(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 September 2018 (27.09.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/172893 A1

(51) International Patent Classification:
H04W 76/19 (2018.01) *H04W 76/27* (2018.01)

(21) International Application Number:
PCT/IB2018/051772

(22) International Filing Date:
16 March 2018 (16.03.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/476,269 24 March 2017 (24.03.2017) US

(71) Applicant: **NOKIA TECHNOLOGIES OY** [FI/FI]; Karaportti 3, 02610 Espoo (FI).

(71) Applicant *(for LC only)*: **NOKIA USA INC.** [US/US]; 200 South Mathilda Ave, Sunnyvale, California 94086 (US).

(72) Inventors: **KOSKELA, Jarkko Tuomo**; Kajuuttapiha 3, 90500 Oulu (FI). **TURTINEN, Samuli Heikki**; Poolatie 3A, 91100 Ii (FI).

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

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

(54) Title: APPARATUS AND METHOD FOR HANDLING RADIO CONNECTION FAILURE AND RESUME IN NEW RADIO SYSTEMS

(57) Abstract: One embodiment is directed to a method comprising entering a connected state; detecting a radio link failure; determining whether a resume identity has been received; and if the resume identity has been received, entering an inactive state or staying the connected state; otherwise, entering an idle state.

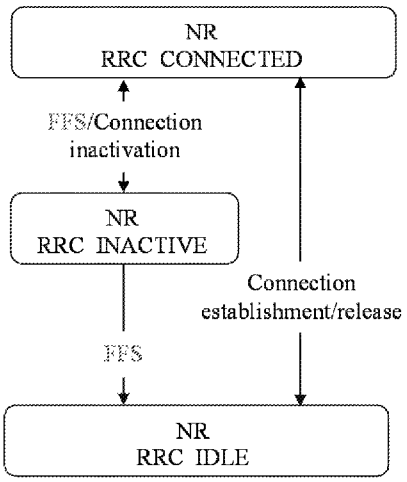


Figure 1

WO 2018/172893 A1

APPARATUS AND METHOD FOR HANDLING RADIO CONNECTION FAILURE AND RESUME IN NEW RADIO SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is related to and claims the benefit and priority of U.S. Provisional Patent Application No. 62/476,269, filed March 24, 2017, the entirety of which is hereby incorporated herein by reference.

BACKGROUND

[0002] This section is intended to provide a background or context to the invention that is recited in the claims. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived, implemented or described. Therefore, unless otherwise indicated herein, what is described in this section is not prior art to the description and claims in this application.

[0003] Third generation partnership project (3GPP) long term evolution (LTE) and its next generation LTE advanced (LTE-A) provide services of existing mobile telecommunications system by means of higher data rates and lower latency with reduced cost. Wireless radio access technologies continue to be improved to handle increased data volumes and larger numbers of subscribers. The 3GPP organization is developing 5th Generation (5G) wireless networks, also known as New Radio (NR), to handle peak data rates of the order of ~10Gbps (gigabits per second) while still satisfying ultra-low latency requirements in existence for certain LTE/LTE-A applications. 5G intends to utilize radio spectrum on the order of GHz or more in the millimeter-wave (mmWave) band; and also to support massive MIMO (m-MIMO). M-MIMO systems are characterized by a much larger number of antennas as compared to 4G systems, as well as finer beamforming and a higher antenna gain.

SUMMARY

[0004] According to a first embodiment, a method can include entering a connected state; detecting a connection failure; determining whether a resume identity has been received; and if the resume identity has been received, entering an inactive state or staying in the connected state; otherwise, entering an idle state.

[0005] According to a second embodiment, an apparatus can include means for entering a connected state; means for detecting a connection failure; means for determining whether a resume

identity has been received; and means for if the resume identity has been received, entering an inactive state or staying in the connected state; otherwise, entering an idle state.

[0006] According to a third embodiment, an apparatus can include at least one processor and at least one memory including computer program code. The at least one memory and the computer program code can be configured to, with the at least one processor, cause the apparatus at least to enter a connected state; detect a connection failure; determine whether a resume identity has been received; and if the resume identity has been received, enter an inactive state or stay in the connected state; otherwise, enter an idle state.

[0007] According to a fourth embodiment, a computer readable medium comprising program instructions for causing an apparatus to perform at least the following: entering a connected state; detecting a connection failure; determining whether a resume identity has been received; and if the resume identity has been received, entering an inactive state or staying in the connected state; otherwise, entering an idle state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] For a more complete understanding of example embodiments of the present invention, reference is now made to the following descriptions taken in connection with the accompanying drawings in which:

[0009] Figure 1 illustrates a user equipment state machine and state transitions in NR.

[0010] Figure 2 illustrates a flowchart in accordance with an example embodiment of the application.

[0011] Figure 3 illustrates a simplified block diagram of example apparatuses that are suitable for use in practicing various example embodiments of this application.

DETAILED DESCRIPTON

[0012] The description below generally refers to 5G NR terms, however this is not intended to be limiting. The description is equally applicable to other wireless networks and technologies.

[0013] The NR study item was recently declared complete. Figure 1 shows, as part of the control plane of the study, the agreed state diagram and state transitions. NR radio resource control (RRC) consists of three states – RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE where the states are described as follows:

- RRC_IDLE:
  - Cell re-selection mobility;

- [For further study (FFS): The UE AS context is not stored in any 5G base station (commonly referred to as a 'gNB') or in the user equipment (UE);]
- Paging is initiated by core network (CN);
- Paging area is managed by CN.

- RRC_INACTIVE:
  - Cell re-selection mobility;
  - CN – NR radio access network (RAN) connection (both C/U-planes) has been established for UE;
  - The UE AS context is stored in at least one gNB and the UE;
  - Paging is initiated by NR RAN;
  - RAN-based notification area is managed by NR RAN;
  - NR RAN knows the RAN-based notification area which the UE belongs to;
- RRC_CONNECTED:
  - The UE has an NR RRC connection;
  - The UE has an AS context in NR;
  - NR RAN knows the cell which the UE belongs to;
  - Transfer of unicast data to/from the UE;
  - Network controlled mobility, i.e. handover within NR and to/from E-UTRAN.

[0014] In NR, radio link failure (RLF) is going to happen, maybe even more often than in legacy radio technologies due to usage of very high frequencies. A mechanism to locate UE context and (re-)establish RRC connection in case of RLF is needed.

[0015] In an example embodiment, a UE is given a resume identity when the UE moves to RRC_CONNECTED state, which can be used later in a RRC resume procedure to resume from RRC_CONNECTED or RRC_INACTIVE state and/or to fetch UE context within the network. The resume identity may identify the UE within a network area and/or may identify network node or a cell which configures the resume identity. The resume identity can generally better identify a network (NW) node and/or a UE than physical cell identifier (PCI) or cell radio network temporary identifier (C-RNTI) since the latter may have limitations due to, e.g., PCI confusion. After receiving the resume identity, if RLF occurs, in an example embodiment, the UE may stay in RRC_CONNECTED state; in another example embodiment, the UE moves to RRC_INACTIVE state. In both cases, the UE may be mandated (for example, by standard specification) to trigger

resume procedure at once upon the failure declaration. When UE selects a cell, the UE will resume connection with the given resume identity.

[0016] The resume identity can be carried in any suitable signaling protocol message, such as for example, RRC message. For example, it may be provided in a RRC connection setup message during the RRC_IDLE to RRC_CONNECTED state transition, and can be used after the security has been activated. It should be noted that if the security context has not been enabled, the UE may not be allowed to request for RRC connection resume upon RLF or alternatively the network may reject the request immediately. An alternative is to use a RRC connection reconfiguration message to provide the resume identity after the security activation. During RRC_INACTIVE to RRC_CONNECTED state transition, if gNB has changed, a new resume identity may be provided in a RRC connection resume or reconfiguration message, usually after the context fetch has been done. In this case, the new gNB will be the new anchor gNB upon resume. In an example embodiment, the new anchor gNB shall send the context release message to the old anchor gNB only after ensuring the UE has received the new resume identity, based on a feedback sent by the UE, such as for example, a RRC connection resume/reconfiguration complete message. If the UE resumes to the same gNB, the resume identity may or may not be changed by the gNB for the UE. In an example embodiment, it may be changed to prevent users from figuring out network deployment architecture.

[0017] In an example embodiment, the resume identity may be refreshed at each handover in order to update the location of UE context, for example, in case gNB changes. In an example embodiment, the resume identity may be updated in the handover command message, such as for example RRC connection reconfiguration message.

[0018] In an example embodiment, if a UE experiences RLF before receiving resume ID, it may enter IDLE state upon RLF event directly. In another example embodiment, the UE can be configured along with the resume identity, a RAN area in which the UE is allowed to resume after RLF via resume procedure. The RAN area may be equal to RAN notification area which is configured for RRC_INACTIVE state. The RAN area may comprise of a set of cells and/or a RAN notification area code associated to set of cells within the RAN. If the UE cannot select a cell within the configured RAN area, i.e., the UE selects a cell out of the configured RAN area, it may directly enter the RRC_IDLE state and seek to establish RRC connection via RRC connection establishment procedure.

[0019] Note that the various embodiments described herein may also apply upon handover failure or RRC reconfiguration failure besides RLF. In an example embodiment, a UE may apply different access control for resuming from RLF, RRC reconfiguration failure, or handover failure,

than for conventional resume/connection (re-)establishment in order to differentiate various events of RRC connection using the re-establishment via resume procedure. Different establishment causes may be set by the UE when re-establishment via resume procedure is performed. For example, the establishment cause may indicate radio link failure, RRC reconfiguration failure or handover failure event. When the cell access is limited by the network, a UE may not even start accessing the cell. For the re-establishment via resume procedure purpose, the network may give different access barring information than for conventional resume/connection (re-)establishment. For example, the network may configure the UE, via system information, such as System Information Block (SIB), common signalling or dedicatedly to each UE, whether to monitor the general access barring information or the dedicated barring information for re-establishment via resume procedure purpose.

[0020] Figure 2 illustrates a flowchart in accordance with an example embodiment of the application. In the example of Figure 2, a UE enters a connected state at step 201, such as for example, a RRC_CONNECTED state. Upon detecting a connection failure (such as for example RLF or RRC reconfiguration failure/handover failure) at step 202, the UE determines whether a resume identity has been received at step 203. If the resume identity has not been received, the UE enters an idle state at step 204, such as for example, a RRC_IDLE state, where the UE may perform a RRC connection establishment procedure. If the resume identity has been received, the UE enters an inactive state or stays in connected state at step 205, such as for example, a RRC_INACTIVE state or the RRC_CONNECTED state, respectively, where the UE may apply a connection resume procedure to resume/re-establish the connection.

[0021] Reference is made to Figure 3 for illustrating a simplified block diagram of various example apparatuses that are suitable for use in practicing various example embodiments of this application. In Figure 3, a network element (NE) 301, such as for example, a gNB, is adapted for communication with a UE 311. The UE 311 includes at least one processor circuitry 315, at least one memory (MEM) 314 coupled to the at least one processor circuitry 315, and a suitable transceiver (TRANS) 313 (having a transmitter (TX) and a receiver (RX)) coupled to the at least one processor circuitry 315. The at least one MEM 314 stores a program (PROG) 312. The TRANS 313 is for bidirectional wireless communications with the NE 301.

[0022] The NE 301 includes at least one processor circuitry 305, at least one memory (MEM) 304 coupled to the at least one processor circuitry 305, and a suitable transceiver (TRANS) 303 (having a transmitter (TX) and a receiver (RX)) coupled to the at least one processor circuitry 305. The at least one MEM 304 stores a program (PROG) 302. The TRANS 303 is for bidirectional

wireless communications with the UE 311. The NE 301 may be coupled to one or more other NE, which is not shown in this figure.

[0023] As shown in Figure 3, the NE 301 may further include a connection failure and resume control unit 306. The unit 306, together with the at least one processor circuitry 305 and the PROG 302, may be utilized by the NE 301 in conjunction with various example embodiments of the application, as described herein.

[0024] As shown in Figure 3, the UE 311 may further include a connection failure and resume process unit 316. The unit 316, together with the at least one processor circuitry 315 and the PROG 312, may be utilized by the UE 311 in conjunction with various example embodiments of the application, as described herein.

[0025] At least one of the PROGs 302 and 312 is assumed to include program instructions that, when executed by the associated processor, enable the electronic apparatus to operate in accordance with the example embodiments of this disclosure, as discussed herein.

[0026] In general, the various example embodiments of the apparatus 311 can include, but are not limited to, cellular phones, personal digital assistants (PDAs) having wireless communication capabilities, portable computers having wireless communication capabilities, image capture devices such as digital cameras having wireless communication capabilities, gaming devices having wireless communication capabilities, music storage and playback appliances having wireless communication capabilities, Internet appliances permitting wireless Internet access and browsing, as well as portable units or terminals that incorporate combinations of such functions.

[0027] The example embodiments of this disclosure may be implemented by computer software or computer program code executable by one or more of the processor circuitries 305, 315 of the NE 301 and the UE 311, or by hardware, or by a combination of software and hardware.

[0028] The MEMs 304 and 314 may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor-based memory devices, flash memory, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory, as non-limiting examples. The processor circuitries 305 and 315 may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multi-core processor architecture, as non-limiting examples.

[0029] Without in any way limiting the scope, interpretation, or application of the claims appearing below, a technical effect of one or more of the example embodiments disclosed herein may be simplifying UE and NW operation with a mechanism for connection failure and resume

handling. A better coverage for the re-establishment of the RRC connectioncan be achieved as the resume identity can better identify a network node and UE. Another technical effect is that the UE can enter to idle state faster if no cell can be selected that could accept the re-establishment via resume procedure request.

[0030] Embodiments of the present invention may be implemented in software, hardware, application logic or a combination of software, hardware and application logic. The software, application logic and/or hardware may reside on an apparatus such as a user equipment, a gNB or other mobile communication devices. If desired, part of the software, application logic and/or hardware may reside on a network element 301, part of the software, application logic and/or hardware may reside on a UE 311, and part of the software, application logic and/or hardware may reside on other chipset or integrated circuit. In an example embodiment, the application logic, software or an instruction set is maintained on any one of various conventional computer-readable media. In the context of this document, a "computer-readable medium" may be any media or means that can contain, store, communicate, propagate or transport the instructions for use by or in connection with an instruction execution system, apparatus, or device. A computer-readable medium may comprise a non-transitory computer-readable storage medium that may be any media or means that can contain or store the instructions for use by or in connection with an instruction execution system, apparatus, or device.

[0031] It is also noted herein that while the above describes example embodiments of the invention, these descriptions should not be viewed in a limiting sense. Rather, there are several variations and modifications which may be made without departing from the scope of the present invention.

[0032] Further, the various names, such as for example, the names of timers used for the described parameters are not intended to be limiting in any respect, as these parameters may be identified by any suitable names.

[0033] If desired, the different functions discussed herein may be performed in a different order and/or concurrently with each other. Furthermore, if desired, one or more of the above-described functions may be optional or may be combined. As such, the foregoing description should be considered as merely illustrative of the principles, teachings and example embodiments of this invention, and not in limitation thereof.

WE CLAIM:

1. A method comprising:
entering a connected state;
detecting a connection failure;
determining whether a resume identity has been received; and
if the resume identity has been received, entering an inactive state or staying in the connected state; otherwise, entering an idle state.

2. The method according to claim 1, further comprising:
triggering a resume procedure upon the connection failure, if the resume identity has been received.

3. The method according to claim 2, further comprising:
selecting a cell and resuming connection via the resume procedure with the received resume identity.

4. The method according to claim 2 or 3, further comprising:
receiving a configuration of access area in which a user equipment is allowed to resume connection via the resume procedure after the connection failure.

5. The method according to claim 4, further comprising:
if the user equipment fails to select a cell within the configured access area, entering the idle state and establishing connection via a connection establishment procedure.

6. The method according to any of claims 2 to 5, further comprising:
setting an establishment cause during the resume procedure.

7. The method according to any of claims 1 to 6, wherein the resume identity is received in a connection setup message or a connection reconfiguration message.

8. The method according to any of claims 1 to 7, further comprising:
receiving a new resume identity in a connection resume message or a connection reconfiguration message.

9. The method according to any of claims 1 to 8, wherein the resume identity identifies at least one of a user equipment within a network area, a network node or a cell which configures the resume identity.

10. An apparatus, comprising:
at least one processor; and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to
enter a connected state;
detect a connection failure;
determine whether a resume identity has been received; and

if the resume identity has been received, enter an inactive state or stay in the connected state; otherwise, enter an idle state.

11. The apparatus according to claim 10, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to trigger a resume procedure upon the connection failure, if the resume identity has been received.

12. The apparatus according to the claim 11, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to select a cell and resume connection via the resume procedure with the received resume identity.

13. The apparatus according to claim 11 to 12, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to:
receive a configuration of access area in which a user equipment is allowed to resume connection via the resume procedure after the connection failure.

14. The apparatus according to claim 13, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to:
if the user equipment fails to select a cell within the configured access area, enter the idle state and establish connection via a connection establishment procedure.

15. The apparatus according to any of claims 11 to 14, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to set an establishment cause during the resume procedure.

16. The apparatus according to any of claims 10 to 15, wherein the resume identity is received in a connection setup message or a connection reconfiguration message.

17. The apparatus according to any of claims 10 to 16, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to receive a new resume identity in a connection resume message or a connection reconfiguration message.

18. The apparatus according to any of claims 10 to 17, wherein the resume identity identifies at least one of a user equipment within a network area, a network node or a cell which configures the resume identity.

19. An apparatus, comprising:
means for entering a connected state;
means for detecting a connection failure;
means for determining whether a resume identity has been received; and
means for if the resume identity has been received, entering an inactive state or staying in the connected state; otherwise, entering an idle state.

20. The apparatus according to claim 19, further comprising:

means for triggering a resume procedure upon the connection failure, if the resume identity has been received.

21. The apparatus according to claim 20, further comprising:
means for selecting a cell and resuming connection via the resume procedure with the received resume identity.

22. The apparatus according to claim 20 or 21, further comprising:
means for receiving a configuration of access area in which a user equipment is allowed to resume connection via the resume procedure after the connection failure.

23. The apparatus according to claim 22, further comprising:
means for if the user equipment fails to select a cell within the configured access area, entering the idle state and establishing connection via a connection establishment procedure.

24. The apparatus according to any of claims 20 to 23, further comprising:
means for setting an establishment cause during the resume procedure.

25. The apparatus according to any of claims 19 to 24, wherein the resume identity is received in a connection setup message or a connection reconfiguration message.

26. The apparatus according to any of claims 19 to 25, further comprising:
means for receiving a new resume identity in a connection resume message or a connection reconfiguration message.

27. The apparatus according to any of claims 19 to 26, wherein the resume identity identifies at least one of a user equipment within a network area, a network node or a cell which configures the resume identity.

28. A computer readable medium comprising program instructions for causing an apparatus to perform at least the following:
entering a connected state;
detecting a connection failure;
determining whether a resume identity has been received; and
if the resume identity has been received, entering an inactive state or staying in the connected state;
otherwise, entering an idle state.

29. The computer readable medium according to claim 28, further comprising program instructions for causing the apparatus to perform:
triggering a resume procedure upon the connection failure, if the resume identity has been received.

30. The computer readable medium according to claim 29, further comprising program instructions for causing the apparatus to perform:
selecting a cell and resuming connection via the resume procedure with the received resume identity.

31. The computer readable medium according to claim 29 or 30, further comprising program instructions for causing the apparatus to perform:
receiving a configuration of access area in which a user equipment is allowed to resume connection via the resume procedure after the connection failure.

32. The computer readable medium according to claim 31, further comprising program instructions for causing the apparatus to perform:
if the user equipment fails to select a cell within the configured access area, entering the idle state and establishing connection via a connection establishment procedure.

33. The computer readable medium according to any of claims 29 to 32, further comprising program instructions for causing the apparatus to perform:
setting an establishment cause during the resume procedure.

34. The computer readable medium according to any of claims 28 to 33, wherein the resume identity is received in a connection setup message or a connection reconfiguration message.

35. The computer readable medium according to any of claims 28 to 34, further comprising program instructions for causing the apparatus to perform:
receiving a new resume identity in a connection resume message or a connection reconfiguration message.

36. The computer readable medium according to any of claims 28 to 35, wherein the resume identity identifies at least one of a user equipment within a network area, a network node or a cell which configures the resume identity.

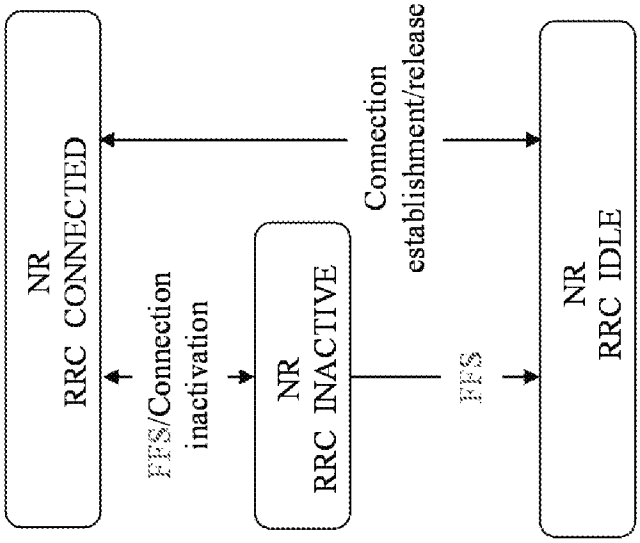

NR
RRC CONNECTED
FFS/Connection
inactivation
NR
RRC INACTIVE
Connection
establishment/release
FFS
NR
RRC IDLE

Figure 1

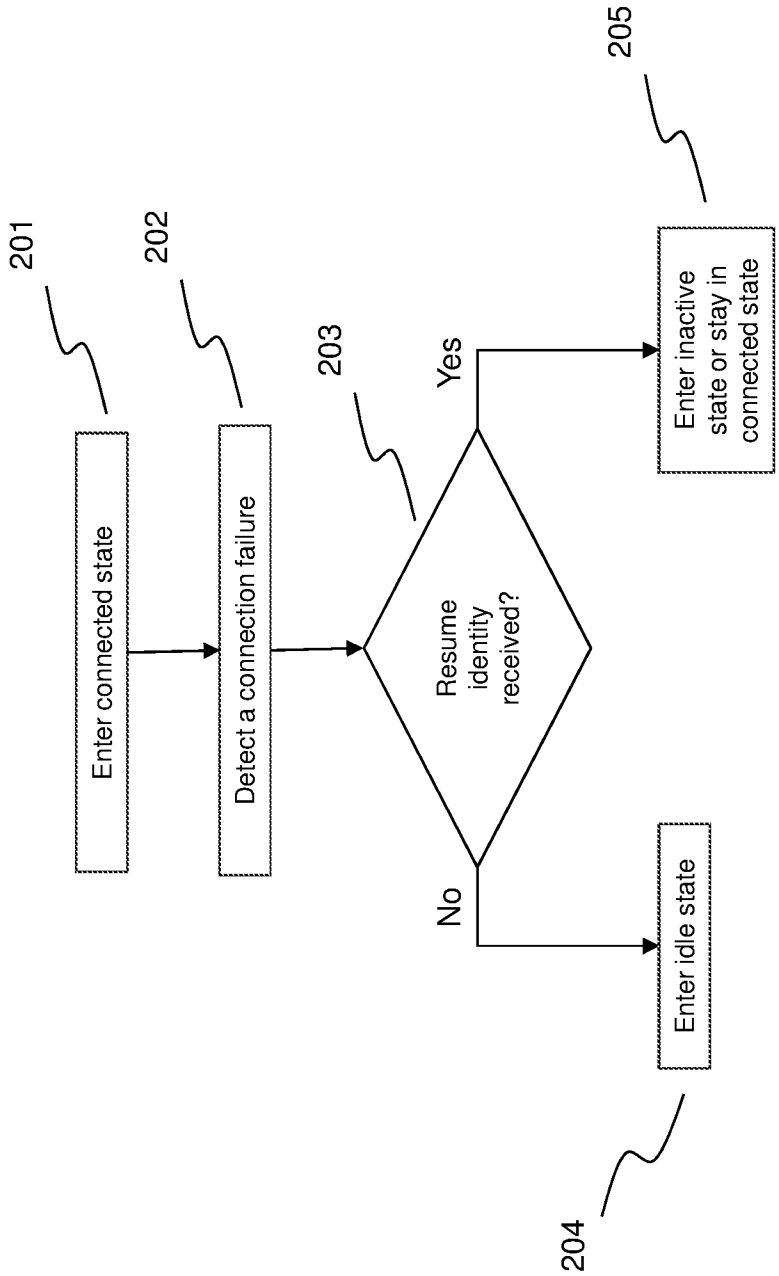

201
Enter connected state
202
Detect a connection failure
203
Resume identity received?
Yes
205
Enter inactive state or stay in connected state
No
204
Enter idle state

Figure 2

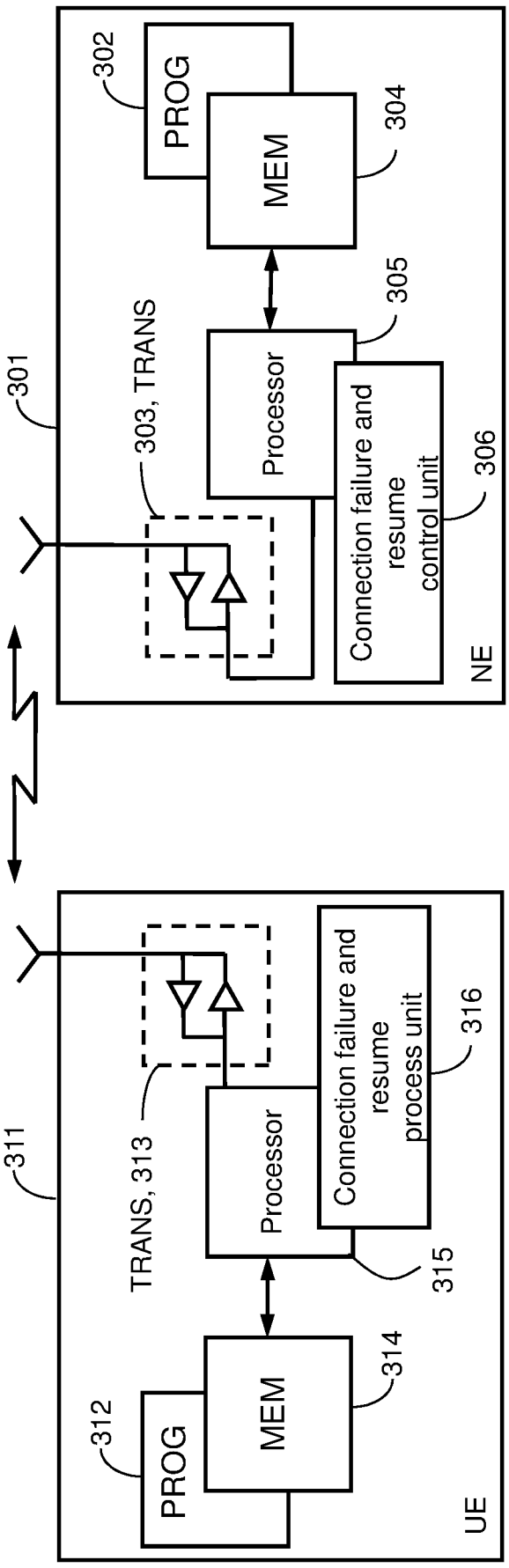

302
PROG
MEM
304
305
Processor
303, TRANS
301
Connection failure and resume control unit
306
NE
TRANS, 313
311
Processor
Connection failure and resume process unit
316
315
314
312
PROG
MEM
UE

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/051772

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Mobility enhancement for NB-IoT UP solution", 3GPP Draft; R2-168104 NB-IoT mobility enhancement for UP solution, Nokia Alcatel-Lucent Shanghai Bell, 2016-11-13.; Sections 1 and 2 --	1-36
A	"Security for RRC Connection Suspend and Resume procedure in solution 18 for Narrow Band CIoT", 3GPP Draft; S3-160157_NBCIoT_Discussion paper_RRC connection suspend and resume, Ericsson, 2016-01-25.; Sections 2.1 and A.1 --	1-36

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26-06-2018	26-06-2018

Name and mailing address of the ISA/SE
Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer
Ralf Boström

Telephone No. + 46 8 782 28 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/051772

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"Introduction of the UE context resume function", 3GPP Draft; 36300_CR0883_(Rel-13)_R3-161433_R2-164568, 2016-06-21.; Section 20.2.2.x ---	1-36
A	US 20130260810 A1 (RAYAVARAPU VENKATA RATNAKAR RAO), 3 October 2013 (2013-10-03); abstract --- --------	1-36

International application No.
PCT/IB2018/051772

Continuation of: second sheet

International Patent Classification (IPC)

H04W 76/19 (2018.01)
H04W 76/27 (2018.01)

US	20130260810 A1	03/10/2013	US	9155121 B2	06/10/2015