United States Patent	12395950
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Kim; Ok Jin

Communication node and method of outputting synchronization signal in the same

Abstract

Provided is a method of outputting a synchronization signal in a communication node comprising: receiving communication connection information from a terminal, identifying detectable position information of a synchronization signal block (SS block) included in the communication connection information, setting a position of the SS block based on the identified detectable position information, and outputting the SS block based on the set position.

Inventors: **Kim; Ok Jin (Seongnam-si, KR)**

Applicant: **SOLiD, INC.** (Seongnam-si, KR)

Family ID: **1000008768034**

Assignee: **SOLiD, INC. (Seongnam-si, KR)**

Appl. No.: **17/834377**

Filed: **June 07, 2022**

Prior Publication Data

Document Identifier	Publication Date
US 20220408386 A1	Dec. 22, 2022

Foreign Application Priority Data

KR	10-2021-0079808	Jun. 21, 2021

Publication Classification

Int. Cl.: **H04W56/00** (20090101); **H04W72/02** (20090101); **H04W72/0453** (20230101); **H04W72/1273** (20230101); **H04W72/52** (20230101)

U.S. Cl.:

CPC **H04W56/001** (20130101); **H04W72/02** (20130101); **H04W72/0453** (20130101); **H04W72/52** (20230101); H04W56/0015 (20130101); H04W72/1273 (20130101)

Field of Classification Search

CPC: H04W (56/001); H04W (72/02); H04W (72/0453); H04W (72/52); H04W (56/0015); H04L (5/14); H04L (27/2602); H04L (27/261); H04L (5/0042); H04L (5/0051); H04L (5/0053); H04L (5/0091); H04L (5/0048); H04L (27/2657); H04L (5/0007); H04L (27/26025); H04L (27/2666); Y02D (30/70)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
10411940	12/2018	Ko	N/A	H04W 72/0453
10798695	12/2019	Kim	N/A	H04B 7/0695
11582806	12/2022	Yan	N/A	H04W 72/23
11658778	12/2022	Fehrenbach	370/329	H04L 5/0064
11930481	12/2023	Oh	N/A	H04W 72/0453
11962438	12/2023	Tsui	N/A	H04B 7/0417
12052722	12/2023	Sato	N/A	H04W 72/1268
2018/0367985	12/2017	Novlan et al.	N/A	N/A
2020/0127755	12/2019	Ko	N/A	H04J 11/0069
2020/0314777	12/2019	Liu	N/A	H04W 72/0446
2021/0368534	12/2020	Sato	N/A	H04W 72/569
2022/0046644	12/2021	Oh	N/A	H04L 5/0048
2023/0345486	12/2022	Kim	N/A	H04W 56/0015

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
109120390	12/2018	CN	N/A
10-2019-0017641	12/2018	KR	N/A
2018/204285	12/2017	WO	N/A

OTHER PUBLICATIONS

Extended European Search Report dated Oct. 25, 2022 in European Application No. 22178037.2. cited by applicant

ITL, “Multiple SS block indication in wideband CC”, 3GPP TSG RAN WG1 NR Ad-Hoc#2, Jun. 27-30, 2017, R1-1711352, Qingdao, P.R. China (5 pages total). cited by applicant

---

Primary Examiner: O Connor; Brian T

Attorney, Agent or Firm: Sughrue Mion, PLLC

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims the benefit of Korean Patent Application No. 10-2021-0079808, filed on Jun. 21, 2021, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

1. Field

(2) The disclosure relates to a communication node and method of outputting a synchronization signal in the communication node.

2. Description of the Related Art

(3) Since around 2019 when fifth generation (5G) new radio (NR) terminals were supplied, 5G mobile communication has been commercially used. The 5G NR employs a time division duplexing (TDD) scheme, which makes it necessary to perform time synchronization between a terminal and a base station (or repeater). For the time synchronization, the terminal needs to obtain a synchronization signal block (SS block) output from the base station or repeater and attain synchronization by identifying a primary synchronization signal (PSS) and a secondary synchronization signal (SSS) included in the SS block.

(4) In traditional long term evolution (LTE), the SS block is always located at a center frequency, so the synchronization may be attained by calculating a correlation only for the PSS and SSS bands of the center frequency. On the other hand, in the 5G NR, the position of the SS block is no longer fixed, and the position of the SS block may be freely adjusted. In this case, however, when the SS block having a different position for each communication operator is output, the terminal needs to be equipped with hardware capable of processing wideband signals to support various frequency bands for the SS block, so the cost and power consumption of the terminal may increase. In addition, the existing terminals having hardware capable of processing only narrowband signals may no longer access the communication system such as the base station.

SUMMARY

(5) The disclosure provides a communication node enabling terminals to access and communicate therewith according to respective communication specifications of the terminals, and a method of outputting a synchronization signal in the communication node.

(6) The disclosure also provides a communication node capable of using frequency bands for mobile communication more efficiently, and a method of outputting a synchronization signal in the communication node.

(7) According to an aspect of an embodiment, a method of outputting a synchronization signal in a communication node comprising: receiving communication connection information from a terminal; identifying detectable position information of a synchronization signal block (SS block) included in the communication connection information; setting a position of the SS block based on the identified detectable position information; and outputting the SS block based on the set position.

(8) According to an exemplary embodiment, the setting of the position of the SS block comprises setting a position of the SS block so that the SS block is output at a frequency included in a frequency band corresponding to the detectable position information.

(9) According to an exemplary embodiment, the setting of the position of the SS block comprises setting an orthogonal frequency division multiplexing (OFDM) symbol position and a subcarrier position of the SS block so that the SS block is output at a frequency included in a frequency band

corresponding to the detectable position information.
(10) According to an exemplary embodiment, the setting of the position of the SS block comprises, when a plurality of frequency bands corresponding to the detectable position information are identified, selecting a frequency band based on a load of each of the plurality of frequency bands or whether each frequency band is occupied by another terminal, and setting a position of the SS block so that the SS block is output at a frequency included in the selected frequency band.
(11) According to an exemplary embodiment, the communication connection information comprises at least one of frequency-in-use information and available bandwidth information of the terminal.
(12) According to an exemplary embodiment, the method further comprises allocating a communication resource for communication with the terminal based on at least one of the frequency-in-use information and the available bandwidth information included in the communication connection information.
(13) According to an exemplary embodiment, the communication node comprises a base station or a repeater.
(14) According to an aspect of an embodiment, a communication node comprising: a terminal information receiver configured to receive communication connection information from a terminal; a terminal information processor configured to obtain detectable position information of a synchronization signal block (SS block) by processing the received communication connection information; and an SS block output adjuster configured to adjust a position of the SS block for the terminal based on the detectable position information.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The above and other features and advantages of the disclosure will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:
(2) FIG. **1** is a conceptual diagram of a communication system, according to an embodiment of the disclosure;
(3) FIG. **2** is a block diagram of a portion of a communication node, according to an embodiment of the disclosure;
(4) FIG. **3** is a ladder diagram for describing operations of a communication system, according to an embodiment of the disclosure;
(5) FIG. **4** illustrates a synchronization signal block (SS block) output from a communication node;
(6) FIG. **5** illustrates an arrangement of SS blocks placed by a communication node based on a method of outputting a synchronization signal, according to an embodiment of the disclosure;
(7) FIGS. **6**A and **6**B are diagrams for comparing a frequency band allocation form according to an embodiment of the disclosure and a frequency band allocation form according to a traditional mobile communication method; and
(8) FIG. **7** illustrates a base station having a directional antenna outputting SS blocks according to an embodiment of the disclosure.
DETAILED DESCRIPTION
(9) Embodiments of the disclosure are provided to more fully explain the technical idea of the disclosure for those of ordinary skill in the art. The scope of the disclosure is not limited to the following embodiments of the disclosure, and various forms of modification can be made to the following embodiments of the disclosure without departing from the scope of the disclosure. The embodiments are provided to make the disclosure fully and completely understood and to fully convey the technical idea of the disclosure to those of ordinary skill in the art.

(10) In the disclosure, the terms first, second, etc., are used to describe various members, areas, layers, portions and/or components, but it is obvious that the members, areas, layers, portions and/or components should not be limited by the terms. The terms do not imply a specific order, ranks or priorities, but are used to distinguish a member, area, portion, or component from another. Accordingly, a first member, area, portion, or component may also be referred to as a second member, area, portion, or component, without departing from the teachings of the disclosure. For example, a first component may be termed a second component, and a second component may be termed a first component, without departing from the teachings of the disclosure.
(11) Unless otherwise defined, all the terms as herein used have the same meanings as those commonly understood by the ordinary skill in the art to which the disclosure pertains, including technical and scientific terms. Furthermore, the terms as commonly used and defined in the dictionary should be construed as having the same meaning as they imply in the context of relevant technologies, and unless explicitly defined, should not be interpreted in an overly formal sense.
(12) A procedure performed in a particular sequence in an embodiment of the disclosure may be performed in a different sequence in another embodiment of the disclosure. For example, two processes described successively may be performed at substantially the same time or in a reversed sequence.
(13) As for accompanying drawings, for example, it may be appreciated that the forms shown in the drawings may be changed according to a manufacturing technique and/or tolerance. Accordingly, embodiments of the disclosure should not be limited to specific forms as illustrated in the accompanying drawings. For example, embodiments of the disclosure encompass changes of forms caused in a manufacturing process. In the drawings, like reference numerals indicate like elements, so overlapping description thereof will not be repeated.
(14) The expression “A and/or B” as herein used includes each of A and B and both A and B.
(15) Embodiments of the disclosure will now be described in detail with reference to accompanying drawings.
(16) FIG. **1** is a conceptual diagram of a communication system, according to an embodiment of the disclosure. FIG. **2** is a block diagram of a portion of a communication node, according to an embodiment of the disclosure.
(17) Referring to FIG. **1**, a communication system **10** according to an embodiment of the disclosure may include a base station (BS) **110**, a repeater **120**, and at least one terminals (or user equipments (UEs)) **200***a* and **200***b* (hereinafter, collectively denoted by ‘**200**’). In another embodiment of the disclosure, the communication system **10** may not include the repeater **120**.
(18) The BS **110** may provide a communication service according to a mobile communication standard. For example, the BS **110** may provide a fifth generation (5G) mobile communication service such as 5G new radio (NR). In another embodiment of the disclosure, the BS **110** may also provide an old mobile communication service (e.g., a long term evolution (LTE) or LTE-advanced (LTE-A) service) as well as the 5G mobile communication service. The BS **110** may transmit or receive a communication signal directly to or from a terminal **200***a* within its coverage or transmit or receive a communication signal to or from a terminal **200***b* via a repeater **120** arranged in a shadow area such as in a building or underground. The BS **110** may include not only a macro cell but also small cells such as low-power BS equipment, a pico cell, a femto cell, etc.
(19) The repeater **120** may relay communications between the BS **110** and the terminal **200***b*. The repeater **120** may be installed in a shadow area such as in a building or underground in which communication signals from the BS **110** are not smoothly received, without being limited thereto.
(20) In an embodiment of the disclosure, the repeater **120** may relay communication signals in a 5G mobile communication network such as 5G NR, but is not limited thereto. For example, the repeater **120** may relay communication signals in a communication network including a combination of the 5G mobile communication network and a fourth generation (4G) mobile communication network such as LTE or LTE-A network.

(21) The repeater **120** may receive a communication signal transmitted from the BS **110** (e.g., a BS signal), and relay the communication signal (e.g., the BS signal) to the terminal **200***b* located in the coverage of the repeater **120**. The communication signal may be a radio communication signal (e.g., a radio frequency (RF) signal). In an embodiment of the disclosure, the communication signal may be a communication signal that conforms to a 5G NR standard.
(22) For example, in an embodiment of the disclosure, the repeater **120** may include a remote unit (RU) of a distributed antenna system (DAS), a distributed unit (DU) or a remote radio unit (RRU) of an open radio access network (O-RAN), or other various types of repeater known to the public.
(23) Although the repeater **120** is shown in FIG. **1** as relaying communications between one BS **110** and one terminal **200***b* for convenience of explanation, the repeater **120** may relay communications between a plurality of BSs and a plurality of terminals. In another embodiment of the disclosure, the repeater **120** may relay communications between the BS **110** and another repeater (not shown).
(24) The terminal **200** may use a communication service by accessing the BS **110** or the repeater **120**. In the 5G NR, a TDD scheme is used, in which case time synchronization between the terminal **200** and the BS **110** (or the repeater **120**) is required. For this, the BS **110** or the repeater **120** may periodically output a synchronization signal block (SS block). The terminal **200** may receive the SS block and attain synchronization based on a primary synchronization signal (PSS) and a secondary synchronization signal (SSS) included in the SS block.
(25) In traditional LTE, a position of the SS block is fixed at a center frequency, so the synchronization may be attained by calculating a correlation only for the PSS and SSS bands of the center frequency. On the other hand, in the 5G NR, the position of the SS block is not fixed, and the SS block is arranged and output in a different position for each communication operator. In this case, problems may arise in that the terminal **200** needs to be equipped with hardware capable of processing wideband signals to support various frequency bands and the existing terminals capable of processing only narrowband signals may not access the communication system.
(26) In the disclosure, each terminal **200** may be configured to output information for communication connection, instead of the BS **110** or the repeater **120** arranging and outputting the SS block at a preset position. The BS **110** or the repeater **120** may identify a position of the SS block that may be detected by each terminal **200** from the information output by the terminal **200**, and may allocate and output the SS block in the identified position each.
(27) Referring to FIG. **2**, a communication node **300** may include a terminal information receiver **310**, a terminal information processor **320** and an SS block output adjuster **330**. The communication node **300** may correspond to the BS **110** or the repeater **120** as shown in FIG. **1**. The components shown in FIG. **2** may be implemented by using hardware such as at least one processor (not shown), a communication device (circuit), etc., included in the communication node **300**. The components of the communication node **300** are not, however, limited to what are shown in FIG. **2**, and the communication node **300** may include a lot more components.
(28) The terminal information receiver **310** may receive communication connection information output from the terminal **200**. The communication connection information may include information about a communication available frequency and available bandwidth, detectable position information (e.g., frequency band) of the SS block, etc. The communication connection information may be output by the terminal **200** during initial access to the communication node **300**, but in some embodiments of the disclosure, the terminal **200** may periodically output the communication connection information.
(29) The terminal information processor **320** may obtain the aforementioned various information by processing the received communication connection information. The SS block output adjuster **330** may adjust the position of the SS block according to the detectable position information of the SS block of the terminal **200** obtained from the communication connection information. The communication node **300** may enable the terminal **200** to receive the SS block by outputting the SS block based on the adjusted position.

(30) Operations of a communication system according to embodiments of the disclosure will now be described in more detail with reference to FIGS. **3** to **7**.

(31) FIG. **3** is a ladder diagram for describing operations of a communication system, according to an embodiment of the disclosure. FIG. **4** illustrates an SS block output from a communication node. FIG. **5** illustrates an arrangement of SS blocks placed by a communication node based on a method of outputting a synchronization signal, according to an embodiment of the disclosure. FIGS. **6**A and **6**B are diagrams for comparing a frequency band allocation form according to an embodiment of the disclosure and a frequency band allocation form according to a traditional mobile communication method. FIG. **7** illustrates a BS having a directional antenna outputting SS blocks according to an embodiment of the disclosure.

(32) Referring to FIG. **3**, the terminal **200** may transmit information for communication connection to the communication node **300**, in S**100**.

(33) The terminal **200** may output the information for communication connection (hereinafter, communication connection information) to access (connect) the communication node **300** (BS **110** or the repeater **120**). For example, the terminal **200** may output the communication connection information for initial communication connection, without being limited thereto. In another embodiment of the disclosure, the terminal **200** may periodically output the communication connection information even in an idle mode (e.g., null mode or sleep mode), enabling the communication node **300** to get ready to allocate a communication service for the terminal **200**.

(34) The communication connection information may include various information relating to a communication specification of the terminal **200**. The communication specification may depend on communication-related hardware equipped in the terminal **200**. For example, the communication connection information may include information about a frequency-in-use, available bandwidth and a detectable position (e.g., frequency band) of the SS block, etc., of the terminal **200**.

(35) The communication node **300** may identify the detectable position information of the SS block of the terminal **200** from the received information, in S**110**. The communication node **300** may set a position of the SS block based on the identified position in S**120**, and may output the SS block based on the set position in S**130**.

(36) The communication node **300** may identify the detectable position of the SS block from the communication connection information received from the terminal **200**. The detectable position of the SS block may refer to a frequency band in which the terminal **200** is able to receive the SS block. In another embodiment of the disclosure, the detectable position may include a plurality of continuous or discrete frequency bands.

(37) The communication node **300** may set a position ((an OFDM symbol position, a subcarrier position, etc.) of the SS block based on the identified position, and output the SS block based on the set position. In some embodiments of the disclosure, in a case that the identified position corresponds to a plurality of frequency bands, the communication node **300** may select a frequency in one of the identified frequency bands, and set a position of the SS block so that the SS block is output at the selected frequency. For example, the communication node **300** may select a frequency in one frequency band based on whether the identified frequency bands are occupied by other terminals, load conditions of the frequency bands, etc.

(38) The terminal **200** may receive the SS block output from the communication node **300** and decode the received SS block in S**140**. The terminal **200** may access the communication node **300** based on access information obtained by the decoding, in S**150**.

(39) The terminal **200** may obtain the access information for making access to the communication node **300** by decoding the received SS block, and perform communication with the communication node **300** based on the access information obtained. In another embodiment of the disclosure where the communication node **300** is the repeater **120**, a higher layer device (e.g., a BS) of the communication node **300** may include a database to identify a user of the terminal **200** and check usage and/or process charging. The communication node **300** may transmit information for

identifying the terminal **200** and information about data usage of the terminal **200** to the higher layer device, which may in turn identify a user of the terminal **200** and monitor data usage of the user (or the terminal) based on the received information and the database.
(40) Referring first to FIG. **4** in relation to the embodiment of FIG. **3**, an SS block may include a PSS block, an SSS block, and a physical broadcast channel (PBCH) block. Each of the PSS block and the SSS block occupies one OFDM symbol and 127 subcarriers, and the PBCH block is formed across three OFDM symbols and 240 subcarriers.
(41) The PSS block and the SSS block may include information of an identity (ID) for identifying a BS (or cell), e.g., a physical layer cell ID (PCI). For example, the PCI may be comprised of a combination of the PSS and the SSS. The terminal **200** may recognize which cell the terminal **200** belongs to and determine a starting point of a frame to be in sync with the BS (or the repeater), based on the PSS block and the SSS block included in the received SS block.
(42) The PBCH block may include a master information block (MIB) that contains random access information of the BS. The terminal **200** may decode the MIB included in the PBCH block in the received SS block, to obtain various information (e.g., a frame number) required for detecting a signal transmitted from the BS (or the repeater).
(43) Based on the information obtained from the SS block, the terminal **200** may perform communication with the BS (or the repeater).
(44) Referring to an embodiment of FIG. **5**, upon receiving the communication connection information from each of a plurality of terminals **200**, the communication node **300** may arrange the respective SS blocks for the terminals **200** in various positions. As shown, the communication node **300** may receive the communication connection information from each of a first terminal, a second terminal, a third terminal, and a fourth terminal, and obtain detectable position information of the SS block from the received connection information. The communication node **300** may arrange the SS block for each terminal in a different symbol and subcarrier position based on the information obtained, to make the SS block output in different frequency bands.
(45) In accordance with an embodiment of the disclosure, the communication node **300** may be able to allocate an individual communication resource for the terminal **200** (e.g., a frequency band for data transmission or reception with the terminal **200**) based on the frequency-in-use, the available bandwidth, and the SS block detectable position included in the communication connection information of the terminal **200**.
(46) In this regard, referring to FIG. **6**A, in the traditional case as shown in FIG. **6**A, it may be seen that frequency bands are divided for the respective operators. In this case, there are band guards between the operators' frequency bands, which may hinder frequency use efficiency. Furthermore, a manufacturer of the terminal **200** needs to manufacture a dedicated terminal including hardware that only supports a frequency band for a corresponding operator, or needs to manufacture a terminal including high-cost and high-power hardware that supports wideband. In addition, the user of the terminal **200** suffers from various problems, such as having difficulty in freely changing the communication operator.
(47) On the other hand, referring to FIG. **6**B, in accordance with an embodiment of the disclosure, the frequency band is not classified for each communication operator, and the communication node **300** may occupy a variable frequency band based on the communication connection information. In this case, there is no need for the guard band, so the frequency resource may be used more efficiently. Furthermore, the communication node **300** may allocate communication resources for the terminals **200** based on the frequency-in-use and the available bandwidth included in the communication connection information of the terminal **200**. Accordingly, the terminal **200** is less required to have hardware for processing wideband signals, thereby having less power consumption and a reduced manufacturing cost. Moreover, even the traditional terminal having hardware capable of processing narrowband signals is able to perform smooth communication with the communication node **300**.

(48) Referring to FIG. **7**, as the 5G NR uses a higher frequency band (3.5 GHz or 28 GHz) than in the traditional mobile communication method, cell coverage may be reduced due to a propagation path loss. To solve this, beamforming is applied to the 5G NR when the high frequency band is used. As for the beamforming, especially, a hybrid beamforming technology in which analog beamforming is used to cover the coverage and digital beamforming (DBF) is applied with overlapping analog beams may be used. By the nature of the analog beamforming with multiple antennas, a narrow antenna beam may be intensely transmitted far away in a particular direction, but fail to widely cover the entire cell at a time. Rather, in a case that an antenna beam is formed in one direction, antenna beams for the other directions are hardly made and the signal is not transmitted. Accordingly, in this case, a beam sweeping technology may be used by which the entire cell coverage is divided into multiple sections each corresponding to an analog beam and the cell coverage is all covered by sequentially rotating the beam.
(49) Beams output according to the beam sweeping technology may be distinguished from one another by their unique indexes, and the terminal **200** may select a beam having the best reception performance (e.g., a beam with highest reception strength or highest reception rate) among the output beams. In an embodiment of the disclosure, once a beam is selected between a communication node (e.g., a BS) employing the beam sweeping technology and the terminal **200**, the communication node **300** may set a position of the SS block output from the selected beam to correspond to the SS block detectable position of the terminal **200**. In other words, the communication node **300** may set a different position of the SS block included in each beam based on the SS block detectable position of each of the terminals **200**, and set the position variably according to changes in the position of the terminal **200**. For example, when the first terminal is located in a section corresponding to the first beam, the communication node **300** may set a position of the SS block output from the first beam to correspond to the SS block detectable position of the first terminal. Subsequently, when the first terminal is moved from the section corresponding to the first beam to a section corresponding to the second beam, the communication node **300** may set a position of the SS block output from the second beam to correspond to the SS block detectable position of the first terminal.
(50) According to embodiments of the disclosure, a communication node may set and output a position of an SS block based on information transmitted from a terminal, thereby helping the terminal minimize its load and time consumption in discovering the SS block.
(51) Furthermore, unlike the traditional case where frequency bands are divided for each operator, the communication node may be implemented to allocate and provide a communication resource depending on a communication specification of each terminal, thereby maximizing frequency band usage efficiency. In this case, the terminal may not need to be equipped with high-power hardware capable of processing wideband signals, thereby reducing its power consumption, and even traditional terminals capable of processing narrowband signals may receive communication services from the communication node.
(52) Effects according to technical ideas of the disclosure are not limited to what are described above, and throughout the specification it will be clearly appreciated by those of ordinary skill in the art that there may be other effects unmentioned.
(53) The aforementioned embodiments are described merely for example with reference to the drawings for more thorough understanding of the disclosure, and should not be construed as limiting the technical idea of the disclosure.
(54) In addition, it will be apparent to those of ordinary skill in the art to which the disclosure pertains that various changes and modifications can be made without departing from basic principles of the disclosure.

Claims

1. A method of outputting to a terminal a synchronization signal by a communication node, the method comprising: receiving communication connection information from the terminal, the communication connection information comprising position information of a synchronization signal (SS) block for the terminal; identifying the position information of the SS block included in the communication connection information; setting a position of the SS block for the terminal based on the identified position information; and outputting the SS block based on the set position, wherein the setting of the position of the SS block for the terminal comprises, when a plurality of frequency bands for the SS block corresponding to the position information are identified, selecting a frequency band based on whether each of the plurality of frequency bands is occupied by another terminal.
2. The method of claim 1, wherein the setting of the position of the SS block comprises setting an orthogonal frequency division multiplexing (OFDM) symbol position and a subcarrier position of the SS block so that the SS block is output at a frequency included in a frequency band corresponding to the position information.
3. The method of claim 1, wherein the communication connection information comprises at least one of frequency-in-use information and available bandwidth information of the terminal.
4. The method of claim 3, further comprising: allocating a communication resource for communication with the terminal based on at least one of the frequency-in-use information and the available bandwidth information included in the communication connection information.
5. The method of claim 1, wherein the communication node comprises a base station or a repeater.
6. A communication node comprising: a terminal information receiver configured to receive communication connection information from a terminal, the communication connection information comprising position information of a synchronization signal (SS) block for the terminal; a terminal information processor configured to identify the position information of the SS block by processing the received communication connection information; and an SS block output adjuster configured to set a position of the SS block for the terminal based on the position information, and output the SS block based on the set position, wherein when a plurality of frequency bands corresponding to the position information are identified, the SS block output adjuster is further configured to select a frequency band based on whether each frequency band is occupied by another terminal.
7. The communication node of claim 6, wherein the SS block output adjuster is configured to set an orthogonal frequency division multiplexing (OFDM) symbol position and a subcarrier position of the SS block so that the SS block is output at a frequency included in a frequency band corresponding to the position information.
8. The communication node of claim 6, wherein the communication connection information comprises at least one of frequency-in-use information and available bandwidth information of the terminal.
9. The communication node of claim 8, wherein a communication resource for communication with the terminal is allocated based on at least one of the frequency-in-use information and the available bandwidth information included in the communication connection information.
10. The communication node of claim 6, wherein the communication node comprises a base station or a repeater.