.

In a frequency band commonly used by various wireless communication devices, such as an unlicensed band, a wireless communication terminal may access the channel through a contention procedure. Specifically, if the channel to be accessed by the wireless communication terminal is idle for a predetermined time, the wireless communication terminal starts the backoff procedure. In the backoff procedure, the wireless communication terminal obtains a random integer value within a contention window (CW) and sets the random integer value as a backoff timer. When the corresponding channel is idle during a predetermined slot time, the wireless communication terminal decreases the backoff timer. When the value of the backoff timer is 0, the wireless communication

terminal accesses the corresponding channel. At this time, when the corresponding channel is busy, the wireless communication terminal stops the backoff procedure. When the channel to be accessed by the wireless communication terminal is idle for a predetermined time, the wireless communication terminal resumes the backoff procedure again.

Further, the wireless communication terminal may access the channel according to the priority of the data to be transmitted. Specifically, the wireless communication terminal may use the CW determined according to the priority of the data to be transmitted. At this time, the minimum value CWmin and the maximum value CWmax of CW are determined according to the priority of data to be transmitted by the wireless communication terminal. In addition, the predetermined time at which the wireless communication terminal waits to start the backoff procedure is determined according to the priority of the data to be transmitted by the wireless communication terminal. Also, the wireless communication terminal may wait for a designated time according to the priority of the data to be transmitted, and then start the backoff procedure. The designated time according to the priority is referred to as arbitration interframe space (AIFS). This operation is referred to as enhanced distributed channel access (EDCA). In addition, the priority of data may be determined according to an access category (AC).

The base wireless communication terminal may trigger uplink transmission of one or more wireless communication terminals to the base wireless communication terminal. At this time, one or more wireless communication terminals may perform uplink transmission to a base wireless communication terminal using Orthogonal Frequency-Division Multiple Access (OFDMA). Further, the base wireless communication terminal transmits trigger information to one or more wireless communication terminals through a trigger frame or a MAC header to trigger uplink transmissions for the base wireless

communication terminal of one or more wireless communication terminals. At this time, the base wireless communication terminal accesses the channel for uplink transmission of one or more wireless communication terminals. In addition, one or more wireless communication terminals access the channel for uplink transmission of each of the one or more wireless communication terminals. Therefore, when the uplink transmission of one or more wireless communication terminals is scheduled for uplink transmission by the base wireless communication terminal, the uplink transmission of one or more wireless communication terminals has a higher priority than transmission of other wireless communication terminals that transmit data having the same priority. In addition, since the base wireless communication terminal and one or more wireless communication terminals simultaneously access the channel for the same transmission, the channel access efficiency may decrease. Therefore, when the uplink multi-user (UL-MU) transmission is scheduled, it is necessary to adjust the EDCA parameter value.

FIG. 6 shows that a wireless communication terminal according to an embodiment of the present invention adjusts EDCA parameters according to UL MU transmission.

A wireless communication terminal that is scheduled for UL MU transmission may use a channel access method to ensure channel access success with a lower probability than when it is not scheduled for UL MU transmission. Specifically, a wireless communication terminal scheduled for UL MU transmission may use a separate EDCA parameter set. In a specific embodiment, a wireless communication terminal scheduled for UL MU transmission may use an EDCA parameter set that attempts to access the channel with a lower probability than the previously used EDCA parameter set in channel access for transmitting the same data. At this time, the EDCA parameter set is a set of parameters

used in the EDCA operation according to the priority of the data transmitted by the wireless communication terminal. Specifically, the EDCA parameter set may include parameters for CW. At this time, the parameter for CW may include at least one of CWmin and CWmax. In addition, the EDCA parameter set may include a parameter value related to a predetermined time at which the wireless communication terminal waits to start the backoff procedure. At this time, the predetermined time may be the AIFS described above. For convenience of description, a separate EDCA parameter set used by a wireless communication terminal scheduled for UL MU transmission is referred to as an MU EDCA parameter set.

As in the embodiment of FIG. 7, the wireless communication terminal to which the MU EDCA parameter set is applied accesses the channel when the channel to be accessed is idle for a longer AIFS period than the general AIFS period waiting for transmission of the corresponding data. When the corresponding channel is idle during the AIFS corresponding to the MU EDCA parameter set, the wireless communication terminal starts a backoff procedure for the corresponding channel.

The base wireless communication terminal may transmit information on the MU EDCA parameter set to the wireless communication terminals scheduled for UL MU transmission. Specifically, the base wireless communication terminal may transmit an MU EDCA parameter element including information on the MU EDCA parameter set to a wireless communication terminal scheduled for UL MU transmission. At this time, the base wireless communication terminal may transmit the MU EDCA parameter element using the beacon frame. A concrete method of switching the EDCA parameter set will be described in detail with reference to FIG. 7 to FIG. 11.

FIG. 7 shows a method of applying an MU EDCA parameter set by a wireless communication terminal according to an embodiment of the present invention.

The wireless communication terminal may determine whether to apply the MU EDCA parameter set by each AC. Specifically, the wireless communication terminal may determine whether to apply the MU EDCA parameter set by each AC based on UL MU transmission. In a specific embodiment, the wireless communication terminal may apply the MU EDCA parameter set to data transmission corresponding to the AC scheduled for UL MU transmission. This is because if the MU EDCA parameter set is applied to an AC that does not correspond to the UL MU transmission target, the channel access fairness may be degraded.

In the embodiment of FIG. 7, the wireless communication terminal applies the MU EDCA parameter set. At this time, the wireless communication terminal applies the MU EDCA parameter set to some AC (e.g., BE and BK) indicated by the MU EDCA parameter set. Therefore, in order for AC to transmit traffic corresponding to BE and BK, the wireless communication terminal uses the MU EDCA parameter set to access the channel. At this time, the probability that the wireless communication terminal may start transmission within a predetermined time is lower than when a general EDCA parameter set is used.

When the wireless communication terminal determines whether to apply the MU EDCA parameter set for each AC, the wireless communication terminal may guide the AC to which the MU EDCA parameter set is applied to a specific AC to degrade the fairness with other terminals. For example, the wireless communication terminal may induce only the data of the AC having a relatively large backoff timer value to be scheduled for the UL MU transmission. Therefore, the wireless communication terminal may determine whether to apply the MU EDCA parameter set based on the current channel access wait state.

Specifically, when the wireless communication terminal applies the MU EDCA parameter set, the wireless communication terminal may be regulated to mandatorily apply the MU EDCA parameter set to the primary AC with the shortest channel access wait time. At this time, the channel access wait time may be determined based on the value of the remaining backoff timer and the AIFS value. Specifically, the channel access wait time may be the sum of the time corresponding to the backoff timer and the AIFS. When there are a plurality of wireless communication terminals having a minimum channel access wait time, the wireless communication terminal may restrict the EDCA parameter set application condition to mandatorily apply the MU EDCA parameter set to a plurality of ACs.

FIG. 8 shows a method of aggregating multi-TID A-MPDUs by a wireless communication terminal according to an embodiment of the present invention.

The wireless communication terminal may aggregate a plurality of MPDUs corresponding to each of a plurality of TIDs and generate an Aggregate-MAC Protocol Data Unit (A-MPDU). At this time, the A-MPDU may be referred to as a multi-TID A-MPDU. At this time, when the wireless communication terminal intentionally inserts the MPDU of the TID corresponding to the AC having the largest channel access wait time into the multi-TID A-MPDU, the transmission fairness between the wireless communication terminals may be lowered. Therefore, the wireless communication terminal may be restricted to transmit the multi-TID A-MPDU including the MPDU of the TID corresponding to the AC having the smallest channel access wait time. At this time, the size of the MPDU of the TID corresponding to the AC having the smallest channel access wait time included in the multi-TID A-MPDU may be larger than a predetermined size. In addition, when the wireless communication terminal performs the UL MU transmission,

the wireless communication terminal may be restricted to transmit the multi-TID A-MPDU, including the TID indicated by the base wireless communication terminal.

The AC having the smallest channel access wait time in the wireless communication terminal of FIG. 8 is VO. The wireless communication terminal generates the multi-TID A-MDPU, including the MPDU of the TID TID1 corresponding to the VO. The wireless communication terminal transmits the generated multi-TID A-MPDU to the base wireless communication terminal. At this time, the wireless communication terminal may transmit a buffer status report (BSR) through the QoS control field of the MPDU included in the multi-TID A-MPDU. This will be described in more detail with reference to FIG. 10. The wireless communication terminal may maintain channel access fairness with other wireless communication terminals through these embodiments.

As described above, the base wireless communication terminal may transmit information on the MU EDCA parameter set to the wireless communication terminal. This will be described with reference to FIGS. 9 to 11.

FIG. 9 shows an operation in which a wireless communication terminal according to an embodiment of the present invention receives information on an MU EDCA parameter set from a base wireless communication terminal and applies the information on an MU EDCA parameter set.

When the wireless communication terminal transmits the BSR, the wireless communication terminal may apply the MU EDCA parameter set. Specifically, when the wireless communication terminal transmits the BSR, the wireless communication terminal may apply the MU EDCA parameter set to the AC related to the BSR transmission. The AC related to the BSR transmission may be an AC with a buffer state reported through the

BSR. In addition, when the wireless communication terminal transmits the BSR, the wireless communication terminal may apply the MU EDCA parameter set to all ACs. This is because the base wireless communication terminal may schedule UL MU transmission based on the BSR transmitted by the wireless communication terminal. Specifically, the wireless communication terminal may access the channel by applying the MU EDCA parameter set from when the transmission of the BSR is completed, as in the embodiment of FIG. 9(a). The wireless communication terminal may transmit the BSR to the base wireless communication terminal using various methods. This will be described with reference to FIG. 10.

FIG. 10 describes an operation in which a base wireless communication terminal according to an embodiment of the present invention transmits a BSR through a QoS Control field.

The wireless communication terminal may transmit the BSR using the QoS control field of the MAC header. In addition, the format of the BA control field may be the same as that of the embodiment of FIG. 10(a). Specifically, the wireless communication terminal may transmit the BSR using the QoS control field of the MPDU while transmitting the MPDU including the QoS data. In addition, the wireless communication terminal may transmit the BSR using the QoS control field of the MPDU while transmitting the QoS null MPDU that does not include data. Also, the wireless communication terminal may insert a QoS Null MPDU into the A-MPDU regardless of the TID number limitation that the multi-TID A-MPDU may include.

In the uplink single user (UL SU) transmission as in the embodiment of FIG. 10(b), the wireless communication terminal may transmit the BSR using the QoS control field. Further, in the UL MU transmission triggered by the trigger frame, the wireless

communication terminal may transmit the BSR using the QoS control field. In addition, the wireless communication terminal receives the A-MPDU from the base wireless communication terminal, and the wireless communication terminal may transmit the BSR using the QoS control field while transmitting the BA frame for the A-MPDU. In addition, the wireless communication terminal may receive the BSRP, which is a trigger frame for triggering the BSR transmission, and the wireless communication terminal may transmit the BSR using the QoS control field of the QoS Null MPDU.

Again, FIG. 9 is described. In another specific embodiment, the wireless communication terminal may apply the MU EDCA parameter set when receiving the information on UL MU scheduling from the base wireless communication terminal. At this time, the information on the UL MU scheduling may be information indicating that the UL MU transmission is scheduled. In addition, the base wireless communication terminal may transmit information on UL MU transmission scheduling to the wireless communication terminal using at least one of a beacon frame and an action frame. The wireless communication terminal may obtain information on UL MU transmission scheduling from at least one of a beacon frame and an action frame. In this case, the Action frame may be an Action no ACK frame not requiring an ACK frame for the Action frame. Specifically, the wireless communication terminal receives information on the UL MU scheduling from the base wireless communication terminal, and applies the MU EDCA parameter set to the AC indicated by the UL MU scheduling information. In addition, the wireless communication terminal may apply the MU EDCA parameter set to the AC having the history of transmitting the BSR within a predetermined period from when receiving the information on the UL MU scheduling. Information on the UL MU scheduling may be included in the reserved bits of the HE operation element. Also, if the beacon frame

includes an MU EDCA parameter set, the beacon frame implicitly indicates that the UL MU transmission is scheduled. In addition, a field indicating the MU EDCA parameter set may include a field indicating that the UL MU transmission is scheduled. In the embodiment of FIG. 9(b), the wireless communication terminal receives a beacon frame. The wireless communication terminal obtains information on UL MU scheduling from the beacon frame. At this time, the wireless communication terminal applies the MU EDCA parameter set to the AC for which the BSR is transmitted within a period from the reference point to the time when the UL MU scheduling information is received.

In another specific embodiment, the base wireless communication terminal may transmit specific UL MU transmission scheduling information in addition to whether UL MU transmission is scheduled. This will be described with reference to FIG. 11.

FIG. 11 shows an operation in which a wireless communication terminal according to another embodiment of the present invention receives information on an MU EDCA parameter set from a base wireless communication terminal and applies the information on an MU EDCA parameter set.

The base wireless communication terminal may transmit information for identifying the wireless communication terminal for which the UL MU transmission is scheduled. The wireless communication terminal may receive information for identifying the wireless communication terminal scheduled for the UL MU transmission and apply the MU EDCA parameter set based on the information for identifying the wireless communication terminal for which the UL MU transmission is scheduled. Specifically, the base wireless communication terminal may periodically transmit information for identifying a wireless communication terminal scheduled for the UL MU transmission for

a predetermined period. At this time, the base wireless communication terminal may transmit information for identifying a wireless communication terminal scheduled for UL MU transmission for a predetermined period using a beacon frame. Also, the base wireless communication terminal may transmit information for identifying a wireless communication terminal scheduled for UL MU transmission using the TIM element of the beacon frame. In another specific embodiment, the base wireless communication terminal may transmit information for identifying the wireless communication terminal scheduled for the UL MU transmission using an element indicating information related to UL MU scheduling. In addition, the base wireless communication terminal may transmit not only the information for identifying the wireless communication terminal scheduled for the UL MU transmission, but also the information for indicating the AC of the UL MU transmission scheduled data. At this time, the information indicating the AC of the UL MU transmission scheduled data may indicate all ACs in some cases. In addition, the base wireless communication terminal may transmit not only the information for identifying the wireless communication terminal scheduled for the UL MU transmission, but also information indicating the time point at which the UL MU transmission is triggered. At this time, the time point at which the UL MU transmission is triggered may indicate the time point at which the trigger information is transmitted. Specifically, the trigger information may include a trigger frame. In addition, the base wireless communication terminal may transmit the backoff timer value of the backoff procedure for transmitting the trigger information.

In the embodiment of FIG. 11, the first station STA1 transmits a BSR to an access point AP. The access point AP receives the BSR and schedules the uplink transmission of the first station STA1 based on the received BSR. The access point AP transmits

information on the scheduled UL MU transmission using a beacon frame. At this time, the information on the scheduled UL MU transmission may include information for identifying the wireless communication terminal scheduled for the UL MU transmission. At this time, the information on the scheduled UL MU transmission may be a bit map indicating whether the Association ID (AID) or the wireless communication terminal corresponding to the AID is scheduled for the UL MU transmission. The first station STA1 receives the beacon frame from the access point AP and obtains information on the scheduled UL MU transmission from the beacon frame. When the information on the scheduled UL MU transmission indicates that the first station STA1 is scheduled for UL MU transmission, the first station STA1 applies the MU EDCA parameter set.

FIG. 12 shows an operation in which a wireless communication terminal according to another embodiment of the present invention obtains information on an MU EDCA parameter set from a trigger frame and applies the information on an MU EDCA parameter set.

The wireless communication terminal may apply the MU EDCA parameter set based on whether the trigger information received by the wireless communication terminal triggers the multi-user uplink transmission of the wireless communication terminal. Specifically, based on whether the User Info field of the trigger frame received by the wireless communication terminal indicates the wireless communication terminal, the wireless communication terminal may apply the MU EDCA parameter set. In a specific embodiment, the wireless communication terminal may apply the MU EDCA parameter set when receiving the trigger frame. In this embodiment, in order for the wireless communication terminal to apply the MU EDCA parameter, the base wireless

communication terminal does not transmit any additional information. However, the base wireless communication terminal attempts channel access for transmitting the trigger frame, and the wireless communication terminal scheduled for UL MU transmission at this time may also attempt channel access using the existing EDCA parameter set.

Therefore, the base wireless communication terminal may transmit information on the wireless communication terminal triggered after transmitting trigger information using trigger information. Specifically, the base wireless communication terminal may transmit information on a wireless communication terminal to be triggered after a trigger frame is transmitted using the User Info field of the trigger frame. In a specific embodiment, when the field indicating the resource unit (RU) allocation information included in the User Info field indicates a predetermined value, the User Info field may indicate that the wireless communication terminal indicated by the corresponding User Info field is to be triggered after the trigger frame is transmitted. At this time, when the RU assignment information indicated by the User Info field is a predetermined value, the wireless communication terminal may apply the MU EDCA parameter set indicated by the corresponding User Info field. In another specific embodiment, if the value of the field indicating the RU allocation information included in the User Info field is a predetermined value, the field indicating the RU allocation information may indicate an AC to which the MU EDCA parameter set is applied.

In these embodiments, the wireless communication terminal indicated by the User Info field may ignore the remaining fields except the field indicating the RU allocation information and the field indicating the wireless communication terminal indicated by the User Info field in the User Info field. In addition, the size of the User Info field indicating the information on the wireless communication terminal to be triggered after the

transmission of the trigger frame may be smaller than the size of the general User Info field. Specifically, the base wireless communication terminal may transmit the User Info field while omitting at least one of the fields indicating the RU allocation information of the User Info field and the fields other than the field indicating the wireless communication terminal indicated by the User Info field. A User Info field indicating information on a wireless communication terminal to be triggered after the transmission of the trigger frame may indicate information on a plurality of wireless communication terminals to be triggered after the transmission of the trigger frame. At this time, the User Info field may include a group AID. In another specific embodiment, the User Info field may include a broadcast AID.

In the embodiment of FIG. 12(a), the base wireless communication terminal transmits a trigger frame to the wireless communication terminal. The wireless communication terminal indicated by the trigger frame applies the MU EDCA parameter set. At this time, the trigger frame may include information on the wireless communication terminal to be triggered after the trigger frame is transmitted as described above. Specifically, the format of the trigger frame may be the same as that shown in FIG. 12(b).

The base wireless communication terminal transmits a target wake time (TWT) element to signal to the wireless communication terminal a time at which the wireless communication terminal should wake up. Specifically, the base wireless communication terminal may transmit a TWT element using a beacon frame. When the base wireless communication terminal attempts channel access to transmit a trigger frame in a service period indicated by a TWT element, a wireless communication terminal triggered by the trigger frame may attempt channel access for uplink transmission. In this situation, the

channel access attempt of the wireless communication terminal may lower the chance of the channel access success of the base wireless communication terminal. Therefore, the wireless communication terminal may apply the MU EDCA parameter set based on the TWT element. This will be described in more detail with reference to FIG. 13.

FIG. 13 shows an operation in which a wireless communication terminal according to another embodiment of the present invention obtains information on an MU EDCA parameter set from a target wake time element and applies the information on an MU EDCA parameter set.

The wireless communication terminal may apply the MU EDCA parameter set based on the TWT element. Specifically, the wireless communication terminal may apply the MU EDCA parameter set based on the service period indicated by the TWT element. At this time, the service period represents a period that the wireless communication terminal previously agrees to exchange frames with the base wireless communication terminal. In a specific embodiment, the wireless communication terminal may apply the MU EDCA parameter set from a time preceding by a predetermined time from the start time point of the service period indicated by the TWT element. At this time, the predetermined time may be signaled by the base wireless communication terminal. Specifically, the predetermined time may be signaled by the base wireless communication terminal through an element of the beacon frame. For example, the predetermined time may be signaled by the base wireless communication terminal through the MU EDCA parameter set element. Specifically, the predetermined time may be signaled by the base wireless communication terminal through an element of the beacon frame.

In addition, the wireless communication terminal may terminate the MU EDCA parameter set application based on the service period indicated by the TWT element.

Specifically, the wireless communication terminal may be allowed to terminate the MU EDCA parameter set application when a predetermined time elapses from the service period indicated by the TWT element. In a specific embodiment, the wireless communication terminal may terminate the MU EDCA parameter set application based on the start time point of the service period indicated by the TWT element. For example, the wireless communication terminal may be allowed to terminate the MU EDCA parameter set application when a predetermined time elapses from the start time point of the service period indicated by the TWT element. In another specific embodiment, the communication terminal may terminate the MU EDCA parameter set application based on the end time point of the service period indicated by the TWT element. For example, the wireless communication terminal may terminate the MU EDCA parameter set application at the end time point of the service period indicated by the TWT element.

In the embodiment of FIG. 13, the base wireless communication terminal signals a service period for a TWT operation by transmitting a beacon frame including a TWT element. The wireless communication terminal receiving the beacon frame determines the MU EDCA parameter set start time point and the end time point based on the TWT element. Specifically, the wireless communication terminal receiving the beacon frame determines the MU EDCA parameter set application start time point based on the start time point of the service period indicated by the TWT element. In addition, the wireless communication terminal receiving the beacon frame determines the MU EDCA parameter set application end time point based on the start time point of the service period indicated by the TWT element. In another specific embodiment, the wireless communication terminal receiving the beacon frame determines the MU EDCA parameter set application end time point based on the end time point of the service period indicated by the TWT

element.

The MU EDCA parameter is a channel access condition that is more disadvantageous than a typical EDCA parameter set. Therefore, the wireless communication terminal needs to terminate the MU EDCA parameter set application. The wireless communication terminal switches the MU EDCA parameter set to the normal EDCA parameter set when terminating the MU EDCA parameter application. This will be described with reference to FIGS. 14 to 15.

FIG. 14 shows an operation in which a wireless communication terminal according to an embodiment of the present invention terminates the MU EDCA parameter application.

If the MU EDCA parameter set application condition is not satisfied until a certain time elapses from when the timer is set, the wireless communication terminal may set an MU EDCA timer for terminating the MU EDCA parameter set application. Specifically, the wireless communication terminal may set the MU EDCA timer when receiving the trigger information. At this time, when the MU EDCA parameter set application condition is not satisfied for a certain period after setting the MU EDCA timer, the wireless communication terminal may be allowed to terminate the MU EDCA parameter set application. Specifically, if the UL MU transmission of the wireless communication terminal is not scheduled for a certain period from when the MU EDCA timer is set, the wireless communication terminal may be allowed to terminate the MU EDCA parameter set application.

In another embodiment, the wireless communication terminal may set an MU EDCA timer upon receiving a response to the transmission of a trigger-based physical layer protocol data unit (PPDU) of the wireless communication terminal. Specifically,

when the wireless communication terminal receives the response to the trigger-based PPDU transmission, the wireless communication terminal may set the MU EDCA timer. This is because if the trigger-based PPDU transmission of the wireless communication terminal fails, the base wireless communication terminal may again attempt the trigger information transmission. In this embodiment, the wireless communication terminal may prepare for a case in which the response to the trigger-based PPDU transmission is not received. Specifically, when the wireless communication terminal does not receive a response to the trigger-based PPDU transmission from the time when the trigger-based PPDU is transmitted until the time point after the predetermined time, the wireless communication terminal may set the MU EDCA parameter set timer. At this time, the predetermined time may be aSIFSTime) + aRxPHYStartDelay + (2x aSlotTime).

In the embodiment of FIG. 14(a), the wireless communication terminal receives the trigger frame TF from the base wireless communication terminal. The wireless communication terminal transmits a trigger-based PPDU including an MPDU corresponding to TID1 and TID3 to the base wireless communication terminal. The wireless communication terminal receives the M-BA frame indicating the ACK for the MPDU included in the trigger-based PPDU from the base wireless communication terminal. In this operation, the wireless communication terminal may set the MU EDCA timer option1 when receiving the trigger frame TF as described above. In addition, the wireless communication terminal may set the MU EDCA timer option2 when receiving the M-BA frame as described above.

In addition, when the wireless communication terminal reports as the BSR that the buffer for the corresponding AC is empty with respect to one or more ACs to the base wireless communication terminal, the wireless communication terminal receives an ACK

for transmission of data of the corresponding AC, and terminates the MU EDCA parameter set application. In the embodiment of FIG. 14(b), the wireless communication terminal reports to the base wireless communication terminal that the buffer for TID1 is empty while transmitting the trigger-based PPDU. Therefore, when the wireless communication terminal receives the M-BA frame for the last transmission of the MPDU corresponding to TID1, the wireless communication terminal converts the MU EDCA parameter set into a general EDCA parameter set Legacy. In another embodiment, the wireless communication terminal sets a first MU EDCA timer according to reception of the trigger information, and sets the MU EDCA timer according to the reception of the response to the trigger-based PPDU transmission. At this time, the period of the second timer may be shorter than the period of the first MU timer. Specifically, the wireless communication terminal may set a first MU EDCA timer when receiving the trigger information and set an MU EDCA timer when receiving a response to the trigger-based PPDU transmission. In the embodiment of FIG. 14(c), when the wireless communication terminal receives the trigger frame TF, it sets the first MU EDCA timer option1. Also, the wireless communication terminal sets a second MU EDCA timer option2 that expires earlier than the expiration time set by the first MU EDCA timer option when receiving the M-BA frame.

Further, the wireless communication terminal may set the MU EDCA timer according to the MU EDCA parameter application condition. This will be described in detail with reference to FIG. 15.

FIG. 15 shows an operation in which a wireless communication terminal according to another embodiment of the present invention terminates the MU EDCA parameter application.

When the wireless communication terminal applies the MU EDCA parameter, the wireless communication terminal may set the MU EDCA timer. Specifically, when the wireless communication terminal transmits the BSR to the base wireless communication terminal, the wireless communication terminal may apply the MU EDCA parameter set and set the MU EDCA timer. At this time, when the trigger frame received by the wireless communication terminal triggers the data transmission of the AC that transmits the BSR, the wireless communication terminal may update the existing MU EDCA timer to the MU EDCA timer that expires later than the expiration time of the existing MU EDCA timer. In the embodiment of FIG. 15(a), the first station STA1 transmits a BSR to an access point AP. At this time, the first station STA1 applies the MU EDCA parameter set and sets the MU EDCA timer. The first station STA1 receives a trigger frame that triggers the traffic transmission for the AC that transmits the BSR from the access point AP. Accordingly, the first station STA1 updates the previously set MU EDCA timer to the MU EDCA timer that expires later than the expiration time of the previously set MU EDCA timer.

In addition, when the wireless communication terminal applies the MU EDCA parameter set based on the UL MU transmission scheduling information included in the beacon frame, the wireless communication terminal may terminate the MU EDCA parameter set application based on the UL MU transmission scheduling information. Specifically, when the beacon frame does not include information on the UL MU transmission scheduling, the wireless communication terminal may be allowed to terminate the MU EDCA parameter set application based on the beacon frame. Also, if the information on the UL MU transmission scheduling included in the beacon frame indicates that the wireless communication terminal is not scheduled for UL MU transmission, the wireless communication terminal may be allowed to terminate the MU EDCA parameter

set application based on the UL MU transmission scheduling information. In the embodiment of FIG. 15(b), the first station STA1 receives a beacon frame from an access point AP. The first station STA1 obtains information on UL MU transmission scheduling from the beacon frame. When the information on the UL MU transmission scheduling obtained by the first station STA1 indicates that the UL MU transmission of the wireless communication terminal is scheduled, the first station STA1 applies the MU EDCA parameter set. Thereafter, the first station STA1 receives the beacon frame again from the access point AP. The first station STA1 obtains information on UL MU transmission scheduling from the beacon frame. When the information on the UL MU transmission scheduling obtained by the first station STA1 indicates that the UL MU transmission of the wireless communication terminal is not scheduled, the first station STA1 switches from the MU EDCA parameter set to the general EDCA parameter set.

FIG. 16 shows an operation in which a wireless communication terminal according to another embodiment of the present invention applies an MU EDCA parameter.

As described above, when the wireless communication terminal applies the MU EDCA parameter, the wireless communication terminal may set the MU EDCA timer. In addition, as in the embodiment described with reference to FIG. 14, the wireless communication terminal may set the MU EDCA timer upon receiving the response to the trigger-based PPDU transmission. Therefore, the wireless communication terminal may apply the MU EDCA parameter set upon receiving the response to the trigger-based PPDU transmission. Specifically, when the wireless communication terminal receives the response to the trigger-based PPDU transmission, the wireless communication terminal may apply the MU EDCA parameter set. In a specific embodiment, the wireless

communication terminal may apply the MU EDCA parameter set when the following three conditions are satisfied. The first condition is that the wireless communication terminal receives the trigger frame that triggers the transmission of the wireless communication terminal from the base wireless communication terminal. Specifically, the wireless communication terminal receive the trigger frame indicating the AID of the wireless communication terminal. At this time, the trigger frame may be a basic trigger frame. In a specific embodiment, the first condition may include the case where the User Info field of the trigger frame indicates random access and the wireless communication terminal transmits the trigger-based PPDU through a random access. The second condition is to transmit the trigger-based PPDU including the QoS data frame to the base wireless communication terminal according to the reception of the trigger frame. The third condition is that the wireless communication terminal receives an immediate response to the trigger based PPDU from the base wireless communication terminal. At this time, an immediate response may indicate that the recipient transmits a response to the originator within a predetermined time period during the same transmit opportunity (TXOP). When these three conditions are satisfied, the wireless communication terminal may apply the MU EDCA parameter set to the AC of the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal. In addition, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which the immediate response reception for the trigger-based PPDU from the base wireless communication terminal is completed. For example, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which the M-BA frame reception for the trigger-based PPDU from the base wireless communication terminal is completed. Also, when the conditions described above are satisfied before the MU EDCA

timer expires, the wireless communication terminal may update the MU EDCA timer with a period corresponding to the MU EDCA parameter set. When the MU EDCA timer expires, the wireless communication terminal terminates the MU EDCA parameter set application.

In the embodiment of FIG. 16(a), the first station STA1 receives the trigger frame TF from the base wireless communication terminal. At this time, the trigger frame TF indicates the AID of the first station STA1. The first station STA1 transmits a trigger-based PPDU HE TRIG PPDU including an MPDU corresponding to TID1 and TID3 to the base wireless communication terminal. The first station STA1 receives the M-BA frame in response to the trigger-based PPDU HE TRIG PPDU from the base wireless communication terminal. When the first station STA1 completes reception of the M-BA frame, in relation to the first station STA1, the base wireless communication terminal applies the MU EDCA parameter to an AC which the M-BA frame indicates as an ACK. At this time, the first station STA1 sets the MU EDCA timer for an AC which the M-BA frame indicates as an ACK.

Even if a PPDU including an immediate response to a trigger-based PPDU further includes another frame, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which the immediate response reception for the trigger-based PPDU from the base wireless communication terminal is completed. In an embodiment of FIG. 16(b), the base wireless communication terminal transmits another frame DL together while transmitting the M-BA frame for the trigger-based PPDU HE TRIG PPDU to the first station STA1. When the first station STA1 completes the reception of the PPDU including the M-BA frame and another frame DL, the first station STA1 applies the MU EDCA parameter to an AC which the M-BA frame indicates as an ACK. At

this time, the first station STA1 sets the MU EDCA timer for AC in which the M-BA frame indicates an ACK.

Also, when the downlink transmission and the uplink transmission are continuously performed in the same TXOP, the wireless communication terminal may apply the MU EDCA parameter set to the end time point of the corresponding TXOP. In an embodiment of FIG. 16(c), the base wireless communication terminal transmits the M-BA frame for the trigger-based PPDU HE TRIG PPDU transmitted by the first station STA1 and another frame DL together as in the embodiment of FIG. 16(b). At this time, the first station STA1 performs uplink transmission to the base wireless communication terminal again. When the first station SAT1 receives a response to the uplink transmission, in relation to the first station STA1, the base wireless communication terminal applies the MU EDCA parameter to an AC in which the M-BA frame indicates an ACK. At this time, the first station STA1 sets the MU EDCA timer for AC which the M-BA frame indicates as an ACK.

In another specific embodiment, under the condition that the wireless communication terminal applies the MU EDCA parameter set, the trigger frame received by the wireless communication terminal may include a trigger frame variant such as a BSR poll frame. In addition, the wireless communication terminal may receive UL MU response scheduling instead of the trigger frame. Specifically, when the wireless communication terminal transmits the QoS data based on the trigger frame variant or the UL MU response scheduling, the wireless communication terminal may apply the MU EDCA parameter set.

In the above-described embodiments, the wireless communication terminal may determine the MU EDCA parameter set application time and the MU EDCA timer setting time in consideration of the type of the responding requested by the MPDU included in the

trigger-based PPDU. This will be described with reference to FIGS. 17 to 18.

FIG. 17 shows an A-MPDU generated by a wireless communication terminal according to an embodiment of the present invention and a type of responding for a corresponding A-MPDU.

The wireless communication terminal may aggregate one or more MPDUs of a QoS data frame, an action frame, and a control frame into one PSDU and transmit it to the A-MPDU. The A-MPDU including the QoS data frame may be classified into the context of Data Enabled Immediate Response (DEIR) or Data Enabled No Immediate Response (DENIR) depending on whether QoS data requests an Ack. The wireless communication terminal receiving the A-MPDU may determine whether the QoS data requests an Ack according to the value of the ACK Policy subfield of the QoS Control field of the MAC header. At this time, the value of the ACK Policy subfield is indicated for each TID. In addition, the wireless communication terminal may divide a service class of TID into QoSACK and QoSNoACK. The wireless communication terminal transmitting the A-MPDU does not provide the BA agreement for the TID corresponding to the QoSNoACK service class. In addition, the wireless communication terminal transmitting the A-MPDU sets the value of the ACK Policy subfield of the TID corresponding to the QoSNoACK service class to No ACK.

When the wireless communication terminal aggregates a plurality of MPDUs corresponding to one TID and transmits the A-MPDU, the immediate response context of the corresponding A-MPDU is determined according to whether the A-MPDU includes the MPDU of the TID requesting the ACK. Specifically, when the A-MPDU including only a plurality of MPDUs corresponding to one TID includes the MPDU of the TID requesting the ACK, the immediate response context of the corresponding A-MPDU is DEIR. In

addition, when the A-MPDU including only a plurality of MPDUs corresponding to one TID includes the MPDU of the TID not requesting the ACK, the immediate response context of the corresponding A-MPDU is DENIR.

As described above, the wireless communication terminal may aggregate a plurality of MPDUs corresponding to a plurality of TIDs to generate a multi-TID A-MPDU. The immediate response context of the multi-TID A-MPDU may be classified as follows. If the multi-TID A-MPDU includes one or more TIDs requesting an ACK, the immediate response context of the corresponding multi-TID A-MPDU is DEIR. Also, if the multi-TID A-MPDU includes only a TID that does not request an ACK or a frame that does not have a TID, the immediate response context of the corresponding multi-TID A-MPDU is DENIR. In the embodiment of FIG. 17(a), the A-MPDU includes an MPDU with a TID of 1, an MPDU with a TIDR of 2, an MPDU with a TID of 3, and an action frame. An MPDU with a TID of 3 does not request an Ack, but each of an MPDU with a TID of 1, an MPDU with a TID of 2, and an action frame requests an immediate response. Therefore, the immediate response context of the A-MPDU is DEIR. In the embodiment of FIG. 17(b), the A-MPDU includes an MPDU with a TID of 1, an MPDU with a TIDR of 2, an MPDU with a TID of 3, and an action No Ack frame. Each of an MPDU with a TID of 1, an MPDU with a TID of 2, and an action frame requests an immediate response. All of an MPDU with a TID of 1, an MPDU with a TID of 2, an MPDU with a TID of 3, and an action No ACK frame do not request an immediate response. Therefore, the immediate response context of the A-MPDU is DENIR.

In the embodiments described with reference to FIG. 16, the wireless communication terminal applies the MU EDCA parameter and sets the MU EDCA timer, based on the immediate response to the MPDU included in the trigger-based PPDU. As

described with reference to FIG. 17, the QoS data frame included in the trigger-based PPDU may not request an Ack. When the QoS data frame included in the trigger-based PPDU does not request Ack, the MU EDCA parameter set application operation and the MU EDCA timer setting operation of the wireless communication terminal will be described with reference to FIG. 18.

FIG. 18 shows an operation in which a wireless communication terminal according to another embodiment of the present invention applies an MU EDCA parameter.

When the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which transmission of the trigger-based PPDU ends. In addition, if the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may set the MU EDCA timer at the time point at which transmission of the trigger-based PPDU ends. As in the embodiment described with reference to FIG. 16, even if the wireless communication terminal receives a trigger frame variant or transmits a trigger-based PPDU based on UL MU response scheduling, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which transmission of the trigger-based PPDU ends. At this time, the wireless communication terminal may set the MU EDCA timer at the time point at which transmission of the trigger-based PPDU ends. In another specific embodiment, when the immediate response context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the wireless communication terminal may apply the MU EDCA parameter set at the time point at which transmission of the trigger-based PPDU ends. In addition, when the immediate response

context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the wireless communication terminal may set the MU EDCA timer at the time point at which transmission of the trigger-based PPDU ends. In the embodiment of FIG. 18(a), the wireless communication terminal receives the trigger frame TF from the base wireless communication terminal. Upon receiving the trigger frame, the wireless communication terminal transmits a trigger-based PPDU HE TRIG PPDU including an A-MPDU whose immediate response context is DENIR to the base wireless communication terminal. The wireless communication terminal applies the MU EDCA parameter set at the time point at which transmission of the trigger-based PPDU HE TRIG PPDU ends and starts the MU EDCA timer.

In another specific embodiment, when the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may apply the MU EDCA parameter set when a predetermined time elapses after the time point at which transmission of the trigger-based PPDU ends. In addition, when the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may set the MU EDCA timer when a predetermined time elapses after the time point at which transmission of the trigger-based PPDU ends. In another specific embodiment, when the immediate response context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the wireless communication terminal may apply the MU EDCA parameter set when a predetermined time elapses after the time point at which transmission of the trigger-based PPDU ends. In addition, if the immediate response context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the

wireless communication terminal may set the MU EDCA timer when a predetermined time elapses after the time point at which transmission of the trigger-based PPDU ends. At this point, the predetermined time may be a short inter frame space (SIFS). In another specific embodiment, the predetermined time may be a time that is the sum of a predetermined representative ACK transmission time and an SIFS. In the embodiment of FIG. 18(b), the wireless communication terminal receives the trigger frame TF from the base wireless communication terminal. Upon receiving the trigger frame, the wireless communication terminal transmits a trigger-based PPDU HE TRIG PPDU including an A-MPDU whose immediate response context is DENIR to the base wireless communication terminal. The wireless communication terminal applies the MU EDCA parameter set when a predetermined time elapses after the time point at which transmission of the trigger-based PPDU HE TRIG PPDU ends and starts the MU EDCA timer. At this point, the predetermined time may be an SIFS. In another specific embodiment, the predetermined time may be a time that is the sum of the SIFS and the predetermined representative ACK transmission time Ack time.

In another specific embodiment, if the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may apply the MU EDCA parameter set based on an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal. In another specific embodiment, when the immediate response context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the wireless communication terminal may apply the MU EDCA parameter set based on an immediate response to the trigger-based

PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal. In these embodiments, when the wireless communication terminal receives an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal, the wireless communication terminal may apply the MU EDCA parameter set. When the wireless communication terminal does not receive an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal, the wireless communication terminal may apply the MU EDCA parameter set when a predetermined period elapses from when transmitting the trigger-based PPDU transmitted by the wireless communication terminal. The time when the predetermined period elapses after transmitting the trigger-based PPDU transmitted by the wireless communication terminal may be the time when it elapses by aSIFSTime + aSlotTime + aRxPHYStart-Delay from the time point after PHY-TXEND.confirm primitive.

In addition, if the QoS data frame included in the trigger-based PPDU transmitted by the wireless communication terminal does not request an ACK, the wireless communication terminal may set an MU EDCA timer based on an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal. In another specific embodiment, when the immediate response context of the A-MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal is DENIR, the wireless communication terminal may set an MU EDCA timer based on an immediate response to the trigger-based PPDU transmission of another

wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal. In these embodiments, when the wireless communication terminal receives an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal, the wireless communication terminal may set the MU EDCA timer. When the wireless communication terminal does not receive an immediate response to the trigger-based PPDU transmission of another wireless communication terminal that transmits the trigger-based PPDU simultaneously with the wireless communication terminal, the wireless communication terminal may set the MU EDCA timer when a predetermined period elapses from when transmitting the trigger-based PPDU transmitted by the wireless communication terminal. The time when the predetermined period elapses after transmitting the trigger-based PPDU transmitted by the wireless communication terminal may be the time when it elapses by aSIFSTime + aSlotTime + aRxPHYStart-Delay from the time point after PHY-TXEND.confirm primitive.

In the embodiment of FIG. 18(c), the wireless communication terminal receives a trigger frame TF and transmits a trigger-based PPDU HE TRIG PPDU including an A-MPDU whose immediate response context is DENIR to the base wireless communication terminal. When the wireless communication terminal transmits a trigger-based PPDU HE TRIG PPDU, the wireless communication terminal simultaneously detects the M-BA frame transmission for the trigger-based PPDU of another wireless communication terminal that transmits the trigger-based PPDU. The wireless communication terminal applies the MU EDCA parameter set at the time point at which reception of the M-BA frame for the trigger-based PPDU of another wireless communication terminal ends, and

starts the MU EDCA timer. When the wireless communication terminal does not receive the M-BA frame for the trigger-based PPDU of another wireless communication terminal as in the embodiment of FIG. 18(d), the wireless communication terminal applies the MU EDCA parameter set at the time point at which it elapses by aSIFSTime + aSlotTime + aRxPHYStart-Delay from when transmitting the trigger-based PPDU HE TRIG PPDU, and starts the MU EDCA timer.

In these embodiments, the wireless communication terminal may apply the MU EDCA parameter set to the AC corresponding to the QoS data frame transmitted through the trigger-based PPDU as in the embodiment described with reference to FIG. 16.

In another specific embodiment, when a wireless communication terminal transmits a trigger-based PPDU, the wireless communication terminal may be restricted not to transmit a QoS data frame that does not request an ACK. Specifically, when the wireless communication terminal transmits the trigger-based PPDU, the wireless communication terminal may be restricted not to transmit the QoS data frame with the Ack policy subfield set to No Ack.

The operation of the wireless communication terminal to apply a separate MU EDCA parameter set will be described with reference to FIGS. 19 to 21.

FIG. 19 shows an operation in which a wireless communication terminal according to an embodiment of the present invention applies an MU EDCA parameter set.

As described above, the EDCA parameter set may include a backoff timer and a parameter related to CW. When the wireless communication terminal switches the currently used first EDCA parameter set to the second EDCA parameter set, the wireless communication terminal may change the value of the backoff timer currently used in the

backoff procedure based on the second EDCA parameter set. At this time, the first EDCA parameter set may be a general EDCA parameter set, and the second EDCA parameter set may be an MU EDCA parameter set. Also, the first EDCA parameter set may be an MU EDCA parameter set and the second EDCA parameter set may be a general EDCA parameter set. This is because if the wireless communication terminal does not change the value of the backoff timer when switching the EDCA parameter set, the effect of changing the channel access priority caused by the switching of the EDCA parameter set may not be immediately applied.

In a specific embodiment, the wireless communication terminal may multiply the backoff timer currently used in the backoff procedure with a value determined based on the second EDCA parameter set. At this time, the value determined based on the second EDCA parameter set may be a value determined based on the CW parameter value of the second EDCA parameter set. Specifically, a value determined based on the second parameter set may be a value obtained by dividing the CWmin of the second EDCA parameter set by the CWmin of the first EDCA parameter set. In another specific embodiment, the value determined based on the second EDCA parameter set may be a value obtained by dividing the CWmax of the second EDCA parameter set by the CWmax of the first EDCA parameter set. In another specific embodiment, when the value of the backoff timer currently used by the wireless communication terminal in the backoff procedure is smaller than the CWmin of the second EDCA parameter set, the wireless communication terminal may set the value of the backoff timer to the CWmin of the second EDCA parameter set. In addition, when the value of the backoff timer currently used by the wireless communication terminal in the backoff procedure is greater than the CWmax of the second EDCA parameter set, the wireless communication terminal may set the value of the

backoff timer to the CWmax of the second EDCA parameter set.

When the wireless communication terminal switches the currently used first EDCA parameter set to the second EDCA parameter set, the wireless communication terminal may change the parameter value for CW currently used in the backoff procedure based on the second EDCA parameter set. At this time, the parameter for CW may include CWmin and CWmax. Also, the EDCA parameter set may include a short retry limit and a long retry limit, which are parameters for adjusting the CW value according to the number of channel retransmission attempts. Also, the first EDCA parameter set may be a general EDCA parameter set and the second EDCA parameter set may be an MU EDCA parameter set. Also, the first EDCA parameter set may be an MU EDCA parameter set and the second EDCA parameter set may be a general EDCA parameter set. The wireless communication terminal may increase the value of CW in the backoff procedure. At this time, the value of CW is limited to the value of CWmax, and the wireless communication terminal may reset the value of CW to CWmin according to the retry limit value. This is because the restriction may not be applied when the wireless communication terminal switches the EDCA parameter set.

Specifically, when the CW value currently used by the wireless communication terminal in the backoff procedure is smaller than the CWmin of the second EDCA parameter set, the wireless communication terminal may set the CW value to CWmin of the second EDCA parameter set. In addition, when the CW value currently used by the wireless communication terminal in the backoff procedure is greater than the CWmax of the second EDCA parameter set, the wireless communication terminal may set the CW value to the CWmax of the second EDCA parameter set. In addition, if the QoS short retry counter (QSRC) is greater than the short retry limit or the QoS long retry counter (QLRC)

is greater than the short retry limit, the wireless communication terminal may set the CW value to the CWmin of the second EDCA parameter set.

In the embodiment of FIG. 19, the wireless communication terminal switches the legacy EDCA parameter set for the AC BE to the MU EDCA parameter set. At this time, the wireless communication terminal sets the backoff timer value BO_{MU}[BE] to the product of a value a[AC] obtained based on the MU EDCA parameter set and the value of the backoff timer BO[BE] in the current backoff procedure. Also, the wireless communication terminal sets the CW value CWmu[BE] to a larger value of the CW value CW[BE] in the current backoff procedure and CWmin CWmin[BE] in the MU EDCA parameter set. When the wireless communication terminal converts the MU EDCA parameter set into a general EDCA parameter set, the wireless communication terminal sets the CW value CW[BE] to a smaller value of CW CWmu[BE] value in the current backoff procedure and CWmax CWmax[BE] of the Legacy EDCA parameter set.

The specific operation of the wireless communication terminal to set the CW will be further described with reference to FIG. 20 and following drawings.

FIG. 20 shows an operation of changing a CW value while a wireless communication terminal according to an embodiment of the present invention changes an EDCA parameter set.

The wireless communication terminal changes the CW value in the following three situations during the backoff procedure.

1) When the transmission of the initial PPDU of the TXOP fails and the AC of the MPDU is the primary AC

2) When two or more EDCAFs contend in the same wireless communication

terminal and the transmission attempt of the wireless communication terminal collides with another EDCAF having a higher priority in the wireless communication terminal

3) PHY-TXBUSY.indication (BUSY) primitive is responded with respect to PHYTXSTART.request primitive and when a transmission attempt of a wireless communication terminal coordinated by a multiple MAC-station management entity (MM-SME) collides with a transmission attempt of another wireless communication terminal coordinated by the same MM-SME

At this time, the wireless communication terminal changes the CW value according to the following rule.

a) When QSRC QSRC[AC] corresponding to the AC reaches the short retry limit dot11ShortRetryLimit) or QLRC QLRC[AC] corresponding to the AC reaches the long retry limit dot11LongRetryLimit, the wireless communication terminal resets the CW value CW[AC] corresponding to the AC to the CWmin value CWmin [AC].

b) When the value of dot11RobustAVStreamingImplemented is true, and the QoS short drop retry count QSDRC[AC] corresponding to the AC reaches dot11ShortDEIRetryLimit, or the QoS long drop retry count QLDRC[AC] for AC reaches dot11LongDEIRetryLimit, the wireless communication terminal resets the CW value CW[AC] corresponding to the AC to the CWmin value CWmin[AC].

c) Otherwise

c-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2) When the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does

not change the CW value CW[AC] corresponding to the AC.

The situations of 1), 2) and 3) are all cases where the wireless communication terminal retries transmission due to transmission failure, internal contention failure, and the like. Also, in a) and b), the wireless communication terminal resets the CW value due to exceeding the number of retries. In c), the wireless communication terminal changes the CW value to retry the transmission. In a), b), and c), the wireless communication terminal operates without considering the case where the EDCA parameter set is changed. For example, the CW value corresponding to the AC is equal to CWmin, and the wireless communication terminal may apply the EDCA parameter set having the CWmin larger than the previous EDCA parameter set. At this time, the wireless communication terminal uses a CW value smaller than the CWmin of the new EDCA parameter set. Also, the CW value corresponding to the AC is equal to CWmax, and the wireless communication terminal may apply the EDCA parameter set having CWmax smaller than the previous EDCA parameter set. At this time, the wireless communication terminal uses a CW value greater than the CWmax of the new EDCA parameter set. At this time, since this does not correspond to the conditions c-1) and c-2) described above, the wireless communication terminal may not change the CW value within the range of CWmin and CWmax. Therefore, the operation of the wireless communication terminal in c) may be changed as follows.

c-1) In case of a legacy wireless communication terminal (e.g., non-HE STA)

c-1-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2-2) When the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-2) In case of a non-legacy wireless communication terminal (e.g., HE STA)

c-2-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmin value CWmin[AC], the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmin value CWmin[AC].

c-2-2) When the CW value CW [AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2-3) When the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-2-4) When the CW value CW[AC] corresponding to the AC is greater than the CWmax value CWmax[AC], the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmax value CWmax[AC].

In another embodiment, the wireless communication terminal may operate as follows in the above-mentioned c).

c-1) In case of a legacy wireless communication terminal (e.g., non-HE STA)

c-1-1) When the CW value CW [AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2-2) When the CW value CW[AC] corresponding to the AC is equal to the

CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-2) In case of a non-legacy wireless communication terminal (e.g., HE STA)

c-2-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to a larger value of (CW[AC] + 1) x 2 - 1 and the CWmin value CWmin[AC].

[00164] c-2-2) When the CW value CW[AC] corresponding to the AC is equal to or greater than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmax value CWmax[AC].

In another embodiment, the wireless communication terminal may operate as follows in the above-mentioned c).

c-1) In case of a legacy wireless communication terminal (e.g., non-HE STA)

c-1-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2-2) When the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-2) In case of a non-legacy wireless communication terminal (HE STA)

c-2-1) When the CW value CW[AC] corresponding to the AC is smaller than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication

terminal sets the CW value CW[AC] corresponding to the AC to a larger value of CW[AC] + 1) x 2 - 1 and the CWmin value CWmin[AC].

c-2-2) If the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-2-3) If the CW value CW[AC] corresponding to the AC is greater than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmax value CWmax [AC].

FIG. 21 shows an operation of changing a CW value while a wireless communication terminal according to an embodiment of the present invention changes an EDCA parameter set.

In the embodiment described with reference to FIG. 20, only the operation of the non-legacy wireless communication terminal HE STA is considered. However, a similar problem may occur in a legacy wireless communication terminal non-HE STA to which an MU EDCA parameter set is applied. This is because the legacy wireless communication terminal (e.g., non-HE STA) may change some of the values of the EDCA parameter set. Therefore, the wireless communication terminal may operate as follows in the above-mentioned c).

c) Otherwise

c-1-3) When the CW value CW[AC] corresponding to the AC is smaller than the CWmin value CWmin[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmin value CWmin [AC].

c-2) When the CW value CW[AC] corresponding to the AC is larger than the CWmin value CWmin[AC] corresponding to AC and equal to or smaller than the CWmax value CWmax[AC], the wireless communication terminal sets the CW value CW[AC] corresponding to AC to (CW[AC] + 1) x 2 - 1.

c-3) When the CW value CW[AC] corresponding to the AC is greater than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmax value CWmax [AC].

In another embodiment, the wireless communication terminal may operate as follows in the above-mentioned c).

c) Otherwise

c-1-3) When the CW value CW[AC] corresponding to the AC is smaller than the CWmin value CWmin[AC] corresponding to the AC, the wireless communication terminal sets the CW value CW[AC] corresponding to the AC to the CWmin value CWmin [AC].

c-2) When the CW value CW[AC] corresponding to the AC is larger than the CWmin value CWmin[AC] corresponding to AC and smaller than the CWmax value CWmax[AC], the wireless communication terminal sets the CW value CW[AC] corresponding to AC to (CW[AC] + 1) x 2 - 1.

c-3) When the CW value CW[AC] corresponding to the AC is equal to the CWmax value CWmax[AC] corresponding to the AC, the wireless communication terminal does not change the CW value CW[AC] corresponding to the AC.

c-4) When the CW value CW[AC] corresponding to the AC is greater than the CWmax value CWmax[AC] corresponding to the AC, the wireless communication

terminal sets the CW value CW[AC] corresponding to the AC to the CWmax value CWmax [AC].

In another embodiment, the wireless communication terminal may operate as follows in the above-mentioned c).

c) Otherwise

c-1) When the CW value (CW [AC]) corresponding to the AC is smaller than the CWmax value (CWmax[AC]), the wireless communication terminal sets the CW value (CW[AC]) corresponding to the AC to (CW[AC] + 1) x 2 - 1.

c-2) When the CW value (CW[AC]) corresponding to the AC is equal to or greater than the CWmax value (CWmax[AC]) corresponding to the AC, the wireless communication terminal sets the CW value (CW[AC]) corresponding to the AC to the CWmax value (CWmax [AC]).

As described above, the base wireless communication terminal may signal information on the MU EDCA parameter set. The specific format of the information on the MU EDCA parameter set will be described with reference to FIG. 22 to FIG. 23.

FIG. 22 shows a specific format of an MU EDCA parameter set element according to an embodiment of the present invention.

The MU EDCA parameter set element according to an embodiment of the present invention includes an Element ID field and an Element ID extension field for identifying the MU EDCA parameter set element. In addition, the MU EDCA parameter set element includes an MU EDCA QoS Info field. The MU EDCA QoS Info field may include an MU EDCA Parameter Set Update Count field whose value is changed whenever the MU EDCA

parameter set is changed. Specifically, when the base wireless communication terminal changes the MU EDCA parameter set, the base wireless communication terminal may increment the value of the MU EDCA Parameter Set Update Count field by one. The wireless communication terminal receiving the MU EDCA parameter set element may determine whether to change the MU EDCA parameter set based on the MU EDCA Parameter Set Update Count field value. Other fields in the MU QoS Info field other than the MU EDCA Parameter Set Update Count field may have the same format as the EDCA QoS Info field.

In addition, the MU EDCA parameter set element may include information on the MU EDCA timer. Specifically, the MU EDCA parameter set element may include information indicating the expiration time of the MU EDCA timer.

In addition, the MU EDCA parameter set element includes a plurality of MU AC Parameter Record fields indicating information corresponding to each AC. Specifically, the MU EDCA parameter set element includes an MU AC_BE Parameter Record field, an MU AC_BK Parameter Record field, an MU AC_VI Parameter Record field, and an MU AC_VO Parameter Record field. The MU AC Parameter Record field may include an ACI/AIFSN field and an ECWmin/ECWmax field. The wireless communication terminal receiving the MU EDCA parameter set element applies the MU EDCA parameter set information corresponding to each AC based on the MU AC Parameter Record field. Specifically, the wireless communication terminal receiving the MU EDCA parameter set element sets a management information base (MIB) attribute based on the MU AC Parameter Record field.

FIG. 23 shows a specific format of an MU EDCA parameter set element according to another embodiment of the present invention.

Even if the base wireless communication terminal does not transmit the MU EDCA parameter set element in the beacon frame, the base wireless communication terminal may transmit the MU QoS Info field using the beacon frame. Specifically, the base wireless communication terminal may transmit the MU QoS Info field through an element other than the MU EDCA parameter set element. In a specific embodiment, the base wireless communication terminal may transmit the MU QoS Info field through a QoS-related element other than the MU EDCA parameter set element.

In another specific embodiment, the base wireless communication terminal may transmit an MU EDCA parameter set element that does not include an MU QoS Info field. At this time, the specific format of the MU EDCA parameter set element may be as shown in FIG. 23. The wireless communication terminal receiving the QoS Info field may determine whether the wireless communication terminal may not apply the changed EDCA parameter set based on the EDCA Parameter Set Update Count field. When it is determined that the wireless communication terminal does not apply the changed EDCA parameter set and the beacon frame does not include the EDCA parameter set element, the wireless communication terminal may request the transmission of the EDCA parameter set element by transmitting the probe request frame to the base wireless communication terminal. When the base wireless communication terminal is not allowed to transmit the MU QoS Info field together with other elements other than the MU EDCA parameter set element, the MU QoS Info field may not perform the same role as the QoS Info field described above and the need to transmit the MU QoS Info field is also eliminated. Thus, when it is not allowed to transmit the MU QoS Info field together with other elements other than the MU EDCA parameter set element, the base wireless communication terminal may transmit an MU EDCA parameter set element that does not include the MU QoS Info field.

The wireless communication terminal performs an internal contention procedure for data corresponding to each of a plurality of ACs using an internal EDCA queue. Specifically, the wireless communication terminal may operate a plurality of EDCA queues classified according to the access category of data stored in the queue. In addition, the wireless communication terminal may perform a backoff procedure for accessing a channel based on a time corresponding to a backoff timer in each of a plurality of EDCA queues. At this time, a method of using the EDCA queue by the wireless communication terminal will be described in detail with reference to FIG. 24 to FIG. 27.

FIG. 24 shows an EDCA operation after UL MU transmission of a wireless communication terminal according to an embodiment of the present invention.

The wireless communication terminal may operate as follows at the boundary of each slot in the backoff procedure.

1) When the backoff timer is not 0, the wireless communication terminal decrements the value of the backoff timer by one.

2) When data is present in the EDCA queue, and the backoff timer is 0, and transmission is not attempted in another EDCA queue with a high user priority (UP), the wireless communication terminal starts a transmission sequence for the data of the corresponding EDCA queue.

3) When data is present in the EDCA queue, and the backoff timer is 0, and transmission is attempted in another EDCA queue with a high user priority (UP), the wireless communication terminal performs an operation according to an internal collision.

4) When other situations, the wireless communication terminal does not perform any operation.

However, when the back off timer is 0 and the EDCA queue of the wireless

communication terminal is empty, there is a problem because it is not clearly defined that what kind of operation the wireless communication terminal should perform. Specifically, in the following situations, when the backoff timer is 0, the EDCA queue of the wireless communication terminal may be empty.

As described above, the base wireless communication terminal may trigger the uplink transmission of the wireless communication terminal by transmitting the trigger information. At this time, the base wireless communication terminal may obtain TXOP for transmission of trigger information through a backoff procedure. Therefore, the wireless communication terminal may maintain the backoff timer for AC of the data transmitted through the UL MU transmission in a state before the UL MU transmission. At this time, the wireless communication terminal may attempt to access the channel by resuming the backoff procedure for the corresponding AC. Data may not reach the EDCA queue of the AC until the backoff timer reaches 0.

Also, as described with reference to FIGS. 19 to 21, if it is not the case where the wireless communication terminal attempts transmission and fails, even when the EDCA parameter set is changed, the CW value may be maintained as it is. Also, when the EDCA queue of the corresponding AC is empty and new data arrives in the corresponding EDCA queue, the wireless communication terminal obtains a random integer value within the current CW and sets a backoff timer. Thus, the wireless communication terminal may obtain a new backoff timer using the CW calculated according to the previous EDCA parameter set. For example, in the embodiment of FIG. 24, the wireless communication terminal receives the trigger frame TF from the base wireless communication terminal. At this time, the wireless communication terminal stops the back off procedure for data in which AC is VO. The wireless communication terminal maintains the backoff timer of 4

and the CW value of 127. The wireless communication terminal transmits a trigger-based PPDU including QoS data TID 1 and TID 3 in which AC is VO to the base wireless communication terminal based on the trigger frame. The wireless communication terminal receives the M-BA frame from the base wireless communication terminal. The wireless communication terminal receives the M-BA frame and applies the MU EDCA parameter set as described above. Thereafter, the wireless communication terminal restarts the backoff procedure in which the value of the backoff timer is 4 and the CW value is 127. The channel accessed by the wireless communication terminal is idle for the time corresponding to the AIFS and the time corresponding to the backoff timer value of 4. Therefore, the back off timer becomes 0. However, since the wireless communication terminal transmits all data in which AC is VO using the trigger-based PPDU, the EDCA queue for the VO is empty. When new data arrives in the EDCA queue for the VO of the wireless communication terminal, the wireless communication terminal obtains the random value of 66 within the existing CW value of 127 and sets it as the back off timer value regardless of CWmin and CWmax of the MU EDCA parameter set. Also, regardless of UL MU transmission, if the EDCA queue is empty and the backoff timer is 0, this may happen in the following situations. The wireless communication terminal transmits all data of the EDCA queue for the primary AC, and until the value of the backoff timer reaches 0, additional data may not arrive in the EDCA queue for the primary AC. Also, when the base wireless communication terminal performs DL MU transmission using MU-MIMO or DL OFDMA, the base wireless communication terminal may occupy the channel with the primary AC and transmit the data corresponding to the AC other than the primary AC together with the data corresponding to the primary AC. At this time, a backoff timer corresponding to AC other than the primary AC remains, and the EDCA queue of the

corresponding AC may be empty. In addition, if (A-)MSDU corresponding to any AC among the AC with the BA agreement remains and the lifetime of the corresponding MSDU expires, the wireless communication terminal may discard the corresponding (A-)MSDU. At this time, when the EDCA queue for any AC of the wireless communication terminal is empty, the back off timer may reach 0. If the EDCA queue is empty and the backoff timer is 0, the operation of the wireless communication terminal at the slot boundary will be described in detail with reference to FIGS. 25 to 27.

FIG. 25 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to an embodiment of the present invention is empty and the backoff timer is 0.

When the EDCA queue is empty and the backoff timer is 0, the wireless communication terminal may not perform any operation at the slot boundary. Specifically, the wireless communication terminal may maintain the backoff timer to be 0. Also, the wireless communication terminal may not start the transmission sequence. In a specific embodiment, the wireless communication terminal may maintain all state variables of the EDCA function (EDCAF) without modification. In the embodiment of FIG. 25, when the EDCA queue of the wireless communication terminal for VO is empty, the backoff timer BO[VO] reaches 0. At this time, the wireless communication terminal does not perform any operation.

FIG. 26 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to another embodiment of the present invention is empty and the backoff timer is 0.

When the EDCA queue is empty and the backoff timer is 0, the wireless communication terminal may resume the backoff procedure at the slot boundary. At this time, the wireless communication terminal may maintain the CW value without modification. This is because it is not the case that the wireless communication terminal fails to transmit, and there is no need to double CW. Specifically, the wireless communication terminal may maintain all the state variables of the EDCAF except for the backoff timer. Also, when the EDCA queue is empty and the backoff timer is 0 again, the wireless communication terminal may start the backoff procedure again. In the embodiment of FIG. 26, when the EDCA queue of the wireless communication terminal for VO is empty, the backoff timer BO[VO] reaches 0. The wireless communication terminal obtains a random value of 10 within the CW CW[VO] corresponding to the VO while maintaining all other EDCAF state variables, and sets the backoff timer BO[VO] using 10.

FIG. 27 shows the operation of a wireless communication terminal when the EDCA queue of the wireless communication terminal according to another embodiment of the present invention is empty and the backoff timer is 0.

When the EDCA queue is empty and the backoff timer is 0, the wireless communication terminal may initiate the EDCAF at the slot boundary. At this time, the wireless communication terminal may set CW to CWmin. Also, the wireless communication terminal may set QSRC and OLRC to initial values. Specifically, the wireless communication terminal may set QSRC and OLRC to 0. The wireless communication terminal initializes the EDCAF and then starts the backoff procedure again. At this time, the wireless communication terminal may maintain the CW value without

modification. This is because it is not the case that the wireless communication terminal fails to transmit, and there is no need to double CW.

In addition, when the EDCA queue is empty and the backoff timer is 0 again, the wireless communication terminal may initiate the EDCAF at the slot boundary again. When the state variable of the EDCAF maintains the initial value to prevent meaningless initialization, the wireless communication terminal may not perform initialization.

FIG. 28 shows the operation of a wireless communication terminal according to an embodiment of the present invention.

The wireless communication terminal according to an embodiment of the present invention accesses the channel according to the priority of data to be transmitted (S2801). Specifically, the wireless communication terminal may access the channel according to the EDCA procedure described above. At this time, the wireless communication terminal may be a base wireless communication terminal. In addition, the wireless communication terminal may be a wireless communication terminal associated with the base wireless communication terminal.

The wireless communication terminal that wirelessly communicates with a base wireless communication terminal may switch a parameter set used for channel access from a first parameter set to a second parameter set based on whether the UL MU transmission is scheduled. Specifically, the wireless communication terminal may switch the parameter set used for channel access from the first parameter set to the second parameter set based on whether the base wireless communication terminal triggers the UL MU transmission participation of the wireless communication terminal. Further, the base wireless communication terminal transmits a trigger frame to the wireless communication terminal,

and the base wireless communication terminal may trigger the UL MU transmission participation of the wireless communication terminal. Depending on whether the user info field of the trigger frame includes the AID of the wireless communication terminal, the wireless communication terminal may determine whether the base wireless communication terminal triggers the UL MU transmission participation of the wireless communication terminal.

At this time, the parameter set used for the channel access may be a set of parameters used to access the channel according to the priority of the data. Specifically, the parameter set used for channel access may be the EDCA parameter set described above. Specifically, the EDCA parameter set may include parameters for CW. At this time, the parameter for CW may include at least one of CWmin and CWmax. In addition, the EDCA parameter set may include a parameter value related to a predetermined time at which the wireless communication terminal waits to start the backoff procedure. At this time, the predetermined time may be the AIFS described above.

In addition, the wireless communication terminal may determine whether to switch from the first parameter set to the second parameter set for each access category of data. Further, when the wireless communication terminal transmits the BSR, the wireless communication terminal may switch from the first parameter set to the second parameter set. In another specific embodiment, the wireless communication terminal may switch from the first parameter set to the second parameter set when the wireless communication terminal obtains information on the UL MU transmission. In another specific embodiment, the wireless communication terminal may transmit the trigger-based PPDU to the base wireless communication terminal according to the triggering of the base wireless communication terminal. At this time, the wireless communication terminal may switch

from the first parameter set to the second parameter set according to an immediate response to the MPDU included in the trigger-based PPDU. At this time, the wireless communication terminal may switch from the first parameter set to the second parameter set when the wireless communication terminal receive an immediate response to the MPDU included in the trigger-based PPDU. The MPDU included in the trigger-based PPDU may be a QoS data frame.

When the second parameter set application condition is not satisfied until a certain time elapses from when the timer is set, the wireless communication terminal may set the second parameter set timer for terminating the MU EDCA parameter set application. Specifically, based on whether the wireless communication terminal receives an immediate response to the MPDU included in the trigger-based PPDU, the wireless communication terminal may set the second parameter set timer according to the immediate response reception. When the second parameter set timer expires, the wireless communication terminal may be allowed to terminate the second parameter set application. Further, when the wireless communication terminal switches from the first parameter set to the second parameter set, the wireless communication terminal may set the second parameter set timer. In addition, the wireless communication terminal may determine when to switch from the first parameter set to the second parameter set based on the type of responding requested by the MPDU included in the trigger-based PPDU. In addition, the wireless communication terminal may determine when to set the second parameter set timer based on the type of responding requested by the MPDU included in the trigger-based PPDU. When the MPDU included in the trigger-based PPDU transmitted by the wireless communication terminal does not request the ACK, the wireless communication terminal may set the second parameter set timer when the transmission of the trigger-based PPDU

ends. In addition, the wireless communication terminal may set a second parameter set timer for each access category. Specifically, when the MPDU included in the trigger-based PPDU does not request an ACK, the wireless communication terminal may switch the parameter set from the first parameter set to the second parameter set and set the second parameter set timer when the transmission of the trigger based PPDU ends. As described above, the MPDU included in the trigger-based PPDU may be a QoS data frame. The specific operation of the wireless communication terminal may be the same as that described with reference to FIG. 6 through FIG. 18.

In addition, while the wireless communication terminal performs the backoff procedure, the parameters of the parameter set used in the backoff procedure may be changed. When the CW value is larger than CWmax, the wireless communication terminal may set the CW value to CWmax. In addition, when the CW value is smaller than CWmin, the wireless communication terminal may set the CW value to CWmin. Specifically, when the wireless communication terminal switches the currently used first parameter set to the second parameter set, the wireless communication terminal may change the value of the backoff timer currently used in the backoff procedure based on the second parameter set. In a specific embodiment, the wireless communication terminal may multiply the backoff timer currently used in the backoff procedure with a value determined based on the second parameter set. When the wireless communication terminal switches the currently used first parameter set to the second parameter set, the wireless communication terminal may change the parameter value for CW currently used in the backoff procedure based on the second parameter set. At this time, the parameter for CW may include CWmin and CWmax. Specifically, the wireless communication terminal may operate in the same manner as the embodiments described with reference to FIGS. 19 to 21.

The wireless communication terminal may operate a plurality of queues classified according to the access category of data stored in the queue. In addition, the wireless communication terminal may perform a backoff procedure for accessing a channel based on a time corresponding to a backoff timer in each of a plurality of queues. At this time, the queue may represent the EDCA queue described above. When there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the wireless communication terminal may not perform any operation at the slot boundary. At this time, the wireless communication terminal may maintain the backoff timer to be 0. In another specific embodiment, the wireless communication terminal may resume the backoff procedure at the slot boundary. At this time, the wireless communication terminal may maintain the CW value without modification. In another specific embodiment, the wireless communication terminal may initialize a set of channel access parameters at a slot boundary. At this time, the wireless communication terminal may set CW to CWmin. Also, the wireless communication terminal may set QSRC and OLRC to initial values. Specifically, the wireless communication terminal may set QSRC and OLRC to 0. Specifically, the wireless communication terminal may operate in the same manner as the embodiments described with reference to FIGS. 24 to 27.

The wireless communication terminal transmits the data through the accessed channel (S2803).

Although the present invention is described by using wireless LAN communication as an example, it is not limited thereto and may be applied to other communication systems such as cellular communication. Additionally, while the method, device, and system of the present invention are described in relation to specific embodiments thereof, some or all of

the components or operations of the present invention may be implemented using a computer system having a general purpose hardware architecture.

The features, structures, and effects described in the above embodiments are included in at least one embodiment of the present invention and are not necessary limited to one embodiment. Furthermore, features, structures, and effects shown in each embodiment may be combined or modified in other embodiments by those skilled in the art. Therefore, it should be interpreted that contents relating to such combination and modification are included in the range of the present invention.

While the present invention is described mainly based on the above embodiments but is not limited thereto, it will be understood by those skilled in the art that various changes and modifications are made without departing from the spirit and scope of the present invention. For example, each component specifically shown in the embodiments may be modified and implemented. It should be interpreted that differences relating to such modifications and application are included in the scope of the present invention defined in the appended claims.

[Claims]

1. A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:

a transceiver; and

a processor for processing a radio signal received through the transceiver or a radio signal to be transmitted through the transceiver,

wherein the processor is configured to access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal.

2. The wireless communication terminal of claim 1, wherein the processor is configured to switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal.

3. The wireless communication terminal of claim 2, wherein the processor is configured to transmit the trigger-based physical layer protocol data unit (PPDU) to the base wireless communication terminal using the transceiver,

set a second parameter set timer according to an immediate response reception based on whether an immediate response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received, and

when the second parameter set timer expires, terminate the application of the second parameter set.

4. The wireless communication terminal of claim 3, wherein the processor is configured to set the second parameter set timer when the immediate response reception ends.

5. The wireless communication terminal of claim 3, wherein the processor is configured to set the second parameter set timer for an access category of an MPDU for which the immediate response is received.

6. The wireless communication terminal of claim 3, wherein the processor is configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

7. The wireless communication terminal of claim 6, wherein when the MPDU included in the trigger-based PPDU does not request an ACK, the processor is configured to set the second parameter set timer when the transmission of the trigger-based PPDU ends.

8. The wireless communication terminal of claim 3, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

9. The wireless communication terminal of claim 3, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon

frame.

10. The wireless communication terminal of claim 3, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer.

11. The wireless communication terminal of claim 2, wherein the processor is configured to calculate a random integer value within a contention window (CW),

set a backoff timer based on the random integer value, and

access a channel based on the back off timer and a predetermined slot time,

wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

12. The wireless communication terminal of claim 1, wherein the processor is configured to calculate a random integer value in a contention window (CW),

set a backoff timer based on the random integer value,

access a channel based on the back off timer and a predetermined slot time, and

if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the traffic, sets the value of the CW to the CWmax.

13. The wireless communication terminal of claim 1, wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and

when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,

wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

14. The wireless communication terminal of claim 13, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

15. An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:

accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal; and

transmitting the data through the channel.

16. The method of claim 15, wherein the accessing of the channel comprises:

switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal; and

accessing a channel using a second set of parameters based on a priority of the traffic to be transmitted to the base communication terminal by the wireless communication terminal.

17. The method of claim 16, further comprising transmitting a trigger-based PPDU to the base wireless communication terminal using the transceiver,

wherein the switching from the first parameter set to the second parameter set comprises:

setting a second parameter set timer according to an immediate response reception based on whether an immediate response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received, and

when the second parameter set timer expires, terminating the application of the second parameter set.

18. The method of claim 17, wherein the setting of the second parameter set timer comprises setting the second parameter set timer when the immediate response reception ends.

19. The method of claim 17, wherein the setting of the second parameter set timer comprises setting the second parameter set timer for an access category of an MPDU for which the immediate response is received.

20. The method of claim 17, wherein the setting of the second parameter set timer determines when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

[ABSTRACT]

Provided is a wireless communication terminal that communicates wirelessly. The wireless communication terminal includes a transceiver and a processor for processing a radio signal received through the transceiver or a radio signal to be transmitted through the transceiver. The processor accesses a channel according to according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal.

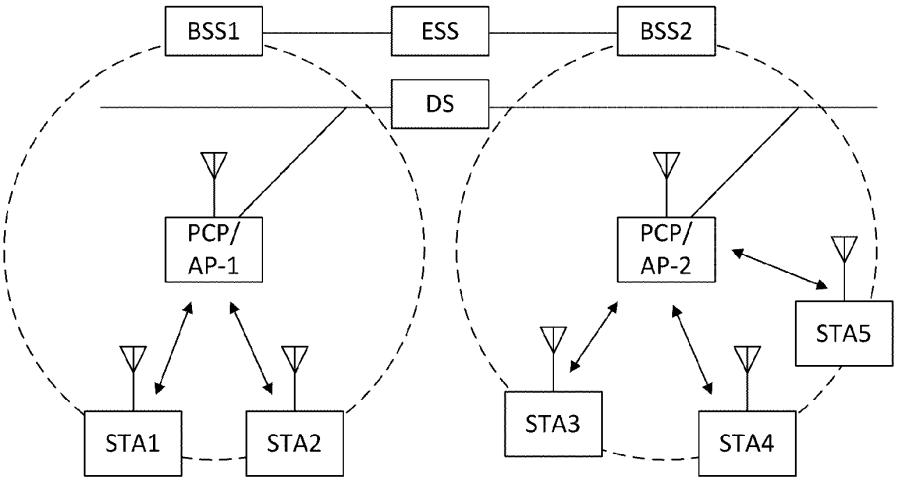

BSS1
ESS
BSS2
DS
PCP/
AP-1
PCP/
AP-2
STA5
STA1
STA2
STA3
STA4

FIG. 1

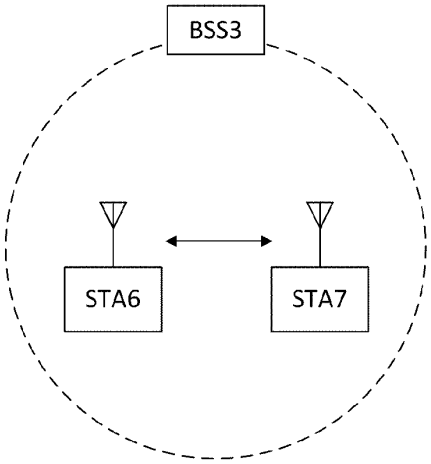

BSS3
STA6
STA7

FIG. 2

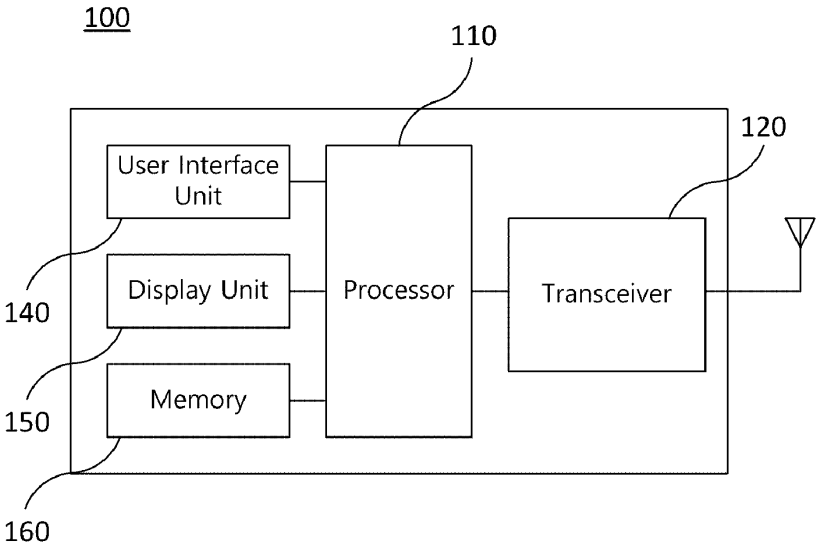

100
110
120
User Interface Unit
Display Unit
Memory
Processor
Transceiver
140
150
160

FIG. 3

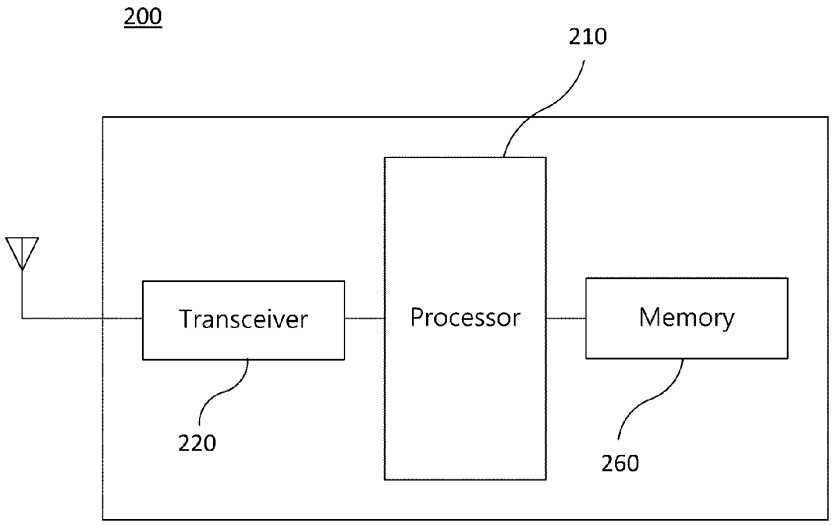

200
210
Transceiver
Processor
Memory
220
260

FIG. 4

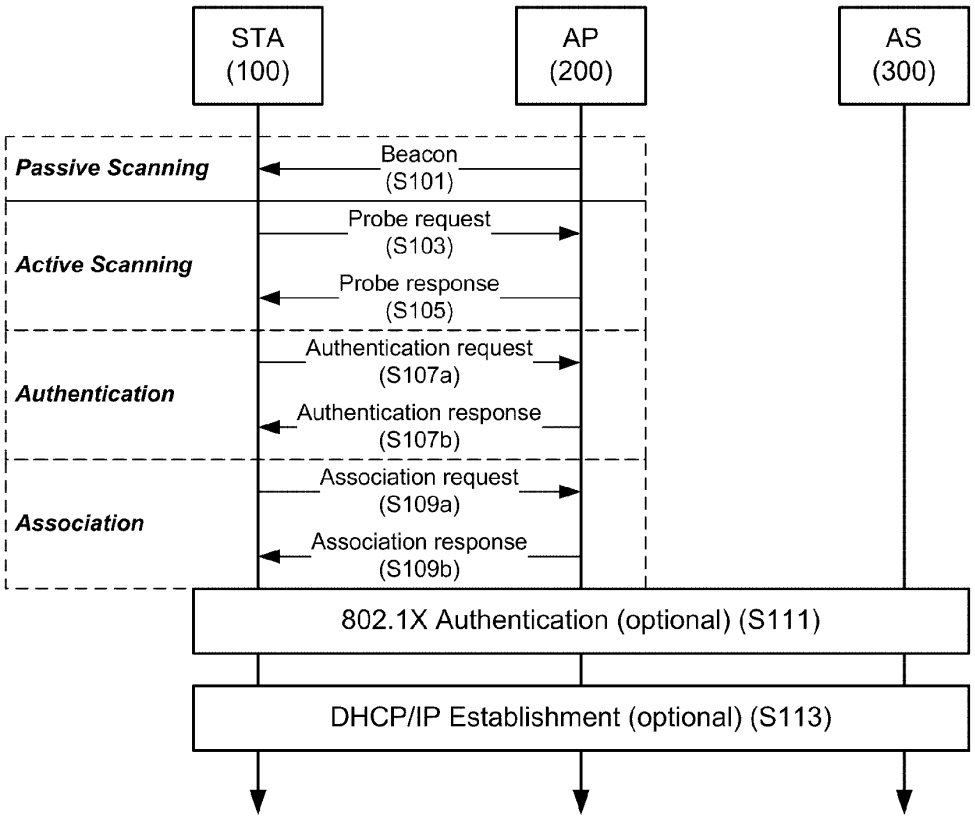

STA
(100)
AP
(200)
AS
(300)
Passive Scanning
Beacon
(S101)
Active Scanning
Probe request
(S103)
Probe response
(S105)
Authentication
Authentication request
(S107a)
Authentication response
(S107b)
Association
Association request
(S109a)
Association response
(S109b)
802.1X Authentication (optional) (S111)
DHCP/IP Establishment (optional) (S113)

FIG. 5

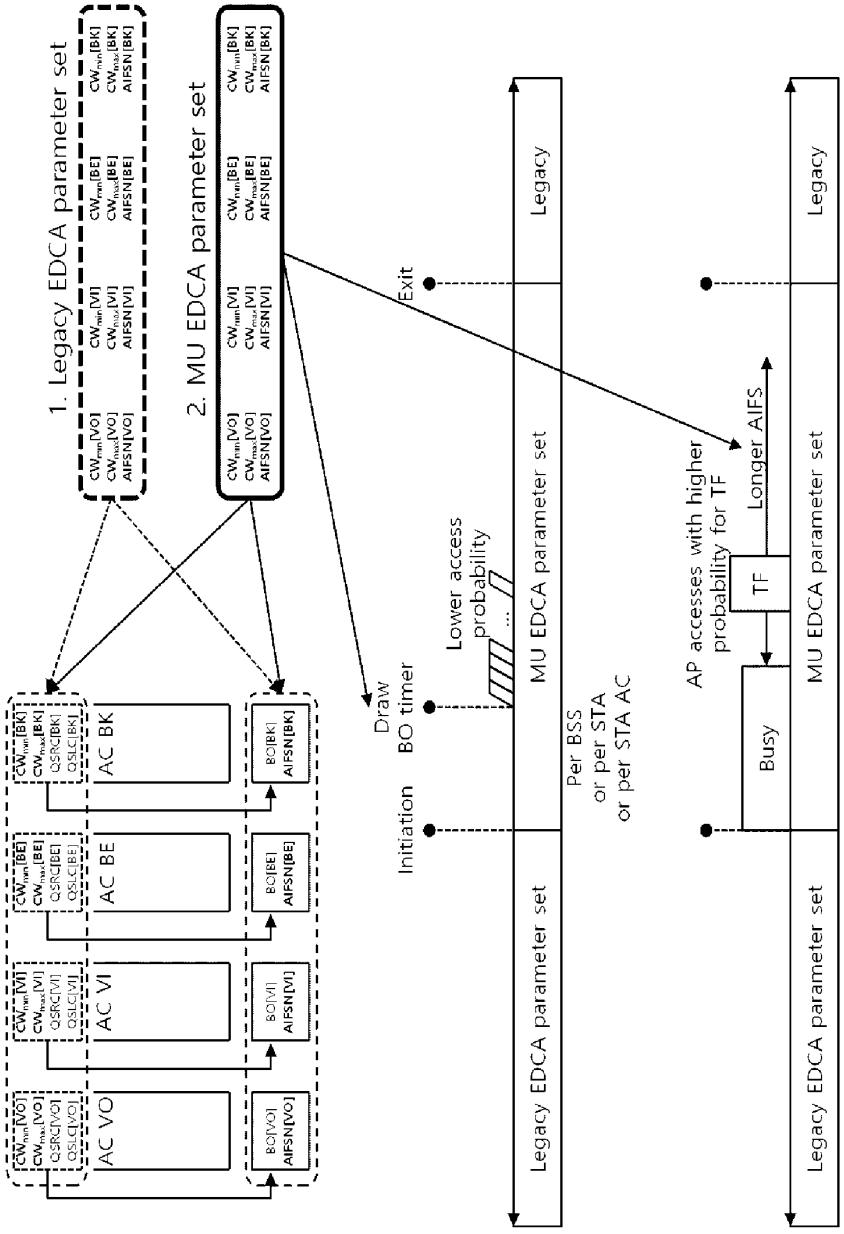
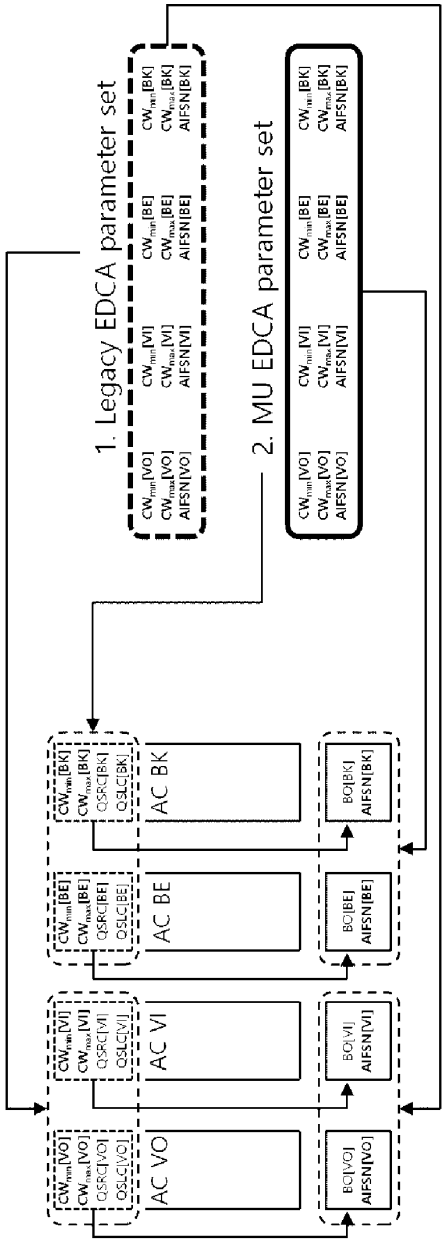

1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK
Draw BO timer
Initiation
Exit
Lower access probability
Per BSS or per STA or per STA AC
Legacy EDCA parameter set
MU EDCA parameter set
Legacy
AP accesses with higher probability for TF
Busy
TF
Longer AIFS

FIG. 6


1. Legacy EDCA parameter set
2. MU EDCA parameter set
AC VO
AC VI
AC BE
AC BK

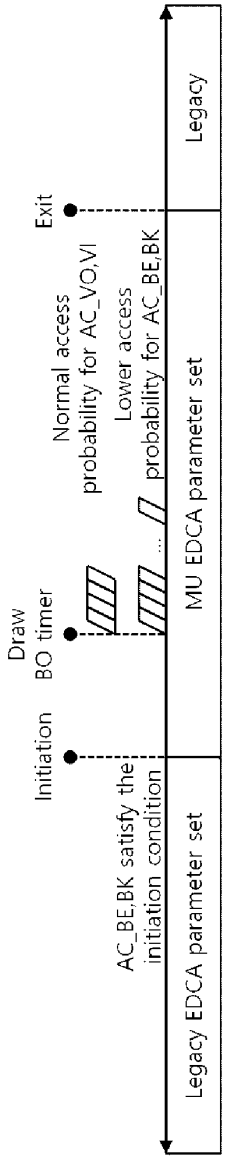

Initiation
Draw BO timer
Exit
Normal access probability for AC_VO,VI
Lower access probability for AC_BE,BK
AC_BE,BK satisfy the initiation condition
Legacy EDCA parameter set
MU EDCA parameter set
Legacy

FIG. 7

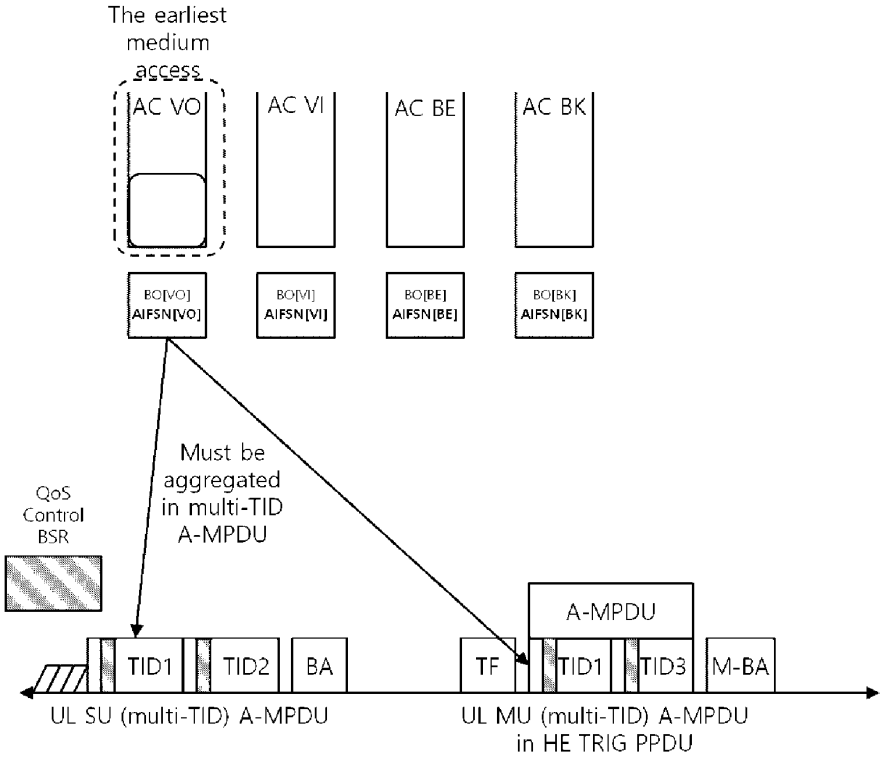

The earliest medium access
AC VO
AC VI
AC BE
AC BK
BO[VO] AIFSN[VO]
BO[VI] AIFSN[VI]
BO[BE] AIFSN[BE]
BO[BK] AIFSN[BK]
Must be aggregated in multi-TID A-MPDU
QoS Control BSR
A-MPDU
TID1
TID2
BA
TF
TID1
TID3
M-BA
UL SU (multi-TID) A-MPDU
UL MU (multi-TID) A-MPDU in HE TRIG PPDU

FIG. 8

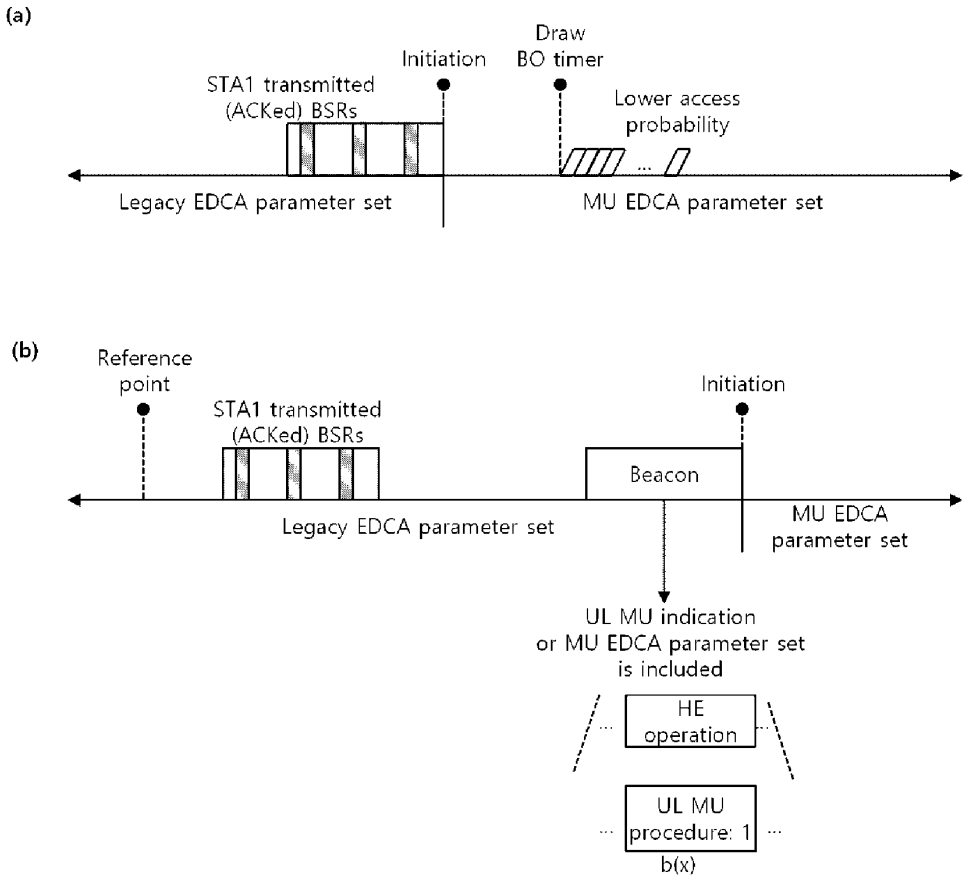

(a)
Initiation
Draw
BO timer
STA1 transmitted
(ACKed) BSRs
Lower access
probability
Legacy EDCA parameter set
MU EDCA parameter set
(b)
Reference
point
STA1 transmitted
(ACKed) BSRs
Initiation
Beacon
Legacy EDCA parameter set
MU EDCA
parameter set
UL MU indication
or MU EDCA parameter set
is included
HE
operation
UL MU
procedure: 1
b(x)

FIG. 9

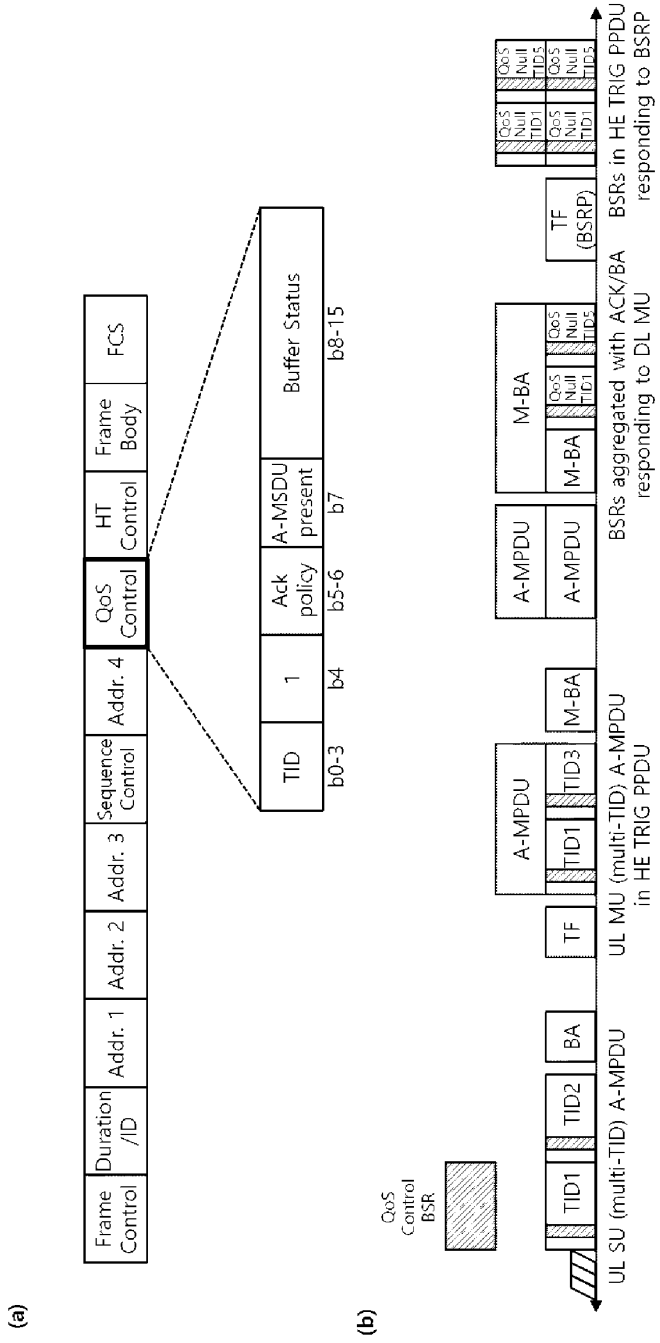

(a)
Frame Control
Duration /ID
Addr. 1
Addr. 2
Addr. 3
Sequence Control
Addr. 4
QoS Control
HT Control
Frame Body
FCS
TID
1
Ack policy
A-MSDU present
Buffer Status
b0-3
b4
b5-6
b7
b8-15
(b)
QoS Control BSR
UL SU (multi-TID) A-MPDU
TID1
TID2
BA
TF
A-MPDU
TID1
TID3
M-BA
UL MU (multi-TID) A-MPDU in HE TRIG PPDU
A-MPDU
A-MPDU
M-BA
M-BA
QoS Null TID1
QoS Null TID5
BSRs aggregated with ACK/BA responding to DL MU
TF (BSRP)
QoS Null TID1
QoS Null TID5
QoS Null TID1
QoS Null TID5
BSRs in HE TRIG PPDU responding to BSRP

FIG. 10

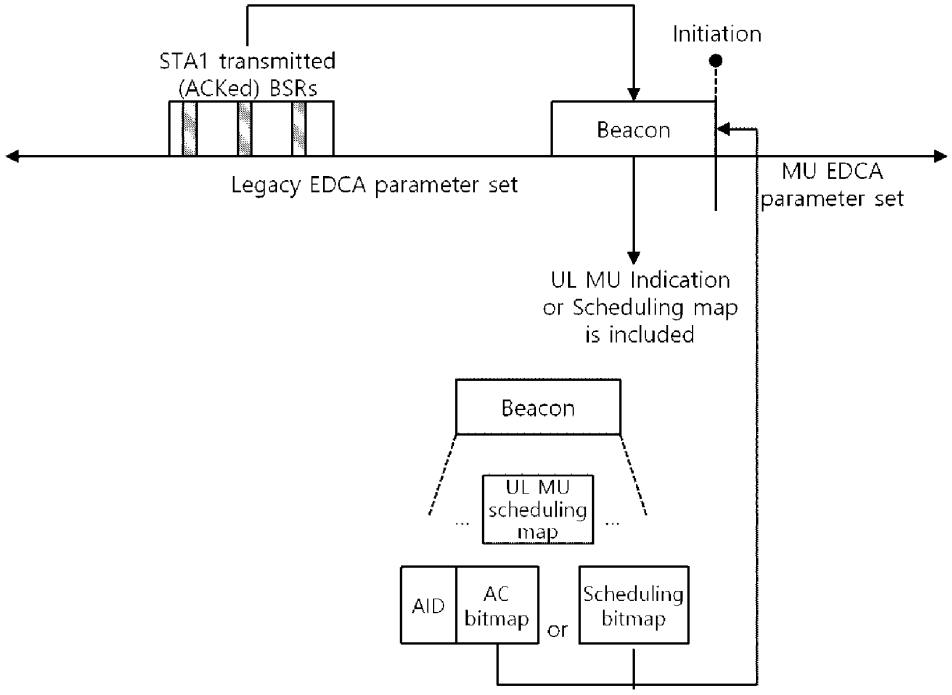

STA1 transmitted
(ACKed) BSRs
Initiation
Beacon
Legacy EDCA parameter set
MU EDCA
parameter set
UL MU Indication
or Scheduling map
is included
Beacon
UL MU
scheduling
map
AID
AC
bitmap
or
Scheduling
bitmap

FIG. 11

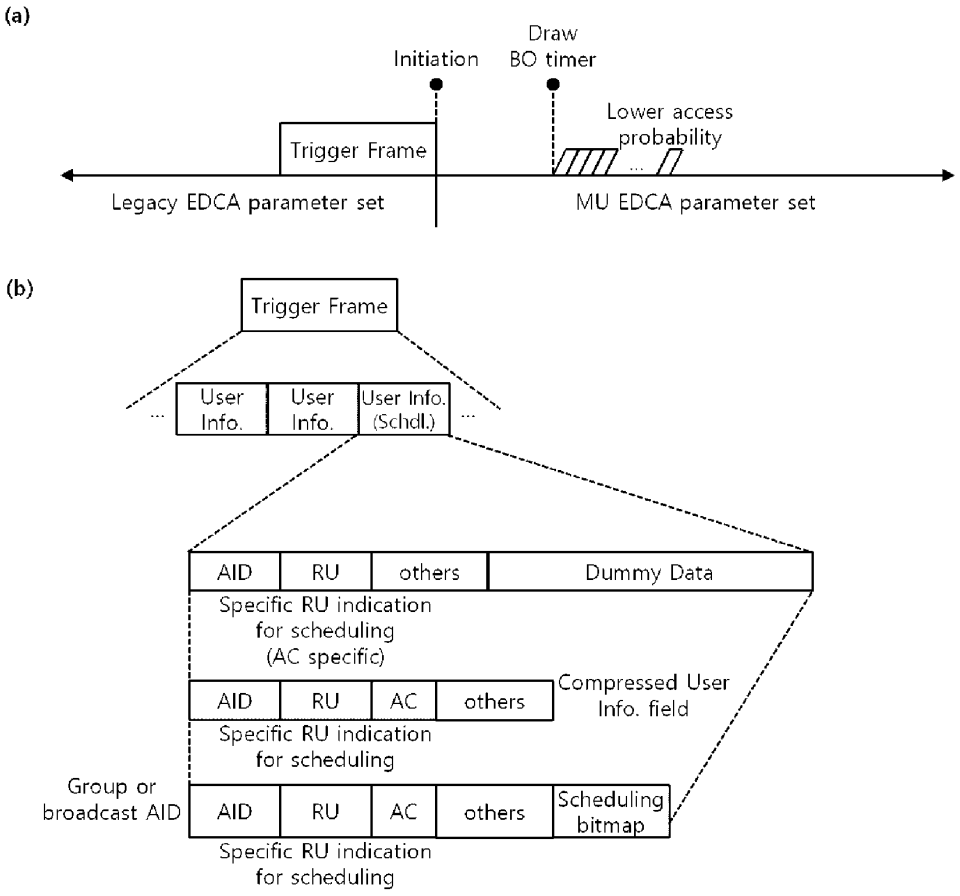

(a)
Initiation
Draw
BO timer
Lower access
probability
Trigger Frame
Legacy EDCA parameter set
MU EDCA parameter set
(b)
Trigger Frame
User
Info.
User
Info.
User Info.
(Schdl.)
AID
RU
others
Dummy Data
Specific RU indication
for scheduling
(AC specific)
AID
RU
AC
others
Compressed User
Info. field
Specific RU indication
for scheduling
Group or
broadcast AID
AID
RU
AC
others
Scheduling
bitmap
Specific RU indication
for scheduling

FIG. 12

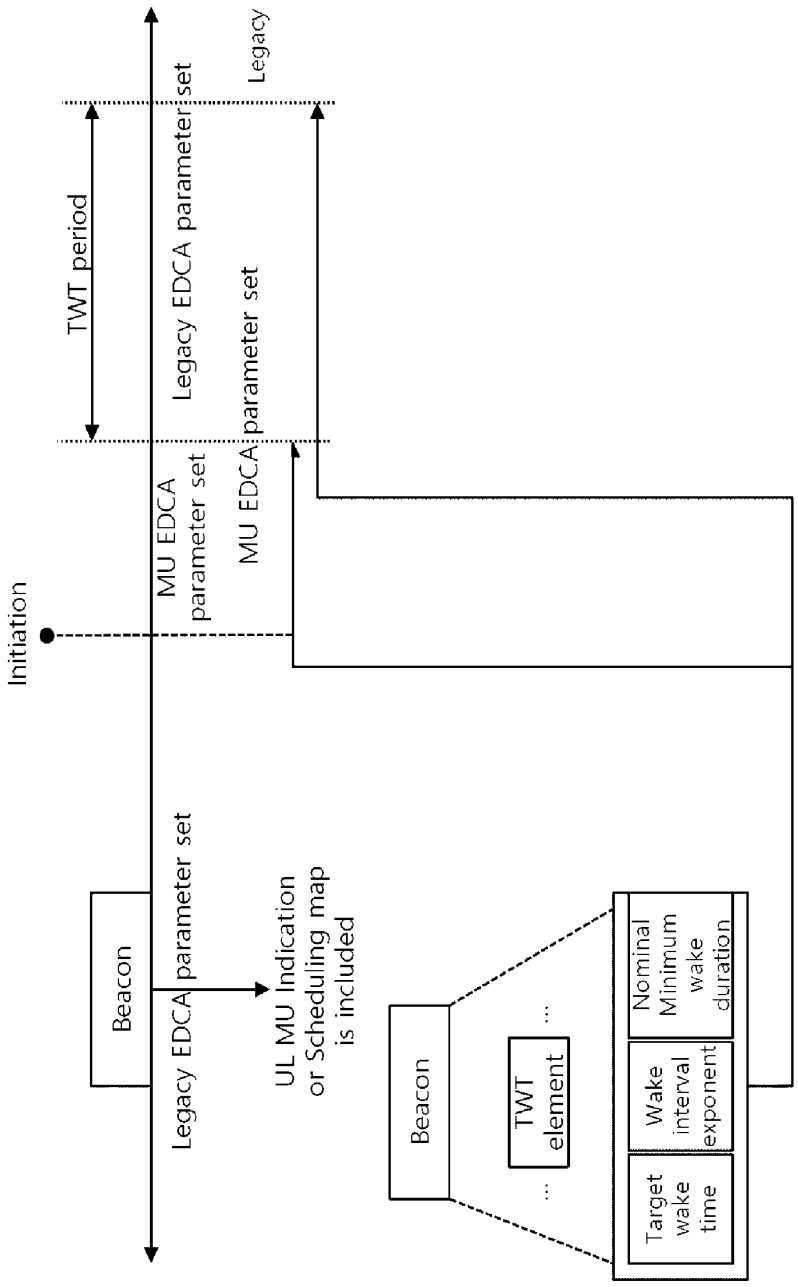

Initiation
MU EDCA parameter set
MU EDCA parameter set
Legacy EDCA parameter set
Legacy
TWT period
Beacon
Legacy EDCA parameter set
UL MU Indication or Scheduling map is included
Beacon
TWT element
Target wake time
Wake interval exponent
Nominal Minimum wake duration

FIG. 13

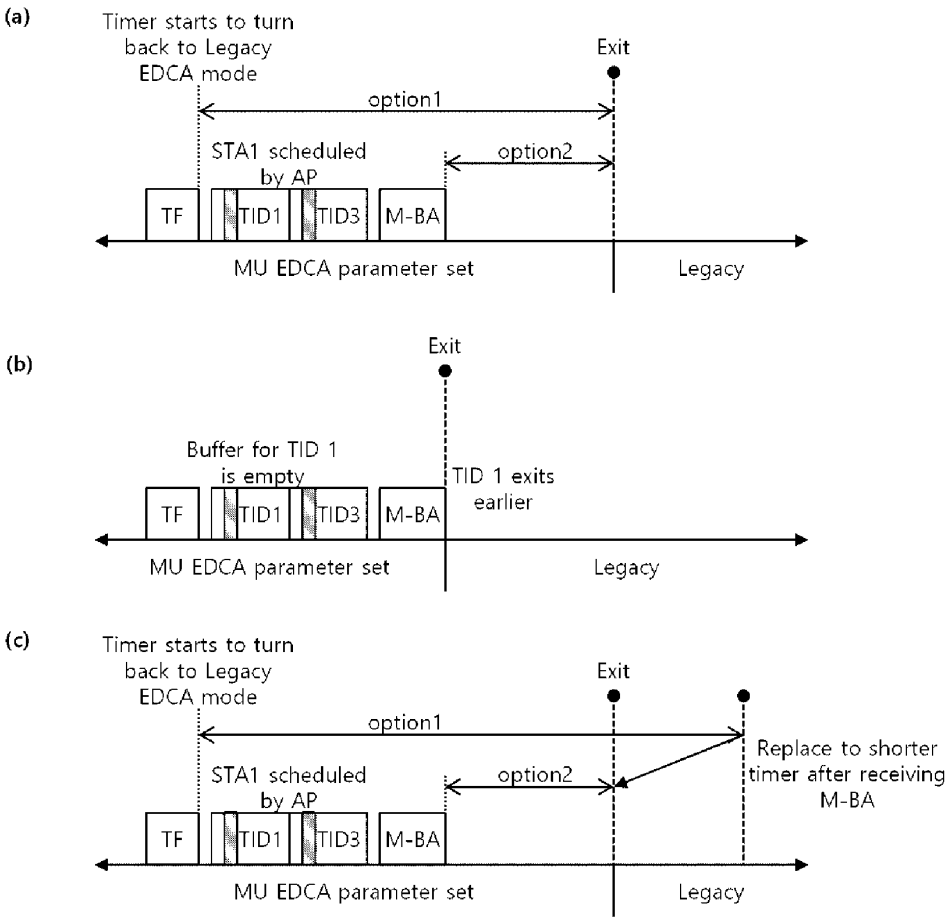

(a)
Timer starts to turn back to Legacy EDCA mode
Exit
option1
STA1 scheduled by AP
option2
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
(b)
Exit
Buffer for TID 1 is empty
TID 1 exits earlier
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy
(c)
Timer starts to turn back to Legacy EDCA mode
Exit
option1
Replace to shorter timer after receiving M-BA
STA1 scheduled by AP
option2
TF
TID1
TID3
M-BA
MU EDCA parameter set
Legacy

FIG. 14

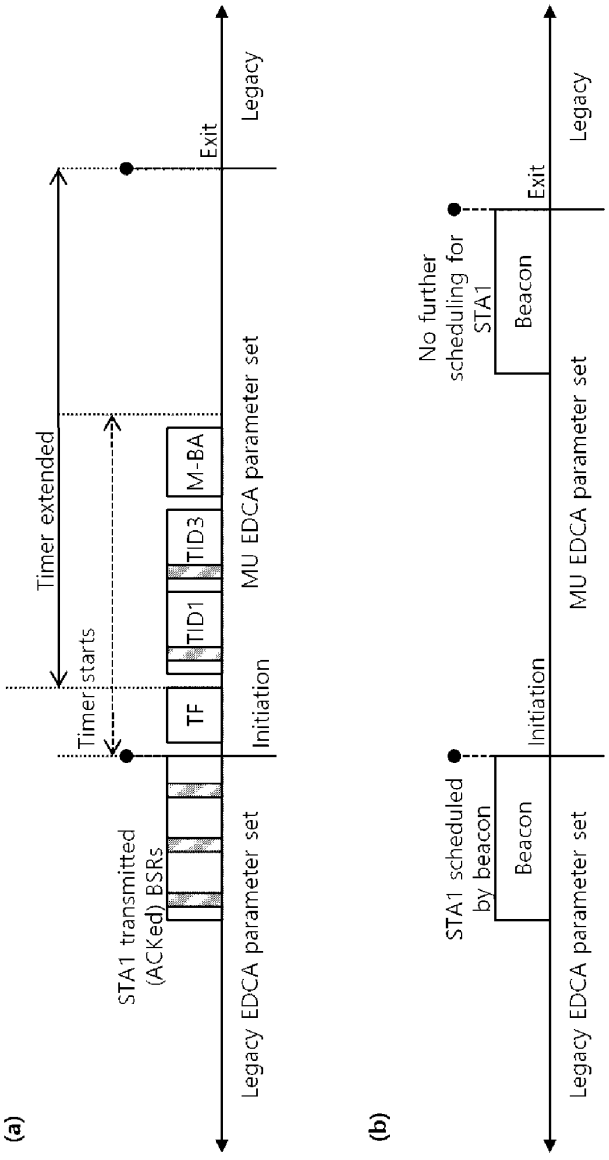

(a)
Legacy EDCA parameter set
STA1 transmitted (ACKed) BSRs
Timer starts
Timer extended
Initiation
TF
TID1
TID3
M-BA
MU EDCA parameter set
Exit
Legacy
(b)
Legacy EDCA parameter set
STA1 scheduled by beacon
Beacon
Initiation
No further scheduling for STA1
Beacon
MU EDCA parameter set
Exit
Legacy

FIG. 15

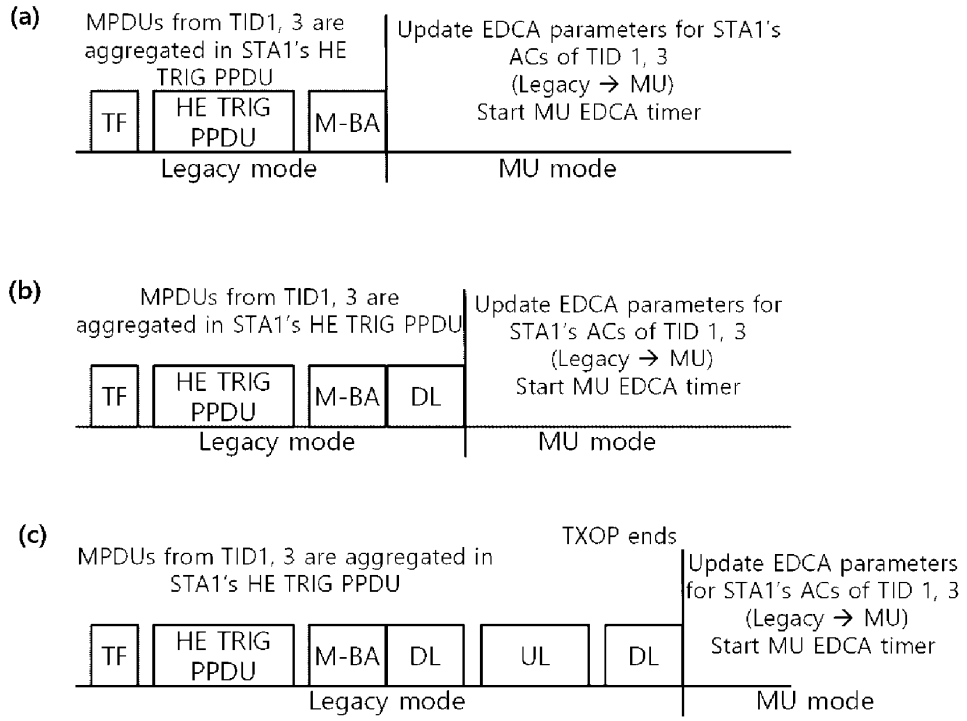
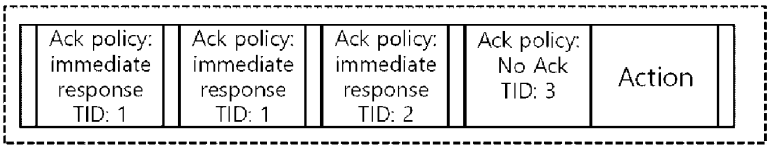

(a)
MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
TF
HE TRIG PPDU
M-BA
Legacy mode
MU mode
(b)
MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
TF
HE TRIG PPDU
M-BA
DL
Legacy mode
MU mode
(c)
TXOP ends
MPDUs from TID1, 3 are aggregated in STA1's HE TRIG PPDU
Update EDCA parameters for STA1's ACs of TID 1, 3 (Legacy → MU) Start MU EDCA timer
TF
HE TRIG PPDU
M-BA
DL
UL
DL
Legacy mode
MU mode

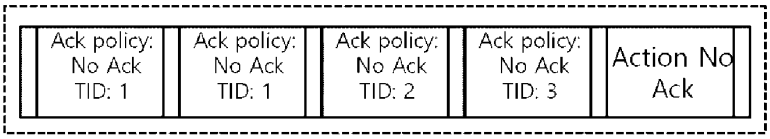
FIG. 16

(a) Data Enabled Immediate Response A-MPDU context



QoS Data frames (No Ack) can be aggregated optionally in an A-MPDU with Data enabled Immediate Response context

(b) Data Enabled No Immediate Response A-MPDU context



QoS Data frames (No Ack) from multiple TIDs

FIG. 17

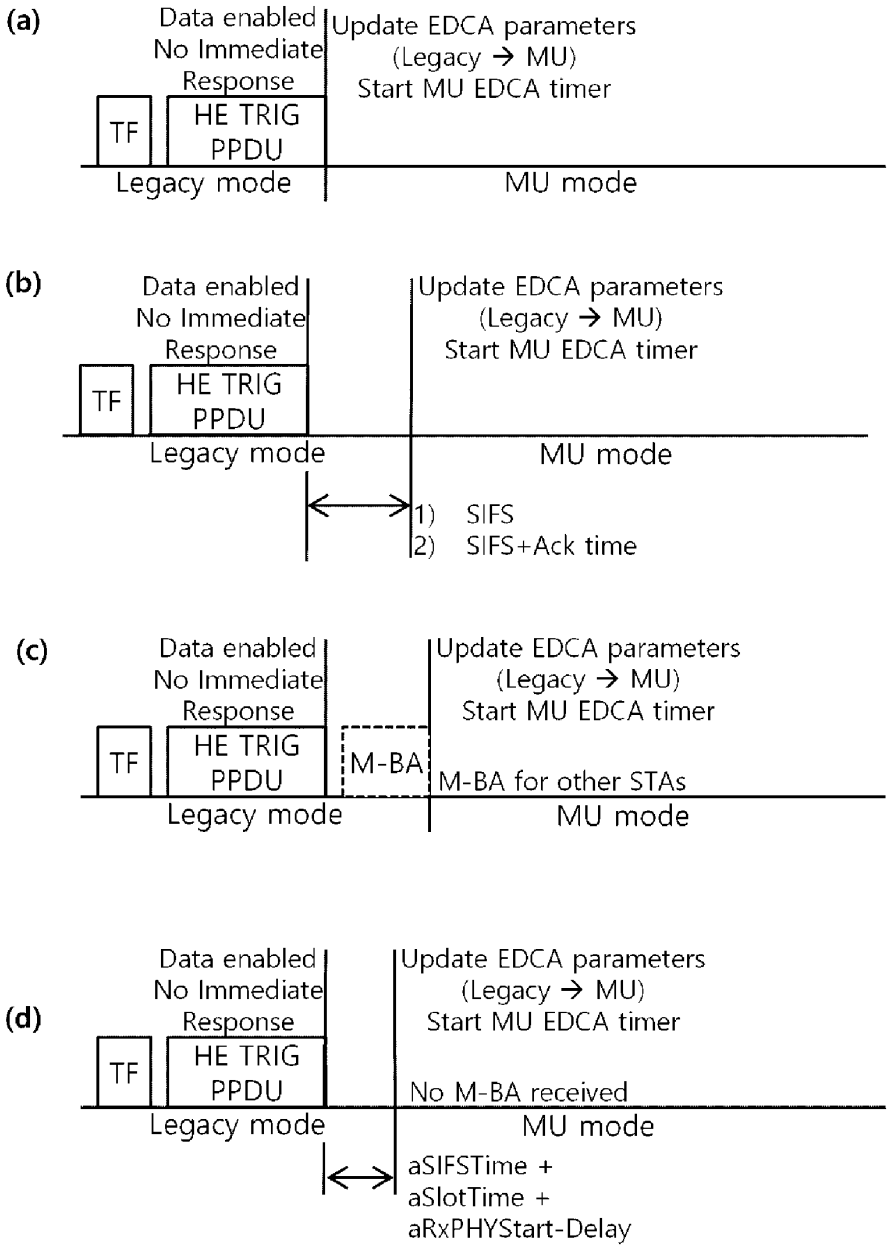

(a)
Data enabled
No Immediate
Response
HE TRIG
PPDU
TF
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
Legacy mode
MU mode
(b)
Data enabled
No Immediate
Response
HE TRIG
PPDU
TF
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
Legacy mode
MU mode
1) SIFS
2) SIFS+Ack time
(c)
Data enabled
No Immediate
Response
HE TRIG
PPDU
TF
M-BA
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
M-BA for other STAs
Legacy mode
MU mode
(d)
Data enabled
No Immediate
Response
HE TRIG
PPDU
TF
Update EDCA parameters
(Legacy → MU)
Start MU EDCA timer
No M-BA received
Legacy mode
MU mode
aSIFSTime +
aSlotTime +
aRxPHYStart-Delay

FIG. 18

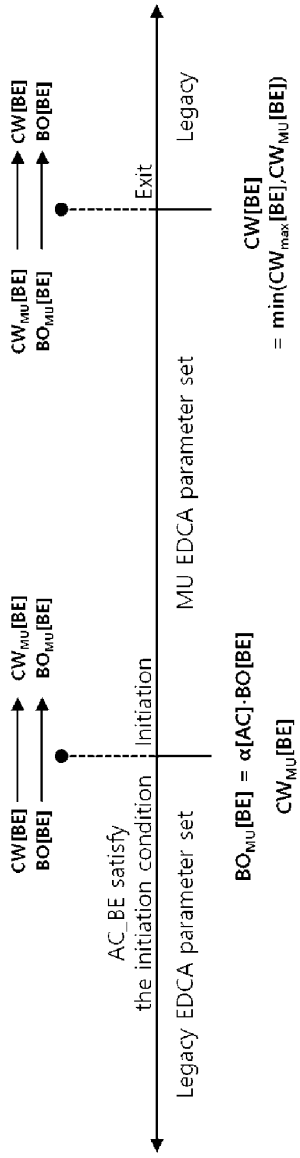

CW[BE]
BO[BE]
CW_MU[BE]
BO_MU[BE]
AC_BE satisfy
the initiation condition
Initiation
Legacy EDCA parameter set
MU EDCA parameter set
BO_MU[BE] = α[AC]·BO[BE]
CW_MU[BE]
= max(CW_min,MU[BE],CW[BE])
CW_MU[BE]
BO_MU[BE]
CW[BE]
BO[BE]
Exit
Legacy
CW[BE]
= min(CW_max[BE],CW_MU[BE])

FIG. 19

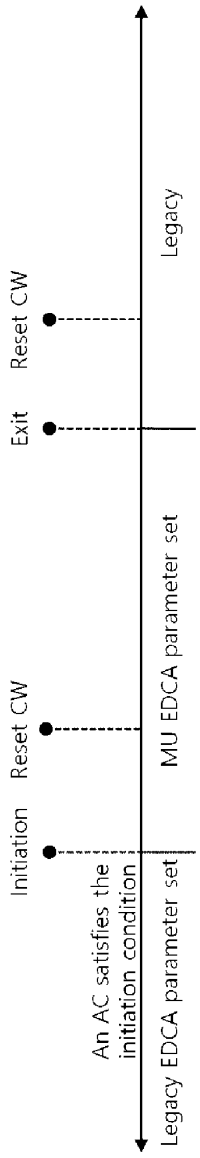

Legacy EDCA parameter set
An AC satisfies the initiation condition
Initiation
Reset CW
MU EDCA parameter set
Exit
Reset CW
Legacy

FIG. 20

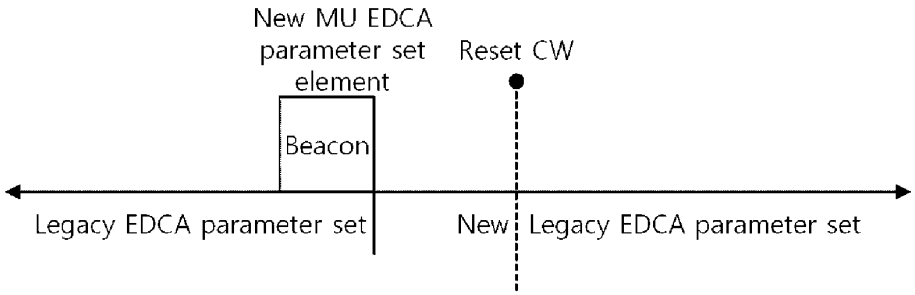

New MU EDCA parameter set element
Reset CW
Beacon
Legacy EDCA parameter set
New
Legacy EDCA parameter set

FIG. 21

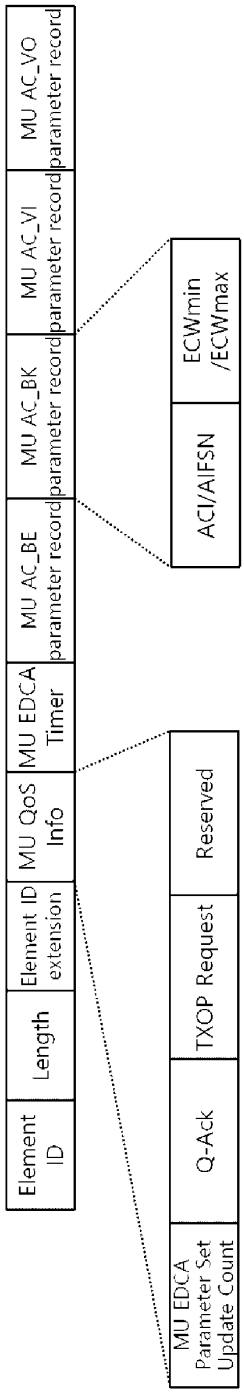

Element ID
Length
Element ID extension
MU QoS Info
MU EDCA Timer
MU AC_BE parameter record
MU AC_BK parameter record
MU AC_VI parameter record
MU AC_VO parameter record
MU EDCA Parameter Set Update Count
Q-Ack
TXOP Request
Reserved
ACI/AIFSN
ECWmin /ECWmax

FIG. 22

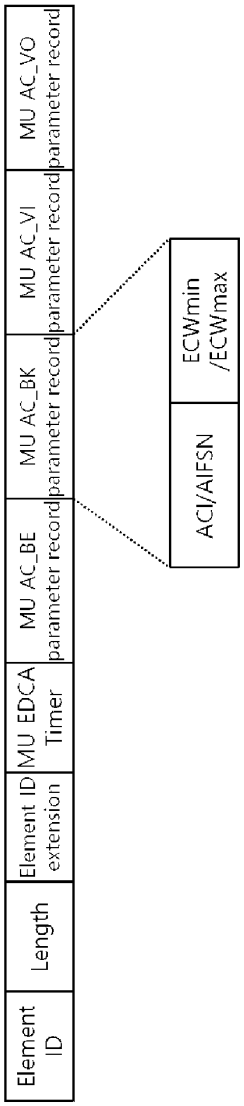

Element ID
Length
Element ID extension
MU EDCA Timer
MU AC_BE parameter record
MU AC_BK parameter record
MU AC_VI parameter record
MU AC_VO parameter record
ACI/AIFSN
ECWmin /ECWmax

FIG. 23

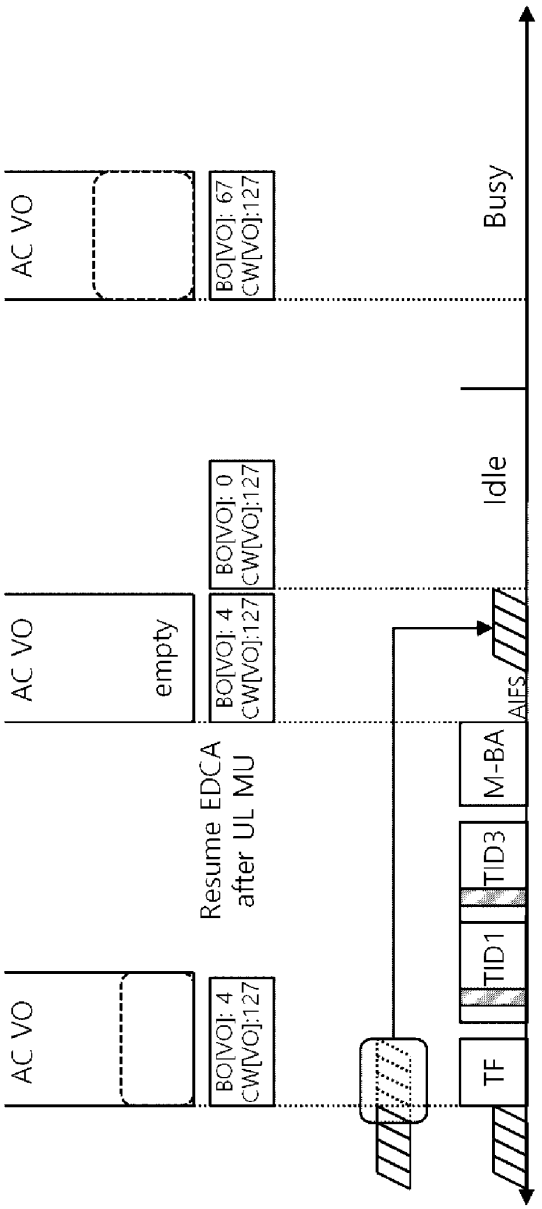

AC VO
BO[VO]: 4
CW[VO]:127
Resume EDCA
after UL MU
AC VO
empty
BO[VO]: 4
CW[VO]:127
BO[VO]: 0
CW[VO]:127
AC VO
BO[VO]: 67
CW[VO]:127
Idle
Busy
TF
TID1
TID3
M-BA
AIFS

FIG. 24

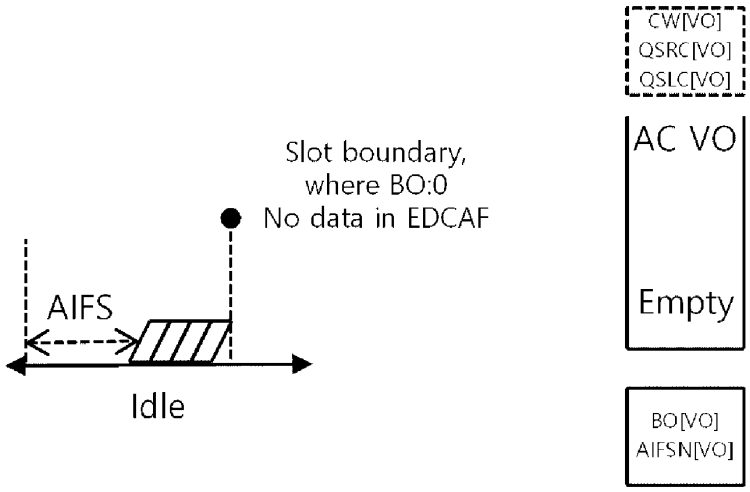

CW[VO]
QSRC[VO]
QSLC[VO]
AC VO
Empty
BO[VO]
AIFSN[VO]
Slot boundary,
where BO:0
No data in EDCAF
AIFS
Idle

FIG. 25

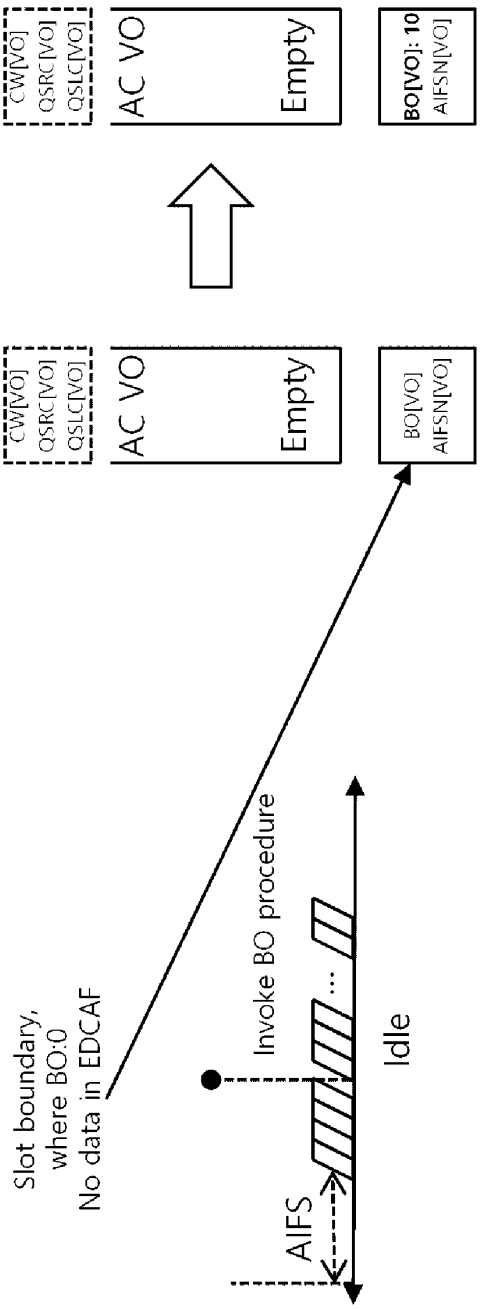

CW[VO]
QSRC[VO]
QSLC[VO]
AC VO
Empty
BO[VO]: 10
AIFSN[VO]
CW[VO]
QSRC[VO]
QSLC[VO]
AC VO
Empty
BO[VO]
AIFSN[VO]
Slot boundary,
where BO:0
No data in EDCAF
Invoke BO procedure
AIFS
Idle

FIG. 26

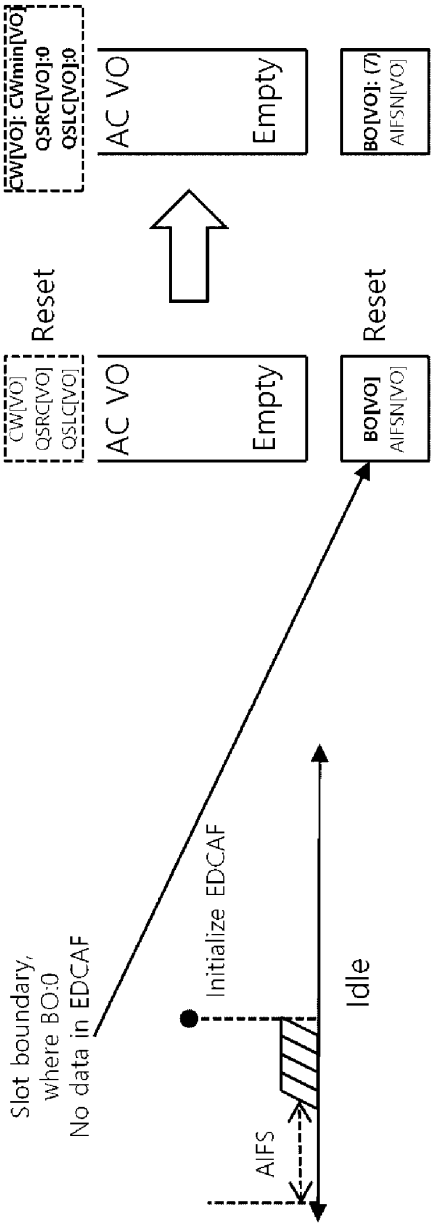

Slot boundary,
where BO:0
No data in EDCAF
Initialize EDCAF
AIFS
Idle
CW[VO]
QSRC[VO]
QSLC[VO]
AC VO
Empty
Reset
BO[VO]
AIFSN[VO]
AC VO
Empty
Reset
CW[VO]: CWmin[VO]
QSRC[VO]:0
QSLC[VO]:0
BO[VO]: (7)
AIFSN[VO]

FIG. 27

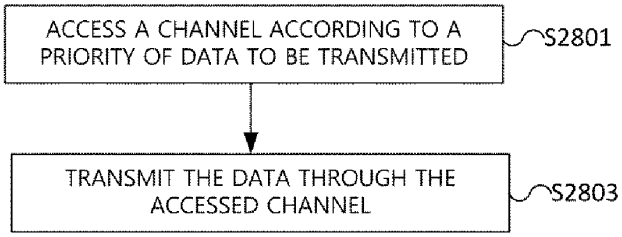

ACCESS A CHANNEL ACCORDING TO A PRIORITY OF DATA TO BE TRANSMITTED
S2801
TRANSMIT THE DATA THROUGH THE ACCESSED CHANNEL
S2803

FIG. 28

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 USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

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: Woojin AHN Date (Optional): Feb. 20. 2019

Signature: _____

LEGAL NAME OF INVENTOR (2)

Inventor: Juhyung SON Date (Optional): Feb 20 2019

Signature: _____

LEGAL NAME OF INVENTOR (3)

Inventor: Geonjung KO Date (Optional): Feb 20, 2019

Signature:

LEGAL NAME OF INVENTOR (4)

Inventor: Jinsam KWAK Date (Optional): Feb. 20, 2019

Signature:

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

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	)	***Re.: Preliminary Amendment***
	)	Group: Not yet assigned
USSN: Not yet assigned	)	Examiner: Not yet assigned
Filing Date: Concurrently herewith	)	Our Ref.: B-9905CON 631950-4
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	)	Date: March 6, 2019

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.

Remarks begin on page 3 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 section entitled "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME" and before the section entitled "Technical Field", to read as follows:

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of International Patent Application No. PCT/KR2017/009841 filed on September 7, 2017, which claims the priority to Korean Patent Application No. 10-2016-0114822 filed in the Korean Intellectual Property Office on September 7, 2016, Korean Patent Application No. 10-2016-0116877 filed in the Korean Intellectual Property Office on September 10, 2016, Korean Patent Application No. 10-2016-0116965 filed in the Korean Intellectual Property Office on September 12, 2016, Korean Patent Application No. 10-0117898 filed in the Korean Intellectual Property Office on September 13, 2016, Korean Patent Application No. 10-2016-0122488 filed in the Korean Intellectual Property Office on September 23, 2016, Korean Patent Application No. 10-2016-0147189 filed in the Korean Intellectual Property Office on November 6, 2016 and Korean Patent Application No. 10-2017-0022227 filed in the Korean Intellectual Property Office on February 20, 2017, the entire contents of which are incorporated herein by reference.

* * *

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 or priority claim.

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.

Very truly yours,

/Young Seok Koo 76,255/

Young Seok Koo
Attorney for the Applicant
Registration No. 76,255
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Los Angeles, CA 90036
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(323) 934-0202 facsimile

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 USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: March 6, 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.

---

[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/KR2017/009841 mailed on January 9, 2018

Written Opinion of the International Searching Authority for PCT/KR2017/009841 mailed on January 9, 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
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(323) 934-2300 voice

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16294883 Document Date: 03/06/2019

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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.

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