



(43) International Publication Date
February 14, 2019 (14.02.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/030929 A1

(51) International Patent Classification:
H04W 72/04 (2009.01) H **04W 72/12** (2009.01)
H04L 27/26 (2006.01)

(21) International Application No.: PCT/JP2017/029223

(22) International Filing Date: August 10, 2017
(10.08.2017)

(25) Language of International Application: Japanese

(26) Language of International Publication: Japanese

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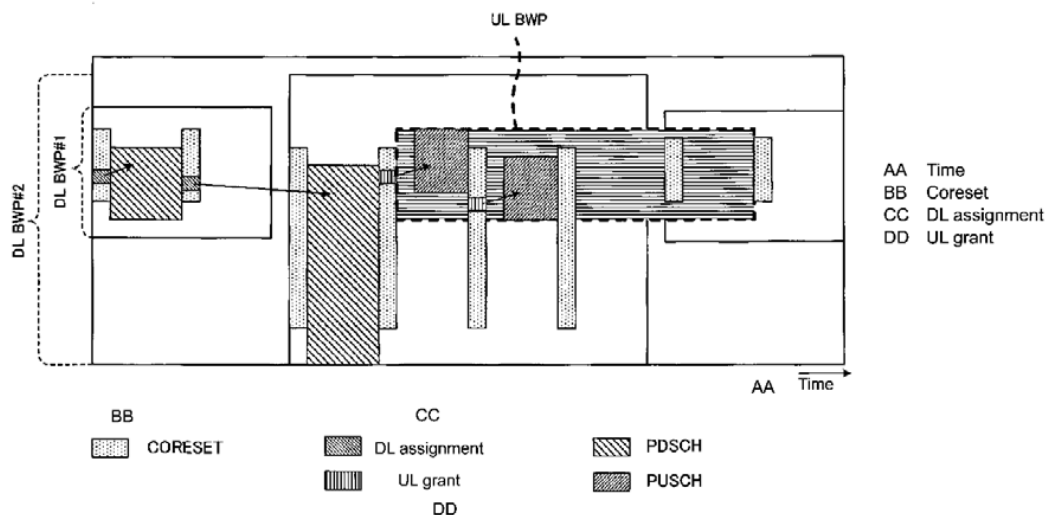
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(81) Designated countries (All types of domestic protections possible unless expressly noted): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) **Title:** USER TERMINAL AND WIRELESS COMMUNICATION METHOD

(54) Title of Invention: USER TERMINAL AND WIRELESS COMMUNICATION METHOD



(57) **Abstract:** The purpose of this invention is to be able to appropriately control the activation/deactivation of one or more frequency bands (for example, BWP) which are set within a carrier. This user terminal is equipped with a receiving unit which receives downlink control information (DCI) by monitoring a control resource domain of a downlink (DL) frequency band within a carrier; and a control unit which controls the transmission of an UL signal in an uplink (UL) frequency band within the carrier, on the basis of the DCI. The control unit controls the activation/deactivation of the UL frequency band.

[Continued]

(84) Designated countries (All types of wide area protections possible unless expressly noted): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasia (AM, AZ, BY, KG, KZ, RU, TJ, TM), Europe (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Attached Publications:

- International Search Report (PCT Sec. 21(3))

(57) Summary: To enable activation/deactivation of one or more frequency bands (for example, BWP) configured in a carrier to be appropriately controlled. The user terminal of the present invention is a user terminal provided with a receiving unit for monitoring a control resource domain of a frequency band for downlink (DL) in a carrier and receiving downlink control information (DCI) and a control unit for controlling transmission of an uplink (UL) signal in a frequency band for UL in the carrier based on the DCI, wherein the control unit controls activation or deactivation of the frequency band for UL.

Specification

Title of Invention: USER TERMINAL AND WIRELESS COMMUNICATION METHOD

Technical Field

[0001] The present invention relates to a user terminal and a wireless communication method in a next generation mobile communication system.

Background Art

[0002] In a UMTS (Universal Mobile Telecommunications System) network, Long Term Evolution (LTE: Long Term Evolution) has been specified for the purposes of further increasing a high-speed data rate, providing low delay, and the like (non-patent document 1). In addition, successor systems of LTE (also referred to as, for example, LTE-A (LTE-Advanced), FRA (Future Radio Access), 4G, 5G, 5G+ (plus), NR (New RAT), LTE Rel. 14, 15, and the like) are also under study for the purpose of further widening the bandwidth and increasing speed beyond LTE.

[0003] Furthermore, in an existing LTE system (for example, LTE Rel. 8-13), downlink (DL: Downlink) and/or uplink (UL: Uplink) communication is performed using a subframe of 1 ms as a scheduling unit. For example, in the case of a normal cyclic prefix (NCP: Normal Cyclic Prefix), the subframe includes 14 symbols at a subcarrier interval 15 kHz. This subframe is also referred to as a transmission time interval (TTI: Transmission Time Interval) or the like.

[0004] Also, a user terminal (UE: User Equipment) controls reception of a DL data channel (for example, PDSCH: Physical Downlink Shared Channel, also referred to as a DL shared channel, or the like) based on downlink control information (DCI: Downlink Control Information)

(also referred to as a DL assignment, or the like) from a wireless base station (for example, eNB: eNodeB). Furthermore, the user terminal controls transmission of a UL data channel (for example, also referred to as PUSCH: Physical Uplink Shared Channel, UL shared channel, and the like) based on the DCI from the wireless base station (also referred to as UL grant and the like).

Prior Art Documents

Non-Patent Documents

- [0005] Non-Patent Document 1: 3GPP TS 36.300 V8. 12.0 “Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8),” April 2010

Summary of Invention

Problem to Be Solved by Invention

- [0006] In future wireless communication systems (for example, NR), a user terminal monitoring (blind decodes) a control resource domain (for example, a control resource set (CORESET: control resource set)) which is a candidate domain to which a DL control channel (for example, PDCCH: Physical Downlink Control Channel) is allocated, and receiving (detects) DCI is being considered.
- [0007] Furthermore, in future wireless communication systems, using one or more frequency bands (for example, a bandwidth part (BWP)) in a carrier (also referred to as a component carrier (CC), a system band, or the like) for DL and/or UL communication (DL/UL communication) has been considered.
- [0008] In this way, when one or more frequency bands (for example, BWPs) used for DL/UL communication can be configured in a carrier, in order to reduce the processing load (for example, the processing load due to

blind decoding of each frequency band) in a user terminal, it is desired to control activation and/or deactivation (activation/deactivation) of this frequency band appropriately.

[0009] The present invention has been made in view of such points, and an object thereof is to provide a user terminal and a wireless communication method capable of appropriately controlling activation/deactivation of one or more frequency bands (for example, BWP) configured in a carrier.

Means for Solving Problem

[0010] One aspect of the user terminal of the present invention is a user terminal comprising a receiving unit for monitoring a control resource domain of a frequency band for downlink (DL) in a carrier and receiving downlink control information (DCI) and a control unit for controlling transmission of an uplink (UL) signal in a frequency band for UL in the carrier based on the DCI, wherein the control unit controls activation or deactivation of the frequency band for UL.

Effect of Invention

[0011] According to the present invention, it is possible to enable activation/deactivation of one or more frequency bands (for example, BWP) configured in a carrier to be appropriately controlled.

Brief Description of Drawings

[FIG. 1] FIGS. 1A and 1B are diagrams illustrating configuration examples of BWP.

[FIG. 2] A diagram illustrating one example of first activation control according to the first aspect.

[FIG. 3] A diagram illustrating one example of a first fallback mechanism according to the first aspect.

[FIG. 4] A diagram illustrating one example of a second fallback

mechanism according to the first aspect.

[FIG. 5] A diagram illustrating one example of second activation control according to the first aspect.

[FIG. 6] A diagram illustrating one example of third activation control according to the first aspect.

[FIG. 7] FIGS. 7A and 7B are diagrams illustrating one example of deactivation control according to the first aspect.

[FIG. 8] A diagram illustrating one example of configuration of a UL BWP according to a third aspect.

[FIG. 9] A diagram illustrating another example of configuration of the UL BWP according to the third aspect.

[FIG. 10] A diagram illustrating one example of transmission of a UL signal in each UL BWP according to a third aspect.

[FIG. 11] A diagram illustrating one example of activation/deactivation control of a UL BWP according to a third aspect.

[FIG. 12] A diagram illustrating one example of a schematic configuration of a wireless communication system according to the present embodiment.

[FIG. 13] A diagram illustrating one example of an overall configuration of a wireless base station according to the present embodiment.

[FIG. 14] A diagram illustrating one example of a functional configuration of a wireless base station according to the present embodiment.

[FIG. 15] A diagram illustrating one example of an overall configuration of a user terminal according to the present embodiment.

[FIG. 16] A diagram illustrating one example of a functional configuration of a user terminal according to the present embodiment.

[FIG. 17] A diagram illustrating one example of hardware configurations

of a wireless base station and a user terminal according to the present embodiment.

Embodiments of Invention

[0013] In future wireless communication systems (for example, NR, 5G, or 5G+), allocating carriers (also referred to as component carriers (CCs), system bands, or the like) having a bandwidth (for example, 100 to 400 MHz) wider than that of existing LTE systems (for example, LTE Rel. 8-13) is being considered. When the user terminal always uses the entire carrier, power consumption may be enormous. Therefore, in future wireless communication systems, semi-statically configuring (configuring) one or more frequency bands within the carrier in user terminals is being considered. Each frequency band in the carrier is also referred to as a bandwidth part (BWP: Bandwidth Part), a partial band, or the like.

[0014] FIG. 1 is a diagram illustrating a configuration example of a BWP. As illustrated in FIG. 1A, user terminals may be configured with one BWP per carrier.

[0015] Also, as illustrated in FIG. 1B, a plurality of BWPs (here, 2BWP #1 and #2) may be configured per carrier in user terminals. As illustrated in FIG. 1B, the multiple BWPs configured for the user terminal may have different bandwidths. Furthermore, at least a portion of the frequency bands may overlap between the plurality of BWPs. For example, in FIG. 1B, BWP #1 is a portion of the frequency band of BWP #2.

[0016] Also, the user terminal may control activation/deactivation of at least one BWP. Activation of a BWP means that the BWP is in a usable state (or transitions to the usable state), and is also referred to as activation, validation, or the like of configuration information (configuration) of the BWP (BWP configuration information). In addition, deactivation of a

BWP means that the BWP is in an unavailable state (or transitions to the unavailable state), and is also referred to as deactivation, invalidation, or the like of BWP configuration information.

[0017] Note that one BWP (for example, BWP #1 in FIG. 1B) configured in the user terminal may be always kept active, and activation or deactivation of the other BWP(s) (for example, BWP #2 in FIG. 1B) may be controlled. Alternatively, activation or deactivation of all BWPs configured in user terminals (for example, both BWPs #1 and #2 in FIG. 1B) may be controlled.

[0018] The activation/deactivation of the BWP may be explicitly or implicitly performed using at least one of physical layer signaling (for example, DCI), MAC (medium access control) signaling (for example, a MAC control element (MAC CE: MAC Control Element)), and RRC signaling. For example, activating the BWP using user terminal-dedicated (dedicated) RRC signaling is being considered.

[0019] Alternatively, the DCI explicitly or implicitly indicating activation or deactivation of the BWP has been considered. The DCI may be a DCI (DL assignment and/or UL grant) used for scheduling of data channels for user terminals, or may be another DCI (for example, a DCI common to one or more user terminals (group DCI or common DCI)).

[0020] In the explicit indication, indication (indication) information indicating activation or deactivation may be included in the DCI. In the implicit indication, the presence of the DCI (for example, DL assignment and/or UL grant) itself may indicate the activation or deactivation of the BWP.

[0021] Note that the BWP used for the DL communication may be referred to as a DL BWP (frequency band for DL), and the BWP used for the UL communication may be referred to as a UL BWP (frequency band for

UL). At least a portion of the frequency bands of the DL BWP and the UL BWP may overlap each other. Hereinafter, when the DL BWP and the UL BWP are not distinguished from each other, they are collectively referred to as BWP.

- [0022] At least one of the DL BWPs configured in the user terminal (for example, the DL BWP included in the primary CC) includes a control resource domain that is a DL control channel (DCI) assignment candidate. The control resource domain may also be referred to as a control resource set (CORESET: control resource set), a control subband (control subband), a search space set, a search space resource set, a control domain, a control subband, an NR-PDCCH domain, or the like.
- [0023] The user terminal monitors (monitors) one or more search spaces in the CORESET to detect the DCI for that user terminal. The search space may include a common search space (CSS: Common Search Space) in which a DCI common to one or more user terminals (for example, group DCI or common DCI) is mapped and/or a user terminal (UE)-specific search space (USS: UE-specific Search Specific) in which a user terminal-specific DCI (for example, DL assignment and/or UL grant) is mapped.
- [0024] The user terminal may receive the CORESET configuration information (CORESET configuration information) by using higher layer signaling (for example, RRC signaling or SIB). The CORESET configuration information may indicate at least one of a frequency resource (for example, RB count), a time resource (for example, start; FDM symbol number), a time length (duration), a REG (Resource Element Group) bundle size (REG size), a transmission type (for example, interleaved, non-interleaved), a period (for example, monitor period per CORESET), or the like of each CORESET.

[0025] Then, various control methods for activation/deactivation of at least one BWP when one or more BWPs used for DL/UL communication can be configured in a carrier have been studied. However, it is desirable to control the activation/deactivation of the at least one BWP more easily and/or with higher processing efficiency.

[0026] Therefore, the present inventors have studied a method for controlling activation/deactivation of at least one BWP configured in a user terminal more easily and/or with higher processing efficiency, and have arrived at the present invention. In the following first aspect, control of activation/deactivation of at least one DL BWP configured in a user terminal will be mainly described. In the second aspect, the configuration of the BWP (DL BWP and/or UL BWP) will be mainly described. In the third aspect, control of activation/deactivation of at least one UL BWP configured in a user terminal will be mainly described.

[0027] Embodiments of the present invention will be described in detail below with reference to the drawings. Note that although a slot format of one slot is exemplified below, the present invention is also applicable to a slot format of a plurality of slots as appropriate.

[0028] (First Aspect)

In the first aspect, the user terminal monitors (blind decodes) the CORESET (first control resource domain) configured in DL BWP #1 (first frequency band) in the carrier at a predetermined period, and receives the DCI. The user terminal controls activation or deactivation of DL BWP #2 (the second frequency band) in the carrier based on the DCI.

[0029] <First Activation Control>

In the first activation control, the user terminal may monitor a single

CORESET configured in a given DL BWP (for example, DL BWP #1) in the carrier at a predetermined period, and receive (detect) DCI for the DL BWP and/or DCI for (an)other DL BWP(s) (for example, DL BWP #2) in the carrier.

[0030] The DCI for DL BWP #2 is used for scheduling of the PDSCH (DL data channel) for the frequency resources in DL BWP #2. The user terminal activates DL BWP #2 based on the DCI for DL BWP #2. Furthermore, the user terminal controls reception of the PDSCH based on the DCI in the activated DL BWP #2.

[0031] FIG. 2 is a diagram illustrating one example of first activation control according to the first aspect. For example, in FIG. 2, it is assumed that two DL BWPs #1 and #2 are configured in carriers configured in user terminals, as illustrated in FIG. 1B. Furthermore, it is assumed that DL BWP #1 is a portion of the frequency band of DL BWP #2.

[0032] Moreover, in FIG. 2, it is assumed that CORESET #1 is configured in DL BWP #1 and CORESET #2 is configured in DL BWP #2. CORESET #1 and CORESET #2 are each provided with one or more search spaces. For example, in CORESET #1, the DCI for DL BWP #1 and the DCI for DL BWP #2 may each be arranged in different search spaces.

[0033] Also, in FIG. 2, when DL BWP #1 is in the active state, the user terminal monitors (blind decodes) the DCI for DL BWP #1 and the DCI for DL BWP #2 in CORESET #1 at a predetermined period (for example, every one or more slots, every one or more mini-slots, or every predetermined number of symbols).

[0034] When the user terminal detects the DCI for DL BWP #1 in CORESET #1, the user terminal receives the PDSCH scheduled (allocated) in a predetermined time and/or frequency resource (time/frequency resource) of DL BWP #1 based on the DCI for DL BWP #1.

- [0035] Conversely, when the user terminal detects DCI for DL BWP #2 in CORESET #1, the user terminal activates DL BWP #2. Based on the DCI for DL BWP #2 detected in CORESET #1, the user terminal receives the PDSCH scheduled in a predetermined time/frequency resource of DL BWP #2.
- [0036] Note that in FIG. 2, the DCI for DL BWP #1 and the DCI for DL BWP #2 are detected at different timings in CORESET #1, but a plurality of DCIs of different BWPs may be detected at the same timing. For example, a plurality of search spaces corresponding to a plurality of BWPs may be provided in the CORESET #1, and a plurality of DCIs of different BWPs may be transmitted in the plurality of search spaces. The user terminal may monitor a plurality of search spaces in CORESET #1 to detect a plurality of DCIs of different BWPs at the same timing.
- [0037] When DL BWP #2 is activated, the user terminal monitors (blind decodes) the DCI for DL BWP #2 within CORESET #2 at a predetermined period (for example, every one or more slots, every one or more mini-slots, or every predetermined number of symbols). The user terminal may receive the PDSCH scheduled in a predetermined time/frequency resource of DL BWP #2 based on the DCI for DL BWP #2 detected in CORESET #2.
- [0038] Note that in FIG. 2, it is assumed that when the DL BWP #2 is activated, the DL BWP #1 is deactivated, but the DL BWP #1 may be kept active. Also, although FIG. 2 shows a predetermined time for switching between activation and deactivation, the predetermined time may not be present.
- [0039] As illustrated in FIG. 2, when the DL BWP #2 is activated with detection of the DCI for DL BWP #2 in the CORESET of DL BWP #1 as a trigger, the DL BWP #2 can be activated without explicit indication

information, and thus it is possible to prevent an increase in overhead associated with activation control.

[0040] Conversely, in FIG. 2, even when the user terminal fails to detect (misses) DCI for DL BWP #2 (that is, DCI for activation of DL BWP #2) in CORESET #1, the wireless base station cannot recognize the failure of detection. Thus, although the user terminal continues to monitor CORESET #1 of DL BWP #1, the wireless base station may erroneously recognize that DL BWP #2 is available to the user terminal and transmit DCI for scheduling a PDSCH in DL BWP #2 in CORESET #2.

[0041] In this case, when the wireless base station cannot receive delivery acknowledgement information of the PDSCH (also referred to as HARQ-ACK, ACK/NACK, A/N, or the like) within a predetermined period, the wireless base station may recognize that the user terminal has failed to detect DCI for activation of DL BWP #2, and retransmit the DCI for activation in CORESET #1. However, in this method, there is a possibility that the utilization efficiency of radio resources may be reduced.

[0042] Therefore, a fallback mechanism may be introduced in order to resolve the active BWP recognition mismatch between the wireless base station and the user terminal at an early stage. Here, the fallback mechanism may be to provide a common CORESET for more than one BWP (first fallback mechanism) or to keep a single activated BWP (second fallback mechanism).

[0043] <<First Fallback Mechanism>>

In the first fallback mechanism, a common CORESET common to one or more BWPs configured in a user terminal is configured to control activation or deactivation of each BWP.

- [0044] FIG. 3 is a diagram illustrating one example of a first fallback mechanism according to the first aspect. Note that for FIG. 3, differences from FIG. 2 will be mainly described. FIG. 3 differs from FIG. 2 in that one or more BWPs (here, DL BWPs #1 and #2) are provided with a common CORESET (also referred to as BWP-common (common) CORESET, common CORESET, or the like) and a specific CORESET (also referred to as BWP-specific (specific) CORESET, specific CORESET, or the like) for each BWP.
- [0045] As illustrated in FIG. 3, the BWP-common CORESET is set to the same frequency band (the same one or more PRBs) between the DL BWPs #1 and #2. Conversely, the BWP-specific CORESET may be configured to have a different bandwidth (different PRB count) and/or a different frequency band (one or more different PRBs) for each BWP.
- [0046] For example, in FIG. 3, DL BWP #2 has a wider bandwidth than DL BWP #1, and thus a CORESET specific to DL BWP #2 may be configured with a larger number of PRBs than a CORESET specific to DL BWP #1.
- [0047] In the BWP-common CORESET, explicit or implicit indication information for activation of another BWP may be transmitted (in this case, DL BWP #2). For example, in the BWP-common CORESET of FIG. 3, the DCI (DL assignment) for DL BWP #2 scheduling the PDSCH of DL BWP #2 is transmitted as implicit indication information.
- [0048] Furthermore, when the BWP-common CORESET is used as the common search space, control information for transmitting system information (also referred to as SI: System Information, SIB: System Information Block, or the like) and/or a random access response (RAR: Random Access Response) may be transmitted in the BWP-common CORESET.

[0049] Conversely, in each BWP-specific CORESET, the DCI for each BWP may be transmitted. For example, in the CORESET specific to DL BWP #1, the DL assignment for scheduling the PDSCH of DL BWP #1 may be transmitted. Also, in the CORESET specific to DL BWP #2, the DL assignment for scheduling the PDSCH of DL BWP #2 may be transmitted.

[0050] In FIG. 3, regardless of which BWP is activated, the user terminal monitors the BWP-common CORESET at a predetermined period (for example, every one or more slots, every one or more mini-slots, or every predetermined number of symbols). For example, in FIG. 3, the user terminal activates DL BWP #2 and deactivates DL BWP #1 based on the DCI for DL BWP #2 detected in the BWP-common CORESET. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2.

[0051] Furthermore, the user terminal monitors the CORESET specific to the activated BWP at a predetermined period. For example, in FIG. 3, when the DL BWP #1 is activated, the user terminal monitors the CORESET specific to the DL BWP #1 at a predetermined period. The user terminal receives the PDSCH scheduled in DL BWP #1 based on the DCI for DL BWP #1 detected in the CORESET specific to DL BWP #1.

[0052] Conversely, when the DL BWP #2 is activated, the user terminal monitors the CORESET specific to the DL BWP #2 at a predetermined period. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2 detected in the CORESET specific to DL BWP #2.

[0053] In the first fallback mechanism, regardless of which BWP is activated, the user terminal continues to monitor the BWP-common CORESET at a predetermined period. Therefore, even when the user terminal fails to

detect the DCI for DL BWP #2 in the BWP-common CORESET at a certain timing, the user terminal can activate DL BWP #2 based on the DCI for DL BWP #2 detected in the subsequent BWP-common CORESET. For this reason, it is possible to resolve recognition mismatches of the active BWP between the wireless base station and the user terminal at an early stage.

[0054] <<Second Fallback Mechanism>>

In a second fallback mechanism, a single BWP is kept active and the activation or deactivation of other BWPs is controlled.

[0055] A BWP that remains active may also be referred to as an active BWP, a primary BWP, or the like. One or more BWPs whose activation or deactivation is controlled are also referred to as a secondary BWP or the like. Note that when a single BWP is configured in a carrier (for example, in FIG. 1A), the primary BWP is configured and the secondary BWP is not configured.

[0056] The primary BWP may be configured with a common search space and a UE-specific search space. Conversely, in the secondary BWP, the common search space may not be configured and the UE-specific search space may be configured.

[0057] The user terminal monitors the common search space of the primary BWP at a predetermined period. Also, the user terminal monitors the UL grant in the UE-specific search space of the primary BWP at a predetermined period. Conversely, the user terminal may monitor the DL assignment in the UE-specific search space of the primary BWP at a predetermined period, or may stop monitoring the DL assignment when a predetermined condition is satisfied.

[0058] For example, when a secondary BWP is configured and the secondary BWP is activated, the user terminal may monitor the DL assignment in

the UE-specific search space of the secondary BWP and may not monitor the DL assignment in the UE-specific search space of the primary BWP.

[0059] FIG. 4 is a diagram illustrating one example of a second fallback mechanism according to the first aspect. Note that for FIG. 4, differences from FIG. 2 will be mainly described. FIG. 4 is different from FIG. 2 in that DL BWP #1, which is the primary BWP, is kept active and activation or deactivation of DL BWP #2, which is the secondary BWP, is controlled.

[0060] In FIG. 4, CORESET #1 may be configured in DL BWP #1, and CORESET #2 may be configured in DL BWP #2. The CORESET #1 may include a common search space and a UE-specific search space. Conversely, CORESET #2 may not include the common search space and may include the UE-specific search space.

[0061] In FIG. 4, the user terminal activates DL BWP #2 based on the DCI (DL assignment) for DL BWP #2 detected in the common search space of CORESET #1. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2.

[0062] Also, based on the DCI (DL assignment) for DL BWP #1 detected in the UE-specific search space of CORESET #1, the user terminal receives the PDSCH scheduled in DL BWP #1.

[0063] When DL BWP #2 is activated, the user terminal monitors the UE-specific search space of CORESET #2 at a predetermined period. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI (DL assignment) for DL BWP #2 detected in the UE-specific search space.

[0064] Note that even when DL BWP #2 is activated, the user terminal monitors the common search space of CORESET #1 at a predetermined

period. Conversely, when DL BWP #2 is activated, the user terminal monitors the UL grant in the UE-specific search space of CORESET #1 at a predetermined period, but does not need to monitor the DL assignment in the UE-specific search space of CORESET #1.

[0065] In the second fallback mechanism, regardless of whether the secondary BWP is activated, the user terminal continues to monitor the common search space of CORESET #1 of the primary BWP. Therefore, even when the user terminal fails to detect the DCI for the DL BWP #2 in the CORESET #1 at a certain timing, the user terminal can activate the DL BWP #2 based on the DCI for the DL BWP #2 detected in the subsequent CORESET #1. For this reason, it is possible to resolve recognition mismatches of the active BWP between the wireless base station and the user terminal at an early stage.

[0066] <Second Activation Control>

In the second activation control, the user terminal monitors the CORESET for each BWP configured in a certain DL BWP (for example, DL BWP #1) in the carrier at a predetermined period. The user terminal may receive (detect) the DCI for the corresponding BWP in each CORESET. The second activation control is different from the first activation control in that a plurality of CORESETs respectively corresponding to a plurality of BWPs are set to a specific DL BWP. Differences from the first activation control will be mainly described below.

[0067] In the second activation control, when one or more BWPs (one or more DL BWPs and/or one or more UL BWPs) are configured in the user terminal, one or more CORESETs corresponding to each of the one or more DL BWPs may be provided in at least one DL BWP.

[0068] FIG. 5 is a diagram illustrating one example of second activation

control according to the first aspect. For FIG. 5, differences from FIG. 2 will be mainly described. FIG. 5 is different from FIG. 2 in that CORESET #1 for which the DCI for DL BWP #1 is transmitted and CORESET #2 for which the DCI for DL BWP #2 is transmitted are provided in DL BWP #1.

[0069] In FIG. 5, when DL BWP #1 is activated and DL BWP #2 is deactivated, the user terminal monitors CORESET #1 and CORESET #2 configured in DL BWP #1 at a predetermined period. Note that the monitoring periods of CORESET #1 and CORESET #2 may be the same or different.

[0070] The user terminal receives the PDSCH scheduled in DL BWP #1 based on the DCI for DL BWP #1 detected in CORESET #1 DL BWP #1.

[0071] Also, when the DCI for DL BWP #2 is detected in CORESET #2 of DL BWP #1, the user terminal activates DL BWP #2 and deactivates DL BWP #1. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2 detected in CORESET #2 of DL BWP #1.

[0072] Also, in FIG. 5, when DL BWP #1 is deactivated and DL BWP #2 is activated, the user terminal monitors CORESET #2 configured in DL BWP #2 at a predetermined period. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2 detected in CORESET #2 of DL BWP #2.

[0073] Note that, even in the second activation control, the foregoing first fallback mechanism or second fallback mechanism may be applied in order to resolve the recognition mismatch of the active BWP between the wireless base station and the user terminal at an early stage.

[0074] In the above second activation control, a plurality of CORESETs

corresponding to a plurality of BWPs configured in a user terminal are configured in a certain DL BWP, and thus resources of the CORESET (corresponding to CORESET #2 in FIG. 5) can be used as resources of the PDSCH in the period in which activation control is not performed.

[0075] <Third Activation Control>

In the third activation control, the user terminal may monitor the CORESET configured in a certain DL BWP (for example, DL BWP #1) in the carrier at a predetermined period, and receive (detect) a DCI for activation of another DL BWP(s) (for example, DL BWP #2).

[0076] The DCI for activation indicates activation of another DL BWP. For example, the DCI may be a DCI for scheduling (DL assignment or UL grant) or may be a DCI in a dedicated format. When such is a DCI for scheduling, a specific value (for example, 0) may be set in the resource allocation field in the DCI. The DCI for activation may include an index of a BWP to be activated (BWP index).

[0077] FIG. 6 is a diagram illustrating one example of third activation control according to the first aspect. For FIG. 6, differences from FIG. 2 will be mainly described. FIG. 6 is different from FIG. 2 in that activation of DL BWP #2 is explicitly instructed using the DCI for activation of DL BWP #2.

[0078] In FIG. 6, when DL BWP #1 is activated and DL BWP #2 is deactivated, the user terminal monitors CORESET #1 configured in DL BWP #1 at a predetermined period. When the DCI for activation is detected in CORESET #1, the user terminal activates DL BWP #2.

[0079] In FIG. 6, when DL BWP #2 is activated, the user terminal starts monitoring CORESET #2 of DL BWP #2 at a predetermined period. The user terminal receives the PDSCH scheduled in DL BWP #2 based on the DCI for DL BWP #2 detected in CORESET #2 of DL BWP #2.

[0080] When the user terminal succeeds in detecting the DCI for activation, the user terminal may transmit ACK (Acknowledge) to the wireless base station. For example, the user terminal may transmit the ACK by using a UL control channel (for example, PUCCH) or a UL data channel (for example, PUSCH) of the UL BWP. The wireless base station may start scheduling the PDSCH in DL BWP #2 after receiving the ACK from the user terminal.

[0081] Alternatively, the wireless base station may start scheduling the PDSCH in DL BWP #2 in CORESET #2 even without receiving an ACK from the user terminal. In this case, since the user terminal continues to monitor CORESET #1, the user terminal cannot detect the DCI for DL BWP #2 that schedules the PDSCH in DL BWP #2. Therefore, the wireless base station may recognize the failure of detection of DCI for activation in the user terminal by DTX.

[0082] In the third activation control described above, activation of the DL BWP is explicitly instructed, and thus when ACK is transmitted in response thereto, it is possible to appropriately perform activation without wastefully transmitting the PDSCH. Note that the foregoing first fallback mechanism or second fallback mechanism may also be applied to the third activation control.

[0083] <Deactivation Control>

The DL BWP activated by the first to third activation controls may be deactivated using explicit deactivation indication information or a timer.

[0084] <<When Using Explicit Indication Information>>

The explicit deactivation indication information (deactivation indication information) may be a MAC CE or a DCI. The DCI may be a DCI for scheduling (DL assignment or UL grant), or may be a DCI of a dedicated format. When such is a DCI for scheduling, a specific value

(for example, 0) may be set in the resource allocation field in the DCI.

The DCI may include an index of a BWP to be deactivated.

[0085] When explicit indication information is used, the BWP can be deactivated earlier than when a timer is used.

[0086] <<When Using Timer>>

When a data channel (for example, a PDSCH and/or a PUSCH) is not scheduled for a predetermined period in an activated BWP (DL BWP and/or UL BWP), the user terminal may deactivate the BWP. For example, in FIGS. 2 to 6, no PDSCH is scheduled for a predetermined period in DL BWP #2, and thus the user terminal deactivates DL BWP #2. Also, in FIGS. 2, 3, 5 and 6, the user terminal deactivates DL BWP #2 and activates DL BWP #1.

[0087] The user terminal may set a timer each time reception of a data channel (for example, the PDSCH and/or the PUSCH) is completed in an activated BWP, and deactivate the BWP when the timer expires. The timer may be a common timer (also referred to as a joint timer or the like) between the DL BWP and the UL BWP, or may be an individual timer.

[0088] When the timer for the DL BWP (DL timer) and the timer for the UL BWP (UL timer) are separately provided, the predetermined period until the DL timer expires may include the DL symbol and may not include the UL symbol. Similarly, in the predetermined period until the UL timer expires, the UL symbol may be included and the DL symbol may not be included.

[0089] Furthermore, when the DL timer and the UL timer are separately provided, the UL BWP may be deactivated immediately after the UL timer expires or may be deactivated after the DL timer expires. Similarly, the DL BWP may be deactivated as soon as the DL timer

expires or may wait for the expiration of the UL timer to be deactivated.

[0090] FIG. 7 is a diagram illustrating one example of deactivation control according to the first aspect. In FIG. 7, it is assumed that the DL BWP #1 (primary BWP) is maintained active, and the DL BWP #2 (secondary BWP) and the UL BWP transition from active to inactive.

[0091] As illustrated in FIG. 7A, when there is UL data (PUSCH) in the UL BWP and the DL timer expires earlier than the UL timer, the DL BWP #2 may be deactivated upon expiration of the DL timer. This is because the UL grant for scheduling UL data in the UL BWP is transmitted in the DL BWP #1.

[0092] Conversely, when there is DL data (PDSCH) and there is no UL data (PUSCH) in DL BWP #2, when the UL timer is set at a point in time when there is no UL data, the UL timer may expire earlier than the DL timer. In this case, when the UL BWP is deactivated in response to expiration of the UL timer, it may be that a feedback signal (for example, ACK/NACK of DL data) cannot be fed back. Therefore, as illustrated in FIG. 7B, the UL timer may be reset at the time point when the feedback signal is generated.

[0093] When a timer is used, it is not necessary to transmit explicit deactivation indication information, and thus it is possible to reduce overhead associated with deactivation control.

[0094] (Second Aspect)

In the second aspect, the configuration of the BWP and configuration information (BWP configuration information) will be described.

[0095] The maximum bandwidth of one or more BWPs (DL BWP and/or UL BWP) configured for a user terminal may be determined based on the category of the user terminal reported by the user terminal. For example, when the category reported by the user terminal supports 100 MHz, the

maximum bandwidth of at least one BWP configured for the user terminal may be 100 MHz.

[0096] The minimum bandwidth of the one or more BWPs configured for the user terminal may be the minimum bandwidth (for example, 5 MHz) supported by any category of user terminal.

[0097] When a BWP is not configured for the user terminal, the user terminal may monitor the entire carrier.

[0098] A BWP may also be associated with a particular numerology (for example, at least one of subcarrier spacing, symbol length, cyclic prefix (CP) length, number of symbols in a slot (or mini-slot), or the like). For example, as illustrated in FIG. 1B, when a plurality of BWPs are configured in the user terminal, identical and/or different numerologies may be used among the plurality of BWPs.

[0099] The BWP configuration information may include at least one of information indicating numerology (for example, subcarrier spacing), information indicating frequency position (for example, center frequency), information indicating bandwidth (for example, the number of resource blocks (also referred to as RB (Resource Block), PRB (Physical RB), or the like), information indicating time resource (for example, the number of symbols per slot (mini-slot)), information indicating the number of MIMO layers, information related to Quasi-Co-Location, or the like.

[0100] The user terminal may receive the BWP configuration information using higher layer signaling (for example, RRC signaling, broadcast information (master information block (MIB: Master Information Block), system information block (SIB: System Information Block), and the like), and/or MAC signaling).

[0101] Also, when a plurality of BWPs are configured in a user terminal and

different slot types (for example, the number of symbols and/or numerology, or the like) are applied between the plurality of BWPs, cross BWP scheduling in which scheduling of another BWP is performed in a specific BWP may not be supported. Conversely, when the same slot type is applied between the plurality of BWPs, the cross BWP scheduling may be applied.

[0102] (Third Aspect)

In a third aspect, one or more UL BWPs in a user terminal and control of activation or deactivation of the UL BWPs will be described.

[0103] The user terminal may be configured with only a single UL BWP, or may be configured with a plurality of UL BWPs.

[0104] Activation or deactivation of each UL BWP may be controlled based on explicit or implicit indication information regardless of activation or deactivation of one or more DL BWPs. For example, when a UL grant is detected by monitoring the CORESET of the DL BWP, the user terminal may activate the UL BWP. Activation or deactivation of the DL BWP may be controlled regardless of presence or absence of a UL grant.

[0105] Alternatively, activation or deactivation of each UL BWP may be controlled according to a pre-associated DL BWP. For example, when a DL BWP is activated, the UL BWP associated with the DL BWP may also be activated. Similarly, when a DL BWP is deactivated, the UL BWP associated with that DL BWP may also be deactivated.

[0106] FIG. 8 is a diagram illustrating one example of configuration of the UL BWP according to the third aspect. For FIG. 8, differences from FIG. 2 will be mainly described. In FIG. 8, DL BWPs #1 and #2 are configured as in FIG. 2, but this differs from FIG. 2 in that a single UL BWP is configured. Note that in FIG. 8, it is assumed that a single UL BWP is configured in the user terminal, but the configuration is not

limited to this.

[0107] For example, in FIG. 8, the user terminal monitors the CORESET configured in the activated DL BWP at a predetermined period. The user terminal activates the UL BWP based on the UL grant detected in the CORESET. The user terminal transmits the PUSCH scheduled in the UL BWP based on the UL grant.

[0108] As illustrated in FIG. 8, the UL BWP may have a bandwidth (PRB count) different from that of the DL BWPs #1 and #2. The UL BWP may be provided in at least a part of the DL BWPs #1 and #2.

[0109] Also, even when the UL BWP is deactivated, when the BWP used for the RACH transmission, the periodic CSI report, or the like is configured separately from the UL BWP, the RACH or the periodic CSI report may be performed without activating the UL BWP.

[0110] FIG. 9 is a diagram illustrating another example of configuration of the UL BWP according to the third aspect. For FIG. 9, differences from FIG. 8 will be mainly described. FIG. 9 is different from FIG. 8 in that a plurality of UL BWPs are configured in the user terminal.

[0111] As illustrated in FIG. 9, at least one of the plurality of UL BWPs may have the same bandwidth (same PRB) as at least one DL BWP. For example, in FIG. 9, UL BWP #1 is configured with the same bandwidth (the same PRB) as DL BWP #1. UL BWP #2 is composed of a portion of DL BWP #2.

[0112] As illustrated in FIG. 9, when a plurality of UL BWPs are configured in the user terminal, the index (BWP index) of the UL BWP in which the PUSCH is scheduled may be included in the UL grant. The user terminal may control activation of the UL BWP based on the BWP index included in the UL grant.

[0113] For example, in FIG. 9, the user terminal monitors the CORESET

configured in the activated DL BWP at a predetermined period. In FIG. 9, BWP index #2 is included in the UL grant detected in this CORESET, and thus the user terminal may deactivate UL BWP #1 and activate UL BWP #2. The user terminal may transmit the PUSCH scheduled in the UL BWP #2 based on the UL grant.

[0114] In FIG. 9, when the UL BWP #2 is activated, the UL BWP #1 is deactivated, but the present invention is not limited thereto. Even when the UL BWP #2 is activated, the UL BWP #1 may be maintained active.

[0115] <Use of Plurality of UL BWPs>

When a plurality of UL BWPs are configured in a user terminal, the same UL signal may be able to be transmitted between the plurality of UL BWPs, or different UL signals may be able to be transmitted. The UL signal is, for example, at least one of a UL data channel (for example, PUSCH), a UL control channel (for example, PUCCH), a reference signal (for example, SRS: Sounding Reference Signal and/or DMRS), and a random access channel (for example, PRACH: Physical Random Access Channel).

[0116] FIG. 10 is a diagram illustrating one example of transmission of a UL signal in each UL BWP according to the third aspect. In FIG. 10, it is assumed that UL BWP #1 and UL BWP #2 having a bandwidth wider than that of UL BWP #1 are configured in the user terminal.

[0117] As illustrated in FIG. 10, UL BWP #1 includes configuration information of the PRACH and/or the PUCCH. Conversely, in UL BWP #1, configuration information of at least one of the PUSCH, the SRS, and the DMRS may not be included or may be included. UL BWP #2 includes configuration information of at least one of the PUSCH, the SRS, and the DRMS. Conversely, in UL BWP #2, the configuration information of the PRACH and/or the PUCCH may not be included or

may be included.

[0118] In this way, the UL signals that are necessarily configured in each UL BWP may be different, and the UL signals that a user terminal can transmit in each UL BWP may be different. For example, in FIG. 10, the user terminal may control transmission of the PRACH and/or the PUCCH in UL BWP #1, and may control transmission of at least one of the PUSCH, SRS, and DMRS in UL BWP #2.

[0119] In FIG. 10, the UL signal that is always configured in each UL BWP can be made different, and thus when a plurality of UL BWPs are configured in the user terminal, it is possible to efficiently transmit the UL signal in each UL BWP.

[0120] <Activation/Deactivation Control>

The user terminal may control activation and/or deactivation of one or more UL BWPs configured in the user terminal based on the explicit or implicit indication information. The explicit indication information may be, for example, a DCI (UL grant) or a MAC CE including a resource allocation field set to a specific value (for example, 0).

[0121] The implicit indication information may be, for example, RAR, message 4, or the UL grant described in FIGS. 8 and 9. The RAR is transmitted from the wireless base station in response to the PRACH from the user terminal. Also, the message 4 is a collision resolution message that is transmitted from the wireless base station in response to a higher layer control message when the user terminal transmits the control message using the resources specified by the UL grant included in the RAR. The user terminal that received the message 4 transitions from an idle state to an RRC connected state.

[0122] Also, the user terminal may control deactivation of the UL BWP by using a timer (joint timer or UL timer). The control of deactivation of the

UL BWP using the timer is as described in FIG. 7 and the like.

- [0123] FIG. 11 is a diagram illustrating one example of activation/deactivation control of the UL BWP according to the third aspect. In FIG. 11, the user terminal may activate UL BWP #2 based on DCI (for example, a UL grant that allocates a PUSCH in UL BWP #2, or DCI for activation (for example, a UL grant in which the resource allocation field is set to a specific value)), MAC CE, RAR or message 4. In this case, the user terminal may deactivate UL BWP #1.
- [0124] Also, in FIG. 11, the user terminal may deactivate UL BWP #2 based on deactivation indication information (for example, MAC CE or DCI) or a timer. In this case, the user terminal may activate UL BWP #1.
- [0125] Note that although the active BWP is changed in FIG. 11, a single UL BWP (for example, UL BWP #1) may always be kept active.
- [0126] (Wireless Communication System)

A configuration of a wireless communication system according to the present embodiment will be described below. In this wireless communication system, the wireless communication method according to each of the above aspects is applied. The wireless communication methods according to the foregoing aspects may be applied alone or in combination.

- [0127] FIG. 12 is a diagram illustrating one example of a schematic configuration of a wireless communication system according to the present embodiment. In a wireless communication system 1, it is possible to apply carrier aggregation and/or dual connectivity in which a plurality of basic frequency blocks (component carriers) are integrated with a system bandwidth (for example, 20 MHz) of the LTE system as one unit. Note that the wireless communication system 1 may be referred to as SUPER 3G, LTE-A (LTE-Advanced), IMT-Advanced, 4G, 5G,

FRA (Future Radio Access), NR (New RAT), or the like.

[0128] The wireless communication system 1 illustrated in FIG. 12 includes a wireless base station 11 that forms a macro cell C1, and wireless base stations 12a to 12c that are disposed in the macro cell C1 and form a small cell C2 smaller than the macro cell C1. Also, a user terminal 20 is disposed in the macro cell C1 and each small cell C2. Different numerologies may be applied between cells. Note that the numerologies may be at least one of a subcarrier interval, a symbol length, a cyclic prefix (CP) length, the number of symbols per transmission time interval (TTI), and a time length of the TTI. Also, a slot may be a time unit based on the numerology that the user terminal applies. The number of symbols per slot may be determined according to the subcarrier spacing.

[0129] The user terminal 20 can be connected to both the wireless base station 11 and the wireless base station 12. It is assumed that the user terminal 20 uses a macro cell C1 and small cell C2 that use different frequencies at the same time by CA or DC. Also, the user terminal 20 can employ CA or DC using a plurality of cells (CCs) (for example, two or more CCs). Furthermore, a user terminal can use a licensed band cc and an unlicensed band CC as a plurality of cells.

[0130] Moreover, the user terminal 20 can perform communication by using time division duplex (TDD) or frequency division duplex (FDD) in each cell (carrier). A TDD cell and an FDD cell may be referred to as a TDD carrier (frame configuration second type), an FDD carrier (frame configuration first type), and the like, respectively.

[0131] In addition, in each cell (carrier), a slot (also referred to as a TTI, a normal TTI, a long TTI, a normal subframe, a long subframe, a subframe, or the like) having a relatively long time length (for example, 1 ms) and/or a slot (also referred to as a mini-slot, a short TTI, a short

subframe, or the like) having a relatively short time length may be applied. Also, two or more time slots may be applied in each cell.

[0132] Between the user terminal 20 and the wireless base station 11, communication can be performed using a carrier (referred to as an existing carrier, a legacy carrier, and the like) having a relatively low frequency band (for example, 2 GHz) and a narrow bandwidth. Conversely, between the user terminal 20 and the wireless base stations 12, carriers having a relatively high frequency band (for example, 3.5 GHz, 5 GHz, 30 to 70 GHz, or the like) and a wide bandwidth may be used, or the same carriers as those between the user terminal 20 and the wireless base station 11 may be used. Note that the configuration of the frequency band used by each wireless base station is not limited to this. Furthermore, the user terminal 20 may be configured with the following BWP. The BWP comprises at least a portion of the carrier.

[0133] Between the wireless base station 11 and the wireless base stations 12 (or between two wireless base stations 12), a wired connection (for example, an optical fiber compliant with CPRI (Common Public Radio Interface), a X2 interface, or the like) or a wireless connection may be established.

[0134] The wireless base station 11 and each wireless base station 12 are connected to a higher station device 30, and are connected to a core network 40 via a higher station device 30. Examples of the higher station device 30 include, but are not limited to, an access gateway device, a radio network controller (RNC), a mobility management entity (MME), and the like. Also, each wireless base station 12 may be connected to the higher station device 30 via the wireless base station 11.

[0135] Note that the wireless base station 11 is a wireless base station having a relatively wide coverage, and may be referred to as a macro base

station, an aggregation node, an eNB (eNodeB), a transmission/reception point, or the like. Also, the wireless base station 12 is a wireless base station having local coverage, and may be referred to as a small base station, a micro base station, a pico base station, a femto base station, an HeNB (Home eNodeB), an RRH (Remote Radio Head), a transmission/reception point, or the like. Hereinafter, when the wireless base stations 11 and 12 are not distinguished from each other, they are collectively referred to as a wireless base station 10.

[0136] Each user terminal 20 is a terminal that supports various communication schemes such as LTE and LTE-A, and may include not only a mobile communication terminal but also a fixed communication terminal. In addition, the user terminal 20 can perform inter-terminal communication (D2D) with other user terminals 20.

[0137] In the wireless communication system 1, as a radio access scheme, OFDMA (orthogonal frequency division multiple access) can be applied to a downlink (DL), and SC-FDMA (single carrier-frequency division multiple access) can be applied to an uplink (UL). OFDMA is a multicarrier transmission scheme in which a frequency band is divided into a plurality of narrow frequency bands (subcarriers), and data is mapped to each subcarrier to perform communication. SC-FDMA is a single-carrier transmission scheme that reduces interference between terminals by dividing a system bandwidth into bands composed of one or continuous resource blocks for each terminal and allowing a plurality of terminals to use different bands. Note that the uplink and downlink radio access schemes are not limited to these combinations, and OFDMA may be used in the UL. Also, SC-FDMA can be applied to a sidelink (SL) used for inter-terminal communication.

[0138] In the wireless communication system 1, DL channels used include a

DL data channel (PDSCH: Physical Downlink Shared Channel, also called a DL shared channel, etc.) shared by each user terminal 20, a broadcast channel (PBCH: Physical Broadcast Channel), an L1/L2 control channel, and the like. DL data (at least one of user data, higher layer control information, SIB (System Information Block), and the like) is transmitted on the PDSCH. Also, an MIB (Master Information Block) is transmitted by the PBCH.

[0139] The L1/L2 control channel includes a DL control channel (PDCCH (Physical Downlink Control Channel) and/or EPDCCH (Enhanced Physical Downlink Control Channel)), a PCFICH (Physical Control Format Indicator Channel), a PHICH (Physical Hybrid-ARQ Indicator Channel), or the like. Downlink control information (DCI) including scheduling information of the PDSCH and the PUSCH and the like are transmitted on the PDCCH. The number of OFDM symbols used for the PDCCH is transmitted by the PCFICH. The EPDCCH is frequency-division multiplexed with the PDSCH and used for transmission of DCI and the like in the same manner as the PDCCH. The PHICH can transmit delivery confirmation information for PUSCH (also called A/N, HARQ-ACK, HARQ-ACK bit, A/N codebook, or the like).

[0140] In the wireless communication system 1, as UL channels, a UL data channel (PUSCH: Physical Uplink Shared Channel, also called a UL shared channel, or the like) shared by each user terminal 20, a UL control channel (PUCCH: Physical Uplink Control Channel), a random access channel (PRACH: Physical Random Access Channel), and the like are used. UL data (user data and/or higher layer control information) is transmitted on the PUSCH. Uplink control information (UCI) including at least one of acknowledgement information (A/N, HARQ-ACK), channel state information (CSI), and the like of the PDSCH is

transmitted by the PUSCH or the PUCCH. A random access preamble for establishing connection with a cell can be transmitted on the PRACH.

[0141] <Wireless Base Station>

FIG. 13 is a diagram illustrating one example of an overall configuration of a wireless base station according to the present embodiment. The wireless base station 10 includes a plurality of transmitting and receiving antennas 101, an amplifier unit 102, a transmitting and receiving unit 103, a baseband signal processing unit 104, a call processing unit 105, and a transmission path interface 106. Note that one or more transmitting and receiving antennas 101, amplifier units 102, and transmitting and receiving units 103 may be included. The wireless base station 10 may constitute a “receiving device” in the UL and may constitute a “transmitting device” in the DL.

[0142] User data to be transmitted from the wireless base station 10 to the user terminal 20 on the downlink is input from the higher station device 30 to the baseband signal processing unit 104 via the transmission path interface 106.

[0143] In the baseband signal processing unit 104, with respect to the user data, transmission processing such as at least one of PDCP (Packet Data Convergence Protocol) layer processing, user data division/coupling, RLC (Radio Link Control) layer transmission processing such as RLC retransmission control, MAC (Medium Access Control) retransmission control (for example, HARQ (Hybrid Automatic Repeat reQuest) processing), scheduling, transmission format selection, channel coding, rate matching, scrambling, inverse fast Fourier transform (IFFT) processing, and precoding processing is performed, and the user data is transferred to the transmitting and receiving unit 103. Also, the downlink

control signal is subjected to transmission processing such as channel coding and/or inverse fast Fourier transform, and is forwarded to the transmitting and receiving unit 103.

[0144] The transmitting and receiving unit 103 converts the baseband signal precoded and output from the baseband signal processing unit 104 for each antenna into a radio frequency band and transmits the radio frequency band. The radio frequency signal frequency-converted by the transmitting and receiving unit 103 is amplified by the amplifier unit 102 and transmitted from the transmitting and receiving antenna 101.

[0145] Such may be composed of a transmitter/receiver, a transmitting and receiving circuit or transmitting and receiving device described based on common knowledge in the technical field to which the present invention pertains. The transmitting and receiving unit 103 may be configured as an integrated transmitting and receiving unit or may be configured by a transmission unit and a reception unit.

[0146] Conversely, for a UL signal, a radio frequency signal received by the transmitting and receiving antenna 101 is amplified by the amplifier unit 102. The transmitting and receiving unit 103 receives the UL signal amplified by the amplifier unit 102. The transmitting and receiving unit 103 frequency-converts the received signal into a baseband signal and outputs the baseband signal to the baseband signal processing unit 104.

[0147] The baseband signal processing unit 104 performs fast Fourier transform (FFT) processing, inverse discrete Fourier transform (IDFT) processing, error correction decoding, MAC retransmission control reception processing, and RLC layer and PDCP layer reception processing on the UL data included in the input UL signal, and transfers the result to the higher station device 30 via the transmission path interface 106. The call processing unit 105 performs at least one of call

processing such as configuration and releasing of a communication channel, state management of the wireless base station 10, and management of radio resources.

[0148] The transmission path interface 106 transmits and receives signals to and from the higher station device 30 via a predetermined interface. In addition, the transmission path interface 106 may transmit and receive signals (backhaul signaling) to and from the adjacent wireless base stations 10 via an inter-base station interface (for example, an optical fiber compliant with CPRI (Common Public Radio Interface) or an X2 interface).

[0149] Also, the transmitting and receiving unit 103 transmits a DL signal (for example, at least one of a DL control signal (also referred to as a DL control channel, DCI, or the like), a DL data signal (also referred to as a DL data channel, DL data, or the like), and a reference signal). In addition, the transmitting and receiving unit 103 receives a UL signal (for example, at least one of a UL control signal (also referred to as a UL control channel, UCI, or the like), a UL data signal (also referred to as a UL data channel, UL data, or the like), and a reference signal).

[0150] Furthermore, the transmitting and receiving unit 103 may transmit higher layer control information (for example, control information by MAC CE and/or RRC signaling).

[0151] FIG. 14 is a diagram illustrating one example of a functional configuration of the wireless base station according to the present embodiment. Note that FIG. 14 mainly illustrates functional blocks of characteristic portions in this embodiment, and it is assumed that the wireless base station 10 also has other functional blocks necessary for wireless communication. As illustrated in FIG. 14, the baseband signal processing unit 104 includes a control unit 301, a transmission signal

generation unit 302, a mapping unit 303, a received signal processing unit 304, and a measurement unit 305.

[0152] The control unit 301 performs control of the entire wireless base station 10. The control unit 301 controls, for example, at least one of DL signal generation by the transmission signal generation unit 302, DL signal mapping by the mapping unit 303, UL signal reception processing (for example, demodulation and the like) by the received signal processing unit 304, and measurement by the measurement unit 305. Also, the control unit 301 may control scheduling of data channels (including DL data channels and/or UL data channels).

[0153] The control unit 301 may control the transmission direction for each symbol in a time unit (for example, a slot) serving as a scheduling unit of the DL data channel. Specifically, the control unit 301 may control generation and/or transmission of slot format-related information (SFI) indicating a DL symbol and/or a UL symbol in a slot.

[0154] Also, the control unit 301 may control the configuration of one or more BWPs (one or more DL BWPs and/or one or more UL BWPs) for the user terminal 20. Specifically, the control unit 301 may control generation and/or transmission of the BWP configuration information (second aspect).

[0155] Also, the control unit 301 may control activation or deactivation of one or more BWPs (one or more DL BWPs and/or one or more UL BWPs) (frequency bands for DL and/or frequency bands for UL in a carrier) configured in the user terminal 20. Specifically, the control unit 301 may control generation and/or transmission of explicit or implicit indication information of the one or more BWPs (first and third aspects).

[0156] Also, the control unit 301 may control the configuration of one or more CORESET (control resource domain) in one or more DL BWPs. In

addition, the control unit 301 may control configuration of a search space in one or more CORESET.

[0157] The control unit 301 may be composed of a controller, a control circuit, or a control device described based on common understanding in the technical field to which the present invention pertains.

[0158] The transmission signal generation unit 302 may generate a DL signal (including at least one of DL data (channel), DCI, a DL reference signal, and control information by higher layer signaling) based on an indication from the control unit 301, and output the DL signal to the mapping unit 303.

[0159] The transmission signal generation unit 302 may be a signal generator, a signal generation circuit, or a signal generation device described based on common understanding in the technical field to which the present invention pertains.

[016] Based on an indication from the control unit 301, the mapping unit 303 maps the DL signal generated by the transmission signal generation unit 302 to a predetermined radio resource and outputs it to the transmitting and receiving unit 103. For example, the mapping unit 303 maps the reference signal to a predetermined radio resource using the arrangement pattern determined by the control unit 301.

[0161] The mapping unit 303 may be a mapper, a mapping circuit, or a mapping device described based on common knowledge in the technical field to which the present invention pertains.

[0162] The received signal processing unit 304 performs reception processing (for example, at least one of demapping, demodulation, and decoding) of UL signals transmitted from the user terminal 20. Specifically, the received signal processing unit 304 may output the received signal and/or the signal after the reception processing to the measurement unit

305.

[0163] The received signal processing unit 304 can be configured by a signal processor, a signal processing circuit, or a signal processing device described based on common understanding in the technical field to which the present invention pertains. Furthermore, the received signal processing unit 304 may constitute a reception unit according to the present invention.

[0164] The measurement unit 305 may measure the UL channel quality based on, for example, the received power (for example, RSRP (Reference Signal Received Power)) and/or the received quality (for example, RSRQ (Reference Signal Received Quality)) of the reference signal. The measurement result may be output to the control unit 301.

[0165] <User Terminal>

FIG. 15 is a diagram illustrating one example of an overall configuration of the user terminal according to the present embodiment. The user terminal 20 has a plurality of transmitting and receiving antennas 201 for MIMO transmission, amplifier units 202, transmitting and receiving units 203, a baseband signal processing unit 204, and an application unit 205. The user terminal 20 may constitute a “transmitting device” in UL and constitute a “receiving device” in DL.

[0166] Radio frequency signals received by the plurality of transmitting and receiving antennas 201 are amplified by the amplifier units 202, respectively. Each transmitting and receiving unit 203 receives the DL signal amplified by the amplifier unit 202. The transmitting and receiving unit 203 frequency-converts the received signal into a baseband signal and outputs the baseband signal to the baseband signal processing unit 204.

[0167] The baseband signal processing unit 204 performs at least one of FFT

processing, error correction decoding, reception processing of retransmission control, and the like on the input baseband signal. The DL data is transferred to the application unit 205. The application unit 205 performs processing related to layers higher than the physical layer and the MAC layer.

[0168] Conversely, UL data is input from the application unit 205 to the baseband signal processing unit 204. In the baseband signal processing unit 204, at least one of retransmission control processing (for example, HARQ processing), channel coding, rate matching, puncturing, discrete Fourier transform (DFT) processing, IFFT processing and the like is performed, and the result is forwarded to each transmitting and receiving unit 203. UCI (for example, at least one of an A/N of a DL signal, channel state information (CSI), a scheduling request (SR), and the like) is also subjected to at least one of channel coding, rate matching, puncturing, DFT processing, IFFT processing, and the like, and transferred to each transmitting and receiving unit 203.

[0169] The transmitting and receiving unit 203 converts the baseband signal output from the baseband signal processing unit 204 into a radio frequency band and transmits the radio frequency band. The radio frequency signal frequency-converted by the transmitting and receiving unit 203 is amplified by the amplifier unit 202 and transmitted from the transmitting and receiving antenna 201.

[0170] Also, the transmitting and receiving unit 203 receives a DL signal (for example, at least one of a DL control signal (also referred to as a DL control channel, DCI, or the like), a DL data signal (also referred to as a DL data channel, DL data, or the like), and a reference signal. Furthermore, the transmitting and receiving unit 203 transmits a UL signal (for example, at least one of a UL control signal (also referred to

as a UL control channel, UCI, or the like), a UL data signal (also referred to as a UL data channel, UL data, or the like), and a reference signal.

[0171] Also, the transmitting and receiving unit 203 may receive higher layer control information (for example, control information by MAC CE and/or RRC signaling).

[0172] The transmitting and receiving unit 203 may be a transmitter/receiver, a transceiver circuit, or a transceiver device described based on common understanding in the technical field to which the present invention pertains. The transmitting and receiving unit 203 may be configured as an integrated transmitting and receiving unit, or may be configured by a transmission unit and a reception unit.

[0173] FIG. 16 is a diagram illustrating one example of a functional configuration of the user terminal according to the present embodiment. Note that in FIG. 16, functional blocks of characteristic portions in the present embodiment are mainly illustrated, and it is assumed that the user terminal 20 also has other functional blocks necessary for wireless communication. As illustrated in FIG. 16, the baseband signal processing unit 204 provided in the user terminal 20 includes a control unit 401, a transmission signal generation unit 402, a mapping unit 403, a received signal processing unit 404, and a measurement unit 405.

[0174] The control unit 301 performs control of the entire user terminal 20. The control unit 401 controls, for example, at least one of UL signal generation by the transmission signal generation unit 402, UL signal mapping by the mapping unit 403, DL signal reception processing by the received signal processing unit 404, and measurement by the measurement unit 405.

[0175] In addition, the control unit 401 may control configuration of one or more BWPs (one or more DL BWPs and/or one or more UL BWPs) in a

carrier. Specifically, the control unit 401 may set the one or more BWPs based on BWP configuration information from the wireless base station 20 (second aspect).

[0176] Also, the control unit 401 may control the configuration of one or more CORESET (control resource domain) in one or more DL BWPs. In addition, the control unit 401 may control configuration of a search space in one or more CORESET.

[0177] Furthermore, the control unit 401 may control monitoring (blind decoding) of the CORESET (or the search space within the CORESET) (control resource domain) and detection of DCI for the user terminal 20 (at least one of DL assignment, UL grant, group DCI, common DCI, activation DCI, and deactivation DCI).

[0178] Moreover, the control unit 401 may control the transmission direction for each symbol in a time unit (for example, slot) serving as a scheduling unit of the DL data channel. Specifically, the control unit 401 may determine the DL symbol and/or the UL symbol in the slot based on the SFI.

[0179] Also, the control unit 401 may control activation or deactivation of one or more BWPs (one or more DL BWPs and/or one or more UL BWPs) (DL frequency bands and/or UL frequency bands in a carrier) configured in the user terminal 20 (first and third aspects).

[0180] Specifically, the control unit 401 may control activation of DL BWP #2 (second frequency band for DL) based on DCI (DL assignment for scheduling PDSCH of DL BWP #2) detected in CORESET of DL BWP #1 (first frequency band for DL) (first aspect). Also, the control unit 401 may control reception of the PDSCH (DL data channel) based on the DCI in DL BWP #2 activated based on the DCI (first and second activation controls).

- [0181] In addition, the control unit 401 may monitor the control resource domain set in the DL BWP #2 activated based on the DCI (the DCI indicating the activation of the DL BWP #2) detected in the MAC CE or the CORESET of the DL BWP #1, and control the reception of another DCI used for the scheduling of the DL data channel in the DL BWP #2 (third activation control).
- [0182] Furthermore, the control unit 401 may control deactivation of DL BWP #2 (second frequency band for DL) based on DCI, a MAC control element, or a predetermined timer (first aspect).
- [0183] Moreover, the control unit 401 may control the transmission of the UL signal in the UL BWP (frequency band for UL) based on the DCI detected in the CORESET (control resource domain) of the DL BWP (frequency band for DL) (third aspect).
- [0184] Additionally, the control unit 401 may control activation or deactivation of one or more UL BWPs (frequency bands for UL). At least one UL BWP may be configured in the same frequency band as at least one DL BWP (frequency band for DL) (third aspect).
- [0185] Also, the control unit 401 may control transmission of a random access channel and/or a UL control channel in UL BWP #1 (first frequency band for UL), and may control transmission of at least one of a UL data channel, a sounding reference signal, and a demodulation reference signal in UL BWP #2 (second frequency band for UL) (third aspect).
- [0186] Furthermore, the control unit 401 may control activation of a UL BWP (frequency band for DL) based on any one of DCI, a MAC (Medium Access Control) control element, a random access response, and a message for collision resolution, or a DL BWP (frequency band for DL) associated with the UL BWP (frequency band for UL) (third

aspect).

[0187] Moreover, the control unit 401 may control deactivation of the UL BWP (frequency band for UL) based on the DCI or the MAC control element, or a predetermined timer.

[0188] The control unit 401 can be composed of a controller, a control circuit, or a control device described based on common understanding in the technical field to which the present invention pertains.

[0189] Based on an indication from the control unit 401, the transmission signal generation unit 402 generates (for example, encodes, rate matches, punctures, modulates, and the like) retransmission control information for UL signals and DL signals, and outputs to the mapping unit 403. The transmission signal generation unit 402 may be a signal generator, a signal generation circuit, or a signal generation device described based on common understanding in the technical field to which the present invention pertains.

[0190] The mapping unit 403 maps the retransmission control information of the UL signal and the DL signal generated in the transmission signal generation unit 402 to a radio resource based on an indication from the control unit 401, and outputs the result to the transmitting and receiving unit 203. For example, the mapping unit 403 maps the reference signal to a predetermined radio resource using the arrangement pattern determined by the control unit 401.

[0191] The mapping unit 403 may be a mapper, a mapping circuit, or a mapping device described based on common knowledge in the technical field to which the present invention pertains.

[0192] The received signal processing unit 404 performs reception processing (for example, at least one of demapping, demodulation, and decoding) on the DL signal. For example, the received signal processing unit 404 may

demodulate the DL data channel by using the reference signal of the arrangement pattern determined by the control unit 401.

[0193] In addition, the received signal processing unit 404 may output the received signal and/or the signal after the reception processing to the control unit 401 and/or the measurement unit 405. The received signal processor 404 outputs, for example, higher layer control information by higher layer signaling, L1/L2 control information (for example, UL grant and/or DL assignment), and the like to the control unit 401.

[0194] The received signal processing unit 404 can be configured by a signal processor, a signal processing circuit, or a signal processing device described based on common understanding in the technical field to which the present invention pertains. Furthermore, the received signal processing unit 404 may constitute a reception unit according to the present invention.

[0195] The measurement unit 405 measures the channel state based on a reference signal (for example, CSI-RS) from the wireless base station 10, and outputs the measurement result to the control unit 401. Note that the measurement of the channel state may be performed for each CC.

[0196] The measurement unit 405 may be composed of a signal processor, a signal processing circuit, or a signal processing device, and a measurement instrument, a measurement circuit, or a measurement device described based on common understanding in the technical field to which the present invention pertains.

[0197] <Hardware Configuration>

Note that the block diagrams used in the description of the foregoing embodiments illustrate blocks of functional units. These functional blocks (configuration units) are realized by any combination of hardware and/or software. Furthermore, the means for realizing each functional

block are not particularly limited. That is, each functional block may be realized by one physically and/or logically coupled device, or may be realized by a plurality of devices obtained by directly and/or indirectly (for example, by wire and/or wirelessly) coupling two or more physically and/or logically separated devices.

[0198] For example, the wireless base station, the user terminal, and the like in the present embodiment may function as a computer that performs the processing of the wireless communication method of the present invention. FIG. 17 is a diagram illustrating one example of a hardware configuration of a wireless base station and a user terminal according to the present embodiment. The wireless base station 10 and the user terminal 20 described above may be physically configured as a computer device including a processor 1001, a memory 1002, a storage 1003, a communication device 1004, an input device 1005, an output device 1006, a bus 1007, and the like.

[0199] In the following description, the term “device” can be read as a circuit, a device, a unit, or the like. The hardware configurations of the wireless base station 10 and the user terminal 20 may be configured to include one or more of the devices illustrated in the figure, or may be configured not to include some of the devices.

[0200] For example, although only one processor 1001 is shown, there may be multiple processors. Also, the operations may be performed by one processor, or the operations may be performed simultaneously, sequentially, or in other manners by one or more processors. The processor 1001 may be implemented by one or more chips.

[0201] Each function in the wireless base station 10 and the user terminal 20 is realized by, for example, causing predetermined software (program) to be read on hardware such as the processor 1001 and a memory 1002,

causing the processor 1001 to perform calculation, and controlling at least one of communication by a communication device 1004, and reading and writing of data in the memory 1002 and a storage 1003.

[0202] For example, the processor 1001 operates an operating system to control the entire computer. The processor 1001 may be configured as a central processing unit (CPU: central processing unit) including an interface with peripheral devices, a control device, an arithmetic device, a register, and the like. For example, the baseband signal processing unit 104 (204), the call processing unit 105, and the like described above may be implemented by the processor 1001.

[0203] In addition, the processor 1001 reads a program (program code), a software module, data, or the like from the storage 1003 and/or the communication device 1004 to the memory 1002, and executes various types of processing in accordance with the program, the software module, the data, or the like. A program that causes a computer to execute at least a part of the operation described in the foregoing embodiment is used as the program. For example, the control unit 401 of the user terminal 20 may be realized by a control program that is stored in the memory 1002 and operates in the processor 1001, and other functional blocks may be similarly realized.

[0204] The memory 1002 is a computer-readable recording medium and may include, for example, at least one of a ROM (Read Only Memory), an EPROM (Erasable Programmable ROM), an EEPROM (Electrically EPROM), a RAM (Random Access Memory), and other appropriate storage media. The memory 1002 may be referred to as a register, a cache, a main memory (main storage device), or the like. The memory 1002 may store a program (program code), a software module, and the like that are executable to implement a wireless communication method

according to an embodiment of the present invention.

[0205] The storage 1003 is a computer-readable storage medium and may be composed of, for example, at least one of a flexible disc, a Floppy® disc, a magneto-optical disc (for example, a compact disc (CD-ROM (Compact Disc ROM)), a digital versatile disc, or a Blu-ray® disc), a removable disc, a hard disc drive, a smart card, a flash memory device (for example, a card, a stick, or a key drive), a magnetic stripe, a database, a server, or any other suitable storage medium. The storage 1003 may be referred to as an auxiliary storage device.

[0206] The communication device 1004 is hardware (transmitting and receiving device) for performing communication between computers via a wired and/or wireless network, and is also referred to as a network device, a network controller, a network card, a communication module, or the like, for example. The communication device 1004 may be configured to include a high-frequency switch, a duplexer, a filter, a frequency synthesizer, and the like in order to realize, for example, frequency division duplex (FDD: Frequency Division Duplex) and/or time division duplex (TDD: Time Division Duplex). For example, the transmitting and receiving antenna 101 (201), the amplifier unit 102 (202), the transmitting and receiving unit 103 (203), the transmission path interface 106, and the like described above may be realized by the communication device 1004.

[0207] The input device 1005 is an input device (for example, a keyboard, a mouse, a microphone, a switch, a button, a sensor, or the like) that receives input from the outside. The output device 1006 is an output device (for example, a display, a speaker, an LED (Light Emitting Diode) lamp, or the like) that performs output to the outside. The input device 1005 and the output device 1006 may be integrated with each

other (for example, a touch panel).

[0208] The devices illustrated in FIG. 17 are connected by a bus 1007 for communicating information. The bus 1007 may be composed of a single bus or may be composed of different buses between devices.

[0209] Also, the wireless base station 10 and the user terminal 20 may be configured to include hardware such as a microprocessor, a digital signal processor (DSP: Digital Signal Processor), an ASIC (Application Specific Integrated Circuit), a PLD (Programmable Logic Device), or an FPGA (Field Programmable Gate Array), and some or all of the functional blocks may be realized by this hardware. For example, the processor 1001 may be implemented by at least one of these pieces of hardware.

[0210] (Modifications)

The terms described in the present specification and/or the terms necessary for understanding the present specification may be replaced with terms having the same or similar meanings. For example, a channel and/or a symbol may be a signal (signaling). The signal may also be a message. The reference signal may be referred to as a reference signal (RS), and may also be referred to as a pilot or a pilot signal according to an applied standard. Also, a component carrier (CC) may be referred to as a cell, a frequency carrier, a carrier frequency, or the like.

[0211] Furthermore, the radio frame may include one or more periods (frames) in the time domain. The one or more periods (frames) constituting the radio frame may be referred to as a subframe. In addition, a subframe may consist of one or more slots in the time domain. A subframe may be a fixed length of time (for example, 1ms) that is not numerology dependent.

[0212] A slot may be composed of one or more symbols (such as an

Orthogonal Frequency Division Multiplexing (OFDM) symbol or a Single Carrier Frequency Division Multiple Access (SC-FDMA) symbol) in the time domain. Also, a slot may be a time unit based on numerology. The slot may also include a plurality of mini-slots. Each mini-slot may consist of one or more symbols in the time domain.

[0213] Each of a radio frame, a subframe, a slot, a mini-slot, and a symbol represents a time unit for transmitting a signal. Respectively different names may be used for the radio frame, the subframe, the slot, the mini-slot, and the symbol. For example, one subframe may be referred to as a transmission time interval (TTI: transmission time interval), a plurality of consecutive subframes may be referred to as a TTI, or one slot or one mini-slot may be referred to as a TTI. That is, the subframe and/or the TTI may be a subframe (1 ms) in the existing LTE, may be a period shorter than 1 ms (for example, 1 to 13 symbols), or may be a period longer than 1 ms.

[0214] Here, TTI refers to, for example, a minimum time unit of scheduling in wireless communication. For example, in the LTE system, a wireless base station performs scheduling to allocate radio resources (such as frequency bandwidth and/or transmission power that may be used in each user terminal) to each user terminal in TTI units. Note that the definition of TTI is not limited to this. The TTI may be a transmission time unit of a channel-coded data packet (transport block) or may be a processing unit of scheduling and/or link adaptation or the like. Note that when one slot or one mini-slot is referred to as the TTI, one or more TTIs (that is, one or more slots or one or more mini-slots) may be a minimum time unit for scheduling. Furthermore, the number of slots (number of mini-slots) configuring the minimum time unit of the scheduling may be controlled.

- [0215] A TTI having a time length of 1 ms may also be referred to as an ordinary TTI (TTI in LTE Rel. 8-12), a normal TTI, a long TTI, an ordinary subframe, a normal subframe, a long subframe, or the like. A TTI shorter than the ordinary TTI may be referred to as a shortened TTI, a short TTI, a partial TTI (partial or fractional TTI), a shortened subframe, a short subframe, or the like.
- [0216] A resource block (RB: resource block) is a resource allocation unit in the time domain and the frequency domain, and may include one or a plurality of consecutive subcarrier waves (subcarrier (subcarrier)) in the frequency domain. Furthermore, the RB may include one or a plurality of symbols in the time domain, and may have a length of one slot, one mini-slot, one subframe, or one TTI. One TTI and one subframe may respectively be configured by one or a plurality of resource blocks. Note that the RB may be referred to as a physical resource block (PRB: physical RB), a PRB pair, an RB pair, or the like.
- [0217] Furthermore, the resource block may be configured by one or a plurality of resource elements (RE: resource element). For example, one RE may be a radio resource domain of one subcarrier and one symbol.
- [0218] Note that the above-described structures of the radio frame, the subframe, the slot, the mini-slot, and the symbol are merely examples. For example, configurations such as a number of subframes included in a radio frame, a number of slots per subframe or radio frame, a number of mini-slots included in a slot, a number of symbols included in a slot or mini-slot, a number of subcarriers included in an RB, a number of symbols in a TTI, a symbol length, a cyclic prefix (CP: cyclic prefix) length, and the like may be changed in various ways.
- [0219] Furthermore, the information, parameters, and the like described in the present specification may be represented by an absolute value, may be

represented by a relative value from a predetermined value, or may be represented by other corresponding information. For example, the radio resources may be indicated by a predetermined index. Moreover, equations and the like using these parameters may be different from those explicitly disclosed in the present specification.

- [0220] The names used for parameters and the like in the present specification are not limiting in any respect. For example, various channels (PUCCH (physical uplink control channel), PDCCH (physical downlink control channel), and the like) and information elements may be identified by any suitable name, and the various names assigned to these various channels and information elements are not limiting in any respect.
- [0221] Information, signals, and the like described in the present specification may be represented using any of a variety of different technologies. For example, data, instructions, commands, information, signals, bits, symbols, chips, and the like that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.
- [0222] Furthermore, information, signals, and the like may be output from a higher layer to a lower layer and/or from a lower layer to a higher layer. Information, signals, and the like may be input and output via a plurality of network nodes.
- [0223] Input and output information, signals, and the like may be stored in a specific location (for example, a memory) or may be managed by a management table. Input and output information, signals, and the like may be overwritten, updated, or appended. Output information, signals, and the like may be deleted. Input information, signals, and the like may

be transmitted to another device.

- [0224] Notification of information is not limited to the aspects/embodiments described in the present specification and may be performed by another method. For example, notification of information may be implemented by physical layer signaling (for example, downlink control information (DCI: downlink control information) or uplink control information (UCI: uplink control information)), higher layer signaling (for example, RRC (radio resource control) signaling, broadcast information (master information block (MIB: master information block), system information block (SIB: system information block), and the like), MAC (medium access control) signaling), other signals, or a combination thereof.
- [0225] Note that physical layer signaling may be referred to as L1/L2 (layer 1/layer 2) control information (L1/L2 control signal), L1 control information (L1 control signal), or the like. Furthermore, RRC signaling may be referred to as an RRC message, and may be, for example, an RRC connection setup (RRC connection setup) message, an RRC connection reconfiguration (RRC connection reconfiguration) message, or the like. Furthermore, MAC signaling may be notified by, for example, a MAC control element (MAC CE (control element)).
- [0226] Furthermore, notification of predetermined information (for example, notification of “being X”) is not limited to being performed explicitly, and may be performed implicitly (for example, by not performing notification of the predetermined information or by notification of other information).
- [0227] The determination may be performed by a value (0 or 1) represented by one bit, may be performed by a boolean value (boolean) represented by true (true) or false (false), or may be performed by comparison of a numerical value (for example, comparison to a predetermined value).

- [0228] Software should be broadly interpreted to mean instructions, instruction sets, code, code segments, program codes, programs, subprograms, software modules, applications, software applications, software packages, routines, subroutines, objects, executable files, executable threads, procedures, functions, and the like, whether referred to as software, firmware, middleware, microcode, hardware description language, or any other name.
- [0229] Furthermore, software, instructions, information, and the like may be transmitted and received via a transmission medium. For example, when software is transmitted from a website, a server, or other remote source using wired technologies (coaxial cable, optical fiber cable, twisted pair, digital subscriber line (DSL: digital subscriber line), or the like) and/or wireless technologies (infrared, microwave, or the like), these wired technologies and/or wireless technologies are included in the definition of transmission medium.
- [0230] The terms “system” and “network” used in the present specification are used interchangeably.
- [0231] In the present specification, the terms “base station (BS: base station),” “wireless base station,” “eNB,” “gNB,” “cell,” “sector,” “cell group,” “carrier,” and “component carrier” are used interchangeably. The base station may also be referred to using the term (fixed station), NodeB, eNodeB (eNB), access point (access point), transmit point, receive point, femto cell, small cell, or the like.
- [0232] The base station may accommodate one or a plurality (for example, three) cells (also referred to as sectors). When the base station accommodates a plurality of cells, the entire power coverage area of the base station may be divided into a plurality of smaller areas, and each smaller area may also provide communication services by a base station

subsystem (for example, a small base station for indoor use (RRH: remote radio head). The term “cell” or “sector” refers to a portion or all of a coverage area of a base station and/or base station subsystem that performs communication services in this coverage.

- [0233] In the present specification, the terms “mobile station (MS: mobile station),” “user terminal (user terminal),” “user equipment (UE: user equipment),” and “terminal” may be used interchangeably. The base station may also be referred to using the term (fixed station), NodeB, eNodeB (eNB), access point (access point), transmit point, receive point, femto cell, small cell, or the like.
- [0234] The mobile station may be referred to by a person skilled in the art as a subscriber station, mobile unit, subscriber unit, wireless unit, remote unit, mobile device, wireless device, wireless communication device, remote device, mobile subscriber station, access terminal, mobile terminal, wireless terminal, remote terminal, handset, user agent, mobile client, client or some other appropriate term.
- [0235] Furthermore, wireless base station in the present specification may be read as user terminal. For example, each aspect/embodiment of the present invention may be applied to a configuration in which communication between a wireless base station and a user terminal is replaced with communication between a plurality of user terminals (D2D: device-to-device). In this case, functions had by the wireless base station 10 above may be made a configuration had by the user terminal 20. Furthermore, “up” and/or “down” may be read as “side.” For example, up channel may be read as side channel.
- [0236] Similarly, user terminal in the present specification may be read as wireless base station. In this case, functions had by the user terminal 20 above may be made a configuration had by the wireless base station 10.

- [0237] In the present specification, a specific operation described as being performed by a base station may be performed by an upper node (upper node) of the base station in some cases. In a network consisting of one or a plurality of network nodes (network nodes) having a base station, it is apparent that various operations performed for communication with a terminal may be performed by the base station, one or more network nodes other than the base station (for example, conceivably but not limited to, an MME (mobility management entity), S-GW (serving-gateway), or the like), or a combination thereof.
- [0238] Each aspect/embodiment described in the present specification may be used alone, may be used in combination, or may be switched and used in accordance with execution. Furthermore, the order of processing procedures, sequences, flowcharts, and the like of each aspect/embodiment described in the present specification may be switched as long as there is no contradiction. For example, the methods described in the present specification present elements of various steps in an example order and are not limited to the particular order presented.
- [0239] The aspects/embodiments described in the present specification may be applied to a system using LTE (long term evolution), LTE-A (LTE-advanced), LTE-B (LTE-beyond), SUPER 3G, IMT-Advanced, 4G (4th generation mobile communication system), 5G (5th generation mobile communication system), FRA (future radio access), New-RAT (radio access technology), NR (new radio), NX (new radio access), FX (future generation radio access), GSM® (Global System for Mobile Communications), CDMA2000, UMB (ultra mobile broadband), IEEE 802.11 (Wi-Fi®), IEEE 802.16 (WiMAX®), IEEE 802.20, UWB (ultra-wideband), Bluetooth®, and other suitable wireless communication methods, and/or an expanded next generation system based on these.

- [0240] Descriptions of “based on” used in the present specification do not mean “based only on” unless otherwise specified. In other words, a description of “based on” means both “based only on” and “based on at least.”
- [0241] Any reference to an element using a designation such as “first,” or “second,” used in the present specification does not generally limit the quantity or order of those elements. These designations may be used in the present specification as a convenient method of distinguishing between two or more elements. Thus, a reference to a first and second element does not mean that only two elements may be employed or that the first element must precede the second element in some manner.
- [0242] The term “determining (determining) (determining)” used in the present specification may encompass a wide variety of operations. For example, “determining (determining)” may be regarded as “determining (determining)” a calculation (calculating), computation (computing), process (processing), derivation (deriving), investigation (investigating), look up (looking up) (for example, looking up in a table, a database, or another data structure), ascertaining (ascertaining), or the like. Furthermore, “determining (determining)” may be regarded as “determining (determining)” a reception (receiving) (for example, receiving information), transmission (transmitting) (for example, transmitting information), input (input), output (output), access (accessing) (for example, accessing data in a memory), or the like. Furthermore, “determining (determining)” may be regarded as “determining (determining)” a resolution (resolving), selection (selecting), choice (choosing), establishment (establishing), comparison (comparing) or the like. That is, “determining (determining)” may be regarded as “determining (determining)” any operation.

[0243] The terms “connected (connected)” and “coupled (coupled)” or any form of these used in the present specification means any direct or indirect connection or coupling between two or more elements and may include the presence of one or more intermediate elements in between two or more “connected” or “coupled” elements. The coupling or connection between elements may be physical, logical, or a combination thereof. As used in the present specification, two elements may be considered to be “connected” or “coupled” to each other by using one or more wires, cables, and/or printed electrical connections, and, as some non-limiting and non-comprehensive examples, by using electromagnetic energy such as electromagnetic energy having wavelengths in the radio frequency domain, microwave domain, and light (both visible and invisible) domain.

[0244] When “including (including),” “comprising (comprising),” and variations of these are used in the present specification or scope of claims, these terms are intended to be comprehensive, as with the term “provided with.” Moreover, the term “or (or)” used in the present specification or scope of claims is not intended to be an exclusive or.

[0245] While the present invention has been described in detail above, it will be apparent to a person skilled in the art that the present invention is not limited to the embodiments described in the present specification. The present invention may be implemented as modified and changed aspects without departing from the spirit and scope of the present invention defined by the statements of the scope of claims. Accordingly, the description of the present specification is for illustrative purposes only and is not meant to limit the present invention in any way.

Scope of Claims

- [Claim 1] A user terminal comprising: a receiving unit for monitoring a control resource domain of a frequency band for downlink (DL) in a carrier and receiving downlink control information (DCI); and
- a control unit for controlling transmission of an uplink (UL) signal in a frequency band for UL in the carrier based on the DCI, wherein the control unit controls activation or deactivation of the frequency band for UL.
- [Claim 2] The user terminal according to claim 1, wherein the frequency band for UL is set to the same frequency band as at least one frequency band for DL in the carrier.
- [Claim 3] The user terminal according to claim 1 or claim 2, wherein the frequency band for UL comprises a first and second frequency band for UL and
- the control unit controls transmission of a random access channel and/or UL control channel in the first frequency band for UL and controls transmission of at least one of a UL data channel, sounding reference signal, and reference signal for demodulation in the second frequency band for UL.
- [Claim 4] The user terminal according to any one of claims 1 to 3, wherein the control unit controls activation of the frequency band for UL based on any one of the DCI, a MAC (medium access control) control element, a random access response, and a message for collision resolution received by the receiving unit, or on a frequency band for DL associated with the frequency band for UL.
- [Claim 5] The user terminal according to any one of claims 1 to 4, wherein the control unit controls deactivation of the frequency band for UL based on the DCI or MAC control element received by the receiving unit, or

on a predetermined timer.

- [Claim 6] A wireless communication method comprising, in a user terminal:
- a step for monitoring a control resource domain of a frequency band for downlink (DL) in a carrier and receiving downlink control information (DCI);
 - a step for controlling transmission of an uplink (UL) signal in a frequency band for UL in the carrier based on the DCI; and
 - a step for controlling activation or deactivation of the frequency band for UL.

[FIG. 1]

FIG. 1A

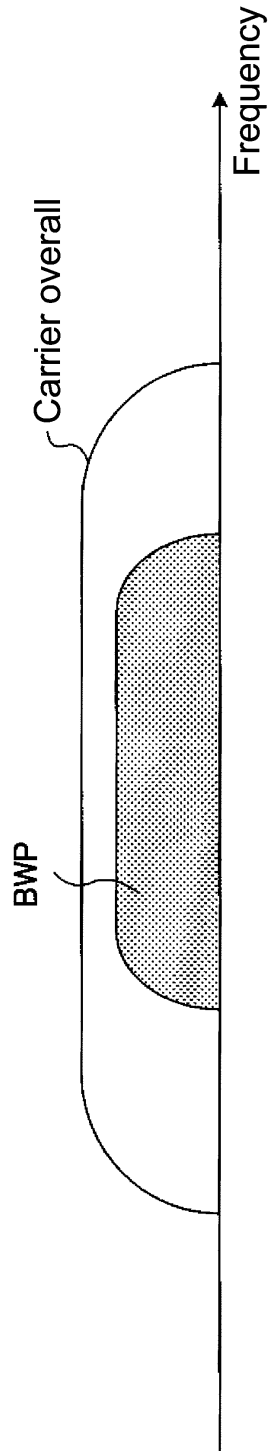
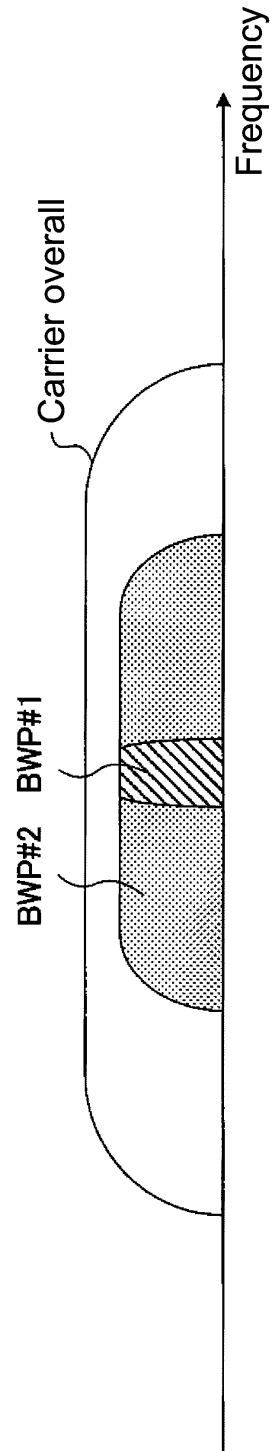
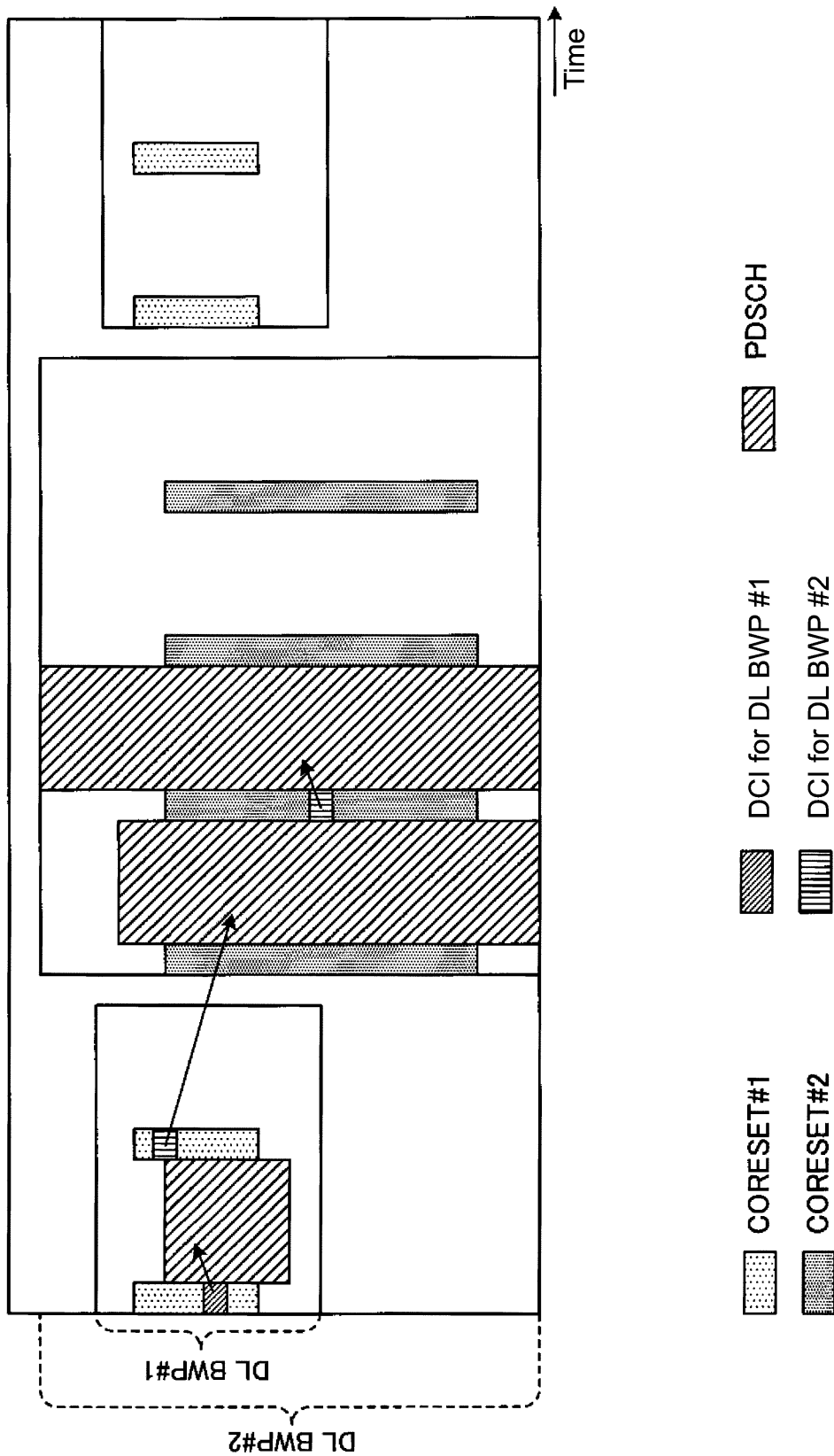


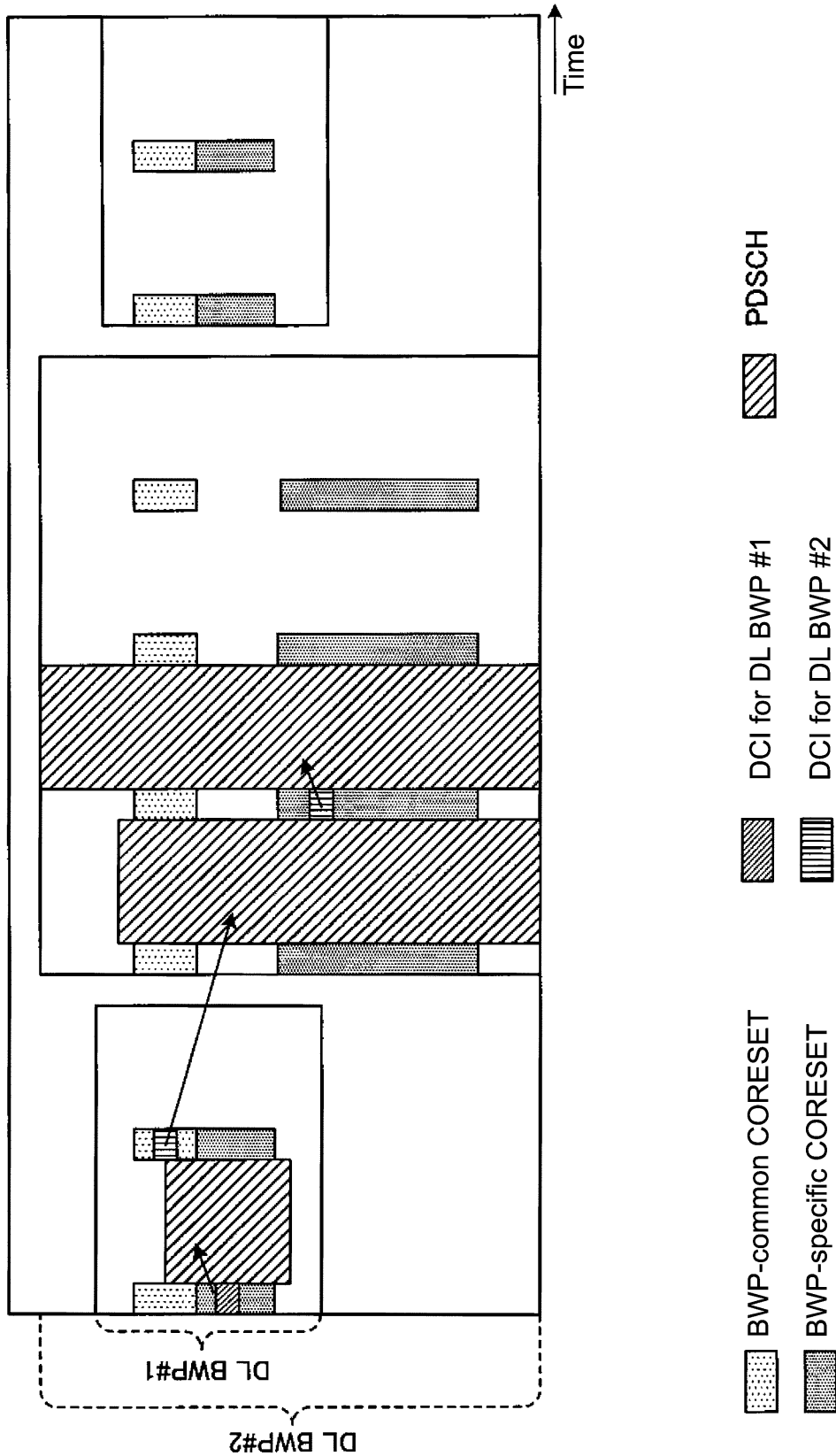
FIG. 1B



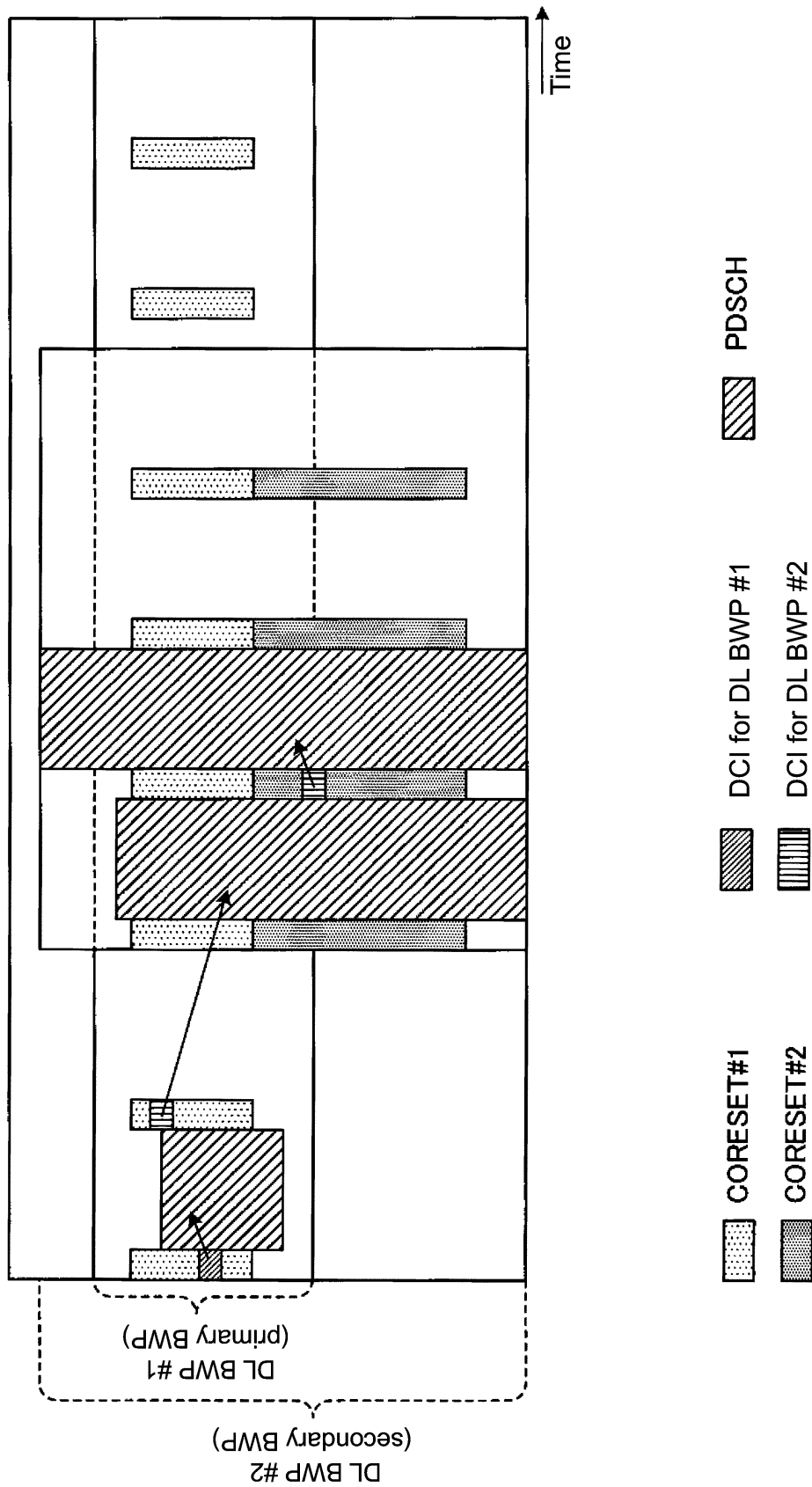
[FIG. 2]



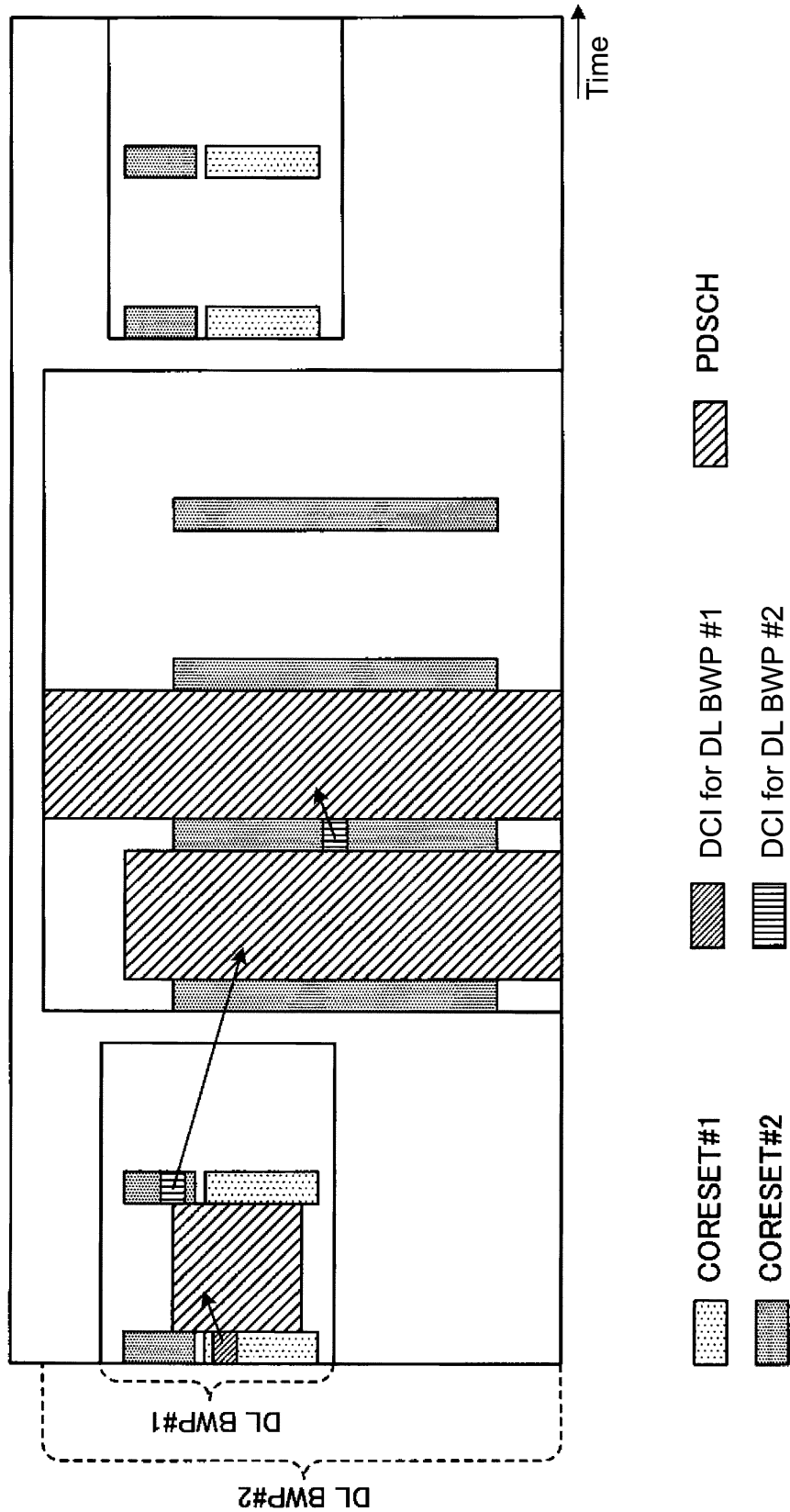
[FIG. 3]



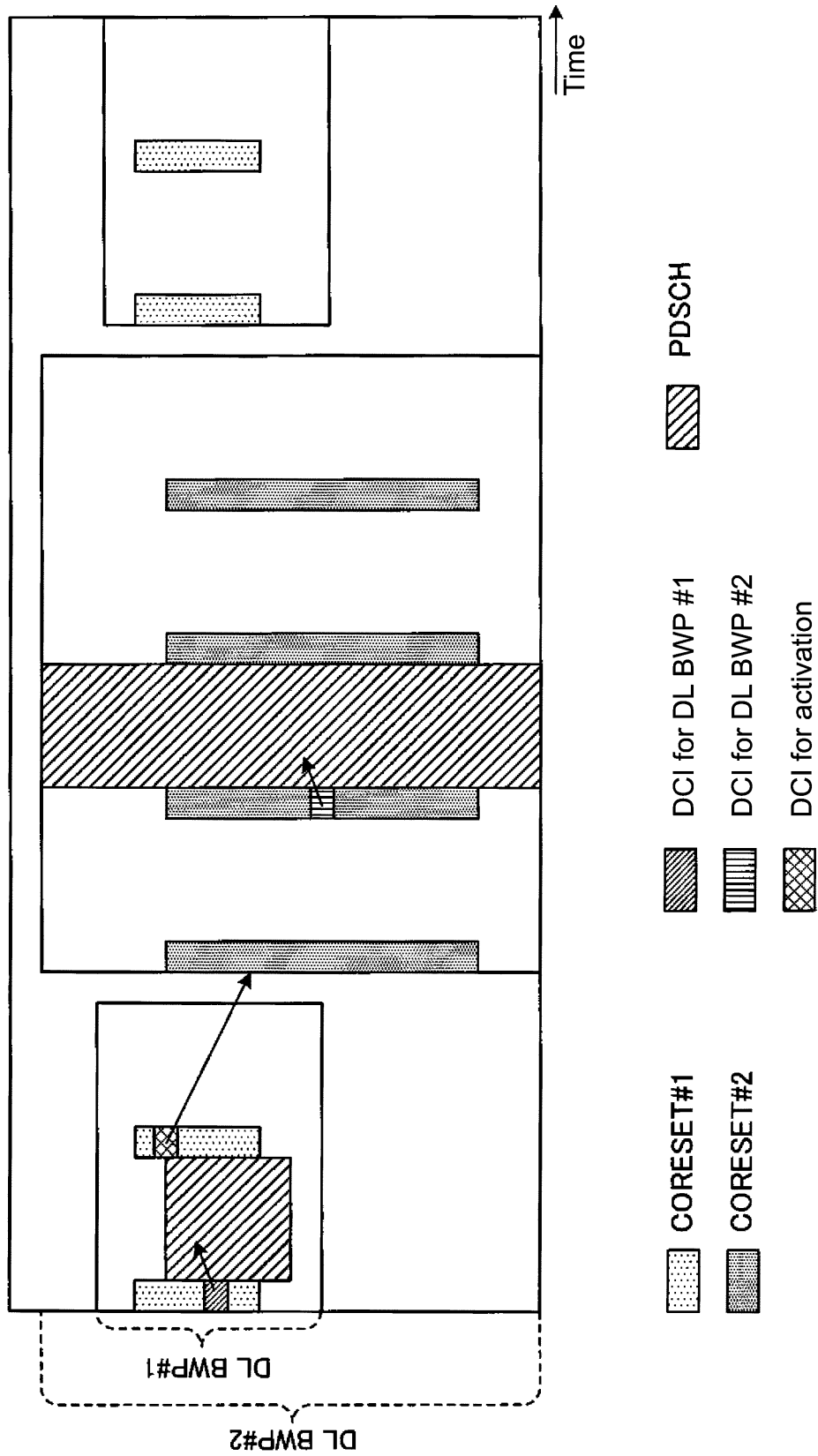
[FIG. 4]



[FIG. 5]



[FIG. 6]



[FIG. 7]
FIG. 7A

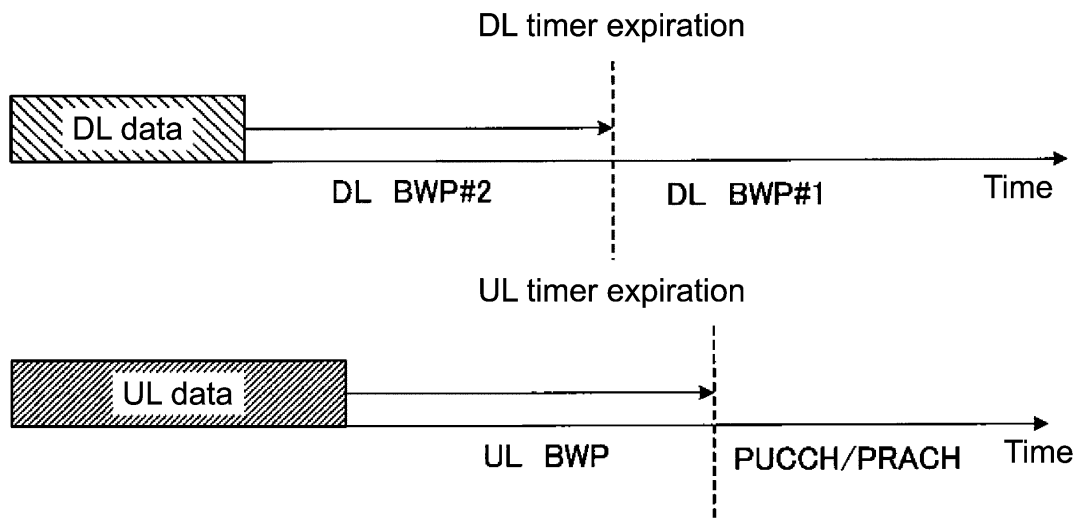
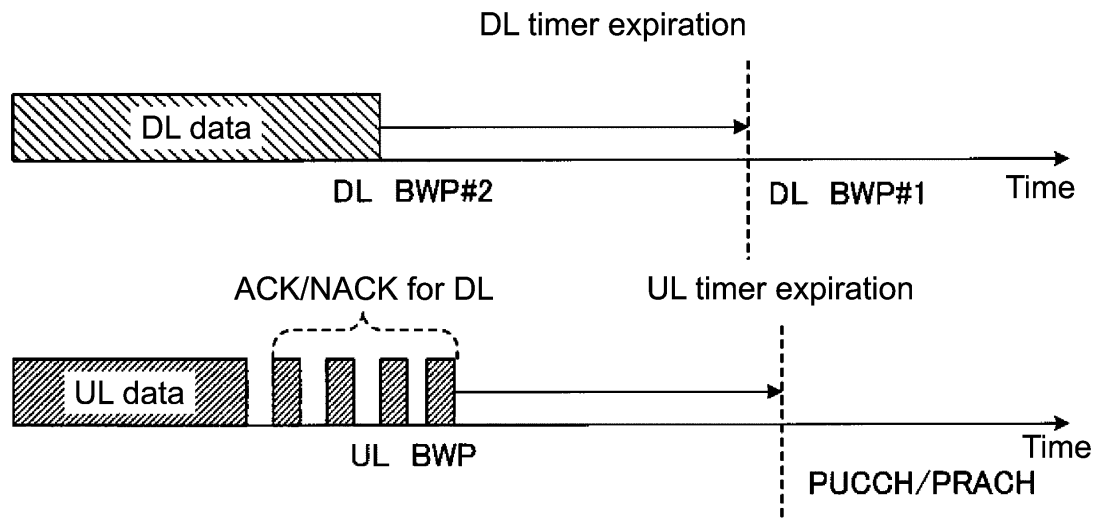
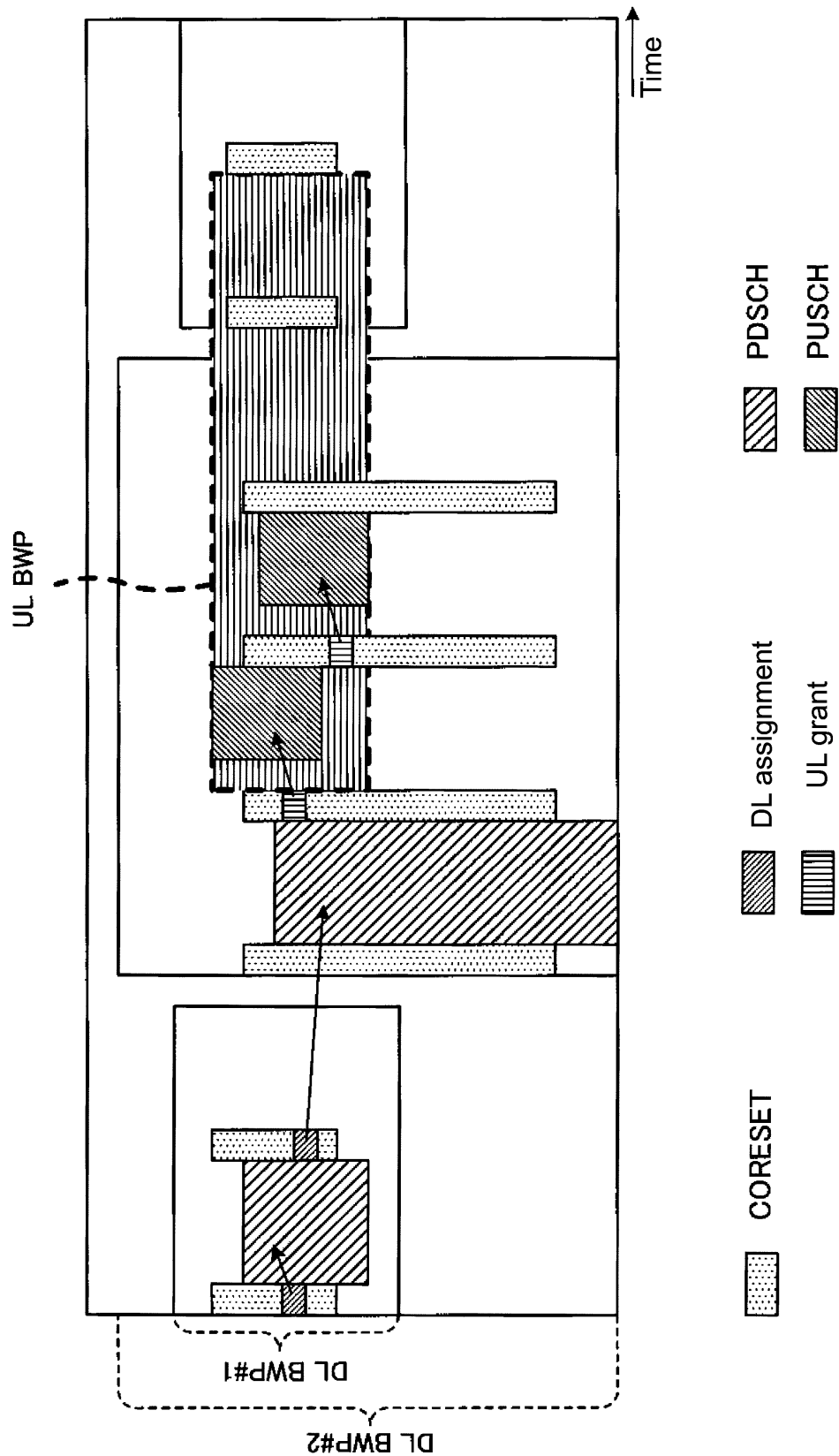


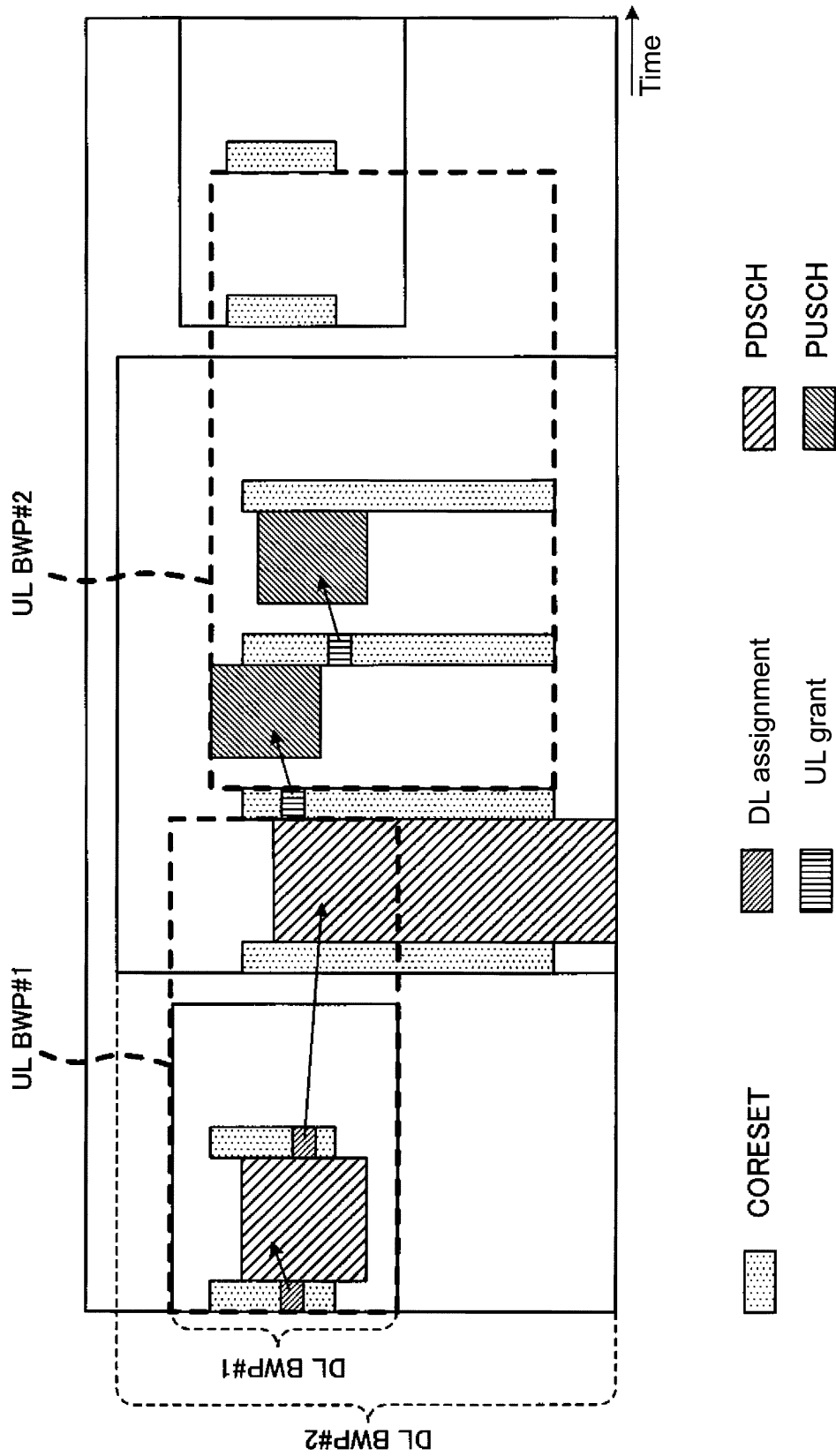
FIG. 7B



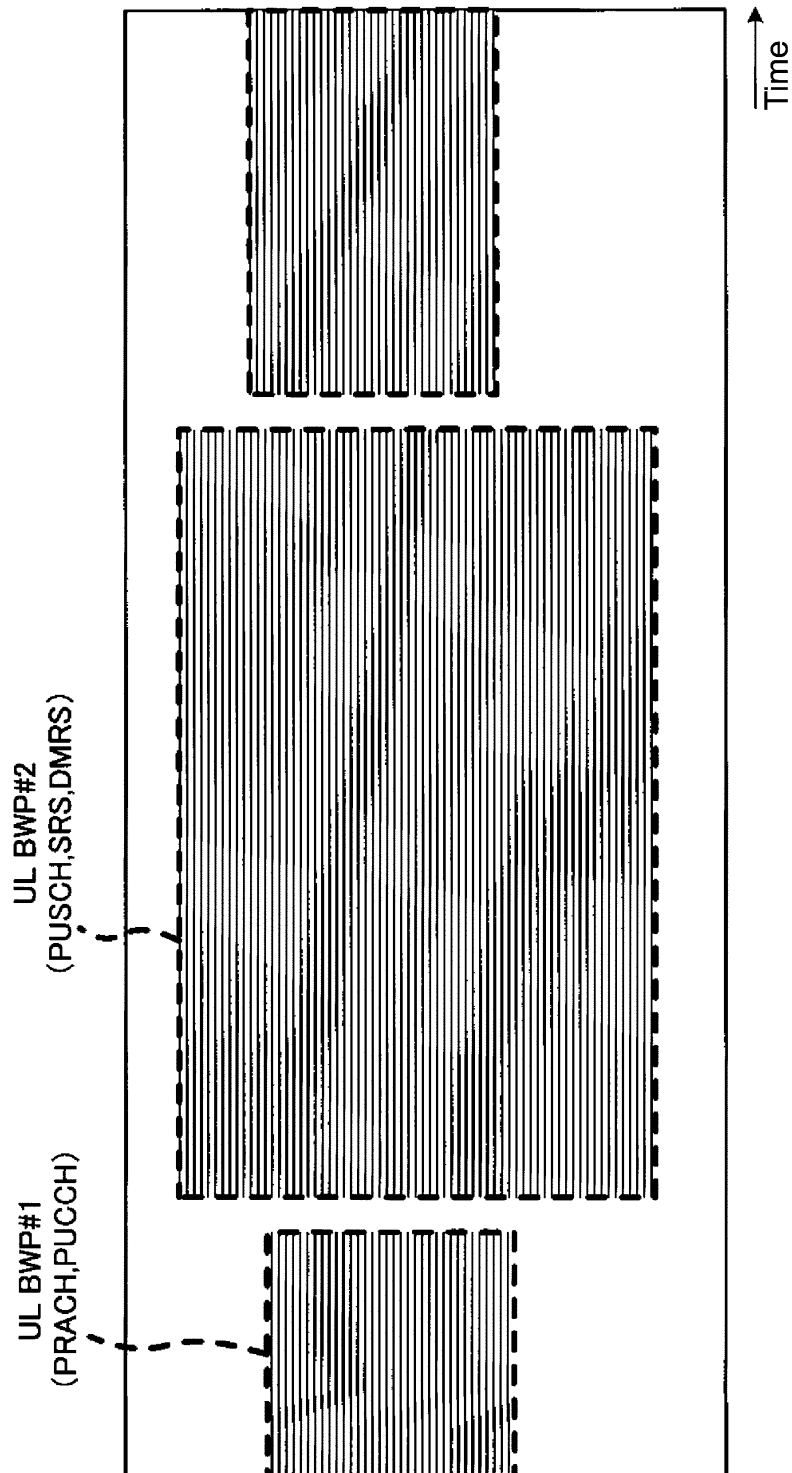
[FIG. 8]



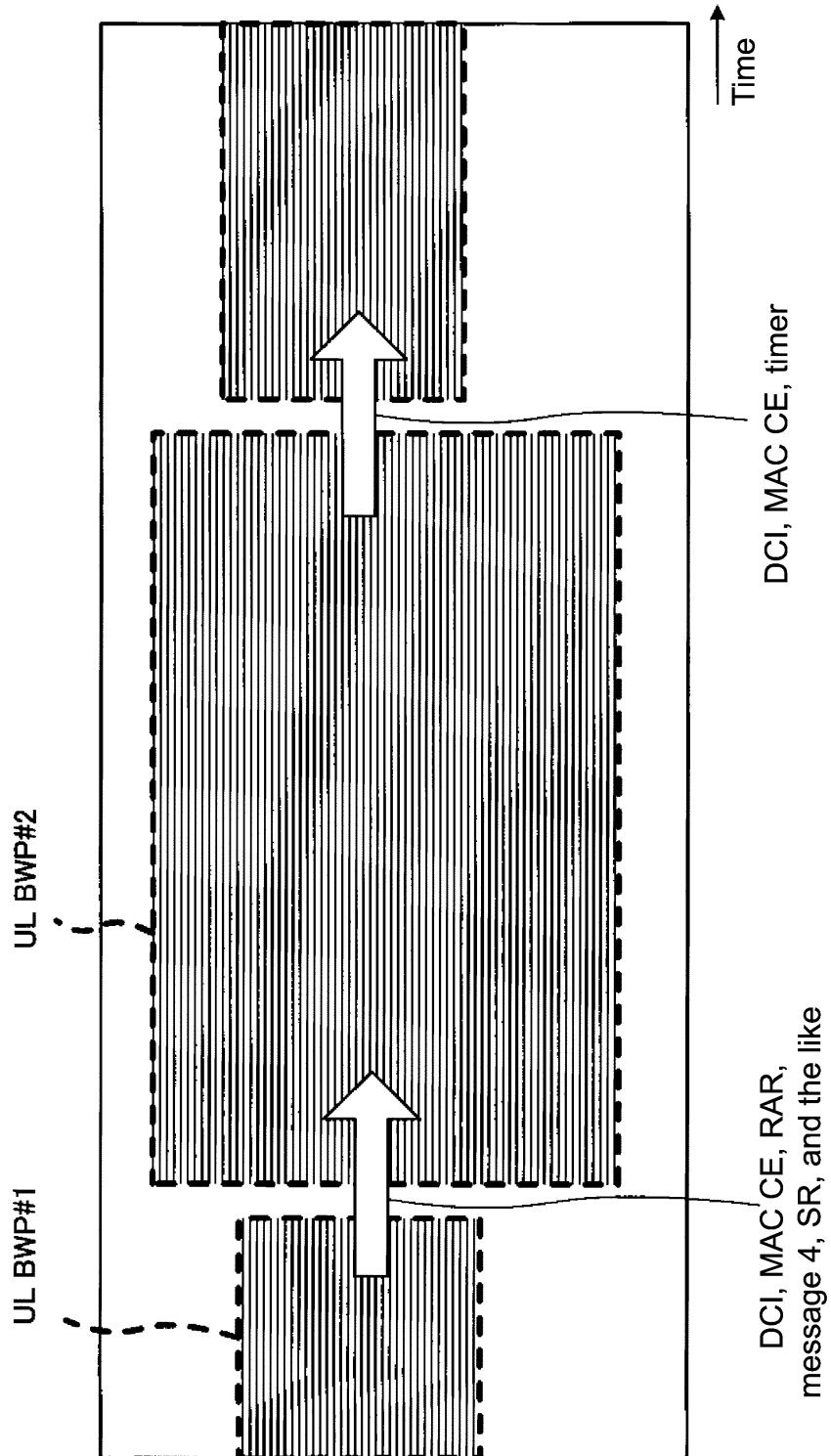
[FIG. 9]



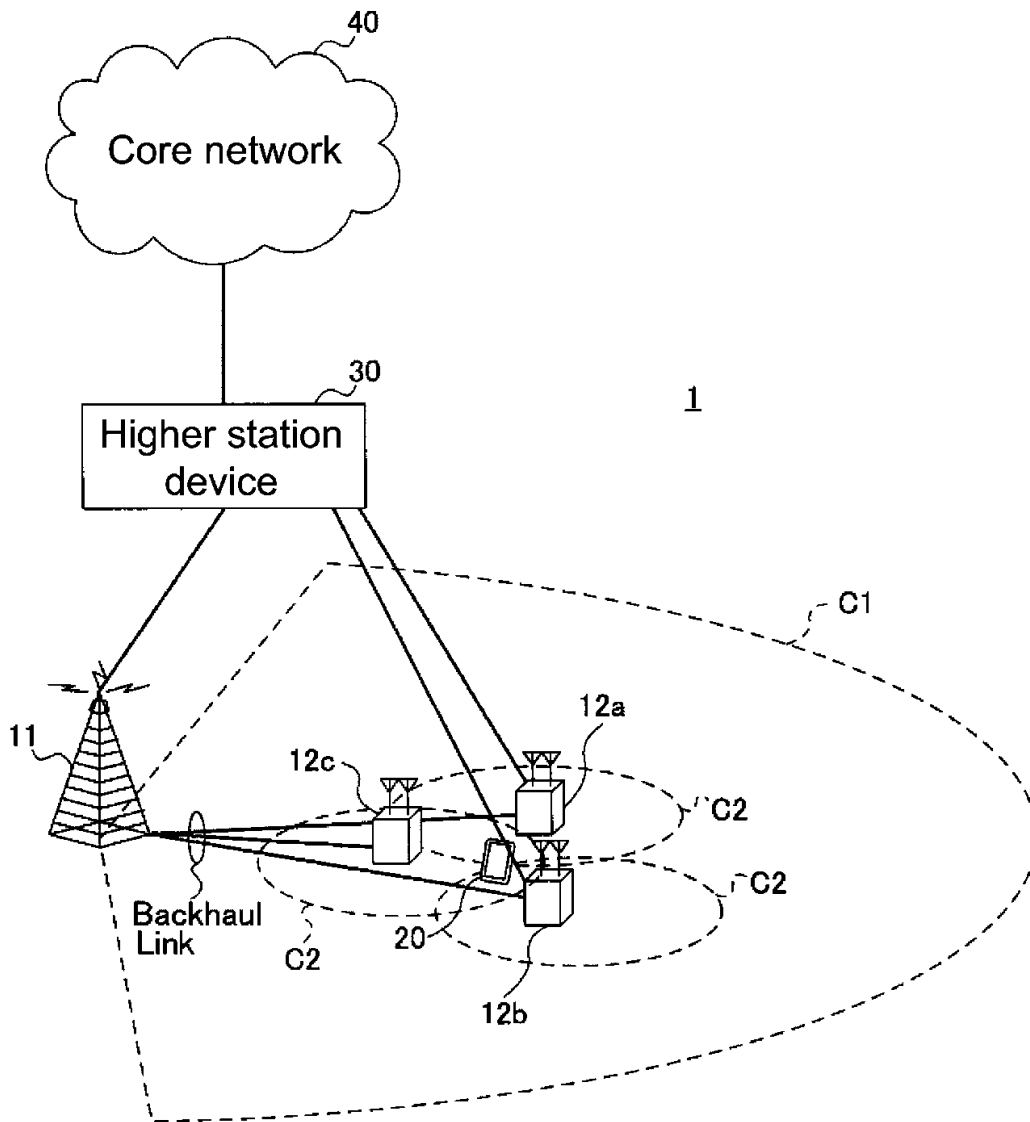
[FIG. 10]



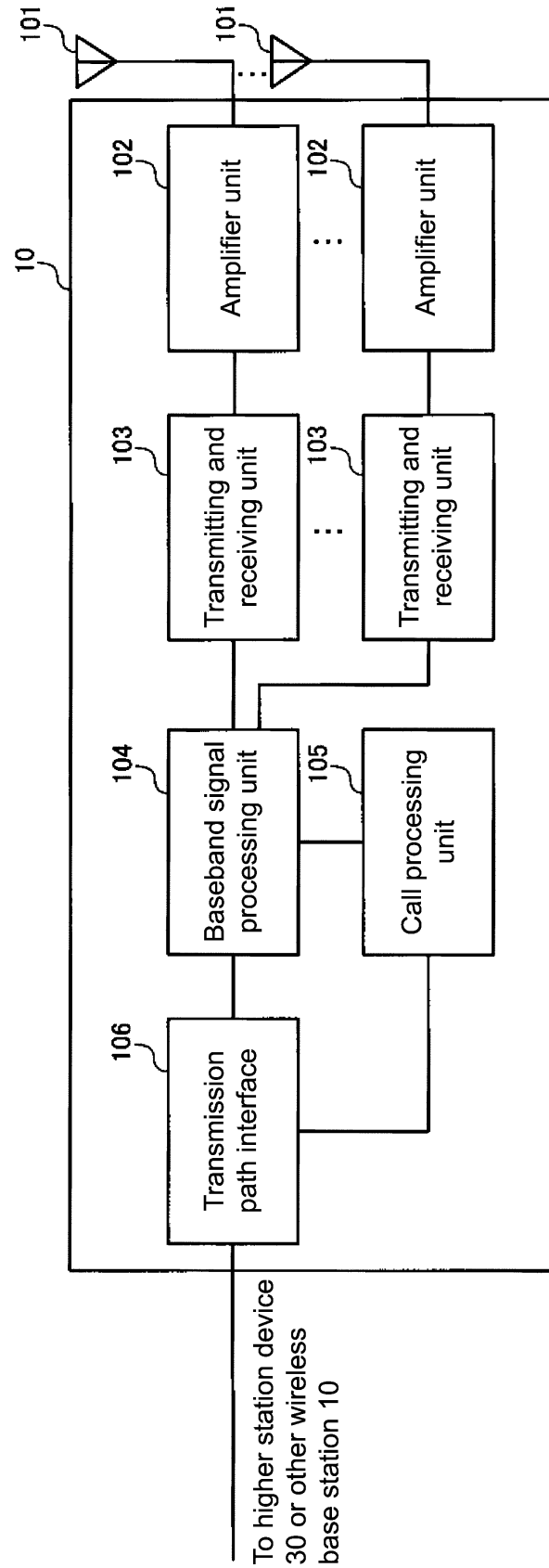
[FIG. 11]



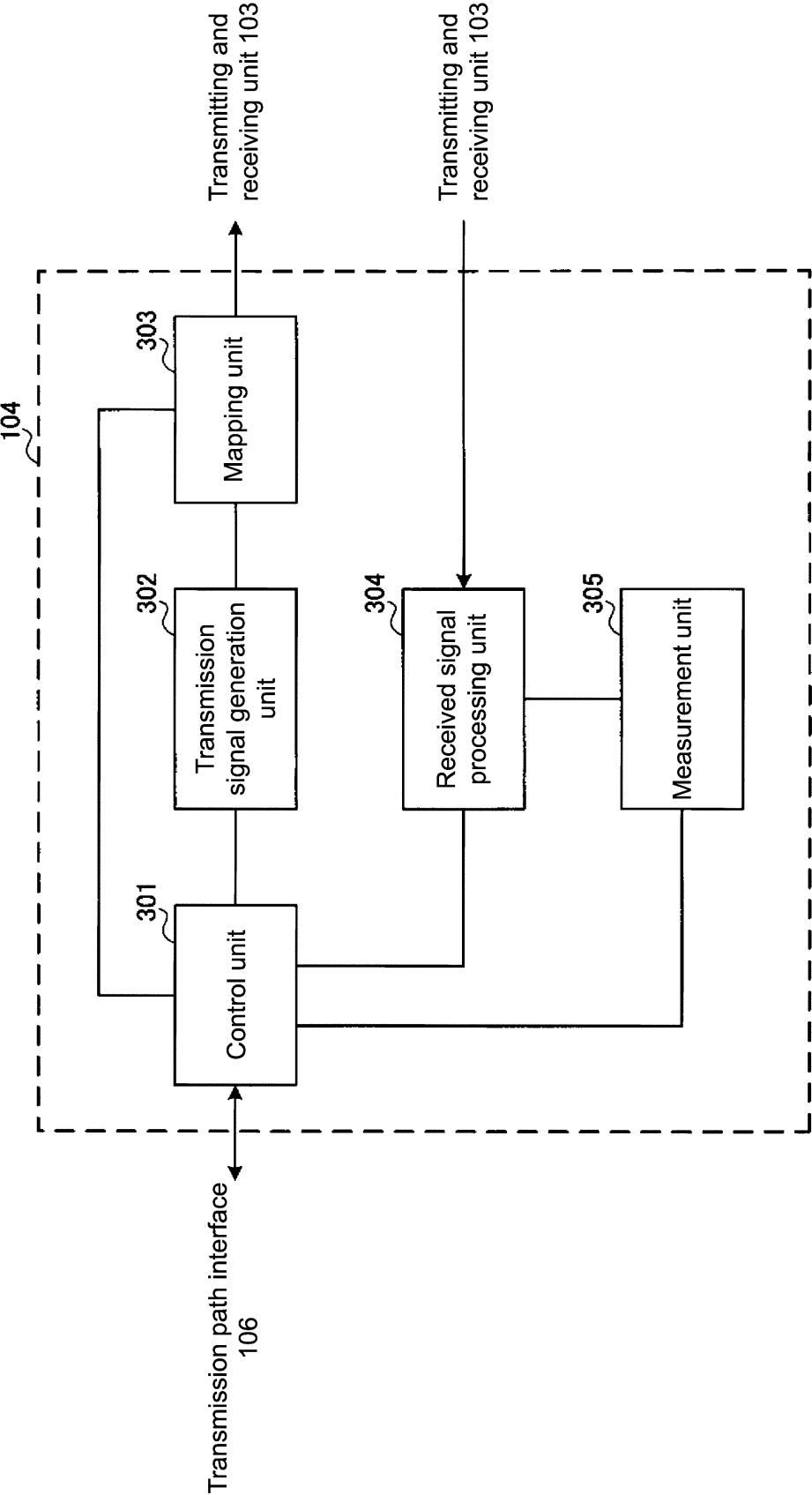
[FIG. 12]



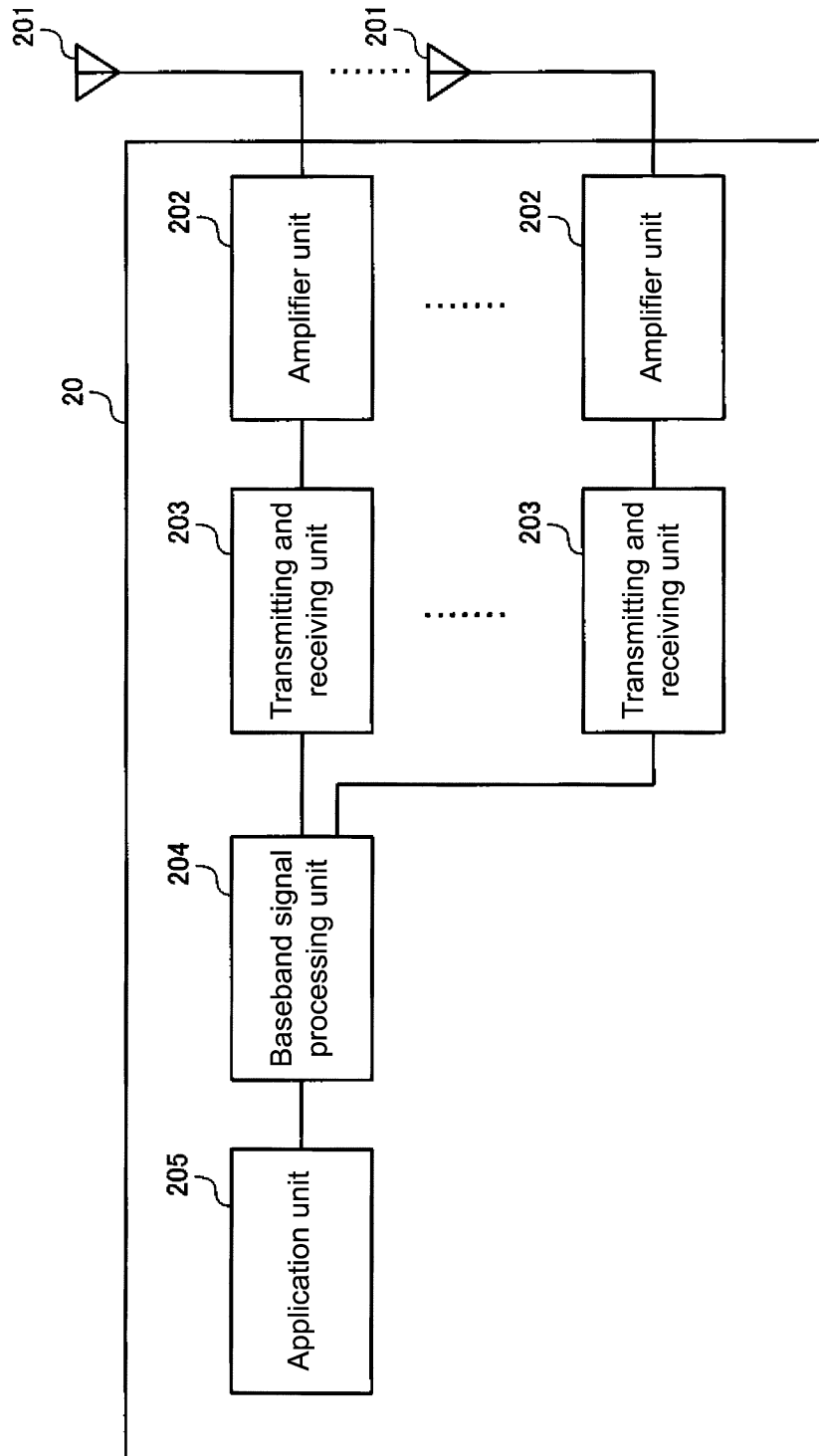
[FIG. 13]



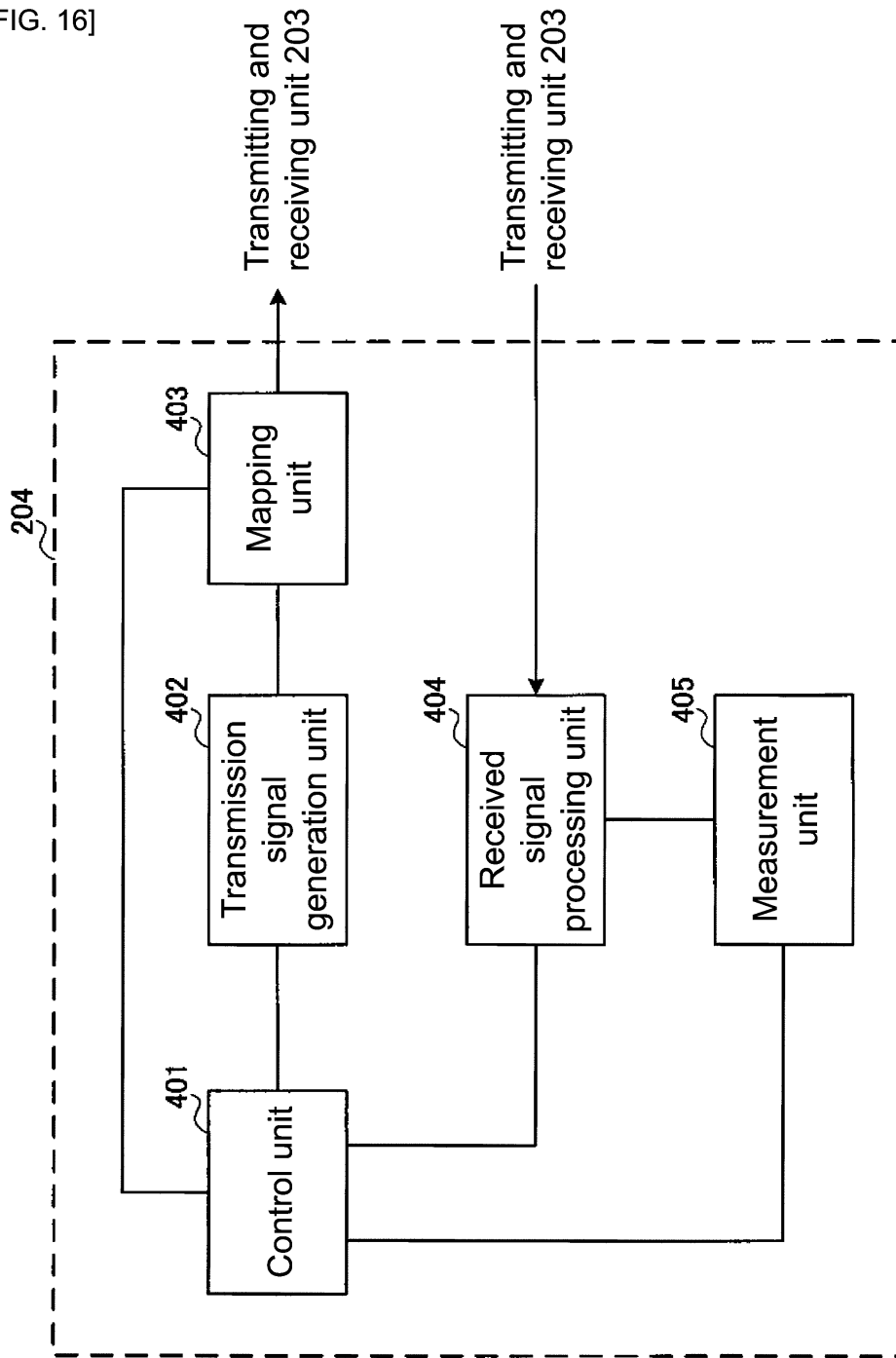
[FIG. 14]



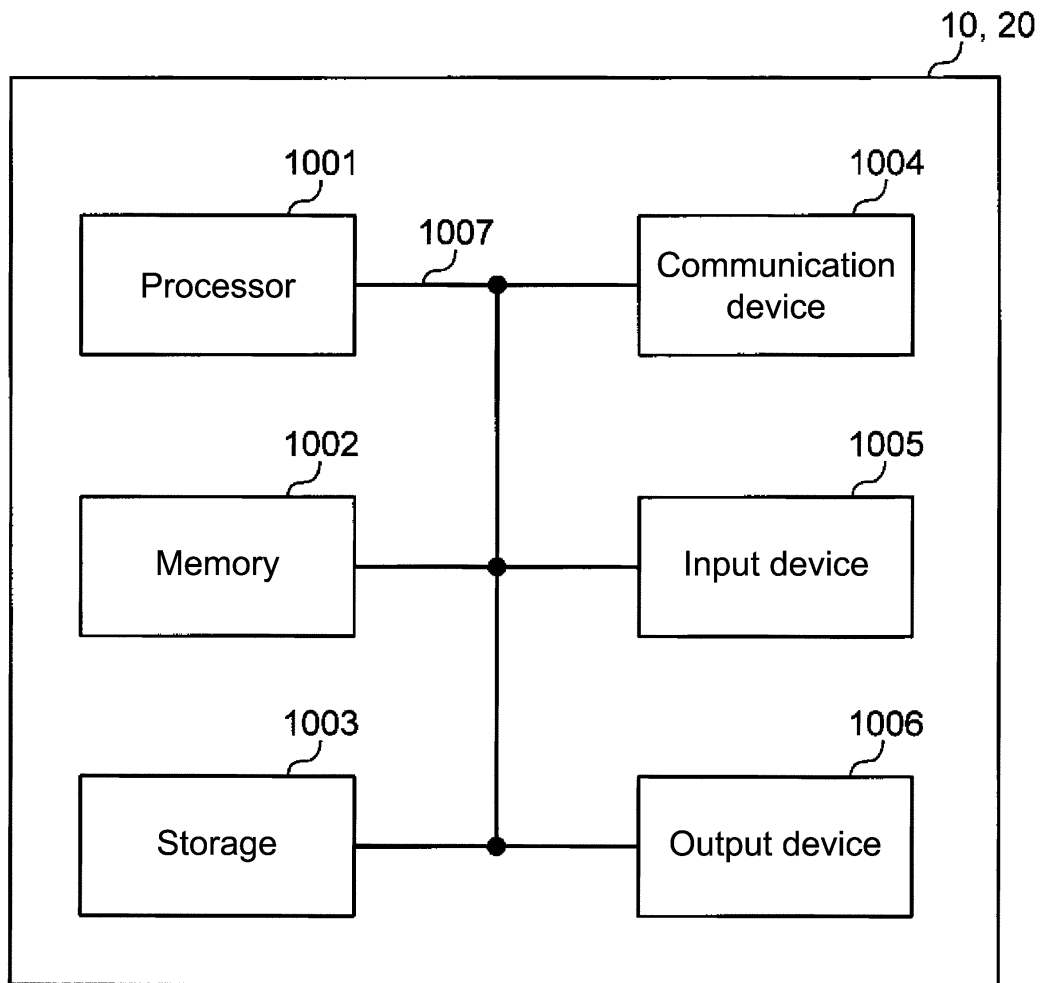
[FIG. 15]



[FIG. 16]



[FIG. 17]





TRANSLATORS' CERTIFICATE OF TRANSLATION

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Questel Project Number: AAB2430008UT-L
Date: August 1, 2024

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We, Eric Vance and David Takata, translators fluent in the Japanese and English languages, on behalf of Questel, do solemnly and sincerely declare that the following is, to the best of our knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Original Document Identifier:	Pegasus_PriorArt_0010766-Pegasus_PriorArt_0010840
Translated Document Identifier:	Pegasus_PriorArt_0010766- Pegasus_PriorArt_0010840_Application.docx_English.sdlxliff Pegasus_PriorArt_0010766-Pegasus_PriorArt_0010840 Callout.docx_English.sdlxliff

Signed this 1st day of August, 2024



Signature

Eric Vance

Name



Signature

David Takata

Name