US 20250267443A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0267443 A1**

TAMURA (43) **Pub. Date: Aug. 21, 2025**

(54) **SNPN-RAN ENTITY, DISTRIBUTION SYSTEM, DISTRIBUTION METHOD, AND NON-TEMPORARY COMPUTER READABLE MEDIUM**

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(21) Appl. No.: **19/203,581**

(22) Filed: **May 9, 2025**

Related U.S. Application Data

(63) Continuation of application No. 17/918,415, filed on Oct. 12, 2022, filed as application No. PCT/JP2021/016282 on Apr. 22, 2021.

(30) **Foreign Application Priority Data**

Apr. 22, 2020 (JP) 2020-076125

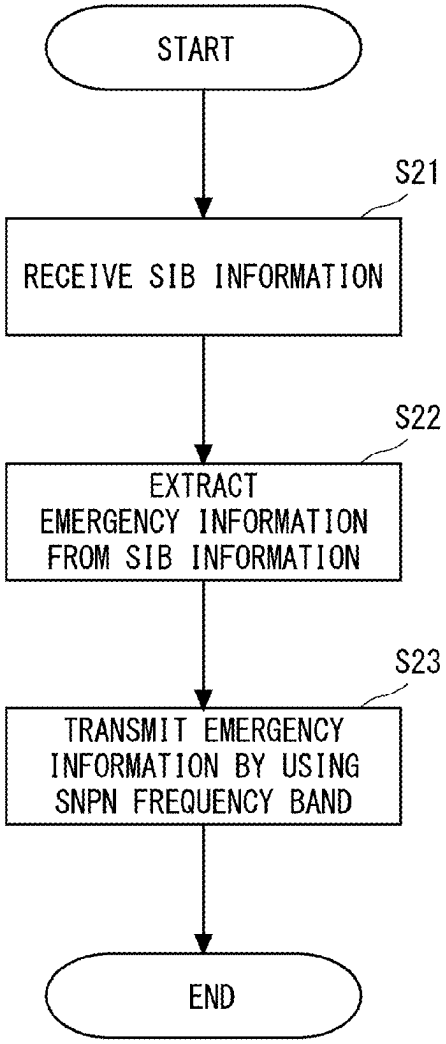
Publication Classification

(51) **Int. Cl.**
H04W 4/90 (2018.01)
H04W 48/10 (2009.01)

(52) **U.S. Cl.**
CPC ***H04W 4/90*** (2018.02); ***H04W 48/10*** (2013.01)

(57) **ABSTRACT**

An object of the present disclosure is to provide an SNPN-RAN entity capable of distributing emergency information to a communication terminal using SNPN. An SNPN-RAN entity (**10**) according to the present disclosure includes: a reception unit (**11**) configured to receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and a transmission unit (**12**) configured to transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.



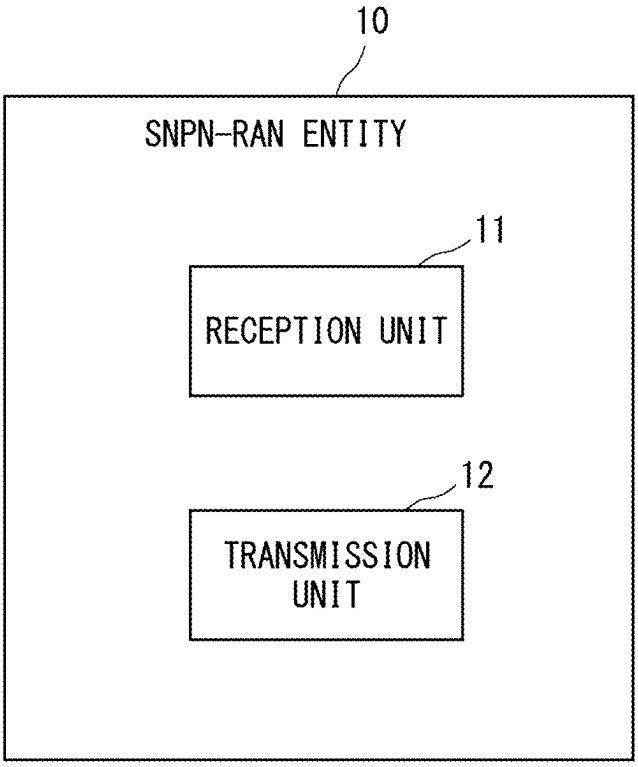


Fig. 1

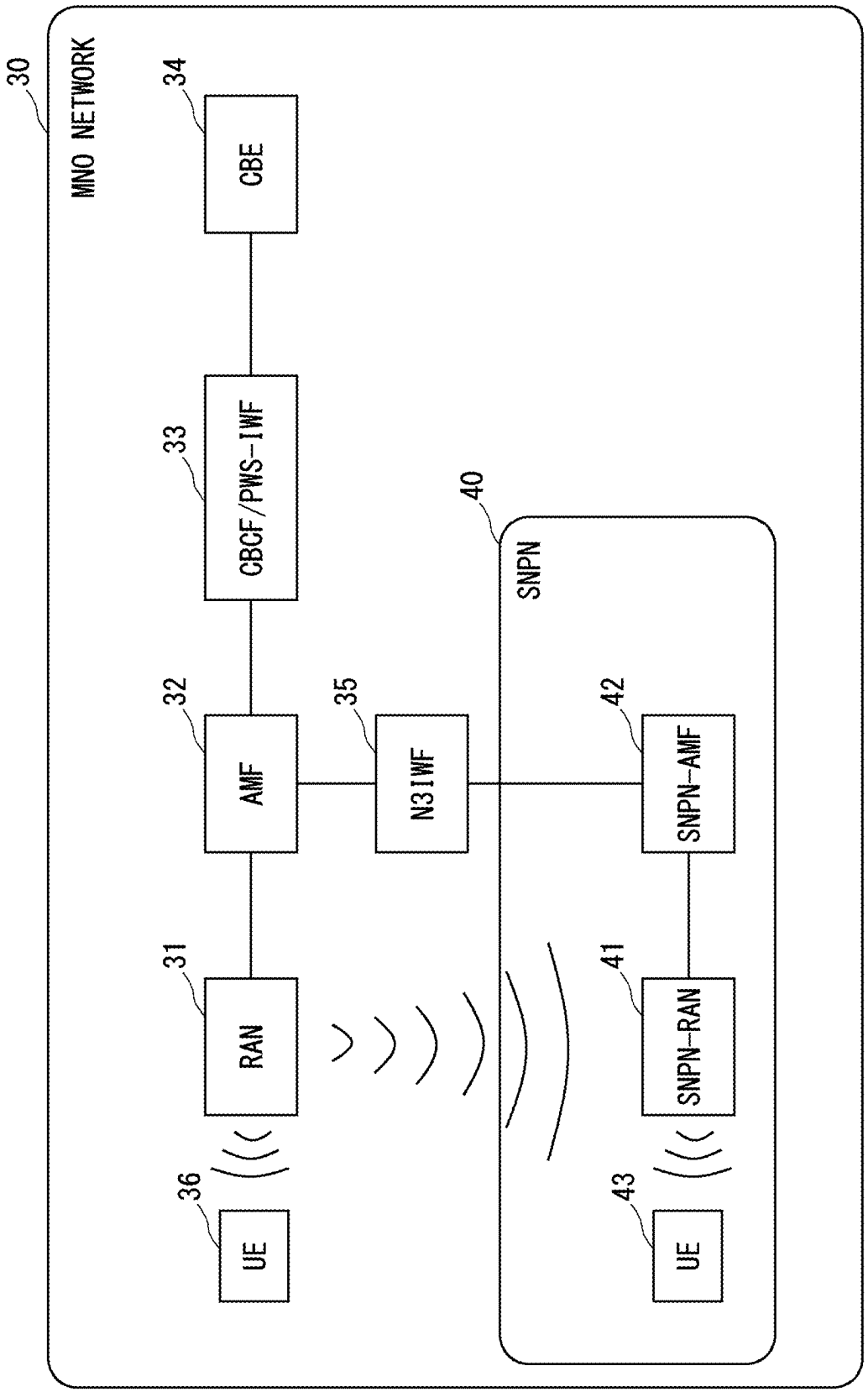

30
MNO NETWORK
34
CBE
33
CBCF/PWS-IWF
40
SNPN
32
AMF
35
N3IWF
42
SNPN-AMF
31
RAN
41
SNPN-RAN
36
UE
43
UE

Fig. 2

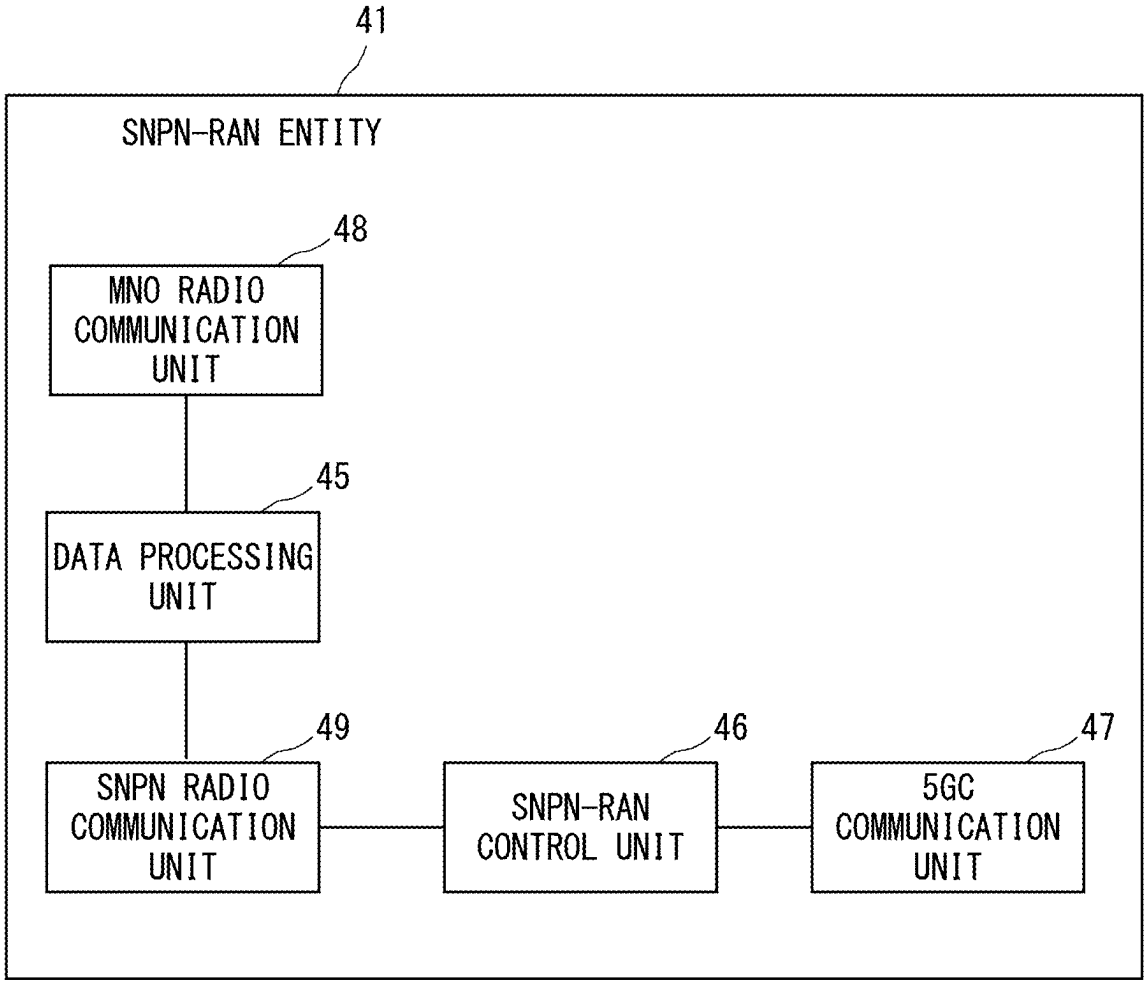

41
SNPN-RAN ENTITY
48
MNO RADIO COMMUNICATION UNIT
45
DATA PROCESSING UNIT
49
SNPN RADIO COMMUNICATION UNIT
46
SNPN-RAN CONTROL UNIT
47
5GC COMMUNICATION UNIT

Fig. 3

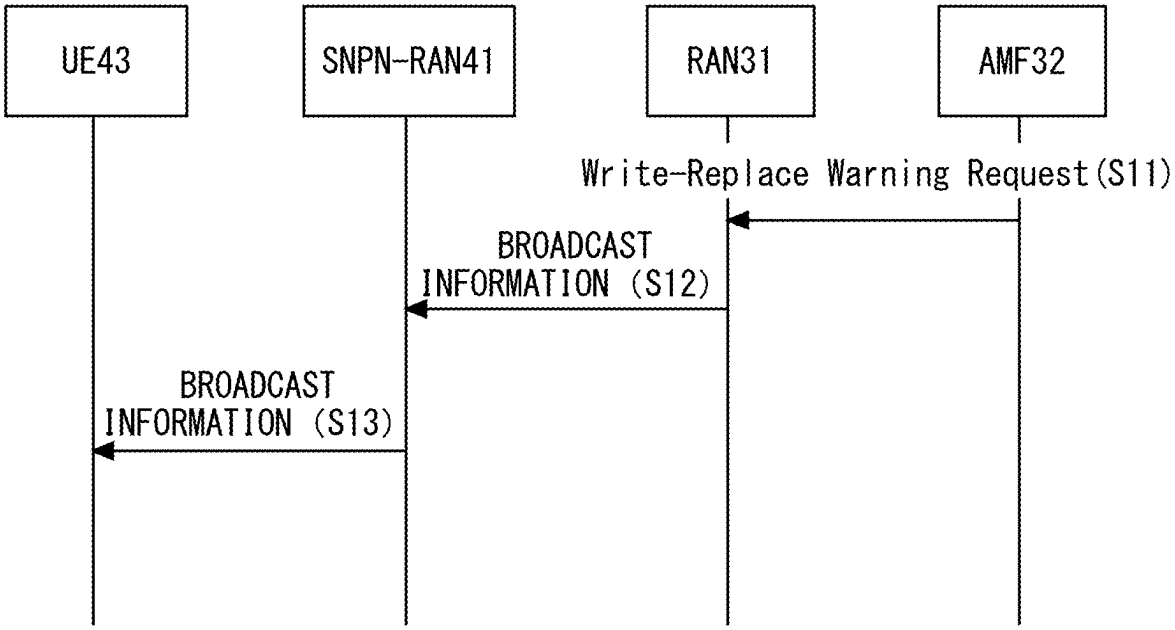

UE43
SNPN-RAN41
RAN31
AMF32
Write-Replace Warning Request(S11)
BROADCAST INFORMATION (S12)
BROADCAST INFORMATION (S13)

Fig. 4

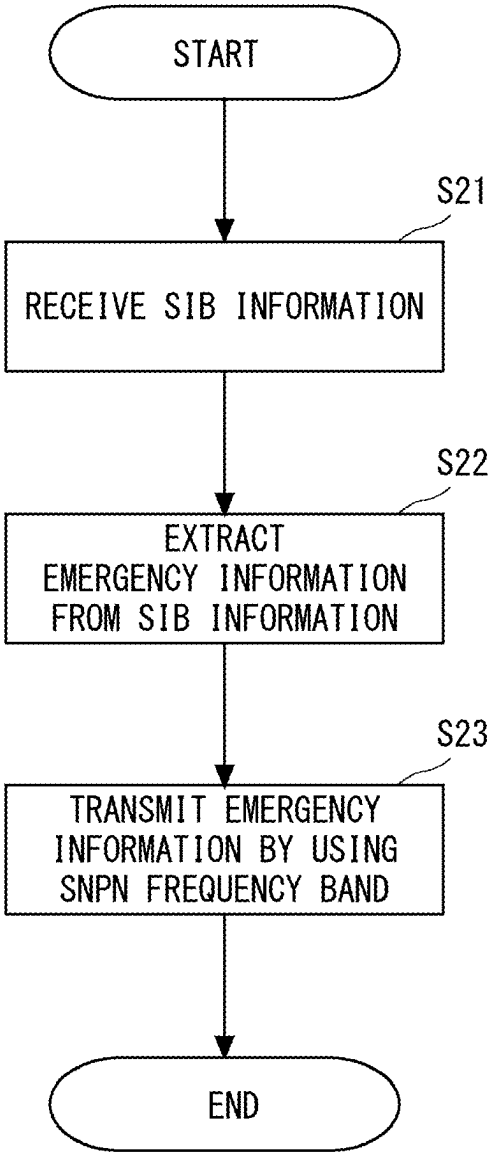

START
S21
RECEIVE SIB INFORMATION
S22
EXTRACT EMERGENCY INFORMATION FROM SIB INFORMATION
S23
TRANSMIT EMERGENCY INFORMATION BY USING SNPN FREQUENCY BAND
END

Fig. 5

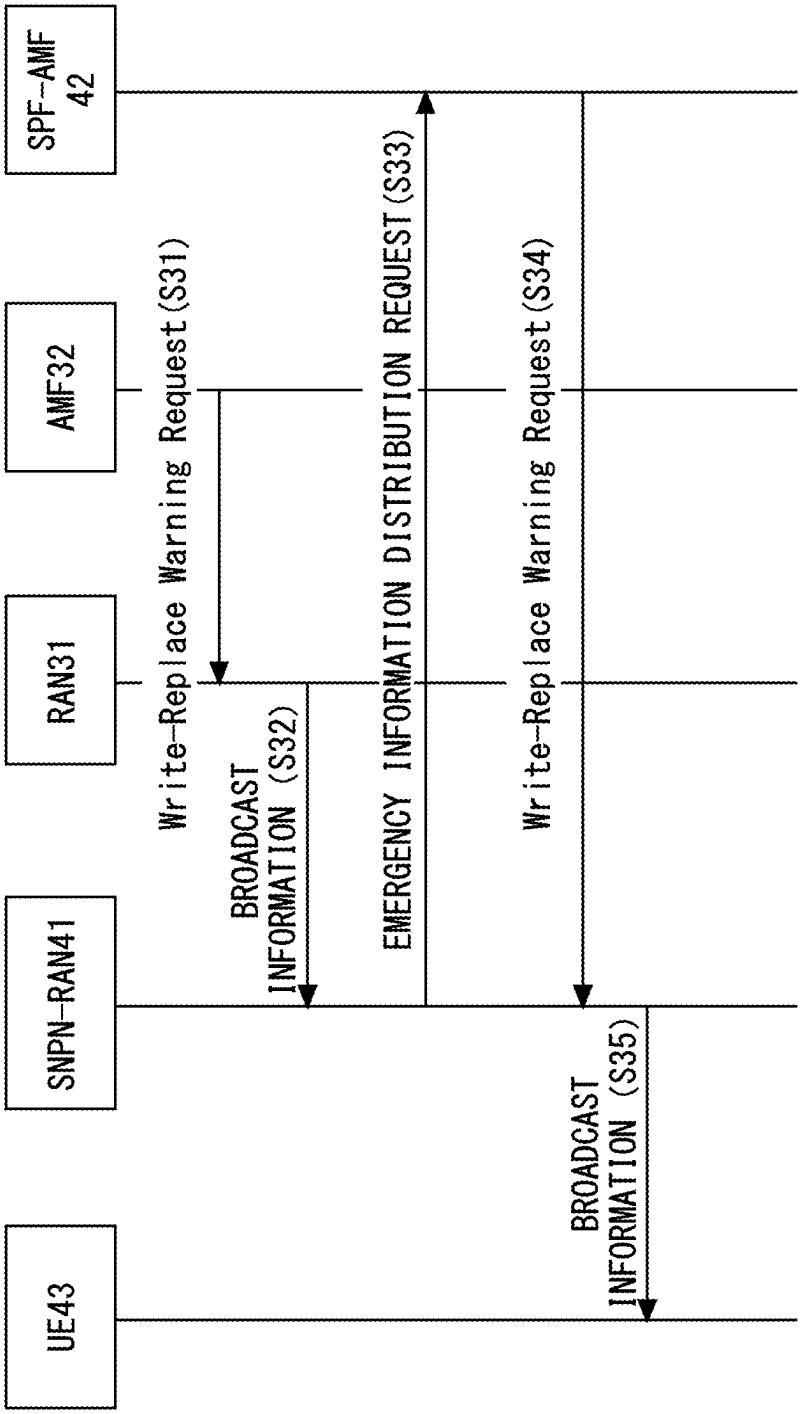

UE43
SNPN-RAN41
RAN31
AMF32
SPF-AMF 42
Write-Replace Warning Request (S31)
BROADCAST INFORMATION (S32)
EMERGENCY INFORMATION DISTRIBUTION REQUEST (S33)
Write-Replace Warning Request (S34)
BROADCAST INFORMATION (S35)

Fig. 6

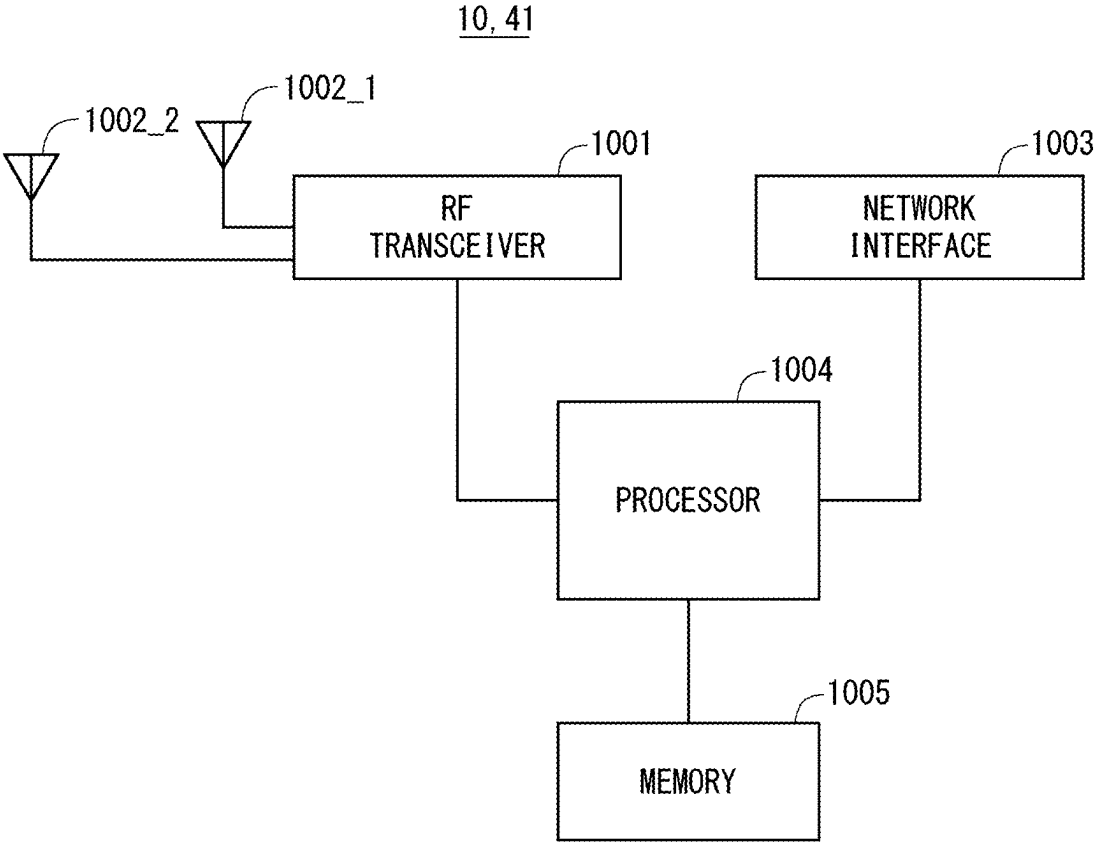

10, 41
1002_1
1002_2
1001
RF
TRANSCEIVER
1003
NETWORK
INTERFACE
1004
PROCESSOR
1005
MEMORY

Fig. 7

SNPN-RAN ENTITY, DISTRIBUTION SYSTEM, DISTRIBUTION METHOD, AND NON-TEMPORARY COMPUTER READABLE MEDIUM

[0001] This application is a Continuation of U.S. application Ser. No. 17/918,415 filed on Oct. 12, 2022, which is a National Stage Entry of PCT/JP2021/016282 filed on Apr. 22, 2021, which claims priority from Japanese Patent Application 2020-076125 filed on Apr. 22, 2020, the contents of all of which are incorporated herein by reference, in their entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a Stand-alone Non-Public Networks (SNPN)-Radio Access Network (RAN) entity, a distribution system, a distribution method, and a program.

BACKGROUND ART

[0003] In 3rd generation partnership project (3GPP), as a radio system for achieving higher-speed communication than long term evolution (LTE), a standard specification of a radio system called 5th Generation (5G) has been established. A communication system that achieves 5G (hereinafter, referred to as a 5G communication system) has a base station supporting 5G (hereinafter, referred to as a 5G base station) as a radio system, and a core network accommodating the base station supporting 5G (hereinafter, referred to as a 5G core network). In the 5G communication system, there are a form in which a communication carrier operates the 5G communication system in order to provide a service for a wide range of general users, and a form in which a provider or an enterprise being different from the communication carrier directly operates the 5G communication system without intervention of the communication carrier. In the 3GPP, stand-alone non-public networks (SNPN) are defined as a 5G communication system directly operated by an enterprise. Apart from a 5G base station and a 5G core network being operated by a communication carrier, the SNPN have a 5G base station and a 5G core network being operated directly by an enterprise. Location information of a communication terminal using the SNPN, subscriber information, and the like are registered in the 5G core network directly operated by the enterprise. Meanwhile, Non Patent Literature 1 discloses a technique for performing interworking with a 5G communication system provided by a communication carrier even in a case of the SNPN.

[0004] Herein, in the 3GPP, a specification of a public warning system (PWS) for distributing information in an emergency such as a disaster is defined. The PWS is used as an earthquake and tsunami warning system (ETWS) for distributing emergency information in Japan. Non Patent Literature 2 defines that emergency information to be distributed in the ETWS is also distributed to a communication terminal for which location information, subscriber information, and the like are not managed in a 5G communication system operated by a communication carrier. Therefore, even in a communication terminal in which location information, subscriber information, and the like are registered only in a 5G core network directly operated by an enterprise, it is necessary to be able to receive information distributed from the ETWS.

CITATION LIST

Non Patent Literature

[0005] Non Patent Literature 1: 3GPP TS23.501 V 16.3.0 (2019-12)

[0006] Non Patent Literature 2: 3GPP TS25.304 V 15.0.0 (2018-06)

SUMMARY OF INVENTION

Technical Problem

[0007] However, Non Patent Literature 2 does not explicitly describe a cooperation procedure between the 5G communication system operated by the communication carrier and the SNPN. Therefore, a procedure of distributing emergency information distributed via the 5G communication system operated by the communication carrier to the SNPN is not clear. As a result, there is a problem that a communication terminal using the SNPN cannot receive the emergency information.

[0008] An object of the present disclosure is to provide an SNPN-RAN entity, a distribution system, a distribution method, and a program that are capable of distributing emergency information to a communication terminal using SNPN.

Solution to Problem

[0009] An SNPN-RAN entity according to a first example aspect of the present disclosure includes: a reception unit configured to receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and a transmission unit configured to transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

[0010] A distribution system according to a second example aspect of the present disclosure includes: a reception apparatus configured to receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and an SNPN-RAN entity configured to transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information received from the reception apparatus to a communication terminal registered in the SNPN.

[0011] A distribution method according to a third example aspect of the present disclosure includes: receiving, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and transmitting, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

[0012] A program according to a fourth example aspect of the present disclosure causes a computer to: receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and transmit, by using a second frequency used in a Stand-Alone

Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

Advantageous Effects of Invention

[0013] According to the present disclosure, it is possible to provide an SNPN-RAN entity, a distribution system, a distribution method, and a program that are capable of distributing emergency information to a communication terminal using SNPN.

BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. **1** is a configuration diagram of an SNPN-RAN entity according to a first example embodiment;
[0015] FIG. **2** is a configuration diagram of a communication system according to a second example embodiment;
[0016] FIG. **3** is a diagram of an SNPN-RAN entity according to the second example embodiment;
[0017] FIG. **4** is a diagram showing a flow of processes for transmitting emergency information according to the second example embodiment;
[0018] FIG. **5** is a diagram showing a flow of processes for transmitting emergency information in the SNPN-RAN entity according to the second example embodiment;
[0019] FIG. **6** is a diagram showing a flow of processes for transmitting emergency information according to a third example embodiment; and
[0020] FIG. **7** is a configuration diagram of the SNPN-RAN entity according to each example embodiment.

EXAMPLE EMBODIMENT

First Example Embodiment

[0021] Example embodiments of the present disclosure will be described below with reference to the drawings. A configuration example of an SNPN-Radio Access Network (RAN) entity (hereinafter referred to as an SNPN-RAN) **10** according to a first example embodiment will be described by using FIG. **1**. The SNPN-RAN **10** may be a computer device that operates by causing a processor to execute a program stored in a memory. The SNPN-RAN **10** includes a reception unit **11** and a transmission unit **12**. The components that compose the SNPN-RAN **10**, such as the reception unit **11** and the transmitter **12**, may be software or modules in which processing is executed by causing a processor to execute a program stored in a memory. Alternatively, the components that compose the SNPN-RAN **10** may be hardware such as circuits or chips.
[0022] The SNPN-RAN **10** may be a base station supporting 5G, the specification of which is defined in 3GPP as a radio communication system. For example, the SNPN-RAN **10** may be a gNB (a gNode B).
[0023] The reception unit **11** receives, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a frequency used by the communication carrier. The network operated by the communication carrier may be referred to as a mobile network operator (MNO) network, a public land mobile network (PLMN), or the like.
[0024] The base station deployed in the network operated by the communication carrier may be, for example, a base station supporting 5G, the specification of which is defined in 3rd Generation Partnership Project (3GPP) as a radio communication system. The base station deployed in the network operated by the communication carrier may be, for example, a gNB (a gNode B). In the following description, the frequency used by the communication carrier is described using the term "carrier frequency".
[0025] The emergency information includes a commercial mobile alert system (CMAS), an earthquake and tsunami warning system (ETWS), a Korean public alert system (KPAS), and information distributed in EU-ALERT, which are defined in Non Patent Literature 3.
[0026] The transmission unit **12** transmits, by using a frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN. In the following description, the frequency used in the SNPN is described using the term "local frequency". The transmission unit **12** transmits the emergency information to a communication terminal that belongs to an area where communication can be performed by using the local frequency.
[0027] As described above, the SNPN-RAN **10** transmits emergency information received from a base station deployed in a network operated by a communication carrier to a communication terminal that belongs to an area where communication can be performed by using a local frequency. By doing so, a communication terminal capable of performing communication using only the local frequency can receive emergency information transmitted in the network operated by the communication carrier.

Second Example Embodiment

[0028] Next, a configuration example of a communication system according to a second example embodiment will be described by using FIG. **2**. The communication system in FIG. **2** illustrates a configuration in which an MNO network **30** includes a SNPN **40**. That is, the SNPN **40** overlaps with some areas of the MNO network **30**. In other words, the MNO network **30** includes the SNPN **40**. Alternatively, some areas of the SNPN **40**, rather than the entire areas of the SNPN **40**, may overlap with some areas of the MNO network **30**. The some areas of the SNPN **40** overlapping the areas of the MNO network **30** may be, for example, areas formed by an SNPN-RAN **41** included in the SNPN **40** to perform radio communication.
[0029] The MNO network **30** includes a radio access network (RAN) entity (hereinafter, referred to as RAN) **31**, an access and mobility function (AMF) entity (hereinafter, referred to as AM F) **32**, a cell broadcast centre function (CBCF)/public warning system-interworking function (PWS-IWF) entity (hereinafter, referred to as CBCF/PWS-IWF) **33**, a cell broadcast entity (CBE) **34**, and a non-3GPP interworking function (N3IWF) entity (hereinafter, referred to as N3IWF) **35**. A user equipment (UE) **36** is a communication terminal held by a user who uses the MNO network **30**.
[0030] The RAN **31** is, for example, a base station supporting 5G as a radio system, and may be, for example, a gNB. The AMF **32** manages access and mobility related to the UE **36** held by a user using the MNO network **30**. Specifically, the AMF **32** manages location information of the UE **36**, and executes an authentication process of the UE **36** in cooperation with an authentication device (not illustrated).
[0031] The CBE **34** may be, for example, a server device and the like managed by an administrative agency that monitors an earthquake, a tsunami, or the like. The CBE **34**

generates emergency information and transmits the generated emergency information to the CBCF/PWS-IWF **33**. The CBCF/PWS-IWF **33** is a device in which a CBCF entity and a PWS-IWF entity are integrated together. When receiving the emergency information from the CBE **34**, the CBCF/PWS-IWF **33** specifies a distribution area of the emergency information. For example, the CBCF/PWS-IWF **33** specifies a cell, a tracking area (TA), or an emergency area (EA) as a distribution area. The EA is a distribution area that can be uniquely set by a communication carrier regardless of the TA.

[0032] The N3IWF **35** communicates with a UE **43** via the SNPN **40**. The N3IWF **35** connects between different networks each other, and relays control data that is related to the UE **43** and is transmitted between the UE **43** and the AMF **32**. The control data may be referred to as control (C)-Plane data. The emergency information may be transmitted as C-Plane data.

[0033] The SNPN **40** includes the SNPN-RAN entity (hereinafter referred to as the SNPN-RAN) **41** and an SNPN-AMF entity (hereinafter referred to as an SNPN-AMF) **42**. The SNPN-RAN **41** may be a base station deployed in the SNPN. For example, the SNPN-RAN **41** may be a gNB supporting 5G as a radio system. The SNPN-RAN **41** receives information transmitted from the RAN **31**. Specifically, like the UE **36** located in a communication area formed by the RAN **31**, the SNPN-RAN **41** receives information. The communication area formed by the RAN **31** is an area in which the RAN **31** communicates with a communication terminal or the like by using a carrier frequency. That is, the SNPN-RAN **41** performs a reception operation similar to that performed by the UE **36** when the SNPN-RAN **41** communicates with the RAN **31**, and operates as a gNB when it communicates with the UE **43**.

[0034] The SNPN-AMF **42** is equivalent to a SNPN core network device. The SNPN-AMF **42** manages access and mobility related to the UE **43** held by a user using the SNPN **40**. Specifically, the SNPN-AMF **42** manages location information of the UE **43**, and executes the authentication process of the UE **43** in cooperation with an authentication device (not illustrated). The UE **43** can only perform communication via the SNPN-RAN **41** and the SNPN-AMF **42** when it is managed by the SNPN-AMF **42**. That is, the UE **43** cannot perform communication via the RAN **31** when it is managed by the SNPN-AMF **42**.

[0035] Next, a configuration example of the SNPN-RAN **41** according to the second example embodiment will be described with reference to FIG. **3**. The SNPN-RAN **41** includes an MNO radio communication unit **48**, a data processing unit **45**, an SNPN radio communication unit **49**, an SNPN-RAN control unit **46**, and a 5GC communication unit **47**. The MNO radio communication unit **48** corresponds to the reception unit **11** shown in FIG. **1**, and the SNPN radio communication unit **49** corresponds to the transmission unit **12** shown in FIG. **1**.

[0036] The MNO radio communication unit **48** receives information transmitted from the RAN **31**. Like the UE **36** etc., the MNO radio communication unit **48** includes an antenna capable of receiving a signal having the carrier frequency used in the RAN **31** and a demodulation unit that demodulates received information. The MNO radio communication unit **48** receives System Information Block (SIB) information transmitted from the RAN **31**. The SIB information includes emergency information. For example, the emergency information is included in SIB6, SIB7, or the like specified in 3GPP. For example, SIB6 contains an ETWS primary notification, and SIB7 contains an ETWS secondary notification. The MNO radio communication unit **48** outputs the received SIB information to the data processing unit **45**.

[0037] Note that, when the MNO radio communication unit **48** receives SIB information from the RAN **31**, the SNPN-RAN **41** may be registered in the AMF **32** like in the case of the UE **36**. That is, the SNPN-RAN **41** may be in a state in which a Registration procedure with the AMF **32** is successfully completed. In this case, like the UE **36** registered in the AMF **32**, the SNPN-RAN **41** can perform communication in the MNO network **30** by using the carrier frequency.

[0038] Alternatively, when the MNO radio communication unit **48** receives SIB information from the RAN **31**, the SNPN-RAN **41** may not be registered in the AMF **32**. That is, the SNPN-RAN **41** may be in a state in which the Registration procedure with the AMF **32** is not executed or a state in which it is not successfully completed. A state in which the SNPN-RAN **41** is not registered in the AMF **32** as described above is referred to as a limited service state. In the MNO network **30**, a communication terminal can receive emergency information such as ETWS even in a limited service state. In other words, a communication terminal in a limited service state can only receive emergency information and cannot perform other communication. Regarding a procedure by which a communication terminal in a limited service state receives emergency information such as ETWS, a generally known procedure specified in 3GPP may be used, and thus a detailed description thereof will be omitted.

[0039] The data processing unit **45** extracts emergency information included in SIB information. In other words, the data processing unit **45** extracts parameters indicating emergency information included in SIB information. Further, the data processing unit **45** includes the extracted emergency information in information, a message, or the like to be transmitted to the UE **43** located in a communication area formed by the SNPN-RAN **41**. For example, the data processing unit **45** may set the emergency information in SIB information to be transmitted to the UE **43**. Alternatively, the data processing unit **45** may include the emergency information in information to be broadcast to the UE **43** located in a communication area formed by the SNPN-RAN **41**. The SIB information transmitted to the UE **43** may be similar to SIB information used in the MNO network **30**. That is, the UE **43** may set the emergency information in SIB6 or SIB7.

[0040] The SNPN-RAN control unit **46** performs resource control, scheduling, or the like related to the UE **43** that communicates with the SNPN radio communication unit **49**. The 5GC communication unit **47** communicates with the SNPN-AMF **42**.

[0041] The SNPN radio communication unit **49** transmits emergency information to the UE **43**. The SNPN radio communication unit **49** may transmit SIB information including emergency information to the UE **43**. The SNPN radio communication unit **49** includes an antenna capable of transmitting a signal having a local frequency and a modulation unit that generates a signal having a local frequency.

[0042] Although it is shown in FIG. **3** that the MNO radio communication unit **48** is included in the SNPN-RAN **41**,

the MNO radio communication unit **48** may instead be installed at a position physically distant from the SNPN-RAN **41**. In this case, an apparatus including the MNO radio communication unit **48** may communicate with the SNPN-RAN **41** via a network, for example, through a cable. In this case, it is necessary for the apparatus including the MNO radio communication unit **48** to be installed in a communication area formed by the RAN **31**. On the other hand, the SNPN-RAN **41** may not be installed in the communication area formed by the RAN **31**.

[0043] Next, a flow of processes for transmitting emergency information according to the second example embodiment will be described with reference to FIG. **4**. First, the AMF **32** transmits a Write-Replace Warning Request message to the RAN **31** (S**11**). The AMF **32** receives the Write-Replace Warning Request message from the CBE **34** via the CBCF/PWS-IWF **33**. The Write-Replace Warning Request message received by the AMF **32** includes emergency information and a distribution area of the emergency information. The AMF **32** transmits the Write-Replace Warning Request message including the emergency information to the RAN **31** included in the distribution area included in the received Write-Replace Warning Request message. The AMF **32** may transmit, to the RAN **31**, a Write-Replace Warning Request message including information specifying a particular Cell as the distribution area.

[0044] The RAN **31** transmits the emergency information to the SNPN-RAN **41** as broadcast information (S**12**). Although not shown in FIG. **4**, the RAN **31** also transmits the broadcast information to a plurality of UEs including the UE **36** located in the communication area of the RAN **31**. The RAN **31** may repeatedly transmit the broadcast information to the SNPN-RAN **41**. When a distribution area is specified in the received Write-Replace Warning Request message, the RAN **31** transmits the broadcast information to the specified Cell. When a distribution area is not specified in the received Write-Replace Warning Request message, the RAN **31** transmits the broadcast information to all the Cells.

[0045] The RAN **31** transmits a Primary Notification and a Secondary Notification to the SNPN-RAN **41** as emergency information. In the Primary Notification, for example, a Warning Type is notified to the UE **43** by the SIB 6 which is the broadcast information. The Warning Type indicates, for example, a disaster type. In the Secondary Notification, for example, a Warning message is notified to the UE **43** by the SIB 7 as the broadcast information. The Warning message indicates, for example, the contents of a message.

[0046] The SNPN-RAN **41** transmits the emergency information received from the RAN **31** to the UE **43** as the broadcast information (S**13**). The SNPN-RAN **41** receives the broadcast information transmitted from the RAN **31** by using a carrier frequency. Further, the SNPN-RAN **41** transmits the broadcast information to the UE **43** by using a local frequency. That is, the SNPN-RAN **41** extracts emergency information from the broadcast information transmitted by using the carrier frequency, and transmits the extracted emergency information to the UE **43** by using the local frequency. Further, the SNPN-RAN **41** may edit the contents of the emergency information to be transmitted to the UE **43** based on the emergency information received from the RAN **31**, and transmit the edited emergency information to the UE **43** by using the local frequency. For example, when the SNPN **40** is set in the factory, the edited emergency information of the SNPN-RAN **41** may be data that can be understood by various types of machines connected to the UE **43** and may, more particularly, be operation instructions for these various types of machines.

[0047] Next, a flow of processes for transmitting emergency information in the SNPN-RAN **41** according to the second example embodiment will be described with reference to FIG. **5**. First, the MNO radio communication unit **48** of the SNPN-RAN **41** receives SIB information (S**21**). The MNO radio communication unit **48** receives SIB information including the Primary Notification or SIB information including the Secondary Notification. The SIB information is transmitted by using a carrier frequency. The MNO radio communication unit **48** demodulates a signal transmitted by using the carrier frequency, and outputs SIB information obtained by the demodulation of the signal to the data processing unit **45**. The MNO radio communication unit **48** of the SNPN-RAN **41** may receive SIB information that has been broadcast by using LTE. For example, when the SNPN using 5G is constructed in an area where a 4G service is provided by the MNO but a 5G service is not yet provided, the MNO radio communication unit **48** receives SIB information of 4G.

[0048] Next, the data processing unit **45** extracts emergency information included in the SIB information (S**22**). For example, the data processing unit **45** may extract a Warning Type when it receives the SIB information including the Primary Notification. Alternatively, when the data processing unit **45** receives the SIB information including the Secondary Notification, it may extract a Warning message.

[0049] Next, the SNPN radio communication unit **49** modulates the emergency information extracted by the data processing unit **45**, and transmits the emergency information to the UE **43** by using a local frequency (S**23**). The SNPN radio communication unit **49** may use a radio frequency of 5G or a radio frequency of 4G as the local frequency.

[0050] As described above, the SNPN-AMF **42** according to the second example embodiment, like the UE **36**, receives broadcast information distributed from the RAN **31**. Further, the SNPN-AMF **42** transmits the emergency information included in the received broadcast information to the UE **43** by using the local frequency. By doing the above, the UE **43** can receive the emergency information distributed in the MNO **30** via the SNPN-RAN **41** even when the UE **43** cannot communicate with the RAN **31** since it is registered in the SNPN-AMF **42**.

Third Example Embodiment

[0051] Next, a flow of processes for transmitting emergency information according to a third example embodiment will be described with reference to FIG. **6**. Steps S**31** and S**32** are similar to Steps S**11** and S**12** shown in FIG. **4**, respectively, and thus descriptions thereof will be omitted.

[0052] When the SNPN-RAN **41** receives emergency information in Step S**32**, it transmits an emergency information distribution request message to the SNPN-AMF **42** (S**33**). The emergency information distribution request message includes the emergency information.

[0053] Next, the SNPN-RAN **41** determines a distribution area of the emergency information and transmits a Write-Replace Warning Request message to the SNPN-RAN **41** deployed in the distribution area (S**34**). FIG. **6** shows that the SNPN-AMF **42** transmits the Write-Replace Warning

Request message only to the SNPN-RAN **41**. However, when a plurality of SNPN-RAN entities are deployed in the SNPN **40**, the SNPN-AMF **42** may transmit the Write-Replace Warning Request messages to two or more SNPN-RAN entities. For example, the SNPN-AMF **42** may transmit the Write-Replace Warning Request messages to SNPN-RAN entities deployed in an area around the SNPN-RAN **41** that has transmitted an emergency information distribution request message. The area around the SNPN-RAN **41** may be defined as being an area within an R (R is a real number greater than or equal to zero) kilometer radius of the SNPN-RAN **41**, or may be defined based on an address, such as the same town, ward, city, prefecture, or the like as that of the SNPN-RAN **41**.

[0054] Alternatively, the SNPN-AMF **42** may transmit the Write-Replace Warning Request messages to all the SNPN-RANS **41** in the SNPN **40**.

[0055] Next, like in the case of Step S**13** shown in FIG. **4**, the SNPN-RAN **41** transmits the emergency information included in the Write-Replace Warning Request to the UE **43** as broadcast information (S**35**). The UE **43** transmits the broadcast information to the UE **43** by using a local frequency.

[0056] As described above, in the processes for transmitting emergency information according to the third example embodiment, the SNPN-RAN **41** receives emergency information and then a plurality of SNPN-RANs in the SNPN **40** transmit the emergency information to the UE via the SNPN-AMF **42**. The SNPN-RAN **41** transmits an emergency information distribution request message to the RAN **31**, whereby even an SNPN-RAN entity which is deployed in the SNPN **40** and is deployed outside the MNO network **30** can receive emergency information that is transmitted through the MNO network **30**.

[0057] Further, when the SNPN-RAN **41** receives the emergency information in Step S**32**, it may transmit the emergency information to the UE **43** like in the case of the second example embodiment. That is, when the SNPN-RAN **41** receives emergency information from the RAN **31**, it may transmit the emergency information to the UE **43** and also transmit an emergency information distribution request message to the SNPN-AMF **42**.

[0058] Next, a description will be given of a configuration example of the SNPN-RAN entity **10** and the SNPN-RAN entity **41** (hereinafter collectively referred to as the SNPN-RAN entity **10** and the like) described in the above example embodiments. FIG. **7** is a block diagram showing a configuration example of the SNPN-RAN entity **10** and the like. As shown in FIG. **7**, the SNPN-RAN entity **10** and the like include an RF transceiver **1001**, a network interface **1003**, a processor **1004**, and a memory **1005**. The RF transceiver **1001** performs analog RF signal processing to communicate with UEs or RAN entities. The RF transceiver **1001** may include a plurality of transceivers. The RF transceiver **1001** is coupled to an antenna **1002_1**, an antenna **1002_2**, and a processor **1004**. The antenna **1002_1** may be used to communicate with the UEs, and the antenna **1002_2** may be used to communicate with the RAN entities. The RF transceiver **1001** receives modulated symbol data (or OFDM symbol data) from the processor **1004**, generates a transmission RF signal, and supplies the generated transmission RF signal to the antennas **1002_1** and **1002_2**. Further, the RF transceiver **1001** generates a baseband reception signal based on a reception RF signal received by the antennas **1002_1** and **1002_2**, and supplies the generated signal to the processor **1004**.

[0059] The network interface **1003** is used for communicating with a network node (e.g., other core network nodes). The network interface **1003** may include, for example, a network interface card (NIC) compliant with IEEE 802.3 series.

[0060] The processor **1004** performs data plane processing and control plane processing including digital baseband signal processing for radio communication. For example, in the case of LTE and 5G, digital baseband signal processing performed by the processor **1004** may include signal processing of a MAC layer and a PHY layer.

[0061] The processor **1004** may include a plurality of processors. For example, the processor **1004** may include a modem processor (e.g., a DSP) that performs the digital baseband signal processing and a protocol stack processor (e.g., a CPU or an MPU) that performs the control plane processing.

[0062] The memory **1005** is constituted of a combination of a volatile memory and a non-volatile memory. The memory **1005** may include a plurality of memory devices that are physically independent from each other. The volatile memory is, for example, a Static Random Access Memory (SRAM), a Dynamic RAM (DRAM), or any combination thereof. The non-volatile memory is a Mask Read Only Memory (MROM), an Electrically Erasable Programmable ROM (EEPROM), a flash memory, a hard disk drive, or any combination thereof. The memory **1005** may include a storage located away from the processor **1004**. In this case, the processor **1004** may access the memory **1005** via the network interface **1003** or a not-illustrated I/O interface.

[0063] The memory **1005** may store software modules (computer programs) including instructions and data to perform the processing by the SNPN-RAN entity **10** and the like described in the above example embodiments. In some implementations, the processor **1004** may load the software modules from the memory **1005** and execute the loaded software modules, thereby performing the processing of the SNPN-RAN entity **10** and the like described in the above example embodiments.

[0064] It should be noted that the present disclosure is not limited to the above-mentioned example embodiments, and can be modified as appropriate within a range not deviating from the gist.

[0065] Some or all of the above example embodiments may also be described as the following supplementary notes, but are not limited to the following.

Supplementary Note 1

[0066] An SNPN-RAN entity comprising:

[0067] a reception unit configured to receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and

[0068] a transmission unit configured to transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

Supplementary Note 2

[0069] The SNPN-RAN entity according to Supplementary note 1, wherein the reception unit is configured to receive the emergency information included in first SIB information transmitted in the network operated by the communication carrier.

Supplementary Note 3

[0070] The SNPN-RAN entity according to Supplementary note 2, further comprising a data processing unit configured to extract the emergency information included in the first SIB information and set the emergency information in second SIB information to be transmitted by using the second frequency,

[0071] wherein the transmission unit is configured to transmit the second SIB information including the emergency information to the communication terminal registered in the SNPN by using the second frequency.

Supplementary Note 4

[0072] The SNPN-RAN entity according to any one of Supplementary notes 1 to 3, wherein the reception unit is configured to receive, as a communication terminal in a limited service state in which it is possible to receive the emergency information transmitted from the base station, the emergency information transmitted from the base station even when the SNPN-RAN entity is not registered in the network operated by the communication carrier.

Supplementary Note 5

[0073] The SNPN-RAN entity according to any one of Supplementary notes 1 to 4, wherein the reception unit is configured to receive the emergency information transmitted from the base station as a communication terminal capable of performing communication in the network operated by the communication carrier in a state in which the SNPN-RAN entity is registered in the network operated by the communication carrier.

Supplementary Note 6

[0074] The SNPN-RAN entity according to any one of Supplementary notes 1 to 5, wherein the transmission unit is configured to transmit the emergency information to an SNPN core network apparatus deployed in the SNPN, and transmit the emergency information to the communication terminal registered in the SNPN by using the second frequency based on a distribution instruction message of the emergency information received from the SNPN core network apparatus.

Supplementary Note 7

[0075] A distribution system comprising:

[0076] a reception apparatus configured to receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and

[0077] an SNPN-RAN entity configured to transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information received from the reception apparatus to a communication terminal registered in the SNPN.

Supplementary Note 8

[0078] The distribution system according to Supplementary note 7, wherein the reception apparatus is configured to receive the emergency information included in first SIB information transmitted in the network operated by the communication carrier.

Supplementary Note 9

[0079] The distribution system according to Supplementary note 8, wherein the SNPN-RAN entity is configured to extract the emergency information included in the first SIB information, set the emergency information in second SIB information to be transmitted by using the second frequency, and transmit the second SIB information including the emergency information to the communication terminal registered in the SNPN by using the second frequency.

Supplementary Note 10

[0080] A distribution method comprising:

[0081] receiving, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and

[0082] transmitting, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

Supplementary Note 11

[0083] A program for causing a computer to:

[0084] receive, from a base station deployed in a network operated by a communication carrier, emergency information transmitted by using a first frequency used by the communication carrier; and

[0085] transmit, by using a second frequency used in a Stand-Alone Non-Public Network (SNPN), the emergency information to a communication terminal registered in the SNPN.

[0086] Although the present disclosure has been described with reference to the example embodiments, the present disclosure is not limited to the above-described example embodiments. Various changes that may be understood by those skilled in the art may be made to the configurations and details of the present disclosure within the scope of the disclosure.

[0087] This application is based upon and claims the benefit of priority from Japanese patent application No. 2020-76125, filed on Apr. 22, 2020, the disclosure of which is incorporated herein in its entirety by reference.

REFERENCE SIGNS LIST

[0088] **10** SNPN-RAN ENTITY
[0089] **11** RECEPTION UNIT
[0090] **12** TRANSMISSION UNIT
[0091] **30** MNO NETWORK
[0092] **31** RAN
[0093] **32** AMF
[0094] **33** CBCF/PWS-IWF
[0095] **34** CBE
[0096] **35** N3IWF
[0097] **36** UE
[0098] **40** SNPN

[0099] **41** SNPN-RAN
[0100] **42** SNPN-AMF
[0101] **43** UE
[0102] **45** DATA PROCESSING UNIT
[0103] **46** SNPN-RAN CONTROL UNIT
[0104] **47** 5GC COMMUNICATION UNIT
[0105] **48** MNO RADIO COMMUNICATION UNIT
[0106] **49** SNPN RADIO COMMUNICATION UNIT

1. A method for a first communication apparatus, the method comprising:

communicating with a base station; and

transmitting, to a second communication apparatus, at least one of a first warning message indicating warning type included in a System Information Block (SIB) 6 and a second warning message indicating a warning included in a SIB 7.

2. The method according to claim **1**, wherein the transmitting comprises broadcasting.

3. The method according to claim **1**, wherein the base station receives, from a core network node, a Write-Replace Warning Message Request.

4. The method according to claim **1**, wherein the second communication apparatus cannot communicate directly with the network to which the base station belongs.

5. A first communication apparatus comprising:

at least one processor configured to execute operations comprising:

communicating with a base station; and

transmitting, to a second communication apparatus, at least one of a first warning message indicating warning type included in a System Information Block (SIB) 6 and a second warning message indicating a warning included in a SIB 7.

6. The first communication apparatus according to claim **5**, wherein the transmitting comprises broadcasting.

7. The first communication apparatus according to claim **5**, wherein the base station receives, from a core network node, a Write-Replace Warning Message Request.

8. The first communication apparatus according to claim **5**, wherein the second communication apparatus cannot communicate directly with the network to which the base station belongs.

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