

CERTIFICATE OF TRANSLATION ACCURACY

I am a professional translator, reviewer, and coordinator specializing in translating Korean, Japanese and Chinese to English and vice versa.

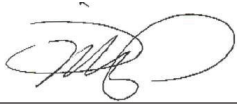
I served as Chief Examiner of the certified court interpreter test for the State of California and as a contract translator and interpreter for various federal agencies through the U.S. Department of State for more than a decade. I served as an instructor at the University of California at Berkeley and the Middlebury Institute of International Studies at Monterey (MIIS) Graduate Program in Translation.

I have more than 30 years of experience translating thousands of technical, legal, and business documents from Korean to English submitted to, among others, Korean judicial authorities, U.S. federal courts, the U.S. International Trade Commission (ITC), and the USPTO Patent Trial and Appeal Board (PTAB).

I certify that I translated the following document from Korean into the English language. I also certify that this is a true, correct, and complete translation of the corresponding source text to the best of my knowledge and ability.

I certify under penalty of perjury that the foregoing is true and correct.

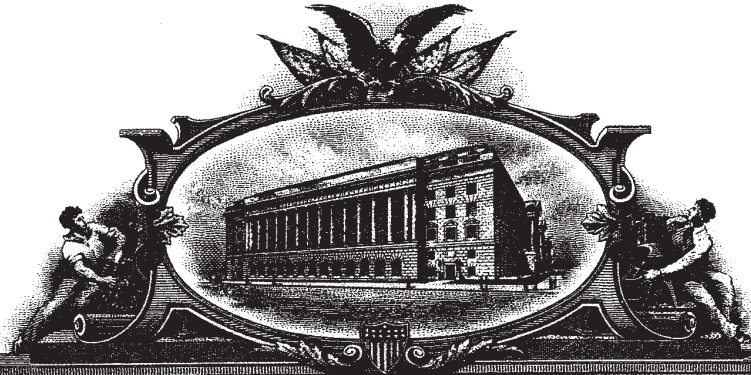
Executed this 25th day of April 2025 in Contra Costa County of the State of California.

By: 
Alex N. Jo
Member, ATA

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:	PCT/KR2016/014437
International filing date:	09 December 2016 (09.12.2016)
Document type:	Certified copy of priority document
Document details:	Country/Office: US
	Number: 62/311,929
	Filing date: 23 March 2016 (23.03.2016)
Date of receipt at the International Bureau:	17 April 2017 (17.04.2017)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-bis)



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

March 23, 2017

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 62/311,929

FILING DATE: *March 23, 2016*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US62/311,929*

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office



W. Montgomery
W. MONTGOMERY
Certifying Officer

Electronic Acknowledgement Receipt	
EFS ID:	25276465
Application Number:	62311929
International Application Number:	
Confirmation Number:	9633
Title of Invention:	CHANNEL BONDING FOR 802.11AX
First Named Inventor/Applicant Name:	Jeongki KIM
Customer Number:	126667
Filer:	Daniel Chung
Filer Authorized By:	
Attorney Docket Number:	BPV2016-0080
Receipt Date:	23-MAR-2016
Filing Date:	
Time Stamp:	05:16:10
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$260
RAM confirmation Number	7373
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	Specification - Not in English	BPV2016-0080_KOR.pdf	4091125 18543663b602624ba7711c125b2069040a64cb8d	no	67
Warnings:					
Information:					
2	Application Data Sheet	BPV2016-0080_NewADS.pdf	998448 58f07de9384ea0fa0e7ff89352bba8ac7ee67e3	no	7
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	29841 a68e44457eb27fdaa93adf143cc8f6ed8910415e	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			5119414		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

**PROVISIONAL APPLICATION FOR UNITED STATES PATENT
IN THE NAMES OF**

**Jeongki KIM, Kiseon RYU, Jinsoo CHOI
and Hangyu CHO**

For

CHANNEL BONDING FOR 802.11AX

Customer Number: 126667

Docket Number: BPV2016-0080

Total number of pages: 67(including cover)

[Specification]**[Title of the Invention]**

Method and Apparatus For Flexible Resource Allocation In Wireless Communication System *[in Korean]* {Method and Apparatus For Flexible Resource Allocation In Wireless Communication System} *[in English]*

[Technical Field]

The present invention relates to a wireless communication system and, more particularly, to a method and apparatus for enabling efficient data transmission by utilizing discontinuous channels or channels with bandwidth sizes that are not supported by existing systems in a wireless local area network (WLAN) system.

[Background Technology of the Invention]

The method proposed herein may be applied to various wireless communication systems; however, for exemplary purposes, the following description will focus on its application to a wireless local area network (WLAN) system.

The standard for WLAN technology has been developed under the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standard. IEEE 802.11a and 802.11b utilize unlicensed bands in the 2.4 GHz or 5 GHz frequency range, with IEEE 802.11b providing a transmission rate of 11 Mbps and IEEE 802.11a providing a transmission rate of 54 Mbps. IEEE 802.11g applies orthogonal frequency-division multiplexing (OFDM) in the 2.4 GHz band, achieving a transmission rate of 54 Mbps. IEEE 802.11n applies multiple-input multiple-output OFDM (MIMO-OFDM), supporting four spatial streams and providing a transmission rate of 300 Mbps. Furthermore, IEEE 802.11n supports a channel

bandwidth of up to 40 MHz, which enables a transmission rate of up to 600 Mbps.

The aforementioned WLAN standards have evolved through the IEEE 802.11ac standard, which supports up to 160 MHz bandwidth and up to eight spatial streams, achieving a maximum transmission rate of 1 Gbit/s. Discussions are currently underway regarding the standardization of IEEE 802.11ax.

[Specifics of the Invention]

[Problems to be Solved by the Invention]

The present invention aims to provide a method and apparatus for a station to efficiently transmit signals in a wireless communication system.

Specifically, the invention seeks to efficiently define a resource allocation method applicable in the next-generation wireless LAN system, IEEE 802.11ax standard, when Orthogonal Frequency Division Multiple Access (OFDMA) or Multi-User Multiple Input Multiple Output (MU-MIMO) is applied.

However, the objects of the present invention are not limited to those mentioned above and also include various effects that will become apparent from the detailed description of the invention provided below.

[Means to Solve the Problem]

According to one aspect of the present invention, in a method for a station (STA) operating in a wireless local area network (WLAN) system to transmit a signal, a first STA configures a wireless frame including a signaling (SIG) field containing control information and a data field capable of data transmission through a discontinuous channel or a 60x MHz (where x is a natural number) channel, and the first STA transmits the configured wireless frame to a second STA, wherein the SIG field includes entire bandwidth information

capable of data transmission through the data field and null indicator information indicating channel regions within the total bandwidth that are not used for data transmission, thereby proposing a signal transmission method.

According to another aspect of the present invention, in a station (STA) device operating in a wireless local area network (WLAN) system, a processor configured to construct a wireless frame including a signaling (SIG) field containing control information and a data field capable of data transmission through a discontinuous channel or a 60x MHz (where x is a natural number) channel; and a transceiver configured to transmit the wireless frame configured by the processor to a second STA, wherein the processor is configured to include, in the SIG field, entire bandwidth information capable of data transmission through the data field and null indicator information indicating channel regions within the total bandwidth that are not used for data transmission, thereby proposing a station device.

The null indicator information may be in a bitmap format, where each bit of the bitmap corresponds to a unit channel region of a predetermined size within the total bandwidth.

The total bandwidth may include a primary channel and one or more secondary channels. In such a case, each bit of the bitmap representing the null indicator information may correspond to a channel other than the primary channel.

The null indicator information may also be in the form of an index representing one of the predetermined channel combinations that constitute a discontinuous channel or a 60x MHz channel used for data transmission.

It is preferable that the null indicator information be included when the total bandwidth is 80 MHz or greater.

When the total bandwidth is 80 MHz, x may be 1, and when the total bandwidth is 160 MHz, x may be 2.

The SIG field may include a first SIG field (SIG A) and a second SIG field (SIG B), wherein the total bandwidth information is included in the first SIG field, and the null indicator information may be included in either the first SIG field or the second SIG field.

Either the first SIG field or the second SIG field may further include a null indicator presence information field that indicates whether null indicator information is present.

[Effect of the Invention]

According to the present invention, a station in a wireless communication system can efficiently transmit signals. Specifically, in a next-generation wireless LAN system compliant with the IEEE 802.11ax standard, resource allocation can be efficiently performed when OFDMA (Orthogonal Frequency Division Multiple Access) or Multi-User MIMO (MU-MIMO) is applied.

However, the effects obtained from the present invention are not limited to those described above, and additional effects not explicitly mentioned herein will be apparent to those skilled in the art from the following description.

[Brief Description of the Drawings]

FIG. 1 is a diagram illustrating an example of the configuration of a wireless LAN system.

FIG. 2 is a diagram illustrating another example of the configuration of a wireless LAN system.

FIG. 3 is a diagram illustrating an exemplary structure of a wireless LAN system.

FIGS. 4 to 8 are diagrams for explaining an example of a frame structure used in an IEEE 802.11 system.

FIG. 9 is a diagram illustrating an example of a PPDU format that may be used in the present invention.

FIG. 10 is a diagram for explaining an uplink case of the concept of multi-user transmission applicable to the present invention.

FIGS. 11 and 12 are diagrams for explaining the inefficiencies of conventional channel allocation methods.

FIGS. 13 and 14 are diagrams for explaining the concept of supporting a discontinuous channel or a 60x MHz channel according to an embodiment of the present invention.

FIG. 15 is a diagram for explaining a resource allocation format for utilizing a discontinuous band or a 60x MHz band according to an embodiment of the present invention.

FIGS. 16 and 17 are diagrams for explaining a detailed form of FIG. 15.

FIGS. 18 and 19 are diagrams for explaining an example of configuring a null indicator in a bitmap format according to an embodiment of the present invention.

FIGS. 20 and 21 are diagrams illustrating a resource allocation method when the total bandwidth is 160 MHz according to an embodiment of the present invention.

FIG. 22 is a diagram for explaining an example of a null indicator information presence indicator field according to an embodiment of the present invention.

FIG. 23 is a block diagram illustrating an exemplary configuration of an AP device (or base station device) and a station device (or terminal device) according to an embodiment of the present invention.

FIG. 24 is a diagram illustrating an exemplary structure of a processor of an AP device or a station device according to an embodiment of the present invention.

[Detailed Specifics for Practicing the Invention]

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. The detailed description set forth below in conjunction with the accompanying drawings is intended to illustrate exemplary embodiments of the present invention and is not intended to represent the only embodiments in which the present invention may be implemented. The following detailed description includes specific details to provide a thorough understanding of the present invention. However, those skilled in the art will recognize that the present invention may be implemented without these specific details.

The following embodiments represent specific combinations of components and features of the present invention. Each component or feature may be considered optional unless explicitly stated otherwise. Each component or feature may be implemented independently of other components or features. Additionally, some components and/or features may be combined to constitute embodiments of the present invention. The order of operations described in the embodiments of the present invention may be modified. Some components or features of one embodiment may be included in another embodiment or replaced with corresponding components or features of another embodiment.

The specific terms used in the following description are provided to facilitate an understanding of the present invention, and the use of such specific terms may be modified in other forms without departing from the technical scope of the present invention.

In some cases, well-known structures and devices are omitted or illustrated in block diagram form focusing on core functions of each structure and device to prevent ambiguity in the concept of the present invention. Furthermore, throughout the entire specification, the same reference numerals are used to denote the same components.

The embodiments of the present invention may be supported by standard documents

disclosed in at least one of the IEEE 802 system, 3GPP system, 3GPP LTE and LTE-A (LTE-Advanced) system, and 3GPP2 system, which are wireless access systems. That is, steps or portions not explicitly described in the embodiments of the present invention for the purpose of clearly disclosing the technical concept of the present invention may be supported by the above-mentioned documents. Additionally, all terms disclosed in the present document may be interpreted in accordance with the definitions provided in these standard documents.

The following technology may be applied to various wireless access systems, including CDMA (Code Division Multiple Access), FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access), OFDMA (Orthogonal Frequency Division Multiple Access), and SC-FDMA (Single Carrier Frequency Division Multiple Access). CDMA may be implemented using wireless technologies such as UTRA (Universal Terrestrial Radio Access) or CDMA2000. TDMA may be implemented using wireless technologies such as GSM (Global System for Mobile Communications)/GPRS (General Packet Radio Service)/EDGE (Enhanced Data Rates for GSM Evolution). OFDMA may be implemented using wireless technologies such as IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, and E-UTRA (Evolved UTRA).

Furthermore, in this specification, the terms "first" and/or "second" may be used to describe various components, but such components should not be limited by these terms. These terms are used solely for the purpose of distinguishing one component from another. For example, within the scope of the present invention, without departing from the concept described in this specification, a first component may be referred to as a second component, and similarly, a second component may likewise be referred to as a first component.

Additionally, throughout this specification, when a part is described as "including" a certain component, it is to be understood that, unless otherwise explicitly stated, the presence

of other components is not excluded but rather that additional components may also be included. Furthermore, the terms "... unit," "... member," and the like, as used in this specification, refer to a unit that processes at least one function or operation and may be implemented as a combination of hardware and/or software.

FIG. 1 is a diagram illustrating an example of the configuration of a wireless local area network (WLAN) system.

As shown in FIG. 1, a WLAN system includes one or more Basic Service Sets (BSSs). A BSS is a set of stations (Stations/STA) that have successfully synchronized and can communicate with each other.

A station is a logical entity that includes a Medium Access Control (MAC) layer and a Physical Layer interface for a wireless medium. Stations include both an Access Point (AP) and a Non-AP Station. Among the stations, a portable terminal operated by a user is a Non-AP Station, and the term "station" may sometimes refer specifically to a Non-AP Station. A Non-AP Station may also be referred to by other names such as a terminal, Wireless Transmit/Receive Unit (WTRU), User Equipment (UE), Mobile Station (MS), Mobile Terminal, or Mobile Subscriber Unit.

An AP is an entity that provides access to a Distribution System (DS) via a wireless medium to associated stations. An AP may also be referred to as a centralized controller, Base Station (BS), Node-B, Base Transceiver System (BTS), or site controller.

A BSS can be classified into an infrastructure BSS and an Independent BSS (IBSS).

The BSS illustrated in FIG. 1 is an Independent BSS (IBSS). An IBSS refers to a BSS that does not include an AP, and since it does not include an AP, access to the DS is not allowed, forming a self-contained network.

FIG. 2 is a diagram illustrating another example of the configuration of a WLAN system.

The BSS illustrated in FIG. 2 is an infrastructure BSS. An infrastructure BSS includes one or more stations and an AP. In an infrastructure BSS, communication between non-AP stations is, in principle, conducted via the AP. However, if a direct link is established between non-AP stations, direct communication between non-AP stations is also possible.

As shown in FIG. 2, multiple infrastructure BSSs may be interconnected via a DS. A set of multiple BSSs connected through a DS is referred to as an Extended Service Set (ESS). Stations included in an ESS can communicate with each other, and within the same ESS, a non-AP station can move from one BSS to another while maintaining seamless communication.

The DS is a mechanism for connecting multiple APs and does not necessarily have to be a network. There are no restrictions on its form as long as it can provide a certain distribution service. For example, the DS may be a wireless network such as a mesh network, or it may be a physical structure that connects APs to each other.

FIG. 3 is a diagram illustrating an exemplary structure of a WLAN system. In FIG. 3, an example of an infrastructure BSS including a DS is illustrated.

In the example of FIG. 3, BSS1 and BSS2 form an ESS. In a WLAN system, a station is a device that operates in accordance with the MAC/PHY regulations of IEEE 802.11. A station includes both an AP station and a non-AP station. A non-AP station typically refers to a device that is directly handled by a user, such as a laptop computer or a mobile phone. In the example of FIG. 3, Station 1, Station 3, and Station 4 correspond to non-AP stations, while Station 2 and Station 5 correspond to AP stations.

In the following description, a non-AP station may also be referred to as a terminal, a Wireless Transmit/Receive Unit (WTRU), User Equipment (UE), Mobile Station (MS), Mobile Terminal, or Mobile Subscriber Station (MSS). Additionally, an AP corresponds to concepts such as a Base Station (BS), Node-B, evolved Node-B (eNB), Base Transceiver System (BTS), or Femto Base Station (FemtoBS) in other wireless communication fields.

FIGS. 4 to 8 are diagrams for explaining an example of a frame structure used in an IEEE 802.11 system.

A station (STA) can receive a Physical Layer Convergence Protocol (PLCP) Packet Data Unit (PPDU). In this case, the PPDU frame format may be configured to include a Short Training Field (STF), a Long Training Field (ETF), a SIGNAL (SIG) field, and a Data field. The PPDU frame format may be set based on the type of PPDU frame format.

For example, a non-High Throughput (non-HT) PPDU frame format may be configured to include only a Legacy Short Training Field (L-STF), a Legacy Long Training Field (L-LTF), a SIG field, and a Data field.

Additionally, the type of PPDU frame format may be set as either an HT-mixed format PPDU or an HT-greenfield format PPDU. In such PPDU formats, additional STF, LTF, or SIG fields of different types may be included between the SIG field and the Data field.

Additionally, referring to FIG. 5, a Very High Throughput (VHT) PPDU format may be configured. In this case, the VHT PPDU format may also include additional (or different types of) STF, LTF, and SIG fields between the SIG field and the Data field.

More specifically, in the VHT PPDU format, at least one or more of a VHT-SIG-A field, a VHT-STF field, a VHT-LTF field, and a VHT-SIG-B field may be included between the L-SIG field and the Data field.

In this case, the STF may be a signal for signal detection, Automatic Gain Control (AGC), diversity selection, and precise time synchronization. Additionally, the LTF may be a signal for channel estimation and frequency offset estimation. STF and LTF combined may be referred to as a PLCP preamble, and the PLCP preamble may be a signal for synchronization and channel estimation in an OFDM physical layer.

Additionally, referring to FIG. 6, the SIG field may include a RATE field and a LENGTH field. The RATE field may include information about the modulation and coding rate of the data. The LENGTH field may include information about the length of the data. Furthermore, the SIG field may include parity bits and SIG TAIL bits, among others.

The Data field may include a SERVICE field, a PLCP Service Data Unit (PSDU), and PPDU TAIL bits, and if necessary, it may also include padding bits.

Referring to FIG. 7, some bits of the SERVICE field may be used for synchronization of the descrambler at the receiving end, while some bits may be configured as reserved bits. The PSDU corresponds to a MAC Protocol Data Unit (MAC PDU) as defined in the MAC layer and may include data generated and used by the upper layers. The PPDU TAIL bits may be used to return the encoder to a zero state. The padding bits may be used to adjust the length of the Data field to a predetermined unit.

Additionally, as described above, the VHT PPDU format may include additional (or different types of) STF, LTF, and SIG fields. In this case, in a VHT PPDU, L-STF, L-LTF, and L-SIG may correspond to the Non-VHT portion of the VHT PPDU. Meanwhile, VHT-SIG A, VHT-STF, VHT-LTF, and VHT-SIG B in the VHT PPDU may correspond to the VHT portion. That is, the VHT PPDU may have separately defined regions for Non-VHT fields and VHT fields. For example, VHT-SIG A may include information necessary for interpreting the VHT PPDU.

In this case, referring to FIG. 8 as an example, VHT-SIG A may be composed of VHT-SIG A1 (FIG. 8(a)) and VHT-SIG A2 (FIG. 8(b)). In this case, VHT-SIG A1 and VHT-SIG A2 may each be composed of 24 data bits, and VHT-SIG A1 may be transmitted before VHT-SIG A2. VHT-SIG A1 may include fields such as BW, STBC, Group ID, NSTS/Partial AID, TXOP_PS_NOT_ALLOWED, and Reserved fields. Additionally, VHT-SIG A2 may include fields such as Short GI, Short GI NSYM Disambiguation, SU/MU[0] Coding, LDPC Extra OFDM Symbol, SU VHT-MCS/MU[1-3] Coding, Beamformed, CRC, Tail, and Reserved fields. Through this, information regarding the VHT PPDU can be identified.

FIG. 9 is a diagram illustrating an example of a PPDU format that may be used in the present invention.

As described above, various types of PPDU formats may be configured. In this case, as an example, a new type of PPDU format may be proposed. The PPDU may include L-STF, L-LTF, L-SIG, and DATA fields. Additionally, in one example, the PPDU frame may further include an HE (High Efficiency) SIG-A field, an HE-STF field, an HE-LTF field, and an HE-SIG B field. In this case, as an example, the HE SIG-A field may include shared information. The shared information may include fields such as Bandwidth, Guard Interval (GI), Length, and BSS Color Field. In one example, the L part (L-STF, L-LTF, L-SIG) may be transmitted

in an SFN (Single Frequency Network) format in units of 20 MHz in the frequency domain. Similarly, the HE SIG-A field may also be transmitted in an SFN format in units of 20 MHz, the same as the L part. If the channel bandwidth is greater than 20 MHz, the L part and HE SIG-A may be duplicated and transmitted in 20 MHz units. Additionally, the HE SIG-B field may contain user-specific information. The user-specific information may include, for example, Station AID, resource allocation information (e.g., allocation size), MCS, Nsts, Coding, STBC, and TXBF. Furthermore, HE SIG-B may be transmitted across the entire bandwidth.

Referring to FIG. 9(b) as an example, the PPDU may be transmitted in an 80 MHz band. In this case, the L part and the HE SIG-A part may be duplicated and transmitted in 20 MHz units, while the HE SIG-B field may be transmitted across the entire 80 MHz bandwidth. However, the above-described transmission method is merely an example and is not limited to the described embodiments.

FIG. 10 is a diagram for explaining the concept of multi-user transmission in the uplink case, which may be applied to the present invention.

As described above, an AP can acquire a TXOP (Transmission Opportunity) to access the medium and occupy the medium through contention to transmit a signal. Referring to FIG. 10, an AP station may transmit a trigger frame to multiple stations to perform uplink multi-user (UL MU) transmission. In this case, as an example, the trigger frame may include UL MU allocation information, such as resource allocation position and size, station IDs, MCS, and MU type (e.g., MIMO, OFDMA). That is, uplink multi-user (UL MU) transmission may refer to a scenario where multiple stations perform uplink transmission to an AP station as multi-users.

The AP station may transmit a trigger frame to multiple stations, and this frame may enable multiple stations to perform uplink data transmission.

The multiple stations may transmit data to the AP after an SIFS (Short Interframe Space) duration, based on the format indicated by the trigger frame. Thereafter, the AP may transmit ACK/NACK information to the stations, thereby facilitating UL MU transmission.

FIGS. 11 and 12 are diagrams for explaining the inefficiency of conventional channel allocation methods.

As shown in FIGS. 11 and 12, conventional Very High Throughput (VHT) stations (STAs) utilize a channel only when a contiguous channel, including the Primary channel, is idle. Specifically, FIG. 11 illustrates a case where data is transmitted over a 20 MHz Primary channel when the Primary channel remains idle for a certain period. FIG. 12 illustrates a case where data is transmitted using a 40 MHz channel, which combines the Primary channel and an adjacent 20 MHz Secondary channel (Secondary 20), when both channels remain idle for a certain period.

However, when utilizing the channel in this manner, inefficiencies may occur. As shown in FIG. 11, since the Secondary 40 channel is not used, inefficiency may arise. Additionally, in the case of FIG. 12, efficiency may be reduced because channels within the Secondary 40 channel that are free of interference are not utilized.

FIGS. 13 and 14 are diagrams for explaining the concept of supporting discontinuous channels or 60x MHz channels according to an embodiment of the present invention.

To address the issues described above in relation to FIGS. 11 and 12, an embodiment of the present invention proposes a system that supports 60x MHz (where x is a natural number) as shown in FIG. 13 or transmits data using discontinuous channels as shown in FIG. 14.

Specifically, FIG. 13 illustrates an example in which, in a scenario similar to FIG. 11, only the busy portions of the channel are excluded, and both the Primary channel and the Secondary 40 channel are utilized to form a 60 MHz channel. If the total bandwidth is 160 MHz, a method is proposed that, unlike conventional approaches, supports channels up to 120 MHz (60×2).

Additionally, FIG. 14 illustrates a method of transmitting data using discontinuous channels, excluding channels experiencing interference, in the scenario depicted at the bottom of FIG. 12. That is, unlike conventional methods that utilize only contiguous channels within the total bandwidth, the proposed method flexibly utilizes resources by excluding only the channels that cannot be used due to interference or other constraints.

In summary, in conventional systems, only information regarding contiguous bandwidths of 20, 40, 80, and 160 (or $80+80$) MHz was briefly indicated in the SIG field (BW field). However, in the present embodiment, a method is proposed for indicating the use of $60 \times$ MHz contiguous bandwidth as well as non-contiguous bandwidth, as described above.

FIG. 15 is a diagram for explaining a resource allocation format for utilizing discontinuous bandwidth or $60 \times$ MHz bandwidth according to an embodiment of the present invention.

When transmitting a frame, as illustrated in FIG. 15, the STA may include information regarding unused bandwidth, null indicator information (e.g., Null bandwidth/channel/sub-channel information or non-contiguous bandwidth/channel/sub-channel information) in the HE-SIG field. It is preferable that this information be included only when the BW is 80 MHz or 160 (or $80+80$) MHz.

That is, the HE-SIG field is proposed to include bandwidth information indicating whether the total bandwidth is 20, 40, 80, or 160 (or $80+80$) MHz, as well as null indicator

information representing the channel regions within the total bandwidth that are not used for data transmission.

It is proposed that information regarding contiguous or non-contiguous bandwidth, instead of a null sub-channel indicator, be included in the HE-SIG field. The contiguous or non-contiguous bandwidth information may indicate the actual bandwidth used or sub-channel information. The preferred unit may be 20 MHz or its multiples (e.g., 40 MHz, 80 MHz, ...).

The HE-SIG field is preferably HE-SIG A, but it may also be indicated through the common part of HE-SIG B, L-SIG, or phase rotation preceding HE-SIG A.

FIGS. 16 and 17 are diagrams for explaining specific implementations of FIG. 15.

As described above, an 11ax wireless frame may include HE-SIG A and HE-SIG B as its SIG fields. Generally, HE-SIG A contains common control information applicable to multiple channels (users), while HE-SIG B may include information specific to each channel (user). Additionally, within HE-SIG B, a certain portion may contain shared information for channels (users), while the remaining portion may be configured to include channel (user)-specific information.

According to the embodiment described above, when transmitting total bandwidth information and null indicator information, both the total bandwidth information and the null indicator information may be configured to be included in HE-SIG A, as illustrated in FIG. 16. Additionally, as illustrated in FIG. 17, the total bandwidth information may be included in HE-SIG A, while the null indicator information may be configured to be included in HE-SIG B.

The following describes specific examples of the above embodiments, in which the null indicator has a bitmap format or an indicator format for channel combinations.

Bitmap-Based Null Indicator

FIGS. 18 and 19 are diagrams illustrating an example of configuring a null indicator in a bitmap format according to an embodiment of the present invention.

The null indicator may have a bitmap format or an index format and may be included in and transmitted via HE-SIG A or HE-SIG B, as mentioned above. If the null indicator is in bitmap format, as shown in the example of FIG. 18, each bit of the bitmap is mapped to a respective 20 MHz bandwidth. A bit set to "1" may indicate an unallocated subband, while a bit set to "0" may indicate an allocated subband. For example, in FIG. 18, the bitmap "0100" represents that, among four 20 MHz unit channels, only the second 20 MHz channel is not used for data transmission, while the first, third, and fourth channels are utilized for data transmission.

Instead of indicating null bandwidth information, the bitmap may directly indicate the actual bandwidth being used. In this case, the bitmap would be set to "1" for channels that are actually in use and "0" for channels that are not used. That is, the null indicator bitmap primarily indicates null bandwidth information but can also represent non-contiguous bandwidth information. Unlike FIG. 18, FIG. 19 illustrates a case where the bitmap indicates the actual bandwidth allocated for data transmission. For example, in the previous case, the non-contiguous bandwidth information could be represented as "1011." FIG. 10 provides further explanation of this concept. While the term "Null Bandwidth Indication" is used for distinction, it can still be considered a type of null indicator.

The bitmap size may be 4 bits for an 80 MHz bandwidth, and for a 160 MHz or 80+80 MHz bandwidth, the bitmap may be configured as an 8-bit bitmap.

FIGS. 20 and 21 illustrate a resource allocation method according to an embodiment of the present invention when the total bandwidth is 160 MHz.

In the case of 160 MHz (or 80+80 MHz), null bandwidth can be indicated in 40 MHz units, as shown in FIG. 20. In this case, similar to the 80 MHz scenario, a 4-bit bitmap would be configured for the 160 MHz bandwidth.

However, in such cases, as illustrated in FIG. 20, some bands within the Secondary 40 MHz segment may remain unused.

Accordingly, FIG. 21-0 illustrates an example in which null bandwidth is indicated in 20 MHz units within a 160 MHz (or 80+80 MHz) bandwidth.

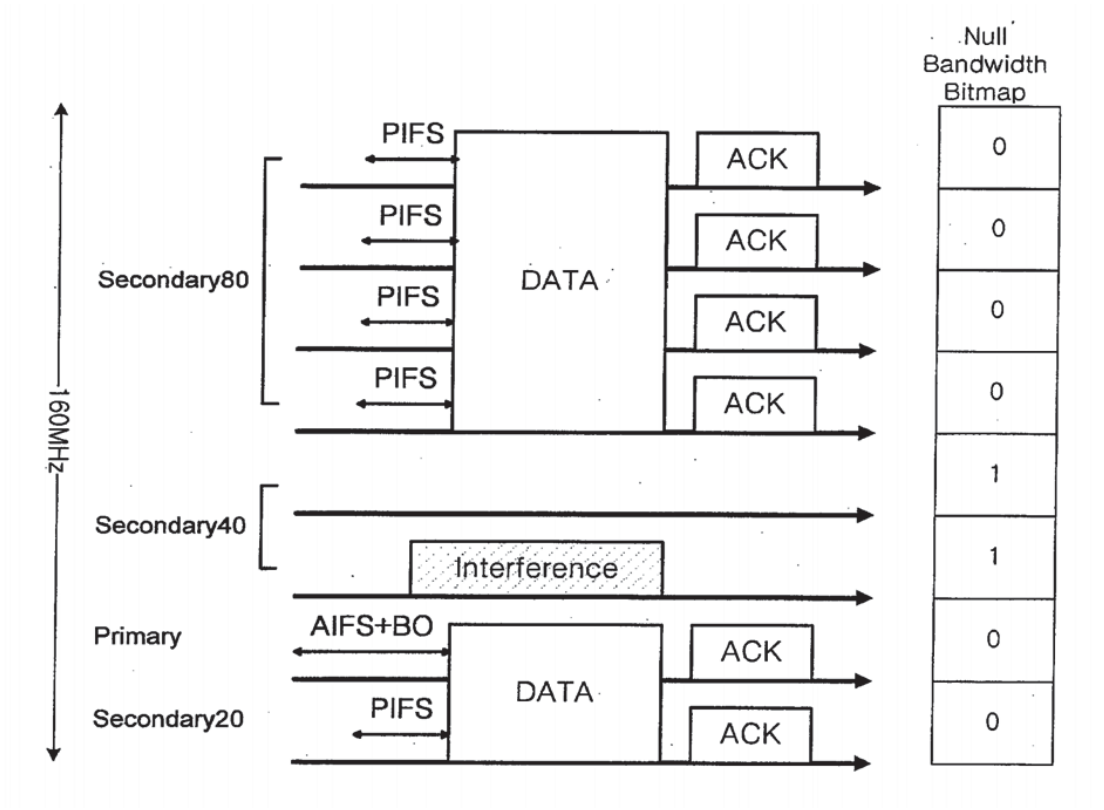


FIG. 21-0

In the above example, if interference is present in some or all of the Secondary 40 MHz,

a case where the entire Secondary 40 MHz is not used is illustrated.

Unlike the example shown in FIG. 21-0, FIG. 21 illustrates a scenario where some bands of the Secondary 40 MHz are used. In this case, the null bandwidth bitmap may be configured as 00000100.

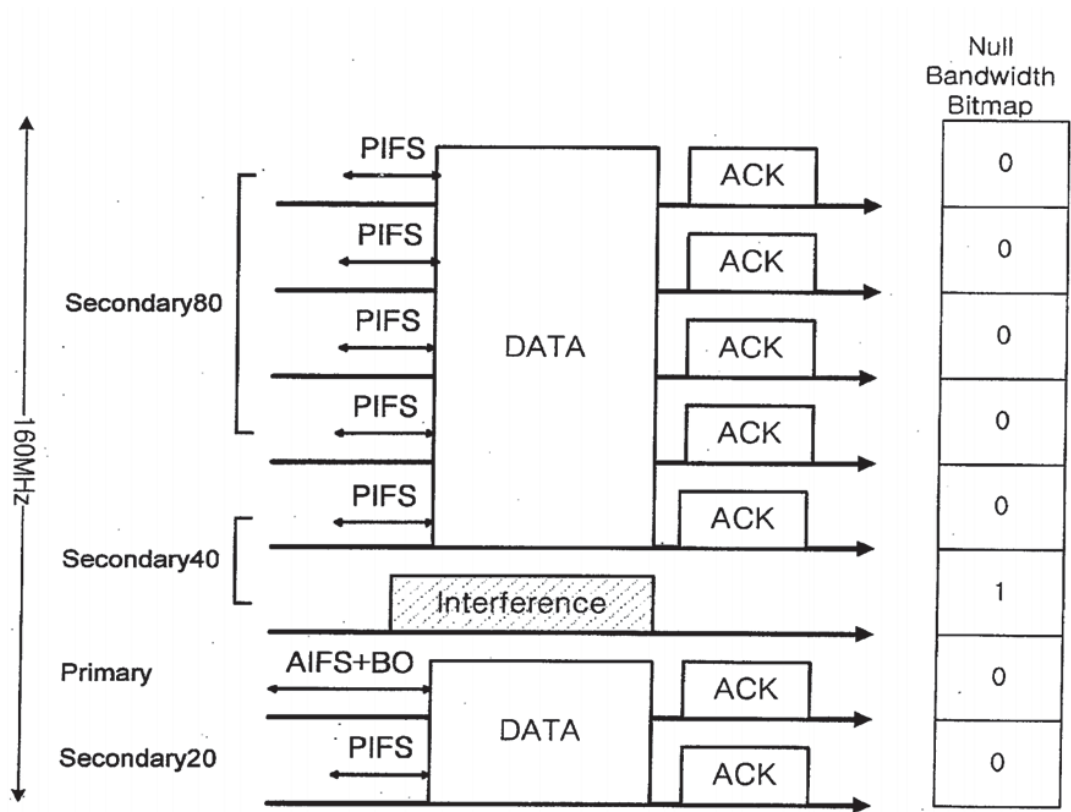


FIG. 21

If the concept of a Primary channel, as in 11ac, is applied, the bitmap may be configured with bits corresponding to channels other than the Primary channel. For example, in an 80 MHz bandwidth, the bitmap may be composed of 3 bits, where each bit corresponds to the inclusion or exclusion of a corresponding Secondary channel. Below, Table 1 presents an example of how the bitmap is configured when targeting only Secondary channels, excluding the Primary channel.

[Table 1]

Bandwidth index bitmap	
000:	20MHz (primary)
100:	40MHz (Contiguous, Primary + Secondary 20)
010:	40MHz (Contiguous, Primary + 1 st sub-CH of Secondary 40)
001:	40MHz (Non-contiguous, Primary + 2 nd sub-CH of Secondary 40)
110:	60MHz (Contiguous, Primary+ Secondary 20 + 1 st sub-CH of Secondary 40)
011:	60MHz (Contiguous, Primary+ Secondary 40)
101:	60MHz (Non-contiguous, Primary + Secondary 20 + 2 nd sub-CH of Secondary 40)
111:	80MHz (Contiguous)

A similar configuration may be applied to 160 MHz (or 80+80 MHz). That is, a 7-bit bitmap may correspond to each Secondary channel (Secondary 20, Secondary 40, Secondary 80) and may indicate which channels are used together with the Primary channels, as shown below.

[Table 2]

0000000:	20MHz (primary)
1000000:	40MHz (Contiguous, Primary + Secondary 20)
0100000:	40MHz (Contiguous, Primary + 1 st sub-CH of Secondary 40)
0010000:	40MHz (Non-contiguous, Primary + 2 nd sub-CH of Secondary 40)
1100000:	60MHz (Contiguous, Primary+ Secondary 20 + 1 st sub-CH of Secondary 40)
0110000:	60MHz (Contiguous, Primary+ Secondary 40)
1010000:	60MHz (Non-contiguous, Primary + Secondary 20 + 2 nd sub-CH of Secondary 40)
1110000:	80MHz (Contiguous)
...	...
1111111:	160MHz or (80+80)MHz

Additionally, 3 bits may be used as a bandwidth index, which includes conventional bandwidth information (20/40/80/160 MHz) and further represents additional contiguous/non-contiguous channel information, as shown below.

[Table 3]

Bandwidth index (3bits) 0: 20MHz (primary) 1: 40MHz (Contiguous, Primary + Secondary 20) 2: 40MHz (Contiguous, Primary + 1st sub-CH of Secondary 40) 3: 40MHz (Non-contiguous, Primary + 2nd sub-CH of Secondary 40) 4: 60MHz (Contiguous, Primary+ Secondary 20 + 1st sub-CH of Secondary 40) 5: 60MHz (Contiguous, Primary+ Secondary 40) 6: 80MHz (Contiguous) 7: 160MHz or 80+80MHz

In the above example, 60 MHz non-contiguous is omitted. Instead, the conventional 160 MHz or 80+80 MHz is included.

If it is not omitted, it would be represented as shown in the table below.

[Table 3-1]

Bandwidth index (4bits) 0: 20MHz (primary) 1: 40MHz (Contiguous, Primary + Secondary 20) 2: 40MHz (Contiguous, Primary + 1st sub-CH of Secondary 40) 3: 40MHz (Non-contiguous, Primary + 2nd sub-CH of Secondary 40) 4: 60MHz (Contiguous, Primary+ Secondary 20 + 1st sub-CH of Secondary 40) 5: 60MHz (Contiguous, Primary+ Secondary 40) 6: 60MHz (Non-contiguous, Primary+Secondary 20 + 2nd sub-CH of Secondary 40) 7: 80MHz (Contiguous) 8: 160MHz or 80+80MHz 9~15: Reserved
--

The meaning of the Secondary channel in Table 1 may be modified as follows.

[Table 3-2]

Bandwidth index (3bits)	
0:	20MHz (primary)
1:	40MHz (Primary CH + 1 st Secondary CH)
2:	40MHz (Primary CH + 2 nd Secondary CH)
3:	40MHz (Primary CH + 3 rd Secondary CH)
4:	60MHz (Primary CH + 1 st Secondary CH + 2 nd Secondary CH)
5:	60MHz (Primary CH + 2 nd Secondary CH + 3 rd Secondary CH)
6:	60MHz (Primary CH + 1 st Secondary CH + 3 rd Secondary CH)
7:	80MHz (Contiguous)

The meaning of the Secondary channel in Table 3 may be modified as follows.

[Table 3-3]

Bandwidth index (3bits)	
0:	20MHz (primary)
1:	40MHz (Primary CH + 1 st Secondary CH)
2:	40MHz (Primary CH + 2 nd Secondary CH)
3:	40MHz (Primary CH + 3 rd Secondary CH)
4:	60MHz (Primary CH + 1 st Secondary CH + 2 nd Secondary CH)
5:	60MHz (Primary CH + 2 nd Secondary CH + 3 rd Secondary CH)
6:	80MHz
7:	160MHz or 80+80MHz

The meaning of the Secondary channel in Table 3 may be modified as follows.

[Table 3-4]

Bandwidth index (4bits)

0:	20MHz (primary)
1:	40MHz (Primary CH + 1 st Secondary CH)
2:	40MHz (Primary CH + 2 nd Secondary CH)
3:	40MHz (Primary CH + 3 rd Secondary CH)
4:	60MHz (Primary CH + 1 st Secondary CH + 2 nd Secondary CH)
5:	60MHz (Primary CH + 2 nd Secondary CH + 3 rd Secondary CH)
6:	60MHz (Primary CH + 1 st Secondary CH + 3 rd Secondary CH)
7:	80MHz (Contiguous)
8:	160MHz or 80+80MHz
9~15:	Reserved

Meanwhile, if Null bandwidth is not included in an 80 MHz or 160 MHz bandwidth, the null bandwidth information may become unnecessary. Therefore, in an embodiment of the present invention, an indication of whether Null bandwidth information is included may be used to selectively include the null bandwidth information. That is, the Null bandwidth presence field may be set to 1, and only in that case, the Null bandwidth information (e.g., bitmap) may be included in the HE-SIG field.

FIG. 22 is a diagram for explaining an example of a null indicator presence field according to an embodiment of the present invention.

If the BW field is included in HE-SIG A, the Null bandwidth information may be included in HE-SIG B and transmitted only when the BW is 80 MHz or 160 MHz, as illustrated in FIG. 22. Furthermore, as shown in FIG. 22, when the Null bandwidth presence field is included, depending on the presence value, the Null bandwidth information may either be included or omitted. In another example, the Null bandwidth presence value may be included in HE-SIG A, and when the Null bandwidth presence is set to 1, the Null bandwidth

information (e.g., information about which sub-channels are used or not used) may be included in HE-SIG B (e.g., the SIG B Common part).

Index-Based Null Indicator

In the above description, the Null bandwidth bitmap is an example of null subband information and may be indicated in forms other than a bitmap.

The table below provides an example of how null subband information can be represented in an index format for an 80 MHz bandwidth.

[Table 4]

Index	P-CH	1st S-CH	2nd S-CH	3rd S-CH	Notes
1	o	o	o	x	60MHz
2	o	o	x	o	
3	o	x	o	o	
4	o	x	o	x	Non-contiguous 40MHz
5	o	x	x	o	

In Table 4, "o" indicates that the corresponding band is allocated, while "x" indicates that the corresponding band is not allocated.

Index 1 represents a contiguous 60 MHz channel, including the Primary channel. Indexes 2 and 3 represent non-contiguous 60 MHz bandwidths. Indexes 4 and 5 represent non-contiguous 40 MHz bandwidths.

The table below provides another example, where the Primary channel is positioned between the Secondary 20 and Secondary 40 channels.

[Table 5]

Index	Secondary 20	Primary CH	Secondary 40	Secondary 40	Notes
1	o	o	o	x	60MHz
2	o	o	x	o	
3	x	o	o	o	
4	x	o	o	x	Non-contiguous 40MHz
5	x	o	x	o	

A frame may also be transmitted without including the Primary channel, and the table below presents an example of this scenario.

[Table 6]

Index	P-CH	1st S-CH	2nd S-CH	3rd S-CH	Notes
1	o	o	o	x	60MHz
2	o	o	x	o	
3	o	x	o	o	
4	x	o	o	o	
5	o	x	o	x	40MHz
6	o	x	x	o	
7	x	o	o	x	
8	x	o	x	o	
9	x	x	o	o	
10	x	o	x	x	20MHz
11	x	x	o	x	
12	x	x	x	o	

Similarly, for 160 MHz, the definition may follow the same approach as described above. The table below illustrates an example where Null bandwidth is indicated in 40 MHz units for a 160 MHz bandwidth.

[Table 7]

Index	P-CH, 1st S-CH	2nd & 3rd S-CH	4th & 5th S-CH	6th & 7th S-CH	Notes
1	o	o	o	x	120MHz
2	o	o	x	o	
3	o	x	o	o	
4	o	x	o	x	Non-contiguous 80MHz
5	o	x	x	o	

A frame may also be transmitted without including the Primary channel, and the table below presents an example where the Primary channel is included.

[Table 8]

Index	P-CH, 1st S-CH	2nd & 3rd S-CH	4th & 5th S-CH	6th & 7th S-CH	Notes
1	o	o	o	x	120MHz
2	o	o	x	o	
3	o	x	o	o	
4	x	o	o	o	
5	o	x	o	x	80MHz
6	o	x	x	o	
7	x	o	o	x	
8	x	o	x	o	
9	x	x	o	o	
10	x	o	x	x	40MHz
11	x	x	o	x	
12	x	x	x	o	

The table below illustrates an example of bandwidth allocation information in 20 MHz units for a 160 MHz bandwidth.

[Table 9]

Index	P-CH,	1st S-CH	2nd S-CH	3rd S-CH	4th S-CH	5th S-CH	6th S-CH	7th S-CH	Notes
1	o	o	o	o	o	o	o	x	140
2	o	o	o	o	o	o	x	o	
3	o	o	o	o	o	x	o	o	
4	o	o	o	o	x	o	o	o	
5	o	o	o	x	o	o	o	o	
6	o	o	x	o	o	o	o	x	
7	o	x	o	o	o	o	o	o	
8	o	o	o	o	o	o	x	x	120
9	o	o	o	o	o	x	o	x	
10	o	o	o	o	x	o	o	x	
11	o	o	o	x	o	o	o	x	
12	o	o	x	o	o	o	o	x	
13	o	x	o	o	o	o	o	x	
14	o	o	o	o	o	x	x	x	100MHz
15	o	o	o	o	x	o	x	x	
16	o	o	o	x	o	o	x	x	
17	o	o	x	o	o	o	x	x	
...	...	...	...	...	...	...	...	...	

Null subband information (non-contiguous BW information) may be used in conjunction with the conventional BW index.

[Table 10]

BW Index		
1	20MHz	
2	40MHz	

3	80MHz				
4	160 or (80+80) MHz				
	P-CH	1st S-CH	2nd S-CH	3rd S-CH	Notes
5	o	o	o	x	60MHz
6	o	o	x	o	
7	o	x	o	o	
8	o	x	o	x	40MHz
9	o	x	x	o	
	P-CH, 1st S-CH	2nd & 3rd S-CH	4th & 5th S-CH	6th & 7th S-CH	Notes
10	o	o	o	x	120MHz
11	o	o	x	o	
12	o	x	o	o	
13	o	x	o	x	80MHz
14	o	x	x	o	

The above example represents a case where the Primary channel is always included in the bandwidth information. In a 160 MHz bandwidth, the basic subband unit is 40 MHz. These indices may be combined in various ways:

(1) Primary channel included & 160 MHz basic subband unit = 40 MHz →

Configured as shown in Table 10

(2) Primary channel included & 160 MHz basic subband unit = 20 MHz

(3) Primary channel not included & 160 MHz basic subband unit = 40 MHz

(4) Primary channel not included & 160 MHz basic subband unit = 20 MHz

In the above cases, subband usage information (e.g., null bandwidth information/non-contiguous subband information, indicating which subbands are not allocated) is referenced in 20 MHz units for an 80 MHz bandwidth and in 40 MHz or 20 MHz units for a 160 MHz bandwidth. These units may also be represented using different names or formats of the same size.

Below, Table 11 illustrates an example of a time-frequency frame structure in an 802.11ax system.

[Table 11]

< Example of time-frequency frame structure in 11ax >	
-	FFT size (4-times extension from existing WiFi numerology): 256FFT for 20MHz, 512FFT for 40MHz, 1024FFT for 80MHz, 2048FFT for contiguous 160MHz or each 1024FFT for non-contiguous 160MHz BW
-	Subcarrier spacing: 78.125kHz (1/4 of existing WiFi numerology)
-	IDFT/DFT length: $3.2 \mu\text{s} * 4 = 12.8 \mu\text{s}$
-	OFDM symbol length: IDFT/DFT length + GI

In the 11ax frame structure as described above, in 20 MHz, a basic resource unit consisting of 242 tones may be used. In 40 MHz, two such resource units may be used. In 80 MHz, four such resource units may be used. In this case, instead of 20 MHz, a 242-tone resource unit may be used as a replacement indicator. Similarly, 40 MHz may be represented as two consecutive 242-tone resource units (242-tone resource unit $\times$ 2 = 40 MHz). In this case, the subband usage information is represented in the same manner as defined above. For example, when represented as a bitmap, in 80 MHz, a 4-bit bitmap may be used. In 160 MHz, if the basic null resource unit is 40 MHz (242-tone resource unit $\times$ 2), a 4-bit bitmap may be used. If the basic null resource unit is 20 MHz (242-tone resource unit), a 16-bit bitmap may be used. The index-based format is defined in the same manner as previously described.

Below is another example of a non-contiguous bandwidth information format.

[Table 12]

● Bandwidth index (4 bits, B4B3B2B1) ■ MSB 1 bit (B4): Indicates whether the bandwidth is 80 MHz. ■ If (B4 == 1) { // In the case of 80 MHz B3B2B1: Each bit is mapped to a respective Secondary channel. B3 is mapped to the first Secondary channel, B2 is mapped to the second Secondary channel, B1 is mapped to the third Secondary channel. For example, "010" indicates that the Primary channel and one Secondary channel are used. } else { // b4==0, Indicates other bandwidths other than 80MHz. B3B2B1 //(primary channel included) 000: 20MHz BW 001: 40MHz BW 010: 160MHz BW or 80 + 80 MHz BW 011 through 111: reserved
--

Below is an example of utilizing the remaining reserved bits to support partial contiguous or non-contiguous channel bonding in 160 MHz.

[Table 13]

● Bandwidth index (4 bits, B4B3B2B1) ■ MSB 1 bit (B4): Indicates whether the bandwidth is 80 MHz.
--

```

■ If (B4 == 1) { // In the case of 80 MHz

    B3B2B1: Each bit is mapped to a respective Secondary channel. B3 is
    mapped to the first Secondary channel (e.g., Secondary 20), B2 is mapped
    to the second Secondary channel (e.g., 1st 20 of Secondary 40), B1 is
    mapped to the third Secondary channel (e.g., 2nd 20 of Secondary 40).
    The order of this can, of course, be changed. For example, "010" indicates
    that the Primary channel and the second Secondary channel are used.

    } else { // b4==0, Indicates other bandwidths other than 80MHz. For bandwidths
    above 80 MHz, the indicated bandwidth includes Primary 80

        B3B2B1 //(primary channel included)

        000: 20MHz BW

        001: 40MHz BW

        010: 160MHz BW or 80 + 80 MHz BW

        011: 100MHz (Contiguous, Primary 80 + 1st secondary CH of
        secondary 80)

        100: 120MHz (Contiguous, Primary 80 + 1st and 2nd secondary CHs
        of secondary 80)

        101: 120MHz (Non-contiguous, Primary 80 + 3rd and 4th secondary
        CHs of secondary 80)

        110: 140MHz (Contiguous, Primary 80 + 1st 2nd and 3rd secondary
        CHs of secondary 80)

        111: 140MHz (Non-Contiguous, Primary 80 + 1st, 3rd and 4th
        secondary CHs of secondary 80)

    }

```

The non-contiguous bandwidth information may be included in L-SIG and transmitted. In this case, combining gain may be obtained starting from HE-SIG A.

[Table 13]

● Bandwidth index (4 bits, B4B3B2B1) ■ MSB 1 bit (b4): Indicates whether the bandwidth is 80 MHz or smaller, including information about the sub-channels. ■ If (b4 == 1) { // In the case of contiguous/non-contiguous BWs <= 80 MHz B3b2b1: Each bit is mapped to a respective Secondary channel. B3 is mapped to the first Secondary channel (e.g., Secondary 20), B2 is mapped to the second Secondary channel (e.g., 1st 20 of Secondary 40), B1 is mapped to the third Secondary channel (e.g., 2nd 20 of Secondary 40). The order of this can, of course, be changed. For example, "010" indicates that the Primary channel and the second Secondary channel are used. } else { // b4==0, indicates other bandwidths other than 80MHz. For bandwidths above 80 MHz, the indicated bandwidth includes Primary 80 B3B2B1 //(primary channel included) 000: 160MHz BW or 80 + 80MHz BW 001: 100MHz (Contiguous, Primary 80 +1st secondary CH of secondary 80) 010: 001MHz (Contiguous, Primary 80 +1st and 2nd secondary CHs of secondary 80) 011: 120MHz (Non-contiguous, Primary 80 +3rd and 4th secondary CHs of secondary 80)
--

100: 120MHz (Non-Contiguous, Primary 80 + 1st and 2nd secondary CHs of secondary 80)
101: 140MHz (Contiguous, Primary 80 + 3rd and 4th secondary CHs of secondary 80)
110: 140MHz (Contiguous, Primary 80 + 1st 2nd and 3rd secondary CHs of secondary 80)
111: 140MHz (Non-Contiguous, Primary 80 + 1st, 3rd and 4th secondary CHs of secondary 80)
}

Combinations for bandwidths above 80 MHz may be represented differently from the combinations described above.

Below is another example of contiguous/non-contiguous BWs.

- Bandwidth index (4 bits, b4b3b2b1)
 - MSB 1 bit (b4): Indicates whether the bandwidth is 80 MHz or smaller (e.g., 20 MHz, 40 MHz) or 160 MHz, including information about the sub-channels.
 - If $b4 = 0$, it indicates a bandwidth of 80 MHz or smaller (i.e., 20 MHz, 40 MHz).
 - If $b4 = 1$, it indicates a 160 MHz bandwidth.
 - If $(b4 == 0)$ { // In the case of contiguous/non-contiguous BWs ≤ 80 MHz

B3b2b1: Each bit is mapped to a respective Secondary channel. B3 is mapped to Secondary 20 (e.g., first Secondary channel), B2 is mapped to 1st 20 of Secondary 40 (e.g., second Secondary channel), B1 is mapped to 2nd 20 of Secondary 40 (e.g., third Secondary channel). The order of this can be changed depending on definitions. For example, "010" indicates that the Primary channel and the second Secondary channel are used.

If all bits are 0 (i.e., b3b2b1 = 000), it indicates a 20 MHz bandwidth. If only the bit corresponding to the secondary channel within the Primary 40 MHz (i.e., B3, corresponding to the Secondary 20 MHz channel) is set to 1 (i.e., B3B2B1 = 100), it indicates a 40 MHz bandwidth. In all other cases, it indicates an 80 MHz bandwidth.

If the bits indicate an 80 MHz bandwidth, contiguous/non-contiguous channels exist within the 80 MHz bandwidth (i.e., contiguous/non-contiguous channels excluding the channels indicated by the 40 MHz bandwidth, or 60 MHz contiguous/non-contiguous channels).

} else { // b4 == 1, indicates a 160 MHz bandwidth, where contiguous/non-contiguous channels may exist.

B3B2B1: Each bit corresponds to 40 MHz units of secondary channels within the 160 MHz (or 80+80 MHz) bandwidth, excluding Primary 40. For example, B3 corresponds to Secondary channels excluding Primary 40 within Primary 80 (i.e., Secondary 40).

B2 corresponds to the first 40 MHz unit of Secondary 80, and B1 corresponds to the second 40 MHz unit of Secondary 80. In the above example, it is assumed that transmission always includes Primary 40.

}

Below is another example of contiguous/non-contiguous BWs.

[Table 15]

● Bandwidth index (3 bits, b0b1b2)

- MSB 1 bit (b0): Indicates whether the bandwidth is 80 MHz or smaller (e.g., 20 MHz, 40 MHz) or 160 MHz, including information about the sub-channels.

- If b0 = 0, it indicates a bandwidth of 80 MHz or smaller (i.e., 20 MHz, 40 MHz).

- If b0 = 1, it indicates a 160 MHz bandwidth.

- If (b0 == 0) { // In the case of contiguous/non-contiguous BWs <= 80 MHz

b1b2: 00 indicates 20MHz BW. 01 indicates 40MHz BW. 10 indicates contiguous 80MHz BW, meaning that the entire 80MHz is used for transmission. 11 indicates channel bonding in 80MHz, where the Primary 20MHz channel and Secondary 40MHz channel are bonded together and used.

} else { // B0 = 1, indicates 160MHz bandwidth, and channels may exist in the bonded state within 160MHz.

B1b2: 00 indicates that the entire 160MHz (or 80+80MHz) is

used (i.e., contiguous 160MHz channel or non-contiguous 80+80MHz channel). 01 indicates that Primary 20MHz and Secondary 80MHz are used within the 160MHz bandwidth. 10 indicates that Primary 40MHz and Secondary 40MHz are used. 11 indicates that Primary 20MHz, Secondary 40MHz, and Secondary 80MHz are used.

}

Below is another example of contiguous/non-contiguous BWs.

[Table 16]

- Bandwidth index (3bits, b0b1b2)

000 indicates a 20 MHz BW. 001 indicates a 40 MHz bandwidth. 010 indicates a contiguous 80 MHz bandwidth, meaning that the entire 80 MHz is used for transmission. 011 indicates channel bonding within the 80 MHz BW, where the Primary 20 MHz channel and the Secondary 40 MHz channel are bonded together and used.

100 indicates that the entire 160 MHz (or 80+80 MHz) is used, meaning that either a contiguous 160 MHz channel or a non-contiguous 80+80 MHz channel is utilized.

101 indicates that within a 160 MHz bandwidth, the Primary 20 MHz and the Secondary 80 MHz are used. 110 indicates that the Primary 40 MHz and the Secondary 80 MHz are used. 111 indicates that the Primary 20 MHz, the Secondary 40 MHz, and the Secondary 80 MHz are used.

In the above example, when b0 is 0, it indicates a bandwidth equal to or smaller than 80 MHz (i.e., 20 MHz, 40 MHz), and in an 80 MHz bandwidth, the sub-channels may be bonded and used. When b0 is 1, it indicates a 160 MHz PPDU transmission bandwidth, where the channels may actually be bonded in either a contiguous or non-contiguous manner for usage.

}

In the above examples, when Null bandwidth information (or Non-contiguous channel information) is indicated using a 20 MHz unit bitmap, it is configured as a 4-bit bitmap for 80 MHz and an 8-bit bitmap for 160 MHz. When excluding the Primary channel, the configuration consists of a 3-bit bitmap for 80 MHz and a 7-bit bitmap for 160 MHz. Additionally, when configuring the bitmap in 40 MHz units for 160 MHz, the bitmap can be configured as a 3-bit bitmap (if the Primary channel is not included in the bitmap) or a 4-bit bitmap depending on whether the Primary channel is included in 160 MHz. If, as shown in Table 17, the Primary channel information (indicating whether Primary 20 or Primary 40 is included in the BW) is included in HE-SIG A, and detailed Null bandwidth information (or Non-contiguous channel information) is included in HE-SIG B, the amount of information included in HE-SIG B can be reduced.

- [Table 17] Bandwidth index (3 bits, b0b1b2) in HE-SIG A

●	Bandwidth index (3 bits, b0b1b2) in HE-SIG A
■	000: 20MHz
■	001: 40MHz
■	010: 80MHz (preamble fully populated on all 4 channels and OFDMA uses 80MHz design)
■	011: 160MHz (preamble fully populated on all 8 channels and OFDMA uses 160MHz design)
■	100: 80MHz channel bonding with preamble on P40
■	101: 80MHz channel bonding with preamble on P20 (no preamble on S20)
■	110: 160MHz channel bonding with preamble on P40
■	111: 160MHz channel bonding with preamble on P20 (no preamble on S20) }

100 and 101 indicate channel bonding information in an 80 MHz bandwidth, where each includes Primary 40 and Primary 20 (i.e., excluding Secondary 20). 110 and 111 indicate channel bonding information in a 160 MHz bandwidth, where each includes Primary 40 and Primary 20 (i.e., excluding Secondary 20).

In this case, the detailed Null bandwidth information (or Non-contiguous channel information) included in HE-SIG B (particularly the HE-SIG B common part) may be defined as in the following examples:

● [Table 18] Channel bonding information in HE-SIG B

●	Channel bonding information (2 bits, b0b1) in HE-SIG B of 80 MHz (i.e., when the BW field in HE-SIG A is 100 or 101): b0 indicates the first 20 MHz channel of Secondary 40, and b1 indicates the second
---	---

20 MHz channel of Secondary 40. 0 indicates that the corresponding 20 MHz channel is not used, and 1 indicates that the corresponding channel is used.

- 01: Indicates that the first 20 MHz channel of Secondary 40 is not used, and only the second 20 MHz channel of Secondary 40 is used.
- 10: Indicates that the first 20 MHz channel of Secondary 40 is used, and the second 20 MHz channel of Secondary 40 is not used.

- Channel bonding information (6 bits, B0B1B2B3B4B5) in HE-SIG B of 160 MHz (i.e., when the BW field in HE-SIG A is 110 or 111): b0 indicates the first 20 MHz channel of Secondary 40; b1 indicates the second 20 MHz channel of Secondary 40; b2 indicates the first 20 MHz channel of Secondary 80; b3 indicates the second 20 MHz channel of Secondary 80; b4 indicates the third 20 MHz channel of Secondary 80; and b5 indicates the fourth 20 MHz channel of Secondary 80. 0 indicates that the corresponding 20 MHz channel is not used, and 1 indicates that the corresponding channel is used.

- 011111: Indicates that only the first 20 MHz channel of Secondary 40 is not used, while all other channels in Secondary 40 and Secondary 80 are used.
- 101111: Indicates that only the second 20 MHz channel of Secondary 40 is not used, while all other channels in

Secondary 40 and Secondary 80 are used.

- Similarly applied in other bitmap [configurations] as well.

In the above example, resource allocation information (i.e., RU allocation field (8 bits) and related user fields) for the channels corresponding to Primary 20 (or Primary 40) and the channels corresponding to the bits set to "1" in the Channel Bonding Information are additionally included in HE-SIG B. For example, if the BW index in HE-SIG A is 100, and the Channel Bonding Information in HE-SIG B is 01, then resource allocation information (RU allocation information) corresponding to the first and fourth channels (e.g., Primary 20 and the second channel of Secondary 40) is included in the HE-SIG B of CH1/CH4.

The table below provides another example of Channel Bonding Information in HE-SIG B. This example assumes that the information in HE-SIG B is configured as illustrated in FIGS below (FIGS. 26-26 and 26-27).

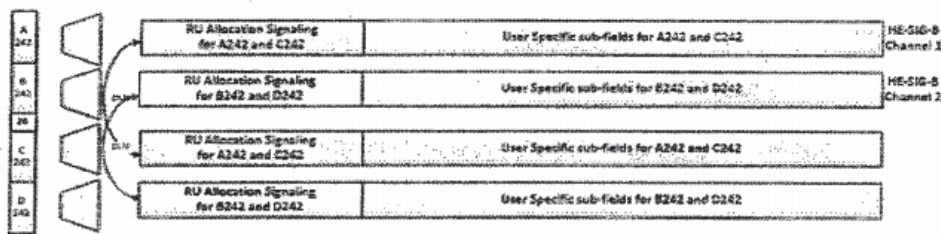


Figure 26-26 - Default mapping of the two HE-SIG-B channels and their duplication in an 80 MHz PPDU

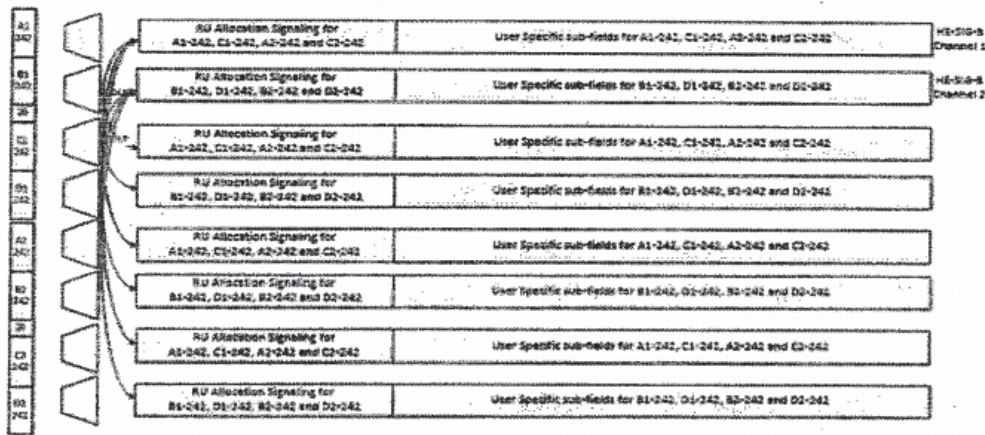


Figure 26-27 - Default mapping of the two HE-SIG-B channels and their duplication in a 160 MHz PPDU

That is, when HE-SIG B is transmitted on each channel, the HE-SIG B information for CH 1, 3, 5, and 7 is duplicated and transmitted on CH 1, 3, 5, and 7, while the HE-SIG B information for CH 2, 4, 6, and 8 is duplicated and transmitted on CH 2, 4, 6, and 8.

In the above example, resource allocation information (RU allocation field (8 bits) and related User fields) for the channels set to "1" is additionally included in HE-SIG B. For example, if the BW index in HE-SIG A is 100, and the Channel Bonding Information in HE-SIG B is 01, then the HE-SIG B of CH 1 includes the RU allocation field corresponding to the first, third, and fourth channels (e.g., Primary 20 and the first and second channels of Secondary 40). Meanwhile, the RU allocation field for CH 3 indicates that the corresponding 242-unit resource allocation is null, and the User field corresponding to the 242-unit resource allocation of CU3 is not included.

In this example, among the reserved values in the RU allocation field included in HE-SIG B, a specific value indicates that the corresponding 242 RU is Null, allowing the STA to recognize that the 242 RU is Null.

Below is another example of Channel Bonding Information.

- [Table 19] Channel bonding information in HE-SIG B

- Channel bonding information bitmap (1 bit, B0) in HE-SIG B of 80 MHz (i.e., when the BW field in HE-SIG A is 100 or 101): The corresponding information in HE-SIG B of CH1 (Primary 20) and CH3 (first 20 MHz of Secondary 40) indicates the usage status of CH4, and the corresponding information in HE-SIG B of CH2 (Secondary 20) and CH4 (second 20 MHz of Secondary 40) indicates the usage status of CH3.

- Channel bonding information bitmap (3 bits, B0B1B2) in HE-SIG B of 160 MHz (i.e., when the BW field in HE-SIG A is 110 or 111): The corresponding information in HE-SIG B of CH1 (Primary 20), CH3 (first 20 MHz of Secondary 40), CH5 (first 20 MHz of Secondary 80), and CH7 (third 20 MHz of Secondary 80) indicates the usage status of CH4 (B0), CH6 (B1), and CH8 (B2). The corresponding information in HE-SIG B of CH2 (Secondary 20), CH4 (second 20 MHz of Secondary 40), CH6 (second 20 MHz of Secondary 80), and CH8 (fourth 20 MHz of Secondary 80) indicates the usage status of CH3 (B0), CH5 (B1), and CH7 (B2).

In the above bitmap, resource allocation information (RU allocation field (8 bits) and related User fields) for channels (242RU) corresponding to bits set to 1 is additionally included

in HE-SIG B. For example, if the BW index in HE-SIG A is 100, and the Channel Bonding Information in HE-SIG B of CH1 is 1, then the Common part of HE-SIG B for CH1 includes and transmits RU allocation fields for CH1, CH3, and CH4.

If the BW index in HE-SIG A is 101, and the Channel Bonding Information in HE-SIG B of CH1 is 1, then the Common part of HE-SIG B for CH1 includes and transmits RU allocation fields for CH1, CH3, and CH4. Additionally, if the Channel Bonding Information in HE-SIG B of CH2 is 0, then the Common part of HE-SIG B for CH2 includes and transmits RU allocation fields for CH2 and CH4. In this case, the RU allocation field included in HE-SIG B of CH1 for CH3 indicates that the 242-tone RU corresponding to CH3 is Null. In this example, among the reserved values in the RU allocation field, a specific value indicates that the 242 RU corresponding to that channel is Null, allowing the STA to determine which 242 RU is Null based on this value.

FIG. 23 is a block diagram illustrating an example configuration of an AP device (or base station device) and a station device (or terminal device) according to an embodiment of the present invention.

The AP (100) may include a processor (110), memory (120), and a transceiver (130). The station (150) may include a processor (160), memory (170), and a transceiver (180).

The transceivers (130 and 180) may transmit and receive wireless signals and, for example, may implement the physical layer according to an IEEE 802 system. The processors (110 and 160) are connected to the transceivers (130 and 180) and may implement the physical layer and/or MAC layer in accordance with an IEEE 802 system.

The processors (110 and 160) may be configured to perform operations according to one or more combinations of the embodiments of the present invention described above. Additionally, modules implementing the operations of the AP and station according to the various embodiments of the present invention may be stored in memory (120 and 170) and executed by the processors (110 and 160). The memory (120 and 170) may be included within the processors (110 and 160) or may be installed externally and connected to the processors (110 and 160) via known means.

The description of the AP device (100) and station device (150) above may also be applied to a base station device and a terminal device in other wireless communication systems (e.g., LTE/LTE-A systems).

The specific configuration of the AP and station device as described above may be implemented such that the various embodiments of the present invention described earlier are independently applied or two or more embodiments are applied simultaneously. For clarity, redundant descriptions are omitted.

FIG. 24 illustrates an example structure of a processor of an AP device or a station device according to an embodiment of the present invention.

The processor of the AP or station may have a multi-layered (layered) structure, and FIG. 23 particularly highlights the MAC sublayer (3810) in the Data Link Layer (DLL) and the Physical Layer (PHY) (3820). As shown in FIG. 19, the PHY (3820) may include a PLCP (Physical Layer Convergence Procedure) entity (3821) and a PMD (Physical Medium Dependent) entity (3822). Both the MAC sublayer (3810) and the PHY layer (3820) conceptually include management entities, referred to as MLME (MAC Sublayer Management Entity) (3811). These entities (3811, 3821) provide layer management service interfaces where the layer management functions operate.

To ensure accurate MAC operation, a Station Management Entity (SME) (3830) exists within each station. The SME (3830) is a layer-independent entity that may exist within a separate management plane or appear to be off to the side of other components. Although the precise functions of the SME (3830) are not specifically described in this document, in general, this entity (3830) appears to perform functions such as gathering layer-dependent states from various Layer Management Entities (LME) and similarly setting the values of layer-specific parameters. The SME (3830) typically operates on behalf of a general system management entity to perform these functions and may implement a standard management protocol.

The entities illustrated in FIG. 24 interact in various ways. FIG. 24 presents several examples of GET/SET primitives being exchanged. The XX-GET.request primitive is used to request the value of a given MIB attribute (Management Information Base attribute information). The XX-GET.confirm primitive is used to return the appropriate MIB attribute value when the Status is "Success", or to return an error indication in the Status field if the request fails. The XX-SET.request primitive is used to request that the specified MIB attribute be set to a given value. If the MIB attribute represents a specific operation, this primitive requests that the operation be executed. The XX-SET.confirm primitive is used to confirm that the specified MIB attribute has been set to the requested value when the Status is "Success", or to return an error condition in the Status field if the request fails. If the MIB attribute represents a specific operation, this primitive confirms that the operation has been executed.

As illustrated in FIG. 24, MLME (3811) and SME (3830) may exchange various MLME_GET/SET primitives through MLME_SAP (3850).

Additionally, various PLME_GET/SET primitives may be exchanged between PLME (3821) and SME (3830) through PLME_SAP (3860), and between MLME (3811) and PLME (3821) through MLME-PLME_SAP (3870).

The embodiments of the present invention described above may be implemented through various means. For example, the embodiments of the present invention may be implemented using hardware, firmware, software, or a combination thereof.

In a hardware-based implementation, the methods according to the embodiments of the present invention may be implemented using one or more of the following: Application-Specific Integrated Circuits (ASICs), Digital Signal Processors (DSPs), Digital Signal Processing Devices (DSPDs), Programmable Logic Devices (PLDs), Field Programmable Gate Arrays (FPGAs), processors, controllers, microcontrollers, or microprocessors.

In a firmware or software-based implementation, the methods according to the embodiments of the present invention may be implemented in the form of modules, procedures, or functions that perform the functions or operations described above. The software code may be stored in a memory unit and executed by a processor. The memory unit may be located inside or outside the processor and may exchange data with the processor using various known means.

As described above, the detailed description of the preferred embodiments of the present invention has been provided to enable those skilled in the art to implement and practice the invention. Although the preferred embodiments of the present invention have been described with reference to specific examples, it will be understood by those skilled in the art that various modifications and changes may be made without departing from the spirit and scope of the present invention as set forth in the claims.

Accordingly, the present invention is not intended to be limited to the embodiments described herein, but rather to be granted the broadest possible scope consistent with the principles and novel features disclosed. Furthermore, while the preferred embodiments of the specification have been illustrated and described above, the present specification is not limited to the specific embodiments described, and various modifications and implementations may be made by those skilled in the art without departing from the scope of the invention as claimed. Such modifications should not be understood separately from the technical idea or outlook of the present specification.

Additionally, in this specification, both apparatus inventions and method inventions have been described, and where necessary, the descriptions of both inventions may be applied complementarily.

[What is claimed is]**[Claim 1]**

A method for transmitting a signal by a station (STA) operating in a wireless local area network (WLAN) system, comprising:

configuring a wireless frame by a first STA, the wireless frame including a signaling (SIG) field containing control information and a data field capable of transmitting data through either a non-contiguous channel or an additional contiguous channel (for example, within 80 MHz, additional 40/60 MHz contiguous channels may exist; within 160 MHz, additional 40/80/100/120/140 MHz channels may exist); and

transmitting the configured wireless frame from the first STA to a second STA,

wherein the SIG field includes information indicating the entire bandwidth available for data transmission through the data field, and includes either null indicator information representing the channel regions within the entire bandwidth that are not used for data transmission, or indicator information representing the channel regions used for data transmission within the entire bandwidth.

[Claim 2]

The method for transmitting a signal according to claim 1,

wherein the null indicator information is in bitmap format,

and each bit of the bitmap corresponds to a predetermined unit channel region within the entire bandwidth.

[Claim 3]

The method for transmitting a signal according to claim 2,
 wherein the entire bandwidth includes a primary channel and a secondary channel,
 and each bit of the bitmap representing the null indicator information corresponds to a
 channel other than the primary channel.

[Claim 4]

The method for transmitting a signal according to claim 1,
 wherein the null indicator information is in the form of an index, indicating one of a
 set of predetermined channel combinations that constitute a non-contiguous channel or a 60x
 MHz channel used for data transmission.

[Claim 5]

The method for transmitting a signal according to claim 1,
 wherein the null indicator information is included only when the entire bandwidth is
 80 MHz or greater.

[Claim 6]

The method for transmitting a signal according to claim 5,
 wherein if the entire bandwidth is 80 MHz, x is 1,
 and if the entire bandwidth is 160 MHz, x is 2.

[Claim 7]

The method for transmitting a signal according to claim 1,

wherein the SIG field includes a first SIG field (SIG A) and a second SIG field (SIG B),

wherein the entire bandwidth information is included in the first SIG field, and wherein the null indicator information is included in either the first SIG field or the second SIG field.

[Claim 8]

The method for transmitting a signal according to claim 7,

wherein either the first SIG field or the second SIG field additionally includes a null indicator presence information field, indicating the presence or absence of the null indicator information.

[Claim 9]

In a station (STA) device operating in a wireless local area network (WLAN) system, a processor configured to construct a wireless frame including a signaling (SIG) field containing control information and a data field capable of transmitting data through either a non-contiguous channel or a 60x MHz (where x is a natural number) channel; and

a transceiver configured to transmit the constructed wireless frame to a second STA,

wherein the processor is configured such that the SIG field includes information on the entire bandwidth available for data transmission through the data field and null indicator information, indicating the channel regions within the entire bandwidth that are not used for data transmission.

[Claim 10]

The station device according to claim 9,
wherein the null indicator information is in bitmap format,
and each bit of the bitmap corresponds to a predetermined unit channel region within
the entire bandwidth.

[Claim 11]

The station device according to claim 10,
wherein the entire bandwidth includes a primary channel and a secondary channel,
and each bit of the bitmap representing the null indicator information corresponds to a
channel other than the primary channel.

[Claim 12]

The station device according to claim 9,
wherein the null indicator information is in the form of an index, indicating one of a
set of predetermined channel combinations that constitute a non-contiguous channel or a 60x
MHz channel used for data transmission.

[Claim 13]

The station device according to claim 9,
wherein the processor is configured to include the null indicator information only
when the entire bandwidth is 80 MHz or greater.

[Claim 14]

The station device according to claim 13,
wherein if the entire bandwidth is 80 MHz, x is 1,
and if the entire bandwidth is 160 MHz, x is 2.

[Claim 15]

The station device according to claim 9,
wherein the SIG field includes a first SIG field (SIG A) and a second SIG field (SIG B),
wherein the entire bandwidth information is included in the first SIG field, and
wherein the null indicator information is included in either the first SIG field or the second SIG field.

[Summary]

[Abstract]

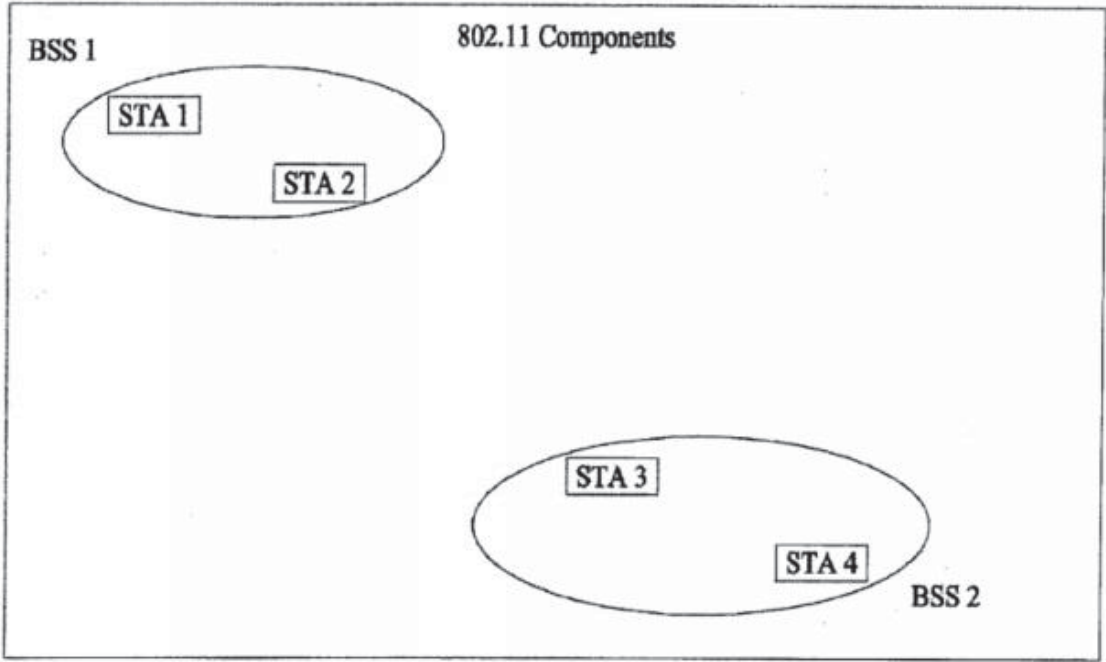
The present document relates to a wireless communication system, and more specifically, to a method for flexibly supporting resource allocation in a wireless LAN system, as well as a signal transmission method and an apparatus using the same.

To achieve this, a first STA configures a wireless frame including a signaling (SIG) field containing control information and a data field capable of transmitting data through either a non-contiguous channel or a 60x MHz (where x is a natural number) channel. The first STA transmits the configured wireless frame to a second STA,

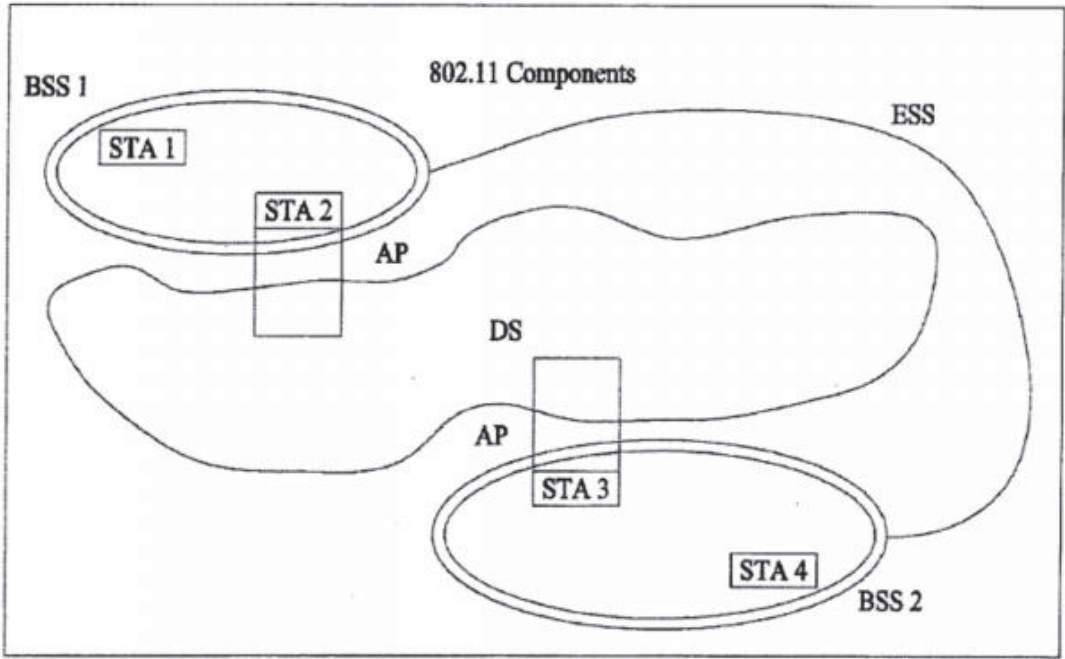
wherein the SIG field preferably includes information on the entire bandwidth available for data transmission through the data field and null indicator information, indicating the channel regions within the entire bandwidth that are not used for data transmission.

[Drawings]

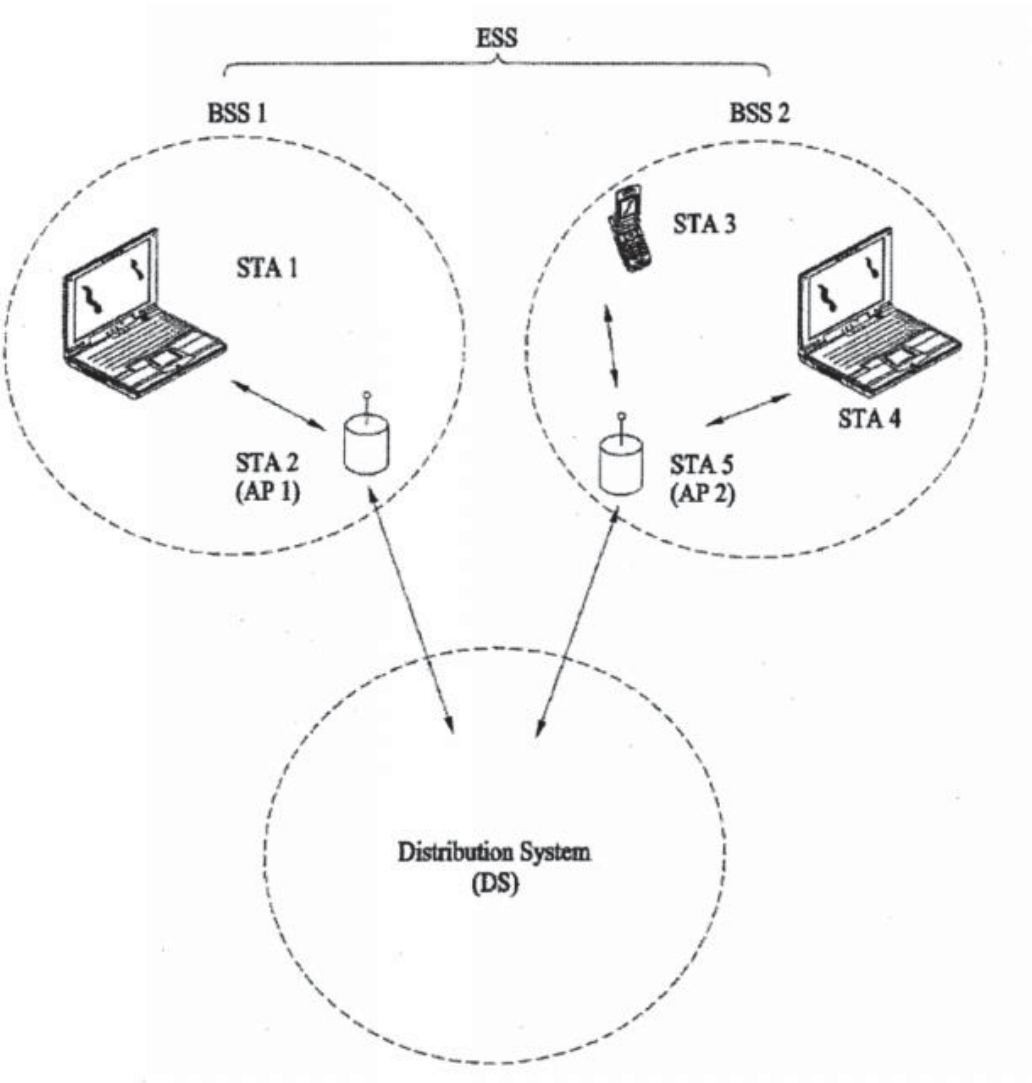
[FIG. 1]



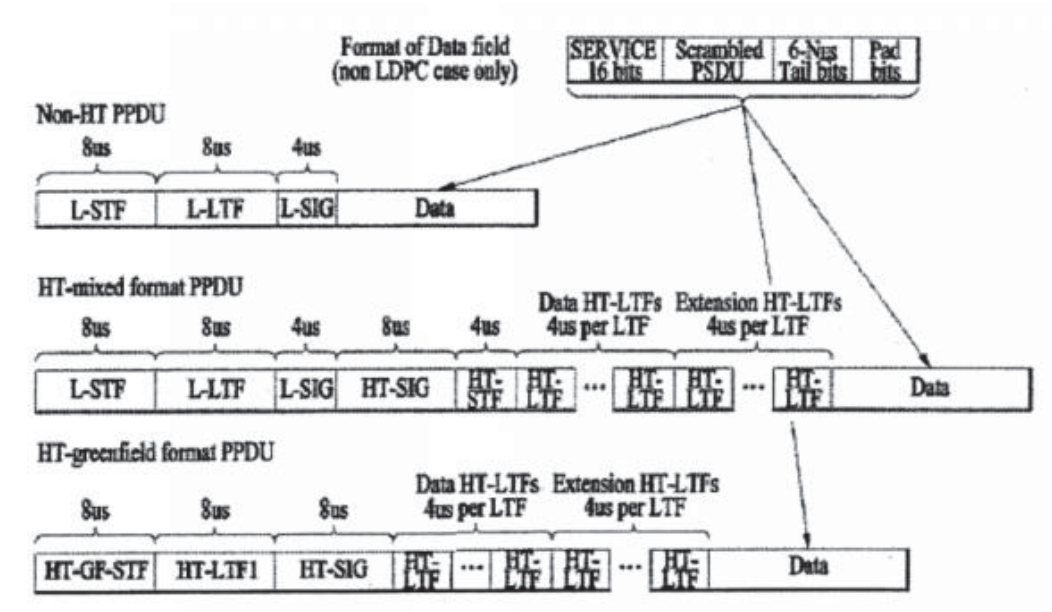
[FIG. 2]



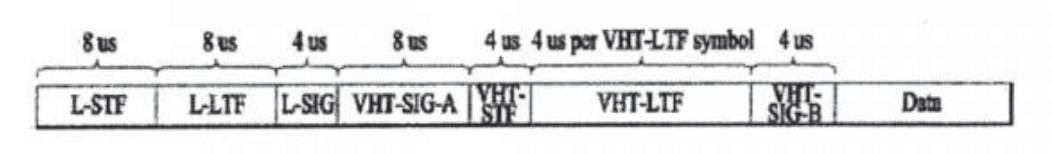
[FIG. 3]



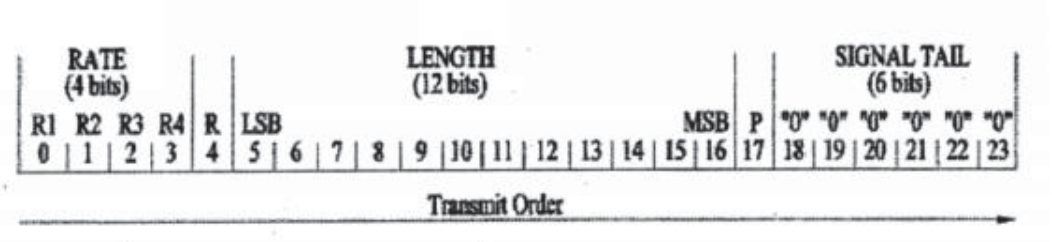
[FIG. 4]



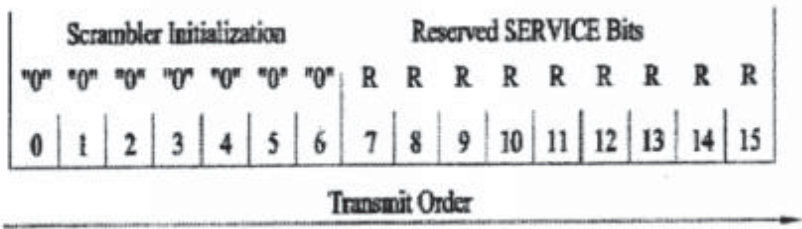
[FIG. 5]



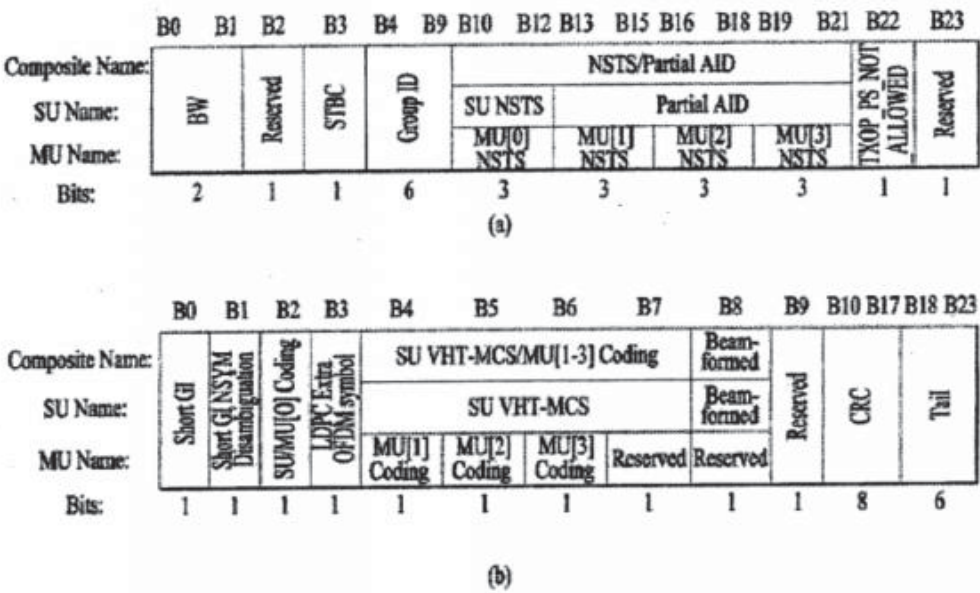
[FIG. 6]



[FIG. 7]



[FIG. 8]



[FIG. 9]

L-STF	L-LTF	L-SIG	HE-SIGA	HE-STF	HE-LTF	HE-SIGB	Data
-------	-------	-------	---------	--------	--------	---------	------

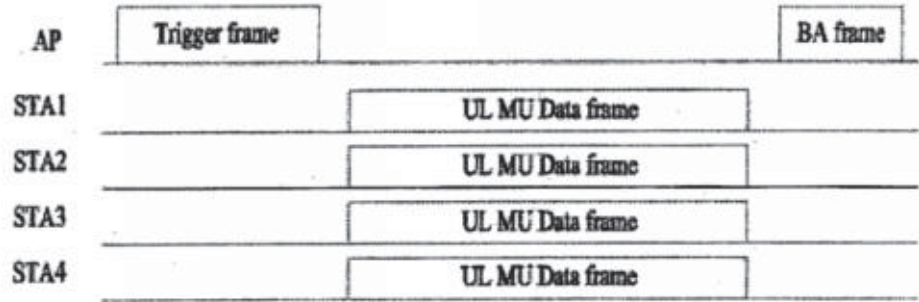
(a)

L-STF	L-LTF	L-SIG	HE-SIGA	HE-SIGB	HE-STF	HE-LTF	Data	Channel
L-STF	L-LTF	L-SIG	HE-SIGA		HE-STF	HE-LTF	Data	
L-STF	L-LTF	L-SIG	HE-SIGA		HE-STF	HE-LTF	Data	
L-STF	L-LTF	L-SIG	HE-SIGA		HE-STF	HE-LTF	Data	

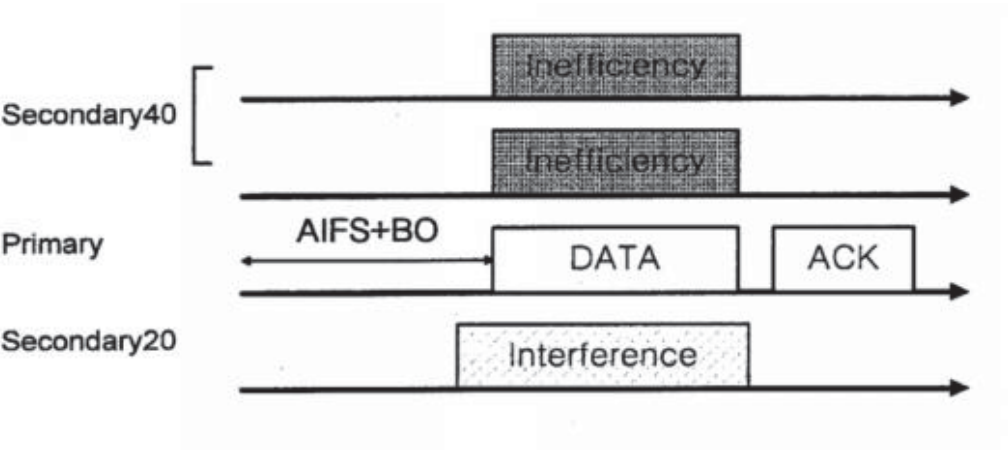
Duplicated Encoding over full BW

(b)

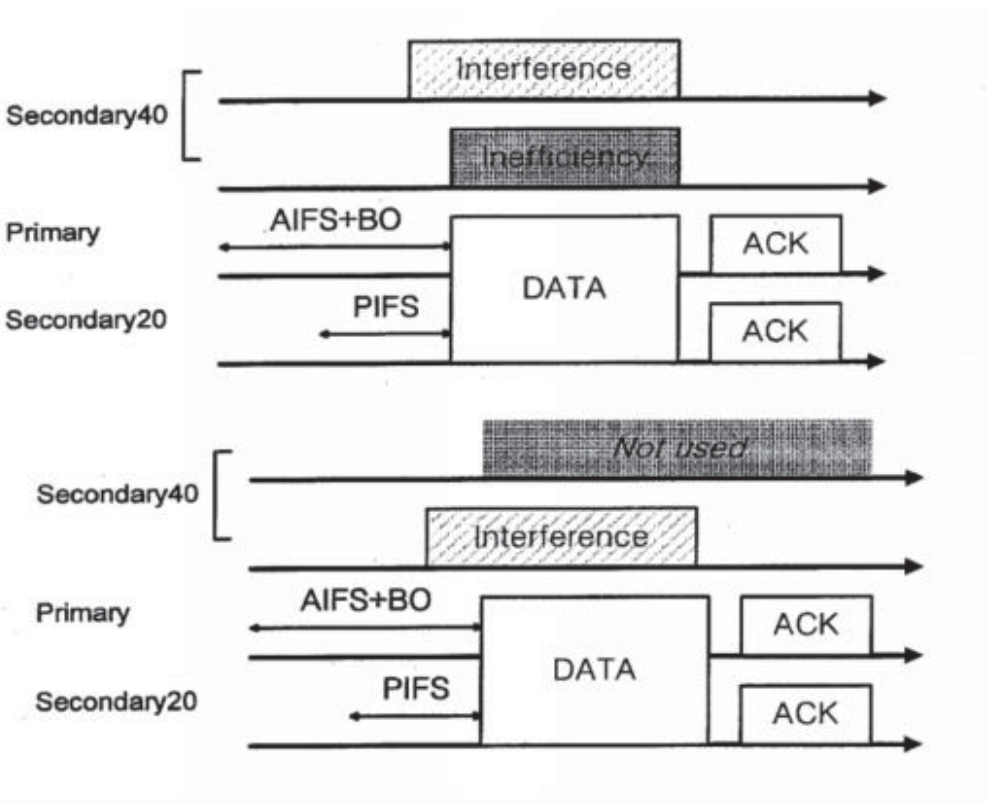
[FIG. 10]



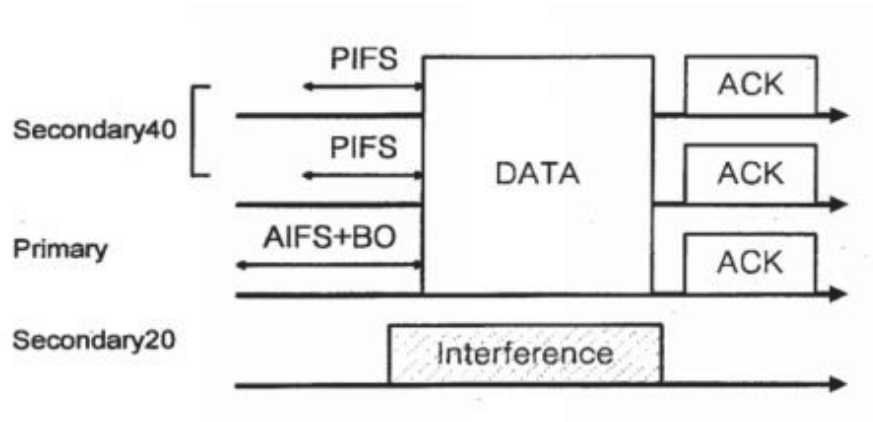
[FIG. 11]



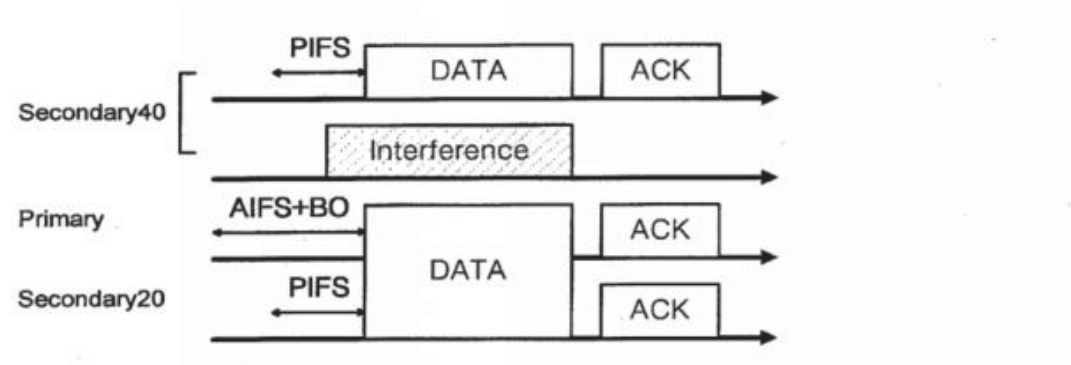
[FIG. 12]



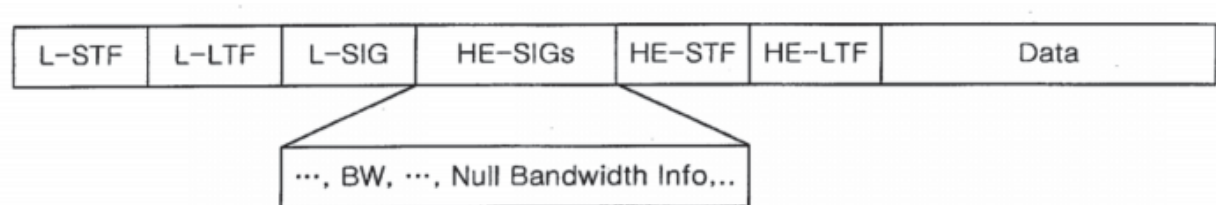
[FIG. 13]



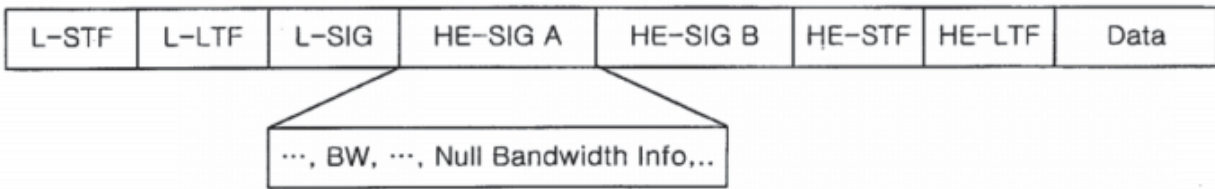
[FIG. 14]



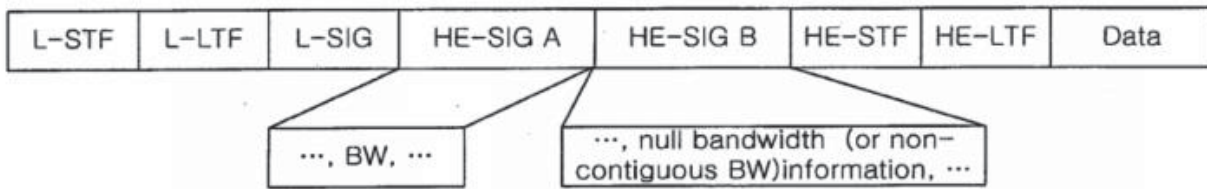
[FIG. 15]



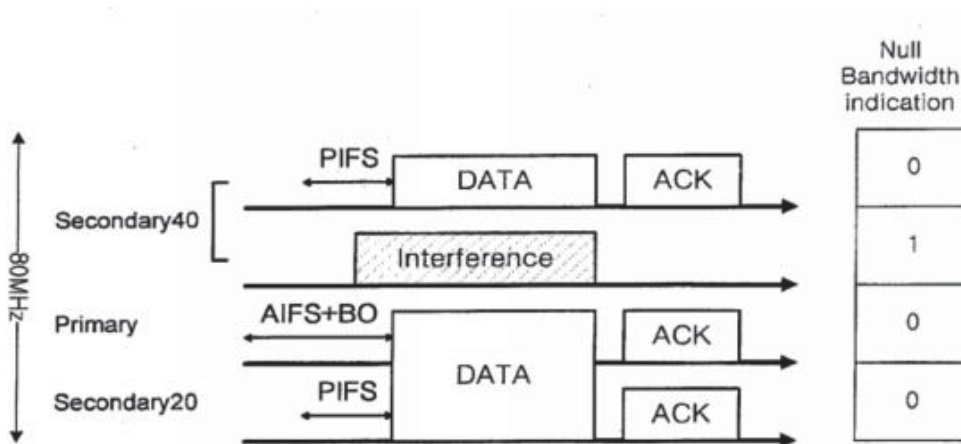
[FIG. 16]



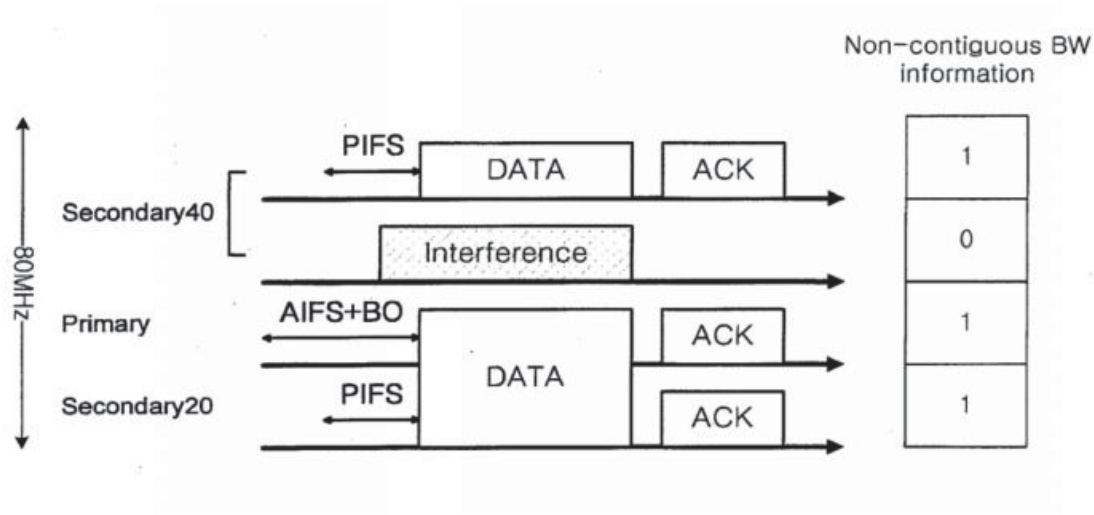
[FIG. 17]



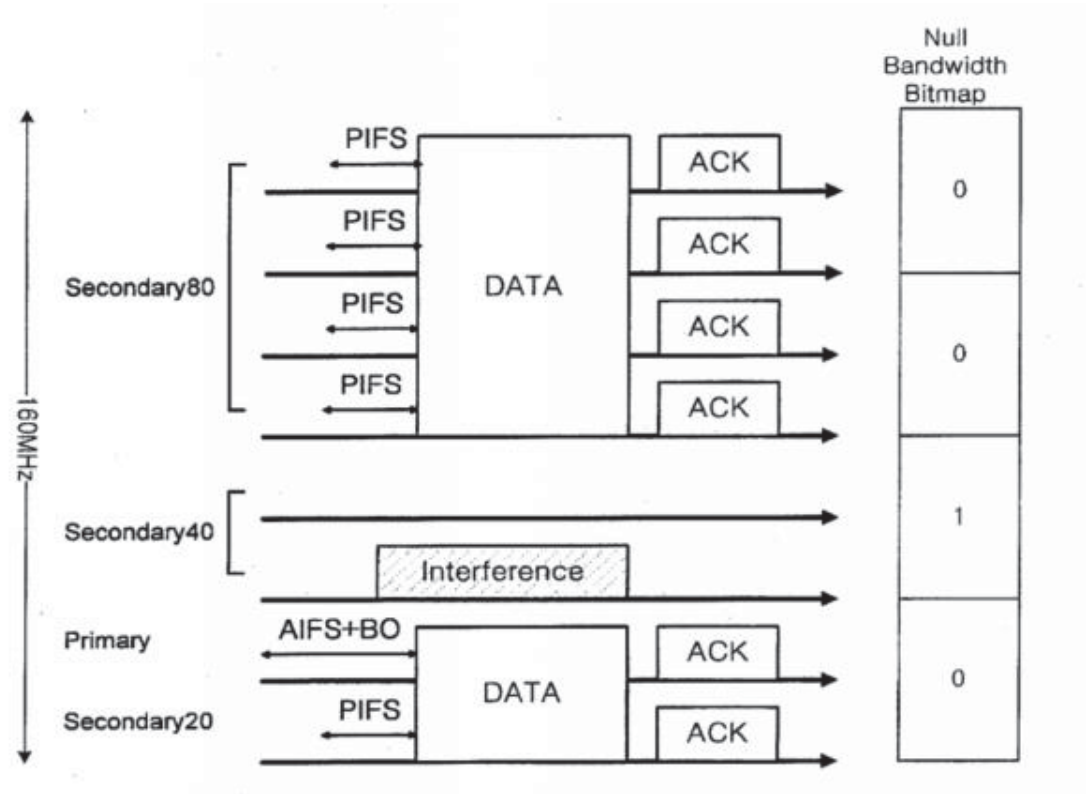
[FIG. 18]



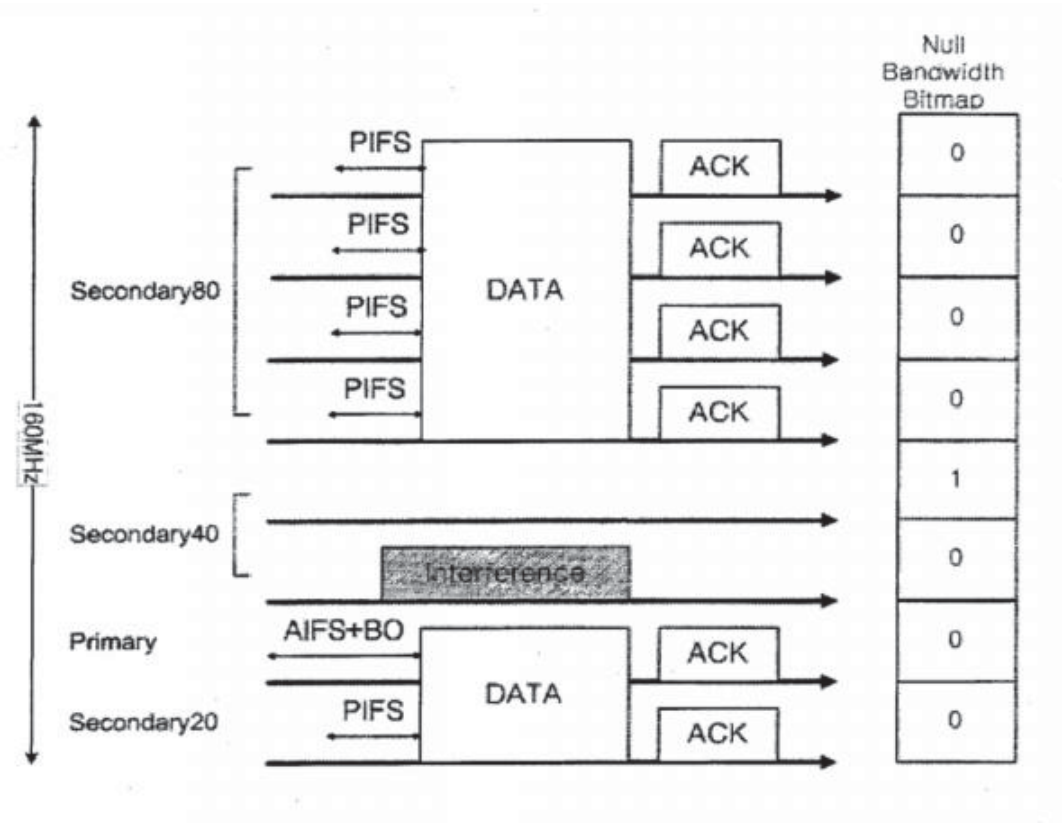
[FIG. 19]



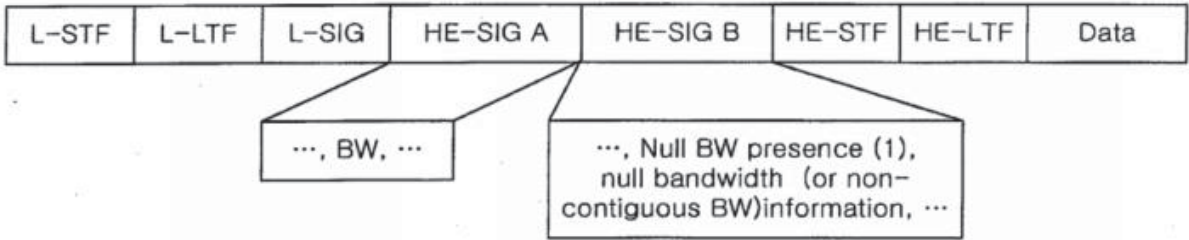
[FIG. 20]



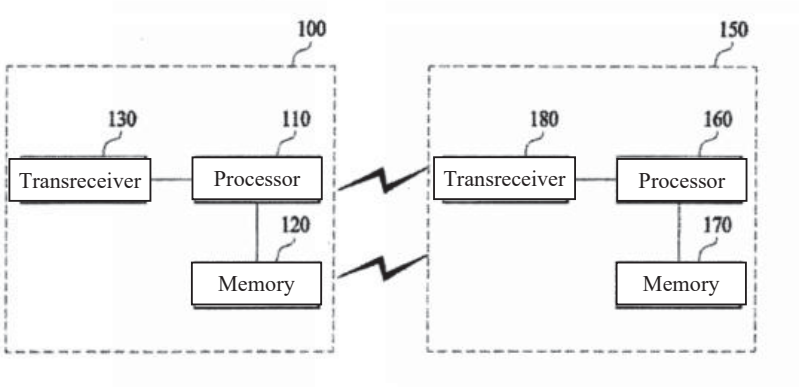
[FIG. 21]



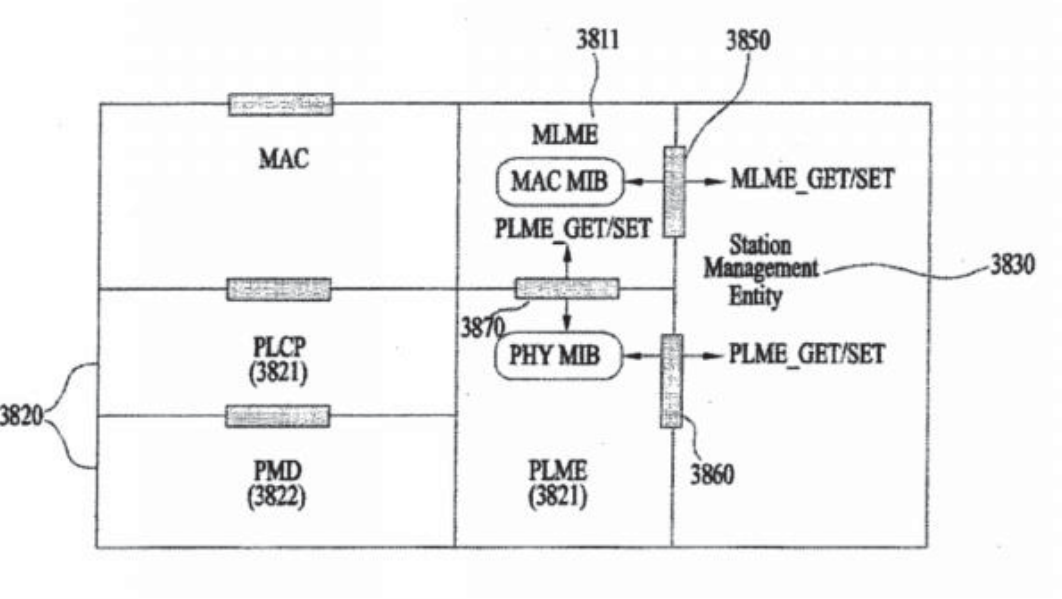
[FIG. 22]



[FIG. 23]



[FIG. 24]



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BPV2016-0080
		Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX		
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	
	Jeongki		KIM		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	SEOUL		Country of Residence	KR	
Mailing Address of Inventor:					
Address 1					
Address 2					
City			State/Province		
Postal Code			Country		
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Kiseon		RYU		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	SEOUL		Country of Residence	KR	
Mailing Address of Inventor:					
Address 1					
Address 2					
City			State/Province		
Postal Code			Country		
Inventor	3				Remove
Legal Name					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BPV2016-0080
		Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jinsoo		CHOI	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	SEOUL	Country of Residence	KR	

Mailing Address of Inventor:

Address 1				
Address 2				
City		State/Province		
Postal Code		Country i		
Inventor	4			Remove
Legal Name				

Prefix	Given Name	Middle Name	Family Name	Suffix
	Hangyu		CHO	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	SEOUL	Country of Residence	KR	

Mailing Address of Inventor:

Address 1				
Address 2				
City		State/Province		
Postal Code		Country i		
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	126667		
Email Address	pro@envisionpat.com	Add Email	Remove Email

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BPV2016-0080
		Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX		

Application Information:

Title of the Invention	CHANNEL BONDING FOR 802.11AX		
Attorney Docket Number	BPV2016-0080	Small Entity Status Claimed	☐
Application Type	Provisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

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	126667		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(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.			
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			
Add			

Foreign Priority Information:

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BPV2016-0080
		Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX		

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. 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(a).

				Remove
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Priority Claimed	
			Yes • No	
Additional Foreign Priority Data may be generated within this form by selecting the Add button.				Add

Authorization to Permit Access:

✕ Authorization to Permit Access to the Instant Application by the Participating Offices If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.
--

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	BPV2016-0080
	Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX	

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.	
Remove	

Assignee	Legal Representative under 35 U.S.C. 117
☐ 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 Assignee is an Organization check here. ☒
--

Organization Name	LG ELECTRONICS INC.
-------------------	---------------------

Mailing Address Information:			
Address 1	128, Yeoui-daero, Yeongdeungpo-gu		
Address 2			
City	Seoul	State/Province	
Country	KR	Postal Code	07336
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.	Add
--	------------------------------------

Signature:	Remove
-------------------	---------------------------------------

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Daniel CHUNG/			Date (YYYY-MM-DD)	2016-03-23
First Name	Daniel	Last Name	CHUNG	Registration Number	57889
Additional Signature may be generated within this form by selecting the Add button.					Add

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	BPV2016-0080
		Application Number	
Title of Invention	CHANNEL BONDING FOR 802.11AX		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

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