

SPECIFICATION

TITLE OF INVENTION

USER DEVICE AND BASE STATION DEVICE

5

TECHNICAL FIELD

[0001]

The present invention relates to a user
device and a base station device in a radio
10 communication system.

BACKGROUND ART

[0002]

Currently, 3GPP (Third Generation
15 Partnership Project) is developing specifications
for a new radio communication system called a New
Radio Access Technology (NR) system as a successor
to an LTE (Long Term Evolution system and an LTE-
Advanced system (e.g., Non-Patent Document 1).

20 [0003]

In the NR system, introduction of a
technology called LTE-NR dual connectivity or Multi
Radio Access Technology (RAT) dual connectivity
(hereinafter referred to as "MR-DC") has been
25 studied such that data is divided between a base
station (eNB) of the LTE system and a base station
(gNB) of the NR system, and data is simultaneously
transmitted and received by these base stations,
similar to dual connectivity in the LTE system
30 (e.g., Non-Patent Document 2).

Related Art Document

[Non-Patent Documents]

[0004]

[Non-Patent Document 1] 3GPP TS 38.300 V15.3.0
(2018-09)

[Non-Patent Document 2] 3GPP TS 37.340 V15.3.0
(2018-09)

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SUMMARY OF INVENTION

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0005]

10 In the MR-DC, the user device is notified of a list in which bands specified in E-UTRA (Evolved Universal Terrestrial Radio Access) and bands specified in the NR coexist. The user device determines a combination of bands (band combination) supported by the user device from the
15 list. Here, in a case in which RAT (Radio Access Technology) is specified from the network, it is necessary to switch processing related to the band combination in the user device between the band combination supported for E-UTRA, the band
20 combination supported for NR, and the band combination supported for MR-DC.

[0006]

The present invention has been accomplished in view of the above-described point
25 so as to provide a technique for determining a band combination supported in a radio communication system utilizing multiple RATs.

[MEANS FOR SOLVING THE PROBLEM]

30 [0007]

According to the present disclosure, a user device includes a receiving unit configured to receive first information and second information from a base station device, the first information

indicating one or more bands that are candidates
for a band combination to be supported, the second
information indicating which RAT (Radio Access
Technology) is to be used; a control unit
5 configured to determine, based on the second
information, the band combination to be supported
from among the one or more bands included in the
first information; and a transmitting unit
configured to transmit, to the base station device,
10 terminal capability information including the
determined band combination.

[ADVANTAGE OF THE INVENTION]

[0008]

15 According to the present disclosure, a
band combination supported in radio communication
systems utilizing multiple RATs can be determined.

BRIEF DESCRIPTION OF DRAWINGS

20 [0009]

FIG. 1 is an example of a configuration
of a radio communication system according to an
embodiment of the present invention;

FIG. 2 is a sequence diagram in which a
25 user device 20 according to an embodiment notifies
a base station device 10 of capability;

FIG. 3 is a diagram illustrating an
example of generating a band combination in an MR-
DC;

30 FIG. 4 is a flowchart illustrating a
procedure for generating a band combination in the
MR-DC according to an embodiment;

FIG. 5 is a diagram illustrating an
example (1) of generating a band combination in the

MR-DC according to an embodiment;

FIG. 6 is a diagram illustrating an example (2) of generating a band combination in the MR-DC according to an embodiment;

5 FIG. 7 is a diagram illustrating an example (3) of generating a band combination in the MR-DC according to an embodiment;

FIG. 8 is a diagram illustrating an example (4) of generating a band combination in the
10 MR-DC according to an embodiment;

FIG. 9 is a diagram illustrating an example (5) of generating a band combination in the MR-DC according to an embodiment;

FIG. 10 is a flow chart illustrating an
15 example of controlling a band combination according to an embodiment;

FIG. 11 is a diagram illustrating an example of controlling a band combination according to an embodiment;

20 FIG. 12 is a diagram illustrating an example of a functional configuration of the base station device 10 according to an embodiment;

FIG. 13 is a diagram illustrating an example of a functional configuration of the user
25 device 20 according to an embodiment; and

FIG. 14 is a diagram illustrating an example of a hardware configuration of the base station device 10 and the user device 20 according to an embodiment.

30

[EMBODIMENTS OF THE INVENTION]

[0010]

In the following, embodiments of the present invention are described with reference to

the drawings.

[0011]

FIG. 1 is an example of a configuration of a radio communication system according to an embodiment of the present invention. FIG. 1 is a schematic diagram illustrating the radio communication system according to the embodiment of the present invention.

[0012]

As illustrated in FIG. 1, a user device 20 communicates with a base station device 10A and a base station device 10B provided by the LTE system and the NR system (hereinafter referred to as the "base station device 10" if the base station device 10A and the base station device 10B are not distinguished), and also supports LTE-NR dual connectivity, i.e., MR-DC, in which the base station device 10A is a master base station and the base station device 10B is a secondary base station. That is, the user device 20 can perform simultaneous transmission or simultaneous reception with the master base station device 10A and the secondary base station device 10B by utilizing multiple component carriers provided by the master base station device 10A and the secondary base station device 10B. In the depicted embodiment, the LTE system and NR system each have only one base station, but in general, many base stations are arranged to cover service areas of the LTE system and NR system.

[0013]

While the following examples are described with respect to LTE-NR dual connectivity, those skilled in the art can readily appreciate

that the user device according to the present disclosure is not limited thereto and is applicable to dual connectivity between multiple radio communication systems utilizing different RATs,
5 i.e., MR-DC.
[0014]

FIG. 2 is a sequence diagram of a process in which the user device 20 according to an embodiment of the present invention notifies the
10 base station device 10 of terminal capability. In FIG. 2, the base station device 10 transmits a terminal capability notification request to the user device 20, and the user device 20 transmits a terminal capability notification to the base
15 station device 10 in response to the terminal capability notification request.
[0015]

In step S1, the base station device 10 transmits an RRC (Radio Resource Control) message
20 "UECapabilityEnquiry" to the user device 20 as the terminal capability notification request. The UECapabilityEnquiry is used to obtain information on radio access capability of the user device 20 over the network. The base station device 10 can
25 specify a type of radio access capability included in the information to be notified to the user device 20 by the UECapabilityEnquiry. For example, the base station device 10 may request notification of the radio access capability related to a band
30 combination supported by the user device 20. In addition, the base station device 10 may request notification of a band combination supported by the user device 20 containing bands included in a list "requestedFreqBandList" notifying the user device

20.

[0016]

Subsequently, in step S2, the user device 20 transmits an RRC message "UECapabilityInformation" to the base station device 10 as a terminal capability notification. The UECapabilityInformation is used to notify the network of information about the radio access capability of the user device 20. The user device 20 transmits, based on UECapabilityEnquiry received from the base state device 10 in step S1, information on the radio access capability supported by the user device 20.

[0017]

In Step S3, the base station device 10 performs normal communication that is adapted to terminal capability in the UECapabilityInformation received from the user device 20 in Step S2. For example, if a supported band combination is included in the UECapabilityInformation received from the user device 20 in step S2, the base station device 10 performs scheduling within a range of the supported band combination.

[0018]

FIG. 3 is a diagram illustrating an example of generating a band combination in the MR-DC. As illustrated in FIG. 3, based on bands included in the "requestedFreqBandList" and an order of the bands included in the list, the user device 20 generates "supportedBandCombination" that is a list of supported band combinations.

[0019]

For example, the user device 20 may select a band combination of the first band and the

second band in the "requestedFreqBandList", as a candidate. Next, a band combination of the first band and the third band is selected as a candidate. Next, a band combination of the first band and the
5 fourth band is selected as a candidate. Next, a band combination of the first band and the fifth band is selected as a candidate. Next, a band combination of the first band and the sixth band is selected as a candidate. Next, a band combination
10 of the second band and the third band is selected as a candidate. Next, a band combination of the second band and the fourth band is selected as a candidate. The user device 20 generates "supportedBandCombination" in the order described
15 above.

[0020]

Here, in the case of the "requestedFreqBandList" illustrated in FIG. 3, since the first to third bands are all NR bands,
20 the band combination containing only NR bands is included at the beginning of the "supportedBandCombination." Since the band combination consisting only of NR bands cannot be applied to MR-DC, in embodiments of the present
25 invention, a method is proposed that is for generating a band combination in which a band combination including an E-UTRA band and an NR band is positioned at the beginning of the "supportedBandCombination."

30 [0021]

FIG. 4 is a flowchart illustrating a flow of a procedure for generating a band combination in the MR-DC according to the present embodiment.

[0022]

In step S11, the user device 20 determines whether the "requestedFreqBandList" is included in the "UECapabilityEnquiry" provided as a notification by the base station device 10. If the
5 "requestedFreqBandList" is included (YES in S11), the process proceeds to step S12. If the "requestedFreqBandList" is not included (NO in S11), the process is terminated

10 [0023]

In step S12, the user device 20 creates a "NR band list" including an NR CA band combination or an NR band supported by the user device 20, from NR bands included in the
15 "requestedFreqBandList." The user device 20 also creates an "E-UTRA band list" including an E-UTRA CA band combination or an E-UTRA band supported by the user device 20, from E-UTRA bands included in the "requestedFreqBandList." Note that the order of
20 bands in the "requestedFreqBandList" is maintained in the order of bands in the "NR band list" or "E-UTRA band list."

[0024]

Subsequently, the user device 20
25 determines whether the requestedFreqBandList includes both an E-UTRA band and an NR band. If both are included (YES in S13), processing proceeds to step S14, and if only one of these is included (NO in S13), processing is terminated.

30 [0025]

In step S14, the user device 20 creates an "MR-DC band combination list" based on the "NR band list" and the "E-UTRA band list" created in step S12, and terminates the process.

[0026]

The user device 20 may position the "MR-DC band combination list" created by the above-described process at the beginning of the
5 "supportedBandCombination", and may position the "NR band list" or the "E-UTRA band list" behind the "MR-DC band combination list."

[0027]

FIG. 5 is a diagram illustrating an
10 example (1) of generating a band combination in the MR-DC according to the present embodiment. FIG. 5 illustrates details of the order of bands when creating the "MR-DC band combination list" from the "NR band list" and the "E-UTRA band list" in step
15 S14 depicted in FIG. 4.

[0028]

As illustrated in FIG. 5, the user device 20 selects a set of a first NR CA band combination in the "NR band list" and a first E-UTRA CA band combination in the "E-UTRA band list" as a candidate. Next, a set of the first NR CA band combination in the "NR band list" and a second E-UTRA CA band combination in the "E-UTRA band list" are selected as a candidate. This step of selecting
25 a candidate including a set of the first NR CA band combination and a band in the "E-UTRA band list" is repeated in accordance with the above-described order. After the set of the first NR CA band combination in the "NR band list" and the last E-UTRA CA band combination in the "E-UTRA band list" is selected, a set of a second NR CA band combination in the "NR band list" and the first E-UTRA CA band combination in the "E-UTRA band list" is selected as a candidate. Similarly, the above-

described selecting step is repeated until the last E-UTRA CA band combination in the "E-UTRA band list" is selected.

[0029]

5 As described above, the "MR-DC band combination list" is created from the "NR band list" and the "E-UTRA band list" in accordance with a rule of "NR band list" first. Note that the "NR CA band combination" or "E-UTRA band combination" described above may include a band as well as a
10 band combination.

[0030]

FIG. 6 is a diagram illustrating an example (2) of generating a band combination in the MR-DC according to the present embodiment. FIG. 6
15 illustrates details of the order of bands when creating the "MR-DC band combination list" from the "NR band list" and the "E-UTRA band list" in step S14 depicted in FIG. 4.

20 [0031]

As illustrated in FIG. 6, the user device 20 selects a set of the first E-UTRA CA band combination in the "E-UTRA band list" and the first NR CA band combination in the "NR band list" as a
25 candidate. Next, a set of the first E-UTRA CA band combination in the "E-UTRA band list" and the second NR CA band combination in the "NR band list" is selected as a candidate. This step of selecting a candidate including a set of the first E-UTRA CA
30 band combination and a band in the "NR band list" is repeated in accordance with the above-described order. After the set of the first E-UTRA CA band combination in the "E-UTRA band list" and the last NR CA band combination in the "NR band list" is

selected, a set of a second E-UTRA CA band combination in the "E-UTRA band list" and the first NR CA band combination in the "NR band list" is selected as a candidate. Similarly, the above-
5 described selecting step is repeated until the last NR CA band combination in the "NR band list" is selected.

[0032]

As described above, the "MR-DC band combination list" is created from the "NR band
10 list" and the "E-UTRA band list" in accordance with a rule of "E-UTRA band list" first. Note that the "NR CA band combination" or "E-UTRA band combination" described above may include a band as
15 well as a band combination.

[0033]

FIG. 7 is a diagram illustrating an example (3) of generating a band combination in the MR-DC according to the present embodiment. FIG. 7
20 illustrates details of the order of bands when creating the "MR-DC band combination list" from the "NR band list" and the "E-UTRA band list" in step S14 depicted in FIG. 4.

[0034]

As illustrated in FIG. 7, the user
25 device 20 selects a set of the first E-UTRA CA band combination in the "E-UTRA band list" and the first NR CA band combination in the "NR band list" as a candidate. Next, a set of the first E-UTRA CA band
30 combination in the "E-UTRA band list" and the second NR CA band combination in the "NR band list" is selected as a candidate. This step of selecting a candidate including a set of the first E-UTRA CA band combination and a band in the "NR band list"

is repeated in accordance with the above-described order. After the set of the first E-UTRA CA band combination in the "E-UTRA band list" and the last NR CA band combination in the "NR band list" is
5 selected, a set of the first NR CA band combination in the "NR band list" and the second E-UTRA CA band combination in the "E-UTRA band list" is selected as a candidate. Similarly, the above-described selecting step is repeated until the last E-UTRA CA
10 band combination in the "E-UTRA band list" is selected.

[0035]

Next, a set of the second E-UTRA CA band combination in the "E-UTRA band list" and the
15 second NR CA band combination in the "NR band list" is selected as a candidate. The above-described selecting step is repeated until the last NR CA band combination in the "NR band list" is selected.

[0036]

20 Next, a set of the second NR CA band combination in the "NR band list" and a third E-UTRA CA band combination in the "E-UTRA band list" is selected as a candidate. The above-described selecting step is repeated until the last E-UTRA CA
25 band combination in the "E-UTRA band list" is selected.

[0037]

As described above, the "MR-DC band combination list" is created from the "NR band
30 list" and the "E-UTRA band list", by alternately selecting the "E-UTRA band list" and the "NR band list". Note that the "NR CA band combination" or "E-UTRA band combination" described above may include a band as well as a band combination.

[0038]

FIG. 8 is a diagram illustrating an example (4) of generating a band combination in the MR-DC according to the present embodiment. FIG. 8 illustrates details of the order of bands when creating the "MR-DC band combination lists" from the "NR band lists" and the "E-UTRA band lists" in step S14 depicted in FIG. 4.

[0039]

10 As illustrated in FIG. 8, the user device 20 selects a set of a first NR CA band combination in the "NR band list" and a first E-UTRA CA band combination in the "E-UTRA band list" as a candidate. Next, a set of the first NR CA band combination in the "NR band list" and a second E-UTRA CA band combination in the "E-UTRA band list" is selected as a candidate. This step of selecting a candidate including a set of the first NR CA band combination and a band in the "E-UTRA band list" is repeated in accordance with the above-described order. After the set of the first E-UTRA CA band combination in the "NR band list" and the last E-UTRA CA band combination in the "E-UTRA band list" is selected, a set of the first E-UTRA CA band combination in the "E-UTRA band list" and the second NR CA band combination in the "NR band list" is selected as a candidate. Similarly, the above-described selecting step is repeated until the last NR CA band combination in the "NR band list" is selected.

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25
30

[0040]

Next, a set of the second NR CA band combination in the "NR band list" and the second E-UTRA CA band combination in the "E-UTRA band list"

is selected as a candidate. The above-described selecting step is repeated until the last E-UTRA CA band combination in the "E-UTRA band list" is selected.

5 [0041]

Next, a set of the second E-UTRA CA band combination in the "E-UTRA band list" and the third NR CA band combination in the "NR band list" is selected as a candidate. The above-described selecting step is repeated until the last NR CA band combination in the "NR band list" is selected.

10 [0042]

As described above, the "MR-DC band combination list" is created from the "NR band list" and the "E-UTRA band list", by alternately selecting the "NR band list" and the "E-UTRA band list". Note that the "NR CA band combination" or "E-UTRA band combination" described above may include a band as well as a band combination.

15 [0043]

FIG. 9 is a diagram illustrating an example (5) of generating a band combination in the MR-DC according to the present embodiment. As illustrated in the "Note" of FIG. 9, the first two bands of the "requestedFreqBandList" may always include one E-UTRA band and one NR band. By using this "requestedFreqBandList", even if the "supportedBandCombination" is generated by the method described in FIG. 3, the user device 20 can notify the base station device 10 of the "supportedBandCombination" in which the MR-DC band combination is first included.

20 [0044]

As in the above-described embodiment,

the user device 20 can extract an "NR band list" and an "E-UTRA band list" from a "requestedFreqBandList" to generate an "MR-DC band combination list". By using the generated "MR-DC
5 band combination list", the user device 20 can notify the base station device 10 of the "supportedBandCombination" in which an MR-DC band combination is first included. In addition, if the base station device 10 always includes an NR band
10 and an E-UTRA band in the first two bands of the "requestedFreqBandList", the base station device 10 can receive the "supportedBandCombination" in which an MR-DC band combination is first included, from the user device 20.

15 [0045]

That is, a notification of a band combination can be provided that is applicable to dual connectivity performed in a radio communication system utilizing multiple RATs.

20 [0046]

[Modified Example 1]

The operation performed by the radio communication system according to the embodiments of the present invention is described above. In
25 the following, another example of an operation performed by the radio communication system is described as a modified example 1.

[0047]

FIG. 10 is a flowchart illustrating an
30 example of a process for controlling a band combination according to an embodiment of the present invention. The user device 20 is assumed to have received, from the base station device 10, a FreqBandList that is information indicating usable

bands and a rat-Type indicating RAT to be used.

[0048]

In step S201, the user device 20 creates a list of band combination candidates with bands
5 included in the FreqBandList. Subsequently, the user device 20 determines whether the rat-Type indicating the RAT to be used is nr. If the rat-Type is nr (YES in S202), processing proceeds to step S203, and if the rat-Type is not nr (NO in
10 S202), the process proceeds to step S206.

[0049]

In step S203, the user device 20 includes only a band combination consisting of nr bands from the list of band combination candidates,
15 into the supportedBandCombinations that is information indicative of a supported band combination. Subsequently, the user device 20 includes featureSets for the supportedBandCombinations (S204). The featureSets
20 includes, for example, the configuration of the physical layer of the uplink or downlink. Subsequently, the user device 20 includes featureSetCombinations corresponding to the supportedBandCombinations and
25 featureSetCombinations corresponding to the featureSets (S205), and the process terminates.

[0050]

In step S206, the user device 20 determines whether the rat-Type indicating the RAT
30 to be used is eutra-nr. If the rat-Type is eutra-nr (YES in S206), the process proceeds to step S207, and if the rat-Type is not eutra-nr (NO in S206), the process proceeds to step S207.

[0051]

In step S207, the user device 20 includes only a band combination consisting of eutra-nr bands from the list of band combination candidates, into the supportedBandCombinations which is information indicative of a supported band combination. The band combination consisting of the eutra-nr bands is a band combination including at least one eutra band and at least one nr band. Subsequently, the user device 20 includes the featureSetCombinations corresponding to the supportedBandCombinations and the featureSetCombinations corresponding to a Capability requests with eutra-nr as the rat-Type (S208), and the process terminates.

15 [0052]

In step S209, the user device 20 determines whether the rat-Type indicating the RAT to be used is eutra. If the rat-Type is eutra (YES in S209), the process proceeds to step S210, and if the rat-Type is not eutra-nr (NO in S209), the process terminates.

20 [0053]

In step S210, the user device 20 includes only a band combination consisting of eutra bands from the list of band combination candidates, into the supportedBandCombinations which is information indicative of a supported band combination. Subsequently, the user device 20 includes featureSets for the supportedBandCombinations (S211). Subsequently, the user device 20 includes featureSetCombinations corresponding to the supportedBandCombinations and featureSetCombinations corresponding to the featureSets (S212), and the process terminates.

25 30

[0054]

The user device 20 may notify the base station device 10 of the generated supportedBandCombinations as

5 UECapabilityInformation.

[0055]

Note that step S202, step S206, and step S209 may be executed in any order. For example, they may be executed in an order of S206, S202, and
10 S209, in an order of S209, S206, and S202, in an order of S202, S209, S206, or in other orders.

[0056]

Note that inclusion of a band combination in an information element
15 supportedBandCombinations may be to "determine" a supported band combination.

[0057]

FIG. 11 is a diagram illustrating an example of controlling a band combination according
20 to the present embodiment. As illustrated in FIG. 11, the process of determining the supported band combination can be switched in accordance with the rat-Type.

[0058]

25 As described in the modified example 1 of the embodiment described above, when RAT of E-UTRA, RAT of NR, and RAT of a combination of E-UTRA and NR are supported, the user device 20 may select appropriate bands to determine a band combination
30 to be supported, in accordance with the RAT to be used.

[0059]

That is, a band combination supported by a radio communication system utilizing multiple

RATs can be determined.

[0060]

(Device Configuration)

Next, a functional configuration example
5 of the base station device 10 and the user device
20 that execute the processes and operations
described above is described. Each of the base
station devices 10 and the user device 20 includes
at least functions to implement the embodiments.
10 However, each of the base station devices 10 and
the user device 20 may include only a part of the
functions in the embodiments.

[0061]

FIG. 12 is a diagram illustrating an
15 example of a functional configuration of the base
station device 10. As illustrated in FIG. 12, the
base station device 10 includes a transmitting unit
110, a receiving unit 120, a setting unit 130, and
a control unit 140. The functional configuration
20 illustrated in FIG. 12 is only one example. Any
types of division of function may be applicable and
each of the functions may have any name, as long as
the operations according to the present embodiment
can be practiced.

25 [0062]

The transmitting unit 110 includes a
function of generating a signal to be transmitted
to the user device 20 and transmitting the signal
wirelessly. The receiving unit 120 includes a
30 function for receiving various signals transmitted
from the user device 20 and acquiring information
of a higher layer, for example, from the received
signal. The transmitting unit 110 also includes a
function of transmitting PSS or NR-PSS, SSS or NR-

SSS, PBCH or NR-PBCH, DL/UL control signals, etc.
to the user device 20. The transmitting unit 110
transmits, to the user device 20, a message
pertaining to the terminal capability notification
5 request, and information indicating a scheduling of
UL or DL. The receiving unit 120 receives a message
pertaining to the terminal capability notification
from the user device 20.

[0063]

10 The setting unit 130 stores preset
setting information and various setting information
transmitted to the user device 20. The contents of
the setting information are, for example,
information on band combinations, information on
15 the terminal capability, and the like.

[0064]

 The control unit 140 carries out control
in the base station device 10 for transmitting, to
the user device 20, a terminal capability
20 notification request message as described in the
embodiment, such as UECapabilityEnquiry, and
carries out control for performing communication
according to the terminal capability upon receiving
a terminal capability notification from the user
25 device 20.

[0065]

 FIG. 13 is a diagram illustrating an
example of a functional configuration of the user
device 20. As illustrated in FIG. 13, the user
30 device 20 includes a transmitting unit 210, a
receiving unit 220, a setting unit 230, and a
control unit 240. The functional configuration
illustrated in FIG. 13 is only one example. Any
types of division of function may be applicable and

each of the functions may have any name, as long as the operations according to the present embodiment can be practiced.

[0066]

5 The transmitting unit 210 generates a transmit signal from transmit data, and transmits the transmit signal wirelessly. The receiving unit 220 receives various signals wirelessly and acquires a higher layer signal from the received
10 physical layer signal. The receiving unit 220 also includes a function to receive PSS or NR-PSS, SSS or NR-SSS, PBCH or NR-PBCH, DL/UL control signals, etc. transmitted from the base station device 10. The transmitting unit 210 transmits a message
15 pertaining to the terminal capability notification to the base station device 10, and the receiving unit 120 receives, from the base station device 10, a message pertaining to the terminal capability notification request, and information indicating a
20 scheduling of UL or DL.

[0067]

 The setting unit 230 stores various setting information received from the base station device 10 by the receiving unit 220. The setting
25 unit 230 also stores preset setting information. The contents of the setting information are, for example, information on band combinations, information on a terminal capability notification, and the like.

30 [0068]

 The control unit 240 performs control pertaining to the generation and transmission of a terminal capability notification message, such as UECapabilityInformation, to be transmitted from the

user device 20 to the base station device 10 as described in the embodiment. Note that a function unit of the control unit 240 related to the transmission, etc. of the terminal capability notification message may be included in the transmitting unit 210, and a function unit of the control unit 240 related to the reception, etc. of the terminal capability notification request message may be included in the receiving unit 220.

10 [0069]

(Hardware Configuration)

Block diagrams (FIGS. 12 and 13) used in the description of the above-described embodiments illustrate blocks of functional units. These functional blocks (components) are implemented by any combination of hardware and/or software. Further, the method of implementing each functional block is not particularly limited. That is, each functional block may be implemented by one device that is physically or logically coupled, or may be implemented by multiple physically or logically separated devices that are connected directly or indirectly (with a wire connection or a wireless connection, for example) each other. Functional blocks may be implemented in combination with software in one or more of the above-described devices.

[0070]

Functions include, but are not limited to, judgment, decision, determination, calculation, computation, processing, derivation, investigation, discovery, confirmation, reception, transmission, output, access, resolution, selection, choosing, establishment, comparison, assumption, expectation,

presumption, broadcasting, notification, communication, forwarding, configuration, reconfiguration, allocation, mapping, and assignment. For example, a functional block
5 (component) that functions to transmit is called a transmitting unit or a transmitter. None of these are particularly limited in their implementation as described above.

[0071]

10 For example, the base station device 10, the user device 20, or the like in the embodiment of the present disclosure may function as a computer for processing the wireless communication method of the present disclosure. FIG. 14 is a
15 diagram illustrating an example of a hardware configuration of the base station device 10 and the user device 20 according to the embodiment of the present disclosure. The above-described base station device 10 and user device 20 may be
20 physically configured as a computer device including a processor 1001, a storage device 1002, an auxiliary storage device 1003, a communication device 1004, an input device 1005, an output device 1006, a bus 1007, and the like.

25 [0072]

 In the following description, the term "device" can be deemed to be replaced with a circuit, device, unit, etc. The hardware configuration of the base station device 10 and the
30 user device 20 may be configured to include one or more of the devices illustrated in the drawing or may be configured without some devices.

[0073]

 Each function in the base station device

10 and the user device 20 is realized by loading a predetermined software (program) on hardware such as the processor 1001 or the storage device 1002, to perform the operation by the processor 1001 to
5 control communication by the communication device 1004 or to control at least one of reading and writing data in the storage device 1002 and the auxiliary storage device 1003.

[0074]

10 The processor 1001, for example, operates an operating system to control the entire computer. Processor 1001 may include a central processing unit (CPU) including an interface with a peripheral device, a control device, a computing
15 device, a register, and the like. For example, the above-described control unit 140, control unit 240, or the like may be implemented by the processor 1001.

[0075]

20 The processor 1001 also reads a program (program code), a software module, data, and the like, from at least one of the auxiliary storage device 1003 and the communication device 1004 into the storage device 1002, and performs various
25 processing in accordance therewith. As a program, a program that causes a computer to execute at least a part of the operations described in the above-described embodiment is used. For example, the control unit 140 of the base station device 10
30 illustrated in FIG. 12 may be implemented by a control program stored in the storage device 1002 and executed by the processor 1001. For example, the control unit 240 of the user device 20 illustrated in FIG. 13 may be implemented by a

control program stored in the storage device 1002 and executed by the processor 1001. While the various processes described above have been described as being executed by one processor 1001, they may be executed simultaneously or sequentially by two or more processors 1001. The processor 1001 may be implemented by one or more chips. Note that the program may be transmitted from a network via a telecommunications line.

10 [0076]

The storage device 1002 is a computer readable storage medium, and may include at least one of, for example, a ROM (Read Only Memory), an EPROM (Erasable Programmable ROM), an EEPROM (Electrically Erasable Programmable ROM), a RAM (Random Access Memory), and the like. The storage device 1002 may be referred to as a register, a cache, a main memory (main storage device), or the like. The storage device 1002 can store an executable program (program code), a software module, etc. to implement the communication method according to the embodiment of the present disclosure.

[0077]

The auxiliary storage device 1003 is a computer readable storage medium, and may be configured by, for example, at least one of an optical disk such as a CD-ROM (Compact Disc ROM), a hard disk drive, a flexible disk, a magneto-optical disk (e.g., a compact disk, a digital versatile disk, a Blu-ray (registered trademark) disk), a smart card, a flash memory (e.g., a card, a stick, a key drive), a floppy (registered trademark) disk, and a magnetic stripe. The auxiliary storage device

1003 may be referred to as an auxiliary storage device. The storage medium described above may be, for example, a database, a server, or other suitable medium including at least one of the
5 storage device 1002 and the auxiliary storage device 1003.

[0078]

The communication device 1004 is hardware (transceiver device) for communicating
10 between computers via at least one of a wired network and a wireless network, and is also referred to, for example, as a network device, a network controller, a network card, a communication module, and the like. The communication device 1004
15 may include, for example, a high frequency switch, a duplexer, a filter, a frequency synthesizer, or the like, to achieve at least one of frequency-division duplexing (FDD) and time-division duplexing (TDD). For example, a transceiver
20 antenna, an amplifier, a transceiver, a transmission line interface, or the like, may be implemented by the communication device 1004. The transceiver may be physically or logically separated from a transmitting unit and a receiving
25 unit.

[0079]

The input device 1005 is an input device (e.g., a keyboard, a mouse, a microphone, a switch, a button, a sensor, etc.) that receives an external
30 input. The output device 1006 is an output device (e.g., a display, speaker, LED lamp, etc.) that performs output to outside. The input device 1005 and the output device 1006 may be of an integrated configuration (e.g., a touch panel).

[0080]

Also, each device, such as the processor 1001 and the storage device 1002, is connected via the bus 1007 for communicating information. The bus
5 1007 may be configured using a single bus or may be configured using different buses between devices.

[0081]

The base station device 10 and the user device 20 may also include hardware such as a
10 microprocessor, a digital signal processor (DSP), an ASIC (Application Specific Integrated Circuit), a PLD (Programmable Logic Device), and a FPGA (Field Programmable Gate Array), wherein the hardware may implement a part or all of the
15 functional blocks. For example, the processor 1001 may be implemented using at least one of these hardware elements.

[0082]

(Conclusion 1 of the Embodiments)

20 As described above, according to the embodiment of the present invention, a user device for communicating with a base station device using a first RAT and a second RAT is provided. The user device includes: a receiving unit that receives,
25 from the base station device, first information indicating one or more bands that are candidates for a band combination to be supported by the user device; a generating unit that generates, based on the first information, terminal capability
30 information including second information including a list including a band combination at a head of the list, the band combination including a band used in the first RAT and a band used in the second RAT; and a transmitting unit that transmits the

generated terminal capability information to the base station device.

[0083]

With the above configuration, a
5 notification indicating that a band combination is applicable to dual connectivity executed in a radio communication system using multiple RATs can be provided.

[0084]

10 Based on the first information, a first list including one or more bands used in the first RAT and a second list including one or more bands used in the second RAT may be generated, and the second information may be generated based on the
15 first list and the second list. Such a configuration allows the user device 20 to provide band combination notification that is applicable to dual connectivity performed in a radio communication system using multiple RATs.

20 [0085]

The second information may be generated by prioritizing an order of the one or more bands of the first list. According to this configuration, the prioritized RAT bands can be reflected in the
25 order of the list of supported band combinations.

[0086]

The second information may be generated by prioritizing an order of the one or more bands of the second list. According to this
30 configuration, the prioritized RAT bands can be reflected in the order of the list of supported band combinations.

[0087]

The second information may be generated

by prioritizing an order of the one or more bands
of the first list and an order of the one or more
bands of the second list alternately. The
arrangement allows multiple RAT bands to be
5 alternately placed in the order of the list of
supported band combinations.
[0088]

Furthermore, according to the embodiment
of the present invention, a base station device for
10 communicating with a user device using a first RAT
and a second RAT is provided. The base station
device includes a transmitting unit transmitting,
to the user device, first information indicating
one or more bands that are candidates for a band
15 combination to be supported by the user device, a
receiving unit that receives, based on the first
information, terminal capability information
including second information including a list
including a band combination at a beginning of the
20 list, the band combination including a band used in
the first RAT and a band used in the second RAT;
and a management unit that controls communication
with the user device based on the received terminal
capability information.
25 [0089]

With the above configuration, a
notification indicating that a band combination is
applicable to dual connectivity executed in a radio
communication system using multiple RATS can be
30 provided
[0090]

(Conclusion 2 of the Embodiments)

As described above, according to the
modified example 1 of the embodiments of the

present invention, a user device is provided including a receiving unit configured to receive first information and second information from a base station device, the first information
5 indicating one or more bands that are candidates for a band combination to be supported, the second information indicating which RAT (Radio Access Technology) is used; a control unit configured to determine, based on the second information, the
10 band combination to be supported from among the one or more bands included in the first information; and a transmitting unit configured to transmit, to the base station device, terminal capability information including the determined band
15 combination.

[0091]

According to the above-described configuration, when RAT of E-UTRA, RAT of NR, and RAT of a combination of E-UTRA and NR are
20 supported, the user device 20 may select appropriate bands to determine a band combination to support, in accordance with the RAT to be used. That is, a band combination supported by a radio communication system utilizing multiple RATs can be
25 determined.

[0092]

The control unit may be configured to include only one or more bands configured for the first RAT in the determined band combination, when
30 the second information indicates a first RAT, and wherein the control unit may be configured to include only one or more bands configured for the second RAT in the determined band combination, when the second information indicates a second RAT.

According to this configuration, when RAT of a combination of E-UTRA and NR are supported, the user device 20 may select appropriate bands to determine a band combination to support, in accordance with the RAT to be used.
[0093]

The control unit may be configured to include at least one band configured for the first RAT and at least one band configured for the second RAT in the determined band combination, when the second information indicates a first RAT and a second RAT. According to this configuration, when RAT of a combination of E-UTRA and NR are supported, the user device 20 may select appropriate bands to determine a band combination to support, in accordance with the RAT to be used.
[0094]

A base station device including:
a transmitting unit configured to transmit first information and second information to a user device, the first information indicating one or more bands that are candidates for a band combination to be supported, the second information indicating which RAT (Radio Access Technology) is to be used;

a receiving unit configured to receive terminal capability information including the band combination to be supported, the band combination to be supported being determined, based on the second information, from among the one or more bands included in the first information based on the second information; and

a control unit configured to control communication with the user device, based on the

received terminal capability information.

[0095]

According to the above-described configuration, when RAT of E-UTRA, RAT of NR, and
5 RAT of a combination of E-UTRA and NR are supported, the user device 20 may select appropriate bands to determine a band combination to support, in accordance with the RAT to be used. That is, a band combination supported by a radio
10 communication system utilizing multiple RATs can be determined.

[0096]

(Supplemental Embodiment)

While the embodiments of the present
15 invention are described above, the disclosed invention is not limited to such embodiments, and those skilled in the art understand various variations, modifications, alternatives, substitutions, and the like. Descriptions are made
20 using specific numerical examples to facilitate understanding of the invention, but, unless otherwise indicated, these values are merely examples and any suitable value may be used. Classification of the items in the above
25 description is not essential to the present invention, and matters described in two or more items may be used in combination as needed, or a matter described in one item may be applied (unless inconsistent) to a matter described in another
30 item. Boundaries of function units or processing units in the functional block diagram do not necessarily correspond to the boundaries of physical parts. Operations of the multiple function units may be performed on physically one part.

Alternatively, an operation of one function unit may be performed on physically multiple parts. With respect to the processing procedures described in the embodiment, an order of the procedures may be changed as long as there is no inconsistency. For the convenience of the description of the process, the base station device 10 and the user device 20 have been described using functional block diagrams, but these devices may be implemented in hardware, software, or a combination thereof. Software operated by the processor of the base station device 10 in accordance with embodiments of the present invention and software operated by the processor of the user device 20 in accordance with embodiments of the present invention may be stored in a random access memory (RAM), a flash memory (RAM), a read-only memory (ROM), an EPROM, an EEPROM, a registers, a hard disk drive (HDD), a removable disk, a CD-ROM, a database, a server, or any other suitable storage medium, respectively. [0097]

Notification of information is not necessarily made in accordance with an aspect or an embodiment described in the present disclosure, but may be performed using other methods. For example, notification of information may be performed by a physical layer signaling (e.g., DCI (Downlink Control Information), UCI (Uplink Control Information)), an upper layer signaling (e.g., RRC (Radio Resource Control) signaling, MAC (Medium Access Control) signaling, broadcast information (MIB (Master Information Block), SIB (System Information Block)), other signals, or combinations thereof. Also, an RRC signaling may also be

referred to as an RRC message, and may be a message such as an RRC connection setup message, or an RRC connection reconfiguration message.

[0098]

5 Each aspect/embodiment described in the present disclosure may be applied to a system using an appropriate system such as LTE (Long Term Evolution), LTE-A (LTE-Advanced), SUPER 3G, IMT-Advanced, 4G (4th generation mobile communication
10 system), 5G (5th generation mobile communication system), FRA (Future Radio Access), NR (new Radio), W-CDMA (registered trademark), GSM (registered trademark), CDMA2000, UMB (Ultra Mobile Broadband), IEEE 802.11 (Wi-Fi (registered trademark)), IEEE
15 802.16 (WiMAX (registered trademark)), IEEE 802.20, UWB (Ultra-WideBand), Bluetooth (registered trademark), or applied to a next-generation system enhanced based on the above systems. Multiple systems may also be combined and applied (e.g.,
20 combinations of at least one of LTE and LTE-A with 5G, etc.).

[0099]

 The processing procedures, sequences, flow charts, etc. of each aspect/embodiment
25 described herein may be reordered, unless inconsistent. For example, the methods described in the present disclosure present elements of various steps using an exemplary sequence, and are not limited to the particular order presented.

30 [0100]

 A particular operation described herein to be performed by the base station device 10 may be performed by an upper node in some cases. It is apparent that in a network consisting of one or

more network nodes having a base station device 10, various operations performed for communication with the user device 20 may be performed by at least one of the base station device 10 and other network
5 nodes (such as, but not limited to, MME or S-GW) other than the base station device 10. The above description explains a case in which one network node other than the base station device 10 is present, but the network node may be a combination
10 of multiple other network nodes (e.g., MME and S-GW).

[0101]

The information or signals, etc. described in the present disclosure may be output
15 from a higher layer (or lower layer) to a lower layer (or upper layer). It may be input and output through multiple network nodes.

[0102]

The input/output information may be
20 stored in a specific location (e.g., memory) or managed using a management table. The input/output information may be overwritten, updated, or appended. The output information may be deleted. The input information, etc. may be transmitted to
25 other devices.

[0103]

The determination in the present disclosure may be made based on a value (0 or 1) expressed in 1 bit, a truth value (Boolean: true or
30 false), or a numerical comparison (e.g., comparison with a predetermined value).

[0104]

The software should be broadly interpreted to mean commands, instruction sets,

codes, code segments, program codes, programs, sub-
programs, software modules, applications, software
applications, software packages, routines,
subroutines, objects, executable files, threads,
5 procedures, functions, and the like, regardless of
whether referred to as software, firmware,
middleware, microcode, hardware description
languages, or by any other name.

[0105]

10 Software, instructions, information, and
the like may also be transmitted and received via a
transmission medium. For example, if the software
is transmitted from a web site, a server, or other
remote sources using at least one of a wired
15 technology (coaxial cable, optical fiber cable, a
twisted pair, a digital subscriber line (DSL),
etc.) and a wireless technology (infrared,
microwave, etc.), at least one of these wired
technology and wireless technology is included in
20 the definition of the transmission medium.

[0106]

The information, signals, and the like
described in the present disclosure may be
represented by using any of various different
25 technologies. For example, data, instructions,
commands, information, signals, bits, symbols,
chips, and the like, which may be referred to
throughout the above description, may be
represented by voltage, current, electromagnetic
30 waves, magnetic fields or particles, optical fields
or photons, or any combination thereof.

[0107]

Terms described in the present
disclosure and terms necessary for understanding

the present disclosure may be replaced by terms having the same or similar meanings. For example, at least one of a channel and a symbol may be a signal (signaling). The signal may also be a message. A component carrier (CC) may also be referred to as a carrier frequency, a cell, a frequency carrier, and the like.

[0108]

The terms "system" and "network" as used in the present disclosure are used interchangeably.

[0109]

Also, the information, parameters, etc. described in the present disclosure may be represented using absolute values, may be represented using relative values from predetermined values, or may be represented using corresponding other information. For example, a wireless resource may be one indicated by an index.

[0110]

The names used in the parameters described above are not limited in any respect. Furthermore, mathematical equations using these parameters may differ from those explicitly disclosed in the present disclosure. Since various channels (e.g., PUCCH, PDCCH, etc.) and information elements can be identified by any suitable name, the various names assigned to these various channels and information elements are not limited in any respect.

[0111]

In the present disclosure, terms such as "base station (BS: Base Station)", "radio base station", "base station device", "fixed station", "NodeB", "eNodeB (eNB)", "gNodeB (gNB)", "access

point", "transmission point", "reception point",
"transmission/reception point", "cell", "sector",
"cell group", "carrier", and "component carrier",
may be used interchangeably. The base station may
5 be referred to as a macro cell, a small cell, a
femtocell, a picocell, and the like.
[0112]

The base station may accommodate one or
more (e.g., three) cells. In a case in which the
10 base station accommodates multiple cells, the
entire coverage area of the base station may be
divided into multiple smaller areas, and in each of
the smaller areas, a communication service can be
provided by a base station subsystem (e.g., RRH:
15 Remote Radio Head). The term "cell" or "sector"
refers to a part or all coverage areas of at least
one of the base stations and base station
subsystems providing a communication service in
this coverage.
20 [0113]

In the present disclosure, terms such as
"mobile station (MS)", "user terminal," "user
equipment (UE)", and "terminal", may be used
interchangeably.
25 [0114]

The mobile station may be referred to by
one of ordinary skill in the art as a subscriber
station, a mobile unit, a subscriber unit, a
wireless unit, a remote unit, a mobile device, a
30 wireless device, a wireless communication device, a
remote device, a mobile subscriber station, an
access terminal, a mobile terminal, a wireless
terminal, a remote terminal, a handset, a user
agent, a mobile client, a client, or some other

suitable terms.

[0115]

At least one of the base stations and the mobile stations may be referred to as a transmitter, a receiver, a communication device, or the like. At least one of the base station and the mobile station may be a device installed in a mobile body, or a mobile body itself, or the like. The mobile body may be a vehicle (such as an automobile and an airplane), an unmanned mobile body (e.g., a drone, an automated vehicle, etc.), or a robot (a manned or unmanned type). It should be noted that at least one of the base stations and the mobile station includes a device that is not necessarily mobile during communication operation. For example, at least one of the base stations and the mobile stations may be an IoT (Internet of Things) device such as a sensor.

[0116]

In addition, the base stations in the present disclosure may be deemed to be replaced with user terminals. For example, each aspect/embodiment of the present disclosure may be applied to a configuration in which communication between a base station and a user terminal is replaced by communication between multiple user devices (may be referred to as D2D (Device-to-Device), V2X (Vehicle-to-Everything), or the like, for example). In this case, a user device may be configured to have functions that the aforementioned base station device has. In addition, the words "up" and "down" may be deemed to be replaced by the words corresponding to the communication between terminals (for example,

"side"). For example, an uplink channel or a downlink channel may be deemed to be replaced with a side channel.

[0117]

5 Similarly, the user terminal in the present disclosure may be deemed to be replaced with a base station. In this case, the base station may be configured to have the function that the aforementioned user terminal has.

10 [0118]

 The terms "determining" and "determining" as used in the present disclosure may encompass a wide variety of operations. For example, judging, calculating, computing, processing, deriving, investigating, looking up, searching, inquiry (e.g., searching a table, database or other data structure), and ascertaining, may be deemed to be "determined". Also, for example, receiving (e.g., receiving information), transmitting (e.g., transmitting information), inputting, outputting, and accessing (e.g., accessing data in memory) may be deemed to be "determined". Further, resolving, selecting, choosing, establishing, comparing, and the like, may be deemed to be "determined". That is, that a certain operation is deemed to be "determined" may be included in a scope of "determining". Also, "determining" may be deemed to be replaced with "assuming", "expecting", "considering", or the like.

30 [0119]

 The terms "connected", "coupled", or any variation thereof means any direct or indirect connection or coupling between two or more

elements, and may include presence of one or more intermediate elements between the two elements "connected" or "coupled" to each other. The coupling or connection between elements may be
5 physical, logical, or a combination of these. For example, "connection" may be deemed to be replaced with "access". As used in the present disclosure, two elements may be considered to be "connected" or "coupled" to each other, using at least one of one
10 or more wires, cables, and printed electrical connections, and, in some non-limiting and non-comprehensive examples, using electromagnetic energy having wavelengths of a radio frequency domain, a microwave domain, and a light domain
15 (both visible and invisible).

[0120]

The reference signal can also be abbreviated as RS, and may be referred to as a pilot depending on the standard applied.

20 [0121]

"Based on" as used in the present disclosure does not mean "based on only" unless otherwise specified. In other words, the phrase "based on" means both "based on only" and "based
25 on at least".

[0122]

Any references to elements using a designation such as "first" or "second" as used in the present disclosure do not generally limit an
30 amount or an order of those elements. These designations may be used in the present disclosure as a convenient way to distinguish between two or more elements. Accordingly, references to the first and second elements do not imply that only two

elements may be adopted or that in some way the first element must precede the second element.

[0123]

5 The "means" in the configuration of each of the above-described devices may be replaced by a "unit", a "circuit", a "device", and the like.

[0124]

10 It is intended that, where the terms "include", "include" and variations thereof are used in the present disclosure, these terms are as comprehensive as the terms "comprising". Further, it is intended that the term "or" as used in this disclosure is not an exclusive OR.

[0125]

15 A wireless frame may consist of one or more frames in the time domain. In the time domain, one or more frames may be referred to as subframes. The subframe may further include one or more slots in the time domain. The subframe may be a fixed
20 time length (e.g., 1 ms) independent of numerology.

[0126]

The numerology may be a communication parameter that is applied to at least one of the transmission and reception of a signal or channel.
25 The numerology may indicate, for example, at least one of a sub-carrier spacing (SCS), a bandwidth, a symbol length, a cyclic prefix length, a transmission time interval (TTI), the number of symbols per TTI, a radio frame configuration, a
30 specific filtering process performed by the transceiver in the frequency domain, a specific windowing process performed by the transceiver in the time domain, and the like.

[0127]

The slot may consist of one or more symbols (OFDM (Orthogonal Frequency Division Multiplexing) symbols, SC-FDMA (Single Carrier Frequency Division Multiple Access) symbols, etc.)
5 in the time domain. The slot may be a time unit based on numerology.
[0128]

The slot may include multiple minislots. Each minislot may consist of one or more symbols in
10 the time domain. The minislot may also be referred to as a subslot. The minislot may consist of fewer symbols than the slot. PDSCH (or PUSCH) transmitted in time units greater than the minislot may be referred to as PDSCH (or PUSCH) mapping type A.
15 PDSCH (or PUSCH) transmitted using the minislot may be referred to as PDSCH (or PUSCH) mapping type B.
[0129]

A radio frame, a subframe, a slot, a minislot, and a symbol all represent a time unit
20 for transmitting a signal. A radio frame, a subframe, a slot, a minislot, and a symbol may be each referred to as different corresponding names.
[0130]

For example, one subframe may be
25 referred to as a transmission time interval (TTI), multiple consecutive subframes may be referred to as a TTI, or one slot or one minislot may be referred to as a TTI. That is, at least one of a the subframe and the TTI may be a subframe (1 ms)
30 in existing LTE, a period shorter than 1 ms (for example, 1 to 13 symbols), or a period longer than 1 ms. The unit representing the TTI may be referred to as a slot, a minislot, or the like, rather than a subframe.

[0131]

Here, the TTI refers to, for example, a minimum time unit for scheduling in wireless communication. For example, in an LTE system, the base station performs scheduling of allocating, to each user device 20, radio resources (such as a frequency bandwidth and transmission power that can be used in each user device 20) in TTI units. Note that a definition of the TTI is not limited to this.

[0132]

The TTI may be a transmission time unit of a channel-coded data packet (transport block), a code block, a code word, or the like, or may be a unit of processing, such as scheduling, link adaptation, or the like. When a TTI is given, a time frame (e.g., the number of symbols) in which a transport block, a code block, a code word, or the like, is actually mapped may be shorter than the TTI.

[0133]

If one slot or one minislot is referred to as a TTI, one or more TTIs (i.e., one or more slots or one or more minislots) may be the minimum time unit for scheduling. Also, the number of slots (the number of minislots) constituting the minimum time unit of the scheduling may be controlled.

[0134]

A TTI having a time length of 1 ms may normally 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, a slot, and the like. A TTI that is usually shorter than an ordinary TTI may be

referred to as a shortened TTI, a short TTI, a partial or fractional TTI, a shortened subframe, a short subframe, a minislot, a subslot, a slot, or the like.

5 [0135]

Note that a long TTI (e.g., an ordinary TTI, a subframe) may be deemed to be replaced with a TTI having a long time exceeding 1 ms, or a short TTI (e.g., a shortened TTI) may be deemed to be replaced with a TTI having a TTI length greater than 1 ms and less than a TTI length of a long TTI.

10 [0136]

A resource block (RB) is a resource allocation unit of the time domain and the frequency domain, and may include one or more consecutive subcarriers in the frequency domain.

15 The number of subcarriers included in the RB may be the same regardless of numerology, for example 12. The number of subcarriers included in the RB may be determined based on the numerology.

20 [0137]

The time domain of the RB may also include one or more symbols, which may be a length of one slot, one minislot, one subframe, or one TTI. One TTI, one subframe, and the like may each include one or more resource blocks.

25 [0138]

The one or more RBs may be referred to as physical resource blocks (PRBs: Physical RBs), a sub-carrier group (SCG), a resource element group (REG), a PRB pair, a RB pair, and the like.

30 [0139]

The resource block may also include one or more resource elements (REs). For example, one

RE may be a radio resource region of 1 subcarrier and 1 symbol.

[0140]

5 A bandwidth part (BWP, which may be referred to as partial bandwidth) may represent a subset of consecutive common resource blocks (common RBs) for certain numerology in a certain carrier. Here, the common RB may be identified by an index of the RB relative to a common reference point of the carrier. The PRB may be defined in a
10 BWP and may be numbered in the BWP.

[0141]

A BWP may include a BWP (UL BWP) for UL and a BWP (DL BWP) for DL. For a UE, one or more
15 BWPs may be configured in one carrier.

[0142]

At least one of the configured BWPs may be active, and the UE may not assume sending or receiving a predetermined signal/channel outside
20 the active BWP. In addition, in the present disclosure, the terms "cell" and "carrier" may be deemed to be replaced with "BWP".

[0143]

Structures of the above-described
25 wireless frame, subframe, slot, minislot and symbol described above are exemplary only. For example, the number of subframes contained in a wireless frame, the number of slots per subframe or wireless frame, the number of minislots contained in a slot,
30 the number of symbols and RBs contained in a slot or a minislot, the number of sub-carriers contained in an RB, and the number of symbols, symbol lengths, cyclic prefixes (CP: Cyclic Prefix) lengths and the like in a TTI can be variously

changed.

[0144]

In the present disclosure, if an article, such as "a", "an", and "the" in English,
5 is added by translation, the present disclosure may include that nouns following these articles are plural.

[0145]

In the present disclosure, a sentence "A
10 and B are different" may mean "A and B are different from each other". The sentence may mean that "A and B are different from C, respectively". Terms such as "apart" or "joined" may be interpreted in the same way as "different".

15 [0146]

Each of the aspects/embodiments described in the present disclosure may be used alone, in combination, or switched during execution. Notification of predetermined
20 information (e.g., notification of "X") is not limited to explicit notification, and the notification may be implicitly made (for example, notification may be made by not notifying predetermined information).

25 [0147]

In the present disclosure, the transmitting unit 210 and the receiving unit 220 are examples of communication units. MN is an example of a first base station device. SN is an
30 example of a second base station device. Data Inactivity Timer is an example of a data inactivity timer.

[0148]

In the present disclosure, FreqBandList

is an example of information indicating bands that are candidates for a band combination to be supported. NR is an example of a first RAT. E-UTRA is an example of a second RAT.

5 [0149]

Although the present disclosure has been described in detail, it is apparent to those skilled in the art that the disclosure is not limited to the embodiments described herein. The present disclosure may be implemented as modifications and alteration without departing from the gist and scope of the present disclosure as defined by the claims. Accordingly, the description of the present disclosure is intended for illustrative purposes and does not have any meaning to limit the disclosure.

LIST OF REFERENCE SYMBOLS

[0150]

20 100 Base station device
200 User device
110 Transmitting unit
120 Receiving unit
130 Setting unit
25 140 Control unit
200 User device
210 Transmitting unit
220 Receiving unit
230 Setting unit
30 240 Control unit
1001 Processor
1002 Storage device
1003 Auxiliary storage device
1004 Communication device

1005 Input device
1006 Output device

CLAIMS

1. A terminal comprising:

5 a receiving unit configured to receive first information and second information from a base station device, the first information indicating one or more bands that are to be candidates for a band combination, the second information indicating
10 which Radio Access Technology, RAT, is to be used;

 a control unit configured to determine, based on the second information, a supported band combination from the one or more bands included in the first information, and to determine at least
15 one of a feature set of the supported band combination or a feature set combination corresponding to the supported band combination;
and

 a transmitting unit configured to transmit, to
20 the base station device, terminal capability information including at least the supported band combination,

 wherein, when the second information indicates NR, the control unit is configured to include only
25 one or more bands configured for the NR in the supported band combination, and the control unit is configured to determine the feature set and the feature set combination of the supported band combination and configured to include the feature
30 set and the feature set combination in the terminal capability information,

 wherein, when the second information indicates E-UTRA, the control unit is configured to include one or more bands configured for the E-UTRA in the

supported band combination, and

wherein, when the second information indicates NR and E-UTRA, the control unit is configured to include at least one band configured for the NR and
5 at least one band configured for the E-UTRA in the supported band combination, and the control unit is configured to determine the feature set combination corresponding to the determined supported band combination, and configured to include the feature
10 set combination in the terminal capability information.

2. A base station device comprising:

15 a transmitting unit configured to transmit first information and second information to a terminal, the first information indicating one or more bands that are to be candidates for a band combination, the second information indicating
20 which Radio Access Technology, RAT, is to be used;
a receiving unit configured to receive terminal capability information including a supported band combination that is determined from the one or more bands included in the first
25 information based on the second information, and at least one of a feature set of the supported band combination or a feature set combination corresponding to the supported band combination;
the receiving unit configured to receive the
30 terminal capability information including at least the supported band combination that is determined from the one or more bands included in the first information based on the second information; and
a control unit that control communication with

the terminal, based on the received terminal capability information,

wherein, when the second information indicates NR, the terminal capability information includes
5 the supported band combination including only one or more bands configured for the NR, and the feature set and the feature set combination of the supported band combination,

wherein, when the second information indicates
10 E-UTRA, the terminal capability information includes the supported band combination only including one or more bands configured for the E-UTRA, and

wherein, when the second information indicates
15 NR and E-UTRA, the terminal capability information includes the supported band combination including at least one band configured for the NR and at least one band configured for the E-UTRA and the feature set combination corresponding to the
20 supported band combination.

3. A communication method by a terminal, the method comprising:

25 a step of receiving first information and second information from a base station device, the first information indicating one or more bands that are to be candidates for a band combination, the second information indicating which Radio Access
30 Technology, RAT, is to be used;

a step of determining, based on the second information, a supported band combination from the one or more bands included in the first information, and determining at least one of a

feature set of the supported band combination or a feature set combination corresponding to the supported band combination; and

5 a step of transmitting, to the base station device, terminal capability information including at least the supported band combination,

wherein, when the second information indicates NR, the step of determining includes only one or more bands configured for the NR in the supported
10 band combination, and the step of determining determines the feature set and the feature set combination of the determined supported band combination and includes the feature set and the feature set combination in the terminal capability
15 information,

wherein, when the second information indicates E-UTRA, the step of determining includes one or more bands configured for the E-UTRA in the supported band combination, and

20 wherein, when the second information indicates NR and E-UTRA, the step of determining includes at least one band configured for the NR and at least one band configured for the E-UTRA in the supported band combination, and the step of determining
25 determines the feature set combination corresponding to the supported band combination, and includes the feature set combination in the terminal capability information.

30 4. A radio communication system comprising:
the terminal according to claim 1; and
the base station device configured to communicate with said terminal.