

(19)



(11)

EP 3 206 351 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

06.10.2021 Bulletin 2021/40

(51) Int Cl.:

H04L 27/26 ^(2006.01)

H04L 1/00 ^(2006.01)

(86) International application number:

PCT/KR2015/003461

(21) Application number: **15848707.4**

(22) Date of filing: **07.04.2015**

(87) International publication number:

WO 2016/056719 (14.04.2016 Gazette 2016/15)

(54) METHOD FOR TRANSMITTING A FRAME IN A WIRELESS LAN SYSTEM

VERFAHREN ZUR FRAMEÜBERTRAGUNG IN EINEM WLAN

PROCÉDÉ D'ÉMISSION D'UNE TRAME DANS UN SYSTÈME DE RÉSEAU LOCAL SANS FIL

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **08.10.2014 US 201462061156 P**
30.10.2014 US 201462072432 P

(43) Date of publication of application:
16.08.2017 Bulletin 2017/33

(60) Divisional application:
21194102.6

(73) Proprietor: **LG Electronics Inc.**
Seoul 150-721 (KR)

(72) Inventors:
• **LIM, Dongguk**
Seoul 137-893 (KR)
• **LEE, Wookbong**
Seoul 137-893 (KR)

- **CHO, Hangyu**
Seoul 137-893 (KR)
- **CHUN, Jinyoung**
Seoul 137-893 (KR)
- **CHOI, Jinsoo**
Seoul 137-893 (KR)
- **PARK, Eunsung**
Seoul 137-893 (KR)

(74) Representative: **Katérle, Axel**
Wuesthoff & Wuesthoff
Patentanwälte PartG mbB
Schweigerstraße 2
81541 München (DE)

(56) References cited:
EP-A2- 2 496 010 WO-A1-2016/029874
US-A1- 2012 177 144 US-A1- 2012 224 612
US-A1- 2012 259 123 US-A1- 2013 128 806
US-A1- 2013 188 572 US-A1- 2013 235 836

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 206 351 B1

Description**TECHNICAL FIELD**

5 **[0001]** The present invention relates to a wireless communication system, and more particularly, to a method for transmitting a frame in a high-density wireless local area network (WLAN) system and station device for performing the same.

BACKGROUND ART

10 **[0002]** First of all, a wireless local area network (WLAN) system is described as an example of the system to which the present invention can be applied.

[0003] Standards for a wireless local area network (WLAN) technology have been developed as Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards. IEEE 802.11a and b use an unlicensed band at 2.4 GHz or 5 GHz. IEEE 802.11b provides a transmission rate of 11 Mbps and IEEE 802.11a provides a transmission rate of 54 Mbps. IEEE 802.11g provides a transmission rate of 54 Mbps by applying orthogonal frequency division multiplexing (OFDM) at 2.4 GHz. IEEE 802.11n provides a transmission rate of 300 Mbps for four spatial streams by applying multiple input multiple output (MIMO)-OFDM. In IEEE 802.11n, a channel bandwidth is supported up to 40 MHz and in this case, a transmission rate of 600 Mbps is provided.

20 **[0004]** The above-described WLAN standards have evolved into IEEE 802.11ac standards that provides a bandwidth of up to 160 MHz and a transmission rate of up to 1 Gbit/s by supporting eight spatial streams. Currently, IEEE 802.11ax standards are under discussion.

[0005] EP 2 496 010 A2 discloses a method and an apparatus for transmitting control and training symbols to improve transmission efficiency in a multi-user wireless communication system. The method comprises the steps of: determining whether a required transmission rate of each data can be satisfied through channel estimation in each of terminals when different data are simultaneously transmitted to each of the terminals, and transmitting a data frame to each of the terminals, the data frame being composed to discriminate the control and training symbols in each of the terminals using a combination of time, frequency, and code area when the required transmission rate of each data is not satisfied according to the determined result.

30 **[0006]** US 2012/224612 A1 discloses a method for transmitting information in a wireless system. In this method, the traffic on a plurality of channels can be determined. A bandwidth for a packet can be selected based on the traffic and available channel bandwidths. A modulation and a coding rate can be selected from a plurality of modulations and associated coding rates. The modulation and coding rate can be applied to a segment of the packet, wherein each segment includes one or more bandwidth units. The packet including the selected modulation and coding rate therein can be transmitted on at least one channel.

DISCLOSURE OF THE INVENTION**TECHNICAL TASK**

40 **[0007]** In the above-mentioned IEEE 802.11ax standards, a new frame structure is under discussion to implement high-speed wireless communication in a high-density wireless environment.

[0008] In particular, since in the new frame structure, a frame portion for a legacy terminal coexists with a frame portion for a terminal supporting IEEE 802.11ax, additional discussion on how to configure and transmit a preamble for the IEEE 802.11ax terminal is required.

TECHNICAL SOLUTIONS

50 **[0009]** The above task is achieved by the claimed subject-matter according to the independent claims.

ADVANTAGEOUS EFFECTS

[0010] According to the present invention, it is possible to operate a frame that not only allows high-efficiency wireless communication but also minimize effects on the existing standard technology.

55 **[0011]** Specifically, SIG B of a frame portion in accordance with the newly defined WLAN standards can be transmitted based on an MCS level lower than the lowest MCS level among existing MCS levels, whereby transmission efficiency can be improved.

DESCRIPTION OF DRAWINGS**[0012]**

FIG. 1 is a diagram illustrating an exemplary configuration of a WLAN system.

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

FIG. 3 is a diagram for explaining a frame structure that can be used in a WLAN system.

FIG. 4 illustrates a frame format according to an IEEE 802.11ac standard technology.

FIG. 5 is a diagram illustrating a frame format available in a new standards as an embodiment of the present invention.

FIG. 6 is a diagram for explaining a frame configuration method according to an embodiment of the present invention.

FIGs. 7 to 9 are diagrams for explaining frame configuration methods according to different embodiments of the present invention.

FIG. 10 is a diagram for explaining a method for distinguishing between an HE PPDU and a legacy PPDU according to an embodiment of the present invention.

FIGs. 11 to 13 are diagrams for explaining station devices according one aspect of the present invention.

BEST MODE FOR INVENTION

Hereinafter, the preferred embodiments of the present invention will be described with reference to the accompanying drawings. It is to be understood that the detailed description, which will be disclosed along with the accompanying drawings, is intended to describe the exemplary embodiments of the present invention, and is not intended to describe a unique embodiment with which the present invention can be carried out.

[0014] The following detailed description includes specific details in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced without such specific details. In some instances, known structures and devices are omitted or are shown in block diagram form, focusing on important features of the structures and devices, so as not to obscure the concept of the present invention.

[0015] The following description relates to a method for transmitting a preamble in a WLAN system and station device for performing the same. To this end, the WLAN system to which the present invention can be applied will be explained in detail.

[0016] FIG. 1 is a diagram illustrating an exemplary configuration of a WLAN system.

[0017] As illustrated in FIG. 1, the WLAN system includes at least one Basic Service Set (BSS). The BSS is a set of STAs that are able to communicate with each other by successfully performing synchronization.

[0018] An STA is a logical entity including a physical layer interface between a Media Access Control (MAC) layer and a wireless medium. The STA may include an AP and a non-AP STA. Among STAs, a portable terminal manipulated by a user is the non-AP STA. If a terminal is simply called an STA, the STA refers to the non-AP STA. The non-AP STA may also be referred to as a terminal, a Wireless Transmit/Receive Unit (WTRU), a User Equipment (UE), a Mobile Station (MS), a mobile terminal, or a mobile subscriber unit.

[0019] The AP is an entity that provides access to a Distribution System (DS) to an associated STA through a wireless medium. The AP may also be referred to as a centralized controller, a Base Station (BS), a Node-B, a Base Transceiver System (BTS), or a site controller.

[0020] The BSS may be divided into an infrastructure BSS and an Independent BSS (IBSS).

[0021] The BSS illustrated in FIG. 1 is the IBSS. The IBSS refers to a BSS that does not include an AP. Since the IBSS does not include the AP, the IBSS is not allowed to access to the DS and thus forms a self-contained network.

[0022] FIG. 2 is a diagram illustrating another exemplary configuration of a WLAN system.

[0023] BSSs illustrated in FIG. 2 are infrastructure BSSs. Each infrastructure BSS includes one or more STAs and one or more APs. In the infrastructure BSS, communication between non-AP STAs is basically conducted via an AP. However, if a direct link is established between the non-AP STAs, direct communication between the non-AP STAs may be performed.

[0024] As illustrated in FIG. 2, the multiple infrastructure BSSs may be interconnected via a DS. The BSSs interconnected via the DS are called an Extended Service Set (ESS). STAs included in the ESS may communicate with each other and a non-AP STA within the same ESS may move from one BSS to another BSS while seamlessly performing communication.

[0025] The DS is a mechanism that connects a plurality of APs to one another. The DS is not necessarily a network. As long as it provides a distribution service, the DS is not limited to any specific form. For example, the DS may be a wireless network such as a mesh network or may be a physical structure that connects APs to one another.

[0026] Based on the above discussion, a frame structure that can be used in the WLAN system will be described.

[0027] FIG. 3 is a diagram for explaining the frame structure that can be used in the WLAN system.

[0028] Specifically, in FIG. 3, reference numeral 310 denotes a physical layer protocol data unit (PPDU) format for a terminal in accordance with IEEE 802.11a/g standards and reference numerals 320 and 330 denote PPDU formats for a terminal in accordance with IEEE 802.11n standards. As shown in FIG. 3, a terminal supporting IEEE 802.11n schemes uses frames denoted by a prefix of "HT-".

[0029] More specifically, the reference numeral 320 denotes an HT-mixed format PPDU of the IEEE 802.11n terminal and the reference numeral 330 denotes an HT-greenfield format PPDU of the IEEE 802.11n terminal.

[0030] In addition, reference numeral 340 denotes a configuration of data in each PPDU and a physical service data unit (PSDU) is included in a data region.

[0031] FIG. 4 illustrates the frame format according to the IEEE 802.11ac standard technology.

[0032] As shown in FIG. 4, a terminal in accordance with IEEE 802.11ac standards supports fields denoted by a prefix of "VHT-".

[0033] Details of individual fields illustrated in FIG. 4 are summarized in Table 1 below.

[Table 1]

Field	Description
L-STF	Non-HT Short Training field
L-LTF	Non-HT Long Training field
L-SIG	Non-HT SIGNAL field
VHT-SIG-A	VHT Signal A field
VHT-STF	VHT Short Training field
VHT-LTF	VHT Long Training field
VHT-SIG-B	VHT Signal B field
Data	The Data field carries the PSDU(s)

[0034] FIG. 5 is a diagram illustrating a frame format available in a new standards as an embodiment of the present invention.

[0035] In FIG. 5, "L-Part" indicates a frame portion for a legacy terminal (i.e., a frame portion for a first type of terminal), and "HE-Part" indicates a frame portion for a terminal in accordance with an enhanced standard technology (e.g., IEEE 802.11ax) (i.e., a frame portion for a second type of terminal). In this case, it is preferred that the frame portion in accordance with the new standards has a length greater by an integer multiple than that of the frame portion for the legacy terminal in a time domain. FIG. 5 shows an example of the frame structure in the 802.11ax where a conventional 1x symbol structure (i.e., 3.2 us) is maintained until an HE-SIG, whereas a 4x symbol structure (i.e., 12.8 us) is used for an HE-preamble and data.

[0036] In the case of the "L-Part" in the example of FIG. 5, an L-STF, L-LTF, and L-SIG can be maintained similar to a configuration of the conventional Wi-Fi system as illustrated in FIG. 3 and FIG. 4.

[0037] The newly defined HE-SIG in the HE-Part may have fields for indicating common control information and user-specific information. As illustrated in FIG. 5, the 1x symbol structure is used in the HE-SIG similar to the L-Part. On the other hand, since the 4x symbol structure is used in the HE-preamble and data, a frequency tone (FT) that can be used per bandwidth is increased by four times compared to the conventional Wi-Fi system. In addition, the number of available tones may also be changed. Therefore, the HE-preamble (HE-STF and HE-LTF) can be newly designed to support the increased FT and the changed available tones.

[0038] Hereinafter, a description will be given of a method for efficiently configuring and transmitting the HE-Part based on the above-mentioned design.

[0039] FIG. 6 is a diagram for explaining a frame configuration method according to an embodiment of the present invention.

[0040] According to the PPDU format illustrated in FIG. 6, a PPDU for a single STA is transmitted in a total of an 80-MHz bandwidth through four 20 MHz channels. However, a PPDU can be transmitted through each of the four 20 MHz channels and thus the four 20 MHz channels may carry PPDUs for different STAs, respectively.

[0041] The L-STF, L-LTF, and L-SIG may be transmitted in an OFDM symbol generated based on 64-FFT (64 sub-carriers) in each 20 MHz channel.

[0042] Meanwhile, it is proposed that the HE-Part includes two signaling fields. In addition, it is assumed that a first signaling field (hereinafter referred to as 'SIG 1' or 'SIG A') carries common control information and a second signaling field (hereinafter referred to as 'SIG 2' or 'SIG B') provides information necessary for data transmission.

[0043] The HE-SIG A may provide common control information, which will be commonly applied to STAs receiving the corresponding PPDU. The HE-SIG A may be transmitted in two or three OFDM symbols. Table 2 shows information included in the HE-SIG A.

[Table 2]

FIELD	BIT NUMBER	DESCRIPTION
Bandwidth	2	Indicating a bandwidth in which a PPDU is transmitted. For example, 20 MHz, 40 MHz, 80 MHz or 160 MHz
Group ID	6	Indicating an STA or a group of STAs that will receive a PPDU
Stream information	12	Indicating the number or location of spatial streams for each STA, or the number or location of spatial streams for a group of STAs
Uplink (UL) indication	1	Indicating whether a PPDU is destined to an AP (uplink) or to an STA (downlink)
MU indication	1	Indicating whether a PPDU is an SU-MIMO PPDU or an MU-MIMO PPDU
Guard Interval (GI) indication	1	Indicating whether a short GI or a long GI is used
Allocation information	12	Indicating a band or a channel (subchannel index or subband index) allocated to each STA in a bandwidth in which a PPDU is transmitted
Transmission power	12	Indicating a transmission power for each channel or each STA

[0044] The names and formats of the individual fields in Table 2 are merely exemplary and an HE-SIG A according to the present invention may have a form different from that shown in Table 2.

[0045] The HE-STF may be used to improve performance of AGC estimation in MIMO transmission and the HE-LTF may be used to estimate an MIMO channel.

[0046] An HE-SIG B may include user-specific information that is required for each STA to receive its data (i.e., a physical layer service data unit (PSDU)). For example, the HE-SIG B may include information on a length of a corresponding PSDU and an MCS level of the corresponding PSDU. Such an HE-SIG B may be transmitted in one or two OFDM symbols.

[0047] Meanwhile, each of the L-STF, L-LTF, L-SIG, and HE-SIG A may be repeatedly transmitted in a 20 MHz channel. That is, the L-STF, L-LTF, L-SIG, and HE-SIG A shown in FIG. 6 are transmitted through four channels but each of them may contain the same information.

[0048] In FIG. 6, an FFT size per unit frequency may be increased from the HE-STF (or from the HE-SIG A). For example, a 256 FFT size may be used in a 20 MHz channel, a 512 FFT size may be used in a 40 MHz channel, and a 1024 FFT size may be used in an 80 MHz channel. If an FFT size is increased, the number of OFDM subcarriers per unit frequency is increased. This is because a spacing between OFDM subcarriers is reduced but an OFDM symbol time is increased. To improve efficiency, a guard interval (GI) after the HE-STF may be configured to be the same as that after the HE-SIG A.

[0049] FIG. 7 is a diagram for explaining a frame configuration method according to another embodiment of the present invention.

[0050] FIG. 7 is identical to FIG. 6, except that the HE-SIG B is placed immediately after the HE-SIG A. The FFT size per unit frequency may be increased after the HE-STF (or the HE-SIG B).

[0051] FIG. 8 is a diagram for explaining a frame configuration method according to a further embodiment of the present invention.

[0052] Similar to FIG. 7, FIG. 8 shows an example in which the HE-SIG B is placed immediately after the HE-SIG A. In FIG. 8, it can be seen that 20 MHz channels are allocated to different STAs, for example, STA 1 to STA 4 and then data is transmitted.

[0053] In the example of FIG. 8, although it is assumed that the HE-SIG B includes information necessary for each STA to receive data as described above, the HE-SIG B is encoded over an entire band. That is, the HE-SIG B may be received by all the STAs. The FFT size per unit frequency may be increased after the HE-STF (or the HE-SIG B).

[0054] FIG. 9 is a diagram for explaining a frame configuration method according to still a further embodiment of the present invention.

[0055] Similar to FIG. 8, FIG. 9 shows an example in which the HE-SIG B is placed immediately after the HE-SIG A.

However, in the example of FIG. 9, the HE-SIG B is separately transmitted in each 20 MHz channel. In this way, the structure shown in FIG. 7 can also be changed such that the HE-SIG B is transmitted in each 20 MHz channel. If the FFT size is increased, an STA that supports conventional IEEE 802.11a/g/n/ac cannot decode a corresponding PPDU. For coexistence between a legacy STA and an HE STA, it is proposed that even though FFT sizes of other fields are increased, each of the L-STF, L-LTF, and L-SIG are transmitted with a 64 FFT size in a 20 MHz channel. For instance, the L-SIG may be transmitted in a single OFDM symbol, an interval for the single OFDM symbol may be 4 μ m, and a GI may be 0.8 μ m.

[0056] The HE-SIG A includes information necessary for the HE STA to receive an HE PPDU. However, the HE-SIG A may be transmitted with a 64 FFT size in a 20 MHz channel so that it can be received by both of the legacy STA and the HE STA. This is because to allow the HE STA to receive not only the HE PPDU but also conventional HT/VHT PPDUs. To this end, a method for enabling a legacy STA and an HE STA to distinguish between an HE PPDU and an HT/VHT PPDU is required.

[0057] FIG. 10 is a diagram for explaining a method for distinguishing between an HE PPDU and a legacy PPDU according to an embodiment of the present invention.

[0058] Specifically, FIG. 10 illustrates an example of a method for distinguishing between PPDUs using phase rotation. That is, for classification of PPDUs, constellation phases of OFDM symbols after the L-STF, L-LTF, and L-SIG may be rotated and transmitted as show in FIG. 10.

[0059] In the case of the HE PPDU illustrated in the example of FIG. 10, phases of three OFDM symbols after the L-SIG are rotated. The phases of OFDM symbol #1 and OFDM symbol #2 are not rotated but the phase of the OFDM symbol #3 may be counterclockwise rotated by 90 degrees and then transmitted. BPSK modulation may be applied to the OFDM symbol#1 and the OFDM symbol #2 and QPSK modulation may be applied to the OFDM symbol#3.

[0060] If the HE-SIG A is transmitted in three OFDM symbols after the L-SIG, it is possible to consider that all the three OFDM symbols are used to transmit the HE-SIG A.

[0061] Meanwhile, HE STAs in accordance with the 11ax should receive both of the aforementioned HE-SIG A and HE-SIG B to receive data. In the case of the HE-SIG B, since as the number of symbols increases, performance of FER decreases (1%), the HE-SIG B may act as a bottleneck in data reception performance. That is, since only a single CRC is used in the HE-SIG B when a large amount of data is transmitted, reception performance may be degraded. Therefore, a more robust transmission method is required.

[0062] In the conventional Wi-Fi system, the lowest MCS level, i.e., MCS 0 (BPSK 1/2) is used for SIG transmission. However, in an embodiment of the present invention, it is proposed to configure and support an MCS level, which will be used to transmit the HE-SIG B, lower than the MCS 0. For instance, BPSK (1/4, 1/2), QPSK (1/2, 3/4), and the like may be used as the MCS level, which will be applied to the HE-SIG B transmission. That is, the MCS level for the HE-SIG B may be set to be higher or lower than the MCS 0. However, since an MCS level lower than the MCS 0 can be supported, more robust transmission is expected.

[0063] In addition, according to an embodiment of the present invention, the HE-SIG A may be configured to carry information on the MCS level used for the HE-SIG B transmission. In this case, even when the MCS level applied to the HE-SIG B is lower than the conventional MCS level 0, it is preferred that the HE-SIG A is previously configured to carry the MCS level.

[0064] Meanwhile, the MCS level applied to the HE-SIG B may be preferably determined in consideration of an MCS level applied to data. Considering that the HE-SIG B includes data necessary for data reception as described above, if an STA that intends to receive the corresponding data successfully receives the HE-SIG B, there may be no problem. Thus, when the MCS level applied to the data is relatively high, it is not necessary to decrease the MCS level applied to the HE-SIG B to the MCS 0. However, to improve transmission reliability of the HE-SIG B, the MCS level applied to the HE-SIG B may be preferably set to be equal to or lower than the MCS level applied to the data.

[0065] According to another embodiment of the present invention, to improve transmission reliability of the HE-SIG A, the HE-SIG A may also be configured to support an MCS lower than the MCS 0. For instance, an MCS level applied to HE-SIG A transmission may be set as BPSK (1/4). This is because since common control information for packet transmission is transmitted through the HE-SIG A, the HE-SIG A needs to have high transmission reliability not only in an indoor environment but also in an outdoor environment.

[0066] To support the MCS lower than the MCS 0 as described above, the HE-SIG A/B may be configured to be repeatedly transmitted. Hereinafter, the repeated HE-SIG A/B transmission will be described in detail.

[0067] FIGs. 11 to 13 are diagrams for explaining station devices according one aspect of the present invention.

[0068] In FIG. 11, a wireless device 50 may correspond to STA1 that transmits a frame or STA2 that receives a frame. Either or both of the STA1 and the STA2 may correspond to an AP.

[0069] The STA1 50 may include a processor 51, a memory 52, and a radio frequency (RF) unit 53 (i.e., transmitting and receiving unit). The RF unit 53 may include a transmitter for frame transmission and a receiver for frame reception.

[0070] In FIG. 11, the processor 50 may be configured to perform the same operation as that described later in FIGs. 12 and 13.

[0071] Referring to FIG. 12, the processor 50 may include a channel coder, an interleaver, a modulator and an IFFT module. In addition, it is proposed that the processor additionally includes a repeater to allow the HE-SIG A and/or the HE-SIG B to support the MCS lower than the MCS 0 as described above.

[0072] As an embodiment, in the case of the HE-SIG A and/or the HE-SIG B, signals are configured using the MCS 0 (i.e., BPSK 1/2) identical to that used in the L-SIG. In addition, the configured signals may be repeatedly transmitted in the course of repetition.

[0073] The signal repetition may be performed such that an entire signal is repeated or some bits of a signal modulated by the modulator are repeated. For example, assuming that a signal generated by passing BPSK 1/2 and a bit interleaver is abcdef... as shown in FIG. 12, a signal repeated by the repeater may be determined as aabbccddeeff.... In this case, a repetition factor N is assumed to be 2.

[0074] Meanwhile, the signal repetition may be performed in unit of n bits where n may be one of 1, 2, 3, 4, 6, 8, 12, and 24. For instance, in case of n=4, assuming that a signal is abcdefgh..., a repeated signal may be determined as abcdabcbdefghfgh....

[0075] The number of times of repetition may be set to be equal to or greater than 2 to improve performance of the HE-SIG A and/or B. When the repetition factor is 2, the HE-SIG A/B may have the same effect as that when a signal is transmitted using BPSK 1/4 after repeating the signal once.

[0076] On the other hand, unlike FIG. 12, the repetition may be performed before the interleaver, that is, immediately after coding is performed by the channel coder.

[0077] Further, to improve performance of the aforementioned repeated signal, an additional interleaver/scrambler may be included as shown in FIG. 12.

[0078] In the OFDMA, the repeatedly loaded information mentioned in the foregoing description may be transmitted through a basic tone unit (BTU) or a combination of BTUs, which has an allocation size similar to that where the HE-SIG A/B signal is loaded, to guarantee its reception performance. In other words, the information may be transmitted using a combination of small allocation sizes or a similar allocation size. For instance, the HE-SIG A may be transmitted using the 1x symbol (64-FFT). In this case, it may be transmitted using 52 tones including four pilots. In addition, in this case, if two BTUs (e.g., 26 tones, 56 tones, etc.) are used to support the OFDMA, data/packets may be transmitted using a 2*26-tone BTU or a 56-tone BTU.

[0079] The detailed description of the preferred embodiments of the present invention has been given to enable those skilled in the art to implement and practice the invention. Although the invention has been described with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and variations can be made in the present invention without departing from the scope of the invention described in the appended claims. Accordingly, the invention should not be limited to the specific embodiments described herein, but should be accorded the broadest scope consistent with the principles and novel features disclosed herein.

INDUSTRIAL APPLICABILITY

[0080] Although the present invention is described on the assumption that the invention is applied to the WLAN system based on IEEE 802.11, the invention is not limited thereto. The present invention can be identically applied to various wireless systems.

Claims

1. A method for transmitting a radio frame by a second type station, STA, in a wireless local area network, WLAN, system, the method comprising:

configuring the radio frame including a first part for a first type STA and a second part for the second type STA, wherein the second part comprises a first signaling field and a second signaling field; and
transmitting the configured radio frame via a bandwidth equal to or greater than 80 MHz,
wherein configuring the radio frame comprises:

processing information for at least one of the first signaling field or the second signaling field to be transmitted via a first 20 MHz of the bandwidth; and
duplicating the information processed for the first 20 MHz into a second 20 MHz within the bandwidth,

wherein the processing information comprises:

encoding and modulating the information based on a lowest Modulation and Coding Scheme, MCS, level

among available MCS levels,
wherein the lowest MCS is used for Binary Phase Shift Keying, BPSK, and 1/2 coding rate; and
repeating the encoded- and modulated-information in a unit of n bits within the 20 MHz channel, wherein
n is an integer being one of 1, 2, 3, 4, 6, 8, 12, 24.

2. The method of claim 1, wherein the first signaling field provides common control information, and wherein the second signaling field provides user-specific control information required for data transmission.
3. The method of claim 1, wherein the second type STA is a terminal that supports communication schemes in accordance with IEEE 802.11ax standards, and wherein the first type STA is a legacy terminal in view of the second type STA.

4. The method of claim 1, wherein the processing information comprises:

encoding the information at 1/2 coding rate;
interleaving the encoded information;
modulating and repeating the interleaved information by BPSK and by 2 or more times; and
transforming the repeated information into a transmission signal for one or more of the first signaling field and the second signaling field of the radio frame.

5. A station device operating as a second type station, STA, in a wireless local area network, WLAN, system, the station device comprising:

a processor configured to configure a radio frame including a first part for a first type STA and a second part for the second type STA; and
a transmitter configured to transmit the radio frame via a bandwidth equal to or greater than 80 MHz, the processor is configured to configure the radio frame by processing information for at least one of the first signaling field or the second signaling field to be transmitted via a first 20 MHz of the bandwidth, and by duplicating the information processed for the first 20 MHz into a second 20 MHz within the bandwidth, wherein the processor is configured to process the information by encoding and modulating the information based on a lowest Modulation and Coding Scheme, MCS, level among available MCS levels, wherein the lowest MCS is used for Binary Phase Shift Keying, BPSK, and 1/2 coding rate; and by repeating the encoded- and modulated-information in a unit of n bits within the 20 MHz channel, wherein n is an integer being one of 1, 2, 3, 4, 6, 8, 12, 24.

6. The station device of claim 5, wherein the processor is configured to configure the first signaling field to provide common control information, and wherein the processor is configured to configure the second signaling field to provide user-specific control information required for data transmission.

7. The station device of claim 5, wherein the second type STA is a terminal that supports communication schemes in accordance with IEEE 802.11ax standards, and wherein the first type STA is a legacy terminal in view of the second type STA.

8. The station device of claim 5, wherein the processor comprises:

an encoder for encoding the information at 1/2 coding rate;
an interleaver for interleaving the encoded information;
a modulation mapper for modulating and repeating the interleaved information by BPSK and by 2 or more times; and
a transformer for transforming the repeated information into a transmission signal for one or more of the first signaling field and the second signaling field of the radio frame.

Patentansprüche

1. Verfahren zum Senden eines Funkrahmens durch eine Station zweiten Typs, STA, in einem drahtlosen lokalen Netzwerk-, WLAN, System, wobei das Verfahren umfasst:

Konfigurieren des Funkrahmens mit einem ersten Teil für eine STA ersten Typs und einem zweiten Teil für die STA zweiten Typs,
wobei der zweite Teil ein erstes Signalisierungsfeld und ein zweites Signalisierungsfeld umfasst; und
Senden des konfigurierten Funkrahmens über eine Bandbreite, die gleich oder größer als 80 MHz ist,
wobei das Konfigurieren des Funkrahmens umfasst:

Verarbeiten von Informationen für zumindest eines von dem ersten Signalisierungsfeld oder dem zweiten Signalisierungsfeld, die über erste 20 MHz der Bandbreite zu senden sind; und
Duplizieren der für die ersten 20 MHz verarbeiteten Informationen in zweiten 20 MHz innerhalb der Bandbreite,

wobei die Verarbeitungsinformationen umfassen:

Codieren und Modulieren der Informationen basierend auf einem niedrigsten Modulations- und Codierungsschema-, MCS, Niveau unter den verfügbaren MCS-Niveaus,
wobei das niedrigste MCS für eine binäre Phasenumtastung, BPSK, und 1/2 Codierate verwendet wird; und
Wiederholen der codierten und modulierten Informationen in einer Einheit von n Bits innerhalb des 20-MHz-Kanals, wobei n eine ganze Zahl von 1, 2, 3, 4, 6, 8, 12, 24 ist.

2. Verfahren nach Anspruch 1, wobei das erste Signalisierungsfeld gemeinsame Steuerinformationen bereitstellt und wobei das zweite Signalisierungsfeld benutzerspezifische Steuerinformationen bereitstellt, die zur Datenübertragung erforderlich sind.

3. Verfahren nach Anspruch 1, wobei die STA zweiten Typs ein Endgerät ist, das Kommunikationsschemata gemäß IEEE-802.11ax-Standards unterstützt, und
wobei die STA ersten Typs im Hinblick auf die STA zweiten Typs ein Altsystem-Endgerät ist.

4. Verfahren nach Anspruch 1, wobei das Verarbeiten von Informationen umfasst: Codieren der Informationen mit einer 1/2 Codierate;

Verschachteln der codierten Informationen;
Modulieren und Wiederholen der verschachtelten Informationen durch BPSK und zweimal oder mehrmals; und
Umwandeln der wiederholten Informationen in ein Übertragungssignal für eines oder mehrere von dem ersten Signalisierungsfeld und dem zweiten Signalisierungsfeld des Funkrahmens.

5. Stationsvorrichtung, das als eine Station zweiten Typs, STA, in einem drahtlosen lokalen Netzwerk-, WLAN, System betrieben wird, wobei die Stationsvorrichtung umfasst:

einen Prozessor, der eingerichtet ist, um einen Funkrahmen mit einem ersten Teil für eine STA ersten Typs und einem zweiten Teil für die STA zweiten Typs zu konfigurieren; und
einen Sender, der eingerichtet ist, um den Funkrahmen über eine Bandbreite zu senden, die gleich oder größer als 80 MHz ist,

wobei der Prozessor eingerichtet ist, um den Funkrahmen zu konfigurieren, indem Informationen für zumindest eines von dem ersten Signalisierungsfeld oder dem zweiten Signalisierungsfeld verarbeitet werden, die über erste 20 MHz der Bandbreite zu senden sind, und die für die ersten 20 MHz verarbeiteten Informationen in zweite 20 MHz innerhalb der Bandbreite dupliziert werden,

wobei der Prozessor eingerichtet ist, um die Informationen durch Codieren und Modulieren der Informationen basierend auf einem niedrigsten Modulations- und Codierungsschema-, MCS, Niveau unter verfügbaren MCS-Niveaus, wobei das niedrigste MCS für eine binäre Phasenumtastung, BPSK und 1/2 Codierate verwendet wird; und durch

Wiederholen der codierten und modulierten Informationen in einer Einheit von n Bits innerhalb des 20-MHz-Kanals zu verarbeiten, wobei n eine ganze Zahl von 1, 2, 3, 4, 6, 8, 12, 24 ist.

6. Stationsvorrichtung nach Anspruch 5, wobei der Prozessor zum Konfigurieren des ersten Signalisierungsfelds eingerichtet ist, um gemeinsame Steuerinformationen bereitzustellen, und
wobei der Prozessor zum Konfigurieren des zweiten Signalisierungsfelds eingerichtet ist, um benutzerspezifische Steuerinformationen bereitzustellen, die zur Datenübertragung erforderlich sind.

7. Stationsvorrichtung nach Anspruch 5, wobei die STA zweiten Typs ein Endgerät ist, das Kommunikationsschemata gemäß IEEE-802.11ax-Standards unterstützt, und wobei die STA ersten Typs im Hinblick auf die STA zweiten Typs ein Altsystem-Endgerät ist.

- 5 8. Stationsvorrichtung nach Anspruch 5, wobei der Prozessor umfasst:

einen Codierer zum Codieren der Informationen mit einer 1/2 Codierate;
einen Verschachteler zum Verschachteln der codierten Informationen;
einen Modulationszuordner zum Modulieren und Wiederholen der verschachtelten Informationen durch BPSK
10 und zweimal oder mehrmals; und
einen Wandler zum Umwandeln der wiederholten Informationen in ein Übertragungssignal für eines oder mehrere des ersten Signalisierungsfeldes und des zweiten Signalisierungsfeldes des Funkrahmens.

15 Revendications

1. Procédé de transmission d'une trame radio par une station, STA, de deuxième type dans un système de réseau local sans fil, WLAN, le procédé comprenant :

20 la configuration de la trame radio incluant une première partie pour une STA de premier type et une deuxième partie pour la STA de deuxième type,
dans lequel la deuxième partie comprend un premier champ de signalisation et un deuxième champ de signalisation ; et
la transmission de la trame radio configurée par l'intermédiaire d'une largeur de bande égale ou supérieure à
25 80 MHz,
dans lequel la configuration de la trame radio comprend :

le traitement d'informations pour au moins un du premier champ de signalisation ou du deuxième champ de signalisation devant être transmis par l'intermédiaire de 20 premiers MHz de la largeur de bande ; et
30 la duplication des informations traitées pour les 20 premiers MHz dans 20 deuxièmes MHz à l'intérieur de la largeur de bande,

dans lequel le traitement d'informations comprend :

35 le codage et la modulation des informations sur la base d'un niveau le plus bas d'un schéma de modulation et de codage, MCS, parmi des niveaux de MCS disponibles,
dans lequel le MCS le plus bas est utilisé pour une modulation par déplacement de phase binaire, BPSK, et un codage au taux 1/2 ; et
la répétition des informations codées et modulées dans une unité de n bits au sein du canal 20 MHz, dans
40 lequel n est un entier étant un parmi 1, 2, 3, 4, 6, 8, 12, 24.

2. Procédé selon la revendication 1, dans lequel le premier champ de signalisation fournit des informations de contrôle communes, et
45 dans lequel le deuxième champ de signalisation fournit des informations de contrôle spécifiques à l'utilisateur requises pour une transmission de données.

3. Procédé selon la revendication 1, dans lequel la STA de deuxième type est un terminal qui supporte des schémas de communication selon les normes IEEE 802.11ax, et
50 dans lequel la STA de premier type est un terminal patrimonial au vu de la STA de deuxième type.

4. Procédé selon la revendication 1, dans lequel le traitement d'informations comprend :

le codage des informations à un taux de codage 1/2 ;
l'entrelacement des informations codées ;
55 la modulation et la répétition des informations entrelacées par BPSK et 2 fois ou plus ; et
la transformation des informations répétées en un signal de transmission pour un ou plus parmi le premier champ de signalisation et le deuxième champ de signalisation de la trame radio.

5. Dispositif de station fonctionnant comme une STA de deuxième type dans un système de réseau local sans fil, WLAN, le dispositif de station comprenant :

un processeur configuré pour configurer une trame radio incluant une première partie pour une STA de premier type et une deuxième partie pour la STA de deuxième type ; et
 un émetteur configuré pour transmettre la trame radio par l'intermédiaire d'une largeur de bande égale ou supérieure à 80 MHz,
 le processeur est configuré pour configurer la trame radio par traitement d'informations pour au moins un du premier champ de signalisation ou du deuxième champ de signalisation devant être transmis par l'intermédiaire de 20 premiers MHz de la largeur de bande, et par duplication des informations traitées pour les 20 premiers MHz dans 20 deuxièmes MHz à l'intérieur de la largeur de bande,
 dans lequel le processeur est configuré pour traiter les informations par codage et modulation des informations sur la base d'un niveau le plus bas d'un schéma de modulation et de codage, MCS, parmi des niveaux de MCS disponibles, dans lequel le MCS le plus bas est utilisé pour une modulation par déplacement de phase binaire, BPSK, et un codage au taux 1/2 ;
 et par répétition des informations codées et modulées dans une unité de n bits au sein du canal 20 MHz, dans lequel n est un entier étant un parmi 1, 2, 3, 4, 6, 8, 12, 24.

6. Dispositif de station selon la revendication 5, dans lequel le processeur est configuré pour configurer le premier champ de signalisation pour fournir des informations de contrôle communes, et
 dans lequel le processeur est configuré pour configurer le deuxième champ de signalisation pour fournir des informations de contrôle spécifiques à l'utilisateur requises pour une transmission de données.

7. Dispositif de station selon la revendication 5, dans lequel la STA de deuxième type est un terminal qui supporte des schémas de communication selon les normes IEEE 802.11ax, et
 dans lequel la STA de premier type est un terminal patrimonial au vu de la STA de deuxième type.

8. Dispositif de station selon la revendication 5, dans lequel le processeur comprend :

un codeur pour coder les informations à un taux de codage 1/2 ;
 un entrelaceur pour entrelacer les informations codées ;
 un mappeur en modulation pour moduler et répéter les informations entrelacées par BPSK et 2 fois ou plus ; et
 un transformateur pour transformer les informations répétées en un signal de transmission pour un ou plus parmi le premier champ de signalisation et le deuxième champ de signalisation de la trame radio.

FIG. 1

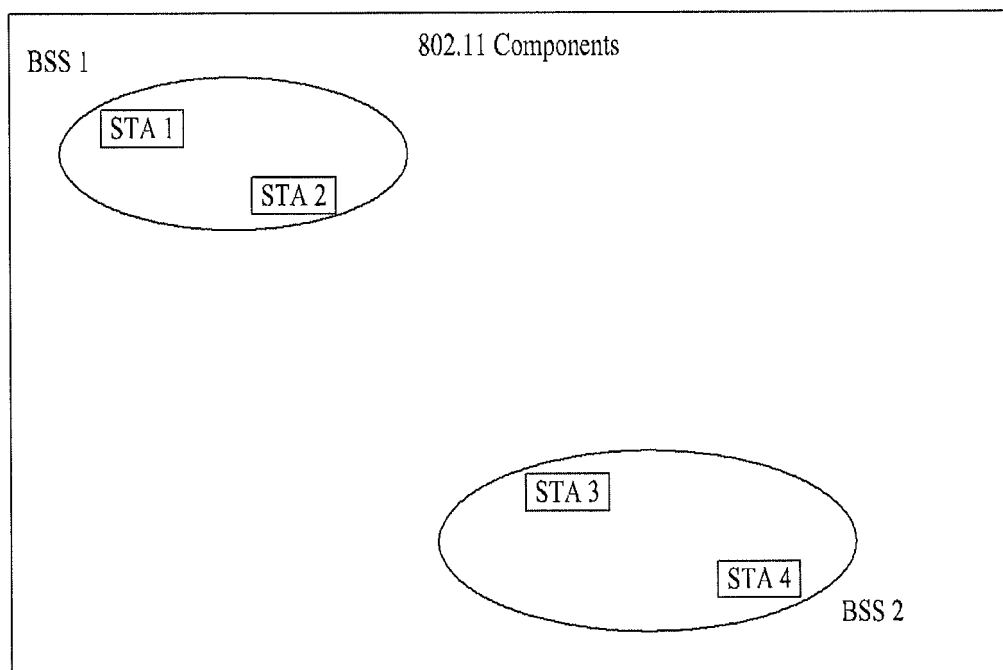


FIG. 2

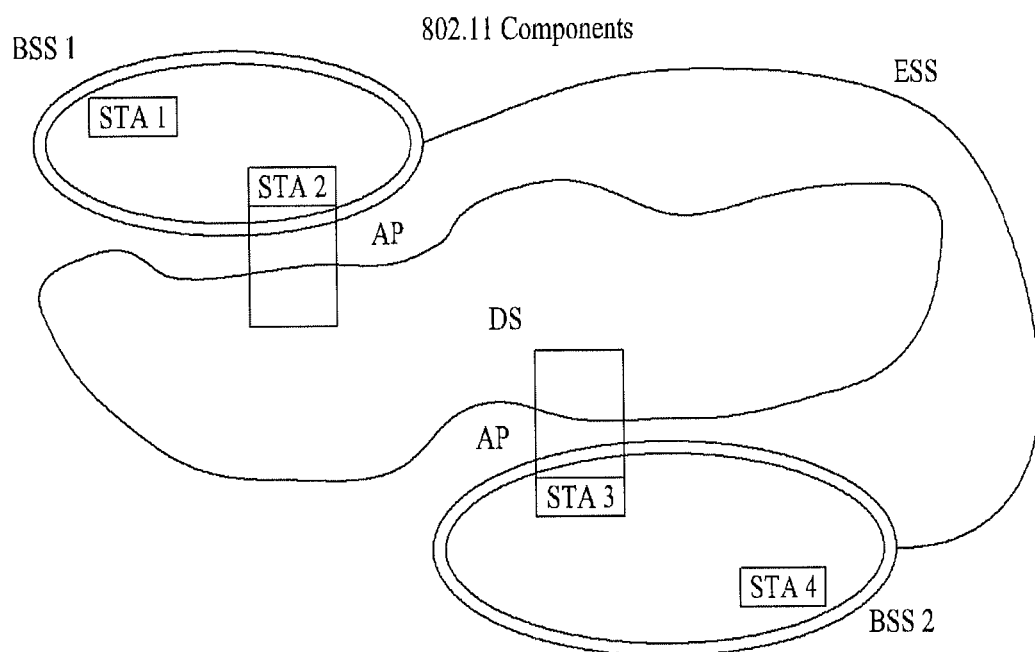


FIG. 3

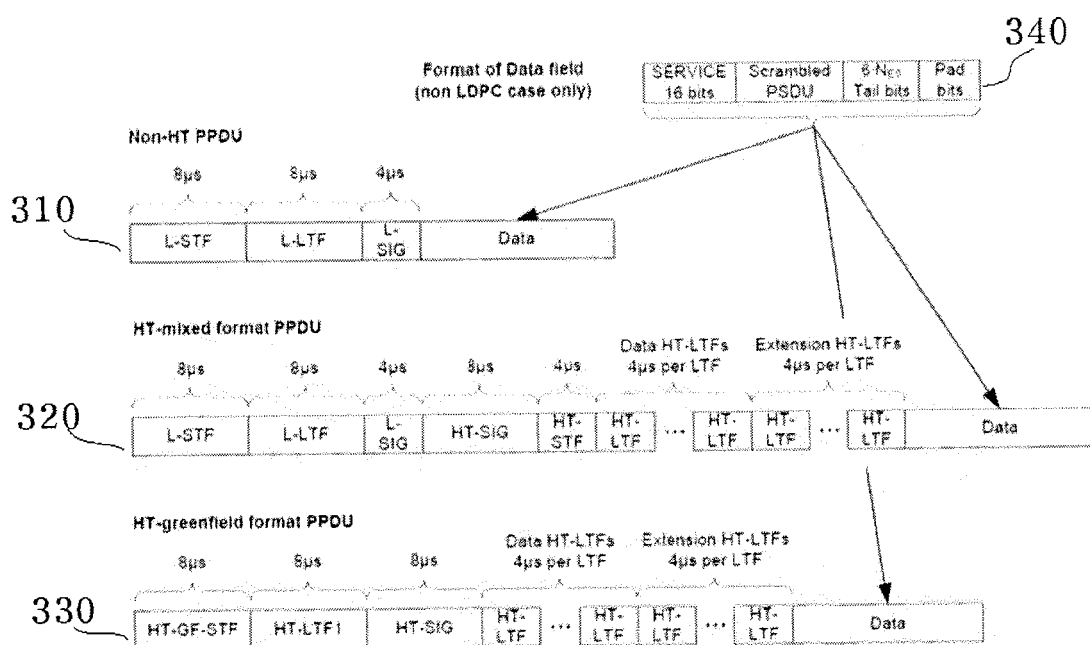


Fig. 4

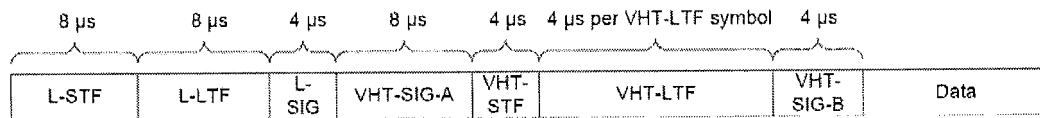


Fig. 5

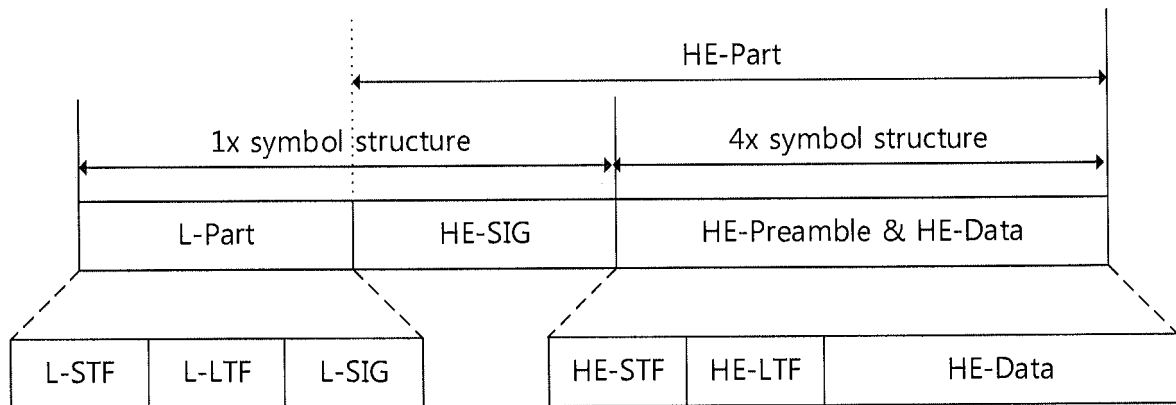


Fig. 6

L-STF	L-LTF	L-SIG	HE-SIG A	HE-STF	HE-LTF	HE-SIG B	Data
L-STF	L-LTF	L-SIG	HE-SIG A				
L-STF	L-LTF	L-SIG	HE-SIG A				
L-STF	L-LTF	L-SIG	HE-SIG A				

Fig. 7

L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data
L-STF	L-LTF	L-SIG	HE-SIG A				
L-STF	L-LTF	L-SIG	HE-SIG A				
L-STF	L-LTF	L-SIG	HE-SIG A				

Fig. 8

L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data for STA1
L-STF	L-LTF	L-SIG	HE-SIG A		HE-STF	HE-LTF	Data for STA2
L-STF	L-LTF	L-SIG	HE-SIG A		HE-STF	HE-LTF	Data for STA3
L-STF	L-LTF	L-SIG	HE-SIG A		HE-STF	HE-LTF	Data for STA4

Fig. 9

L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data for STA 1
L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data for STA 2
L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data for STA 3
L-STF	L-LTF	L-SIG	HE-SIG A	HE-SIG B	HE-STF	HE-LTF	Data for STA 4

Fig. 10

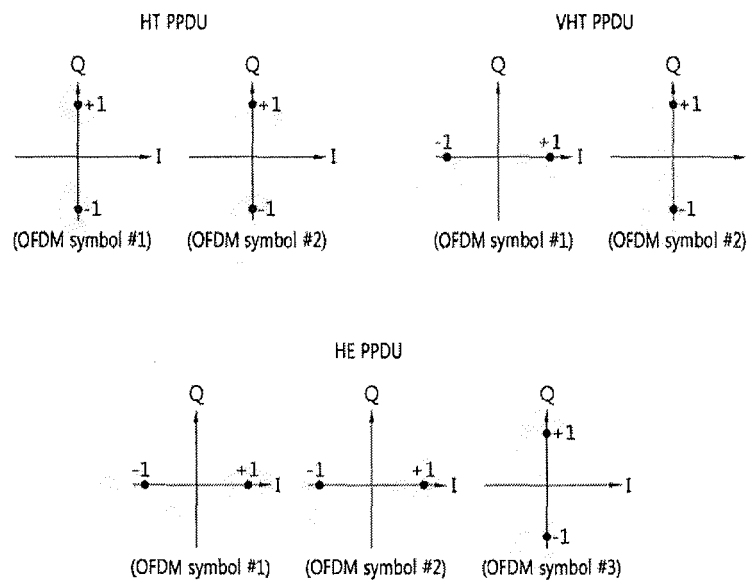


Fig. 11

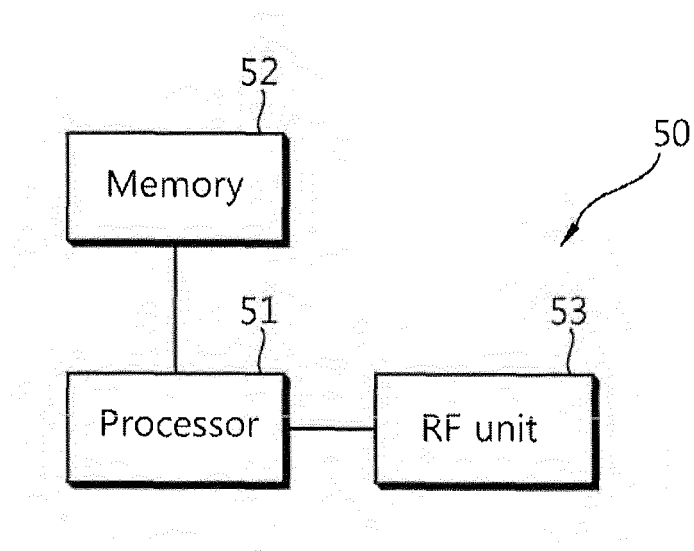


Fig. 12

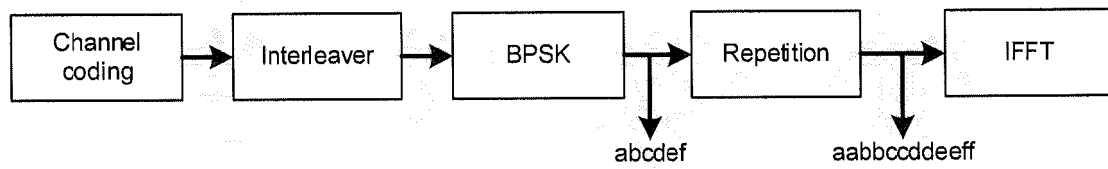
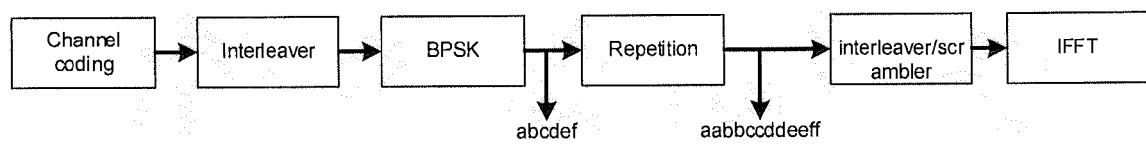


Fig. 13



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2496010 A2 [0005]
- US 2012224612 A1 [0006]