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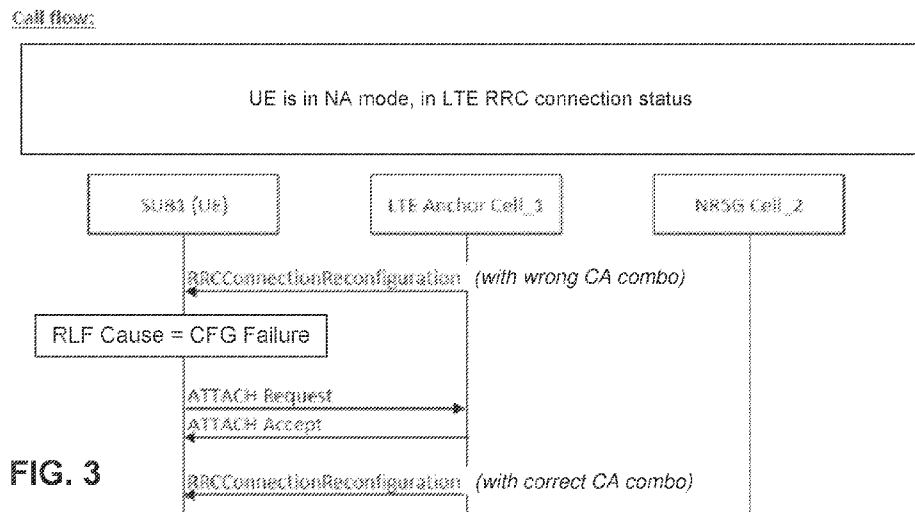


FIG. 3

(57) Abstract: Various aspects of the present disclosure generally relate to wireless communication. In some aspects, a user equipment (UE) may determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service, and transmit an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell. Numerous other aspects are provided.

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RESOLUTION OF RADIO LINK FAILURE DUE TO USER EQUIPMENT CAPABILITY

FIELD OF THE DISCLOSURE

[0001] Aspects of the present disclosure generally relate to wireless communication and to techniques and apparatuses for resolving a radio link failure due to a user equipment capability.

BACKGROUND

[0002] Wireless communication systems are widely deployed to provide various telecommunication services such as telephony, video, data, messaging, and broadcasts. Typical wireless communication systems may employ multiple-access technologies capable of supporting communication with multiple users by sharing available system resources (e.g., bandwidth, transmit power, and/or the like). Examples of such multiple-access technologies include code division multiple access (CDMA) systems, time division multiple access (TDMA) systems, frequency-division multiple access (FDMA) systems, orthogonal frequency-division multiple access (OFDMA) systems, single-carrier frequency-division multiple access (SC-FDMA) systems, time division synchronous code division multiple access (TD-SCDMA) systems, and Long Term Evolution (LTE). LTE/LTE-Advanced is a set of enhancements to the Universal Mobile Telecommunications System (UMTS) mobile standard promulgated by the Third Generation Partnership Project (3GPP).

[0003] A wireless communication network may include a number of base stations (BSs) that can support communication for a number of user equipment (UEs). A user equipment (UE) may communicate with a base station (BS) via the downlink and uplink. The downlink (or forward link) refers to the communication link from the BS to the UE, and the uplink (or reverse link) refers to the communication link from the UE to the BS. As will be described in more detail herein, a BS may be referred to as a Node B, a gNB, an access point (AP), a radio head, a transmit receive point (TRP), a New Radio (NR) BS, a 5G Node B, and/or the like.

[0004] The above multiple access technologies have been adopted in various telecommunication standards to provide a common protocol that enables different user equipment to communicate on a municipal, national, regional, and even global level.

New Radio (NR), which may also be referred to as 5G, is a set of enhancements to the LTE mobile standard promulgated by the Third Generation Partnership Project (3GPP). NR is designed to better support mobile broadband Internet access by improving spectral efficiency, lowering costs, improving services, making use of new spectrum, and better integrating with other open standards using orthogonal frequency division multiplexing (OFDM) with a cyclic prefix (CP) (CP-OFDM) on the downlink (DL), using CP-OFDM and/or SC-FDM (e.g., also known as discrete Fourier transform spread OFDM (DFT-s-OFDM)) on the uplink (UL), as well as supporting beamforming, multiple-input multiple-output (MIMO) antenna technology, and carrier aggregation. However, as the demand for mobile broadband access continues to increase, there exists a need for further improvements in LTE and NR technologies. Preferably, these improvements should be applicable to other multiple access technologies and the telecommunication standards that employ these technologies.

SUMMARY

[0005] In some aspects, a method of wireless communication, performed by a user equipment (UE), may include determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio (NR) data service, and transmitting an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

[0006] In some aspects, a method of wireless communication, performed by UE, may include determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, and transmitting a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

[0007] In some aspects, a user equipment for wireless communication may include memory and one or more processors coupled to the memory. For example, the one or more processors may be operatively, electronically, communicatively, or otherwise coupled to the memory. The memory may include instructions executable by the one or

more processors to cause the user equipment to determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, and transmit an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

[0008] In some aspects, a UE for wireless communication may include memory and one or more processors coupled to the memory. For example, the one or more processors may be operatively, electronically, communicatively, or otherwise coupled to the memory. The memory may include instructions executable by the one or more processors to cause the user equipment to determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, and transmit a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

[0009] In some aspects, an apparatus for wireless communication may include means for determining, while registered in a non-standalone mode, that a UE capability of the apparatus does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, and means for transmitting an attach request to the cell based at least in part on the determining that the UE capability of the apparatus does not support the antenna configuration received from the cell.

[0010] In some aspects, an apparatus for wireless communication may include means for determining, while registered in a non-standalone mode, that a UE capability of the apparatus does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, and means for transmitting a tracking area update request to the cell based at least in part on the determining that the UE capability of the apparatus does not support the antenna configuration received from the cell.

[0011] Aspects generally include a method, apparatus, system, computer program product, non-transitory computer-readable medium, user equipment, base station, wireless communication device, and/or processing system as substantially described herein with reference to and as illustrated by the drawings and specification.

[0012] The foregoing has outlined rather broadly the features and technical advantages of examples according to the disclosure in order that the detailed description that follows may be better understood. Additional features and advantages will be described hereinafter. The conception and specific examples disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present disclosure. Such equivalent constructions do not depart from the scope of the appended claims. Characteristics of the concepts disclosed herein, both their organization and method of operation, together with associated advantages will be better understood from the following description when considered in connection with the accompanying figures. Each of the figures is provided for the purposes of illustration and description, and not as a definition of the limits of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] So that the above-recited features of the present disclosure can be understood in detail, a more particular description, briefly summarized above, may be had by reference to aspects, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only certain typical aspects of this disclosure and are therefore not to be considered limiting of its scope, for the description may admit to other equally effective aspects. The same reference numbers in different drawings may identify the same or similar elements.

[0014] Fig. 1 is a block diagram conceptually illustrating an example of a wireless communication network, in accordance with various aspects of the present disclosure.

[0015] Fig. 2 is a block diagram conceptually illustrating an example of a base station in communication with a user equipment (UE) in a wireless communication network, in accordance with various aspects of the present disclosure.

[0016] Fig. 3 is a diagram illustrating an example of resolving a radio link failure due to a user equipment capability, in accordance with various aspects of the present disclosure.

[0017] Fig. 4 is a diagram illustrating an example process performed, for example, by a UE, in accordance with various aspects of the present disclosure.

[0018] Fig. 5 is a diagram illustrating an example process performed, for example, by a UE, in accordance with various aspects of the present disclosure.

DETAILED DESCRIPTION

[0019] Various aspects of the disclosure are described hereinafter with reference to the accompanying drawings. This disclosure may, however, be embodied in many different forms and should not be construed as limited to any specific structure or function presented throughout this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will convey the scope of the disclosure to those skilled in the art. Based on the teachings herein one skilled in the art should appreciate that the scope of the disclosure is intended to cover any aspect of the disclosure disclosed herein, whether implemented independently of or combined with any other aspect of the disclosure. For example, an apparatus may be implemented or a method may be practiced using any number of the aspects set forth herein. In addition, the scope of the disclosure is intended to cover such an apparatus or method which is practiced using other structure, functionality, or structure and functionality in addition to or other than the various aspects of the disclosure set forth herein. It should be understood that any aspect of the disclosure disclosed herein may be embodied by one or more elements of a claim.

[0020] Several aspects of telecommunication systems will now be presented with reference to various apparatuses and techniques. These apparatuses and techniques will be described in the following detailed description and illustrated in the accompanying drawings by various blocks, modules, components, circuits, steps, processes, algorithms, and/or the like (collectively referred to as “elements”). These elements may be implemented using hardware, software, or combinations thereof. Whether such elements are implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system.

[0021] It should be noted that while aspects may be described herein using terminology commonly associated with 3G and/or 4G wireless technologies, aspects of the present disclosure can be applied in other generation-based communication systems, such as 5G and later, including NR technologies.

[0022] Fig. 1 is a diagram illustrating a wireless network 100 in which aspects of the present disclosure may be practiced. The wireless network 100 may be an LTE network or some other wireless network, such as a 5G or NR network. The wireless network 100 may include a number of BSs 110 (shown as BS 110a, BS 110b, BS 110c, and BS 110d) and other network entities. A BS is an entity that communicates with

user equipment (UEs) and may also be referred to as a base station, an NR BS, a Node B, a gNB, a 5G node B (NB), an access point, a transmit receive point (TRP), and/or the like. Each BS may provide communication coverage for a particular geographic area. In 3GPP, the term “cell” can refer to a coverage area of a BS and/or a BS subsystem serving this coverage area, depending on the context in which the term is used.

[0023] A BS may provide communication coverage for a macro cell, a pico cell, a femto cell, and/or another type of cell. A macro cell may cover a relatively large geographic area (e.g., several kilometers in radius) and may allow unrestricted access by UEs with service subscription. A pico cell may cover a relatively small geographic area and may allow unrestricted access by UEs with service subscription. A femto cell may cover a relatively small geographic area (e.g., a home) and may allow restricted access by UEs having association with the femto cell (e.g., UEs in a closed subscriber group (CSG)). A BS for a macro cell may be referred to as a macro BS. A BS for a pico cell may be referred to as a pico BS. A BS for a femto cell may be referred to as a femto BS or a home BS. In the example shown in Fig. 1, a BS 110a may be a macro BS for a macro cell 102a, a BS 110b may be a pico BS for a pico cell 102b, and a BS 110c may be a femto BS for a femto cell 102c. A BS may support one or multiple (e.g., three) cells. The terms “eNB”, “base station”, “NR BS”, “gNB”, “TRP”, “AP”, “node B”, “5G NB”, and “cell” may be used interchangeably herein.

[0024] In some aspects, a cell may not necessarily be stationary, and the geographic area of the cell may move according to the location of a mobile BS. In some aspects, the BSs may be interconnected to one another and/or to one or more other BSs or network nodes (not shown) in the wireless network 100 through various types of backhaul interfaces such as a direct physical connection, a virtual network, and/or the like using any suitable transport network.

[0025] Wireless network 100 may also include relay stations. A relay station is an entity that can receive a transmission of data from an upstream station (e.g., a BS or a UE) and send a transmission of the data to a downstream station (e.g., a UE or a BS). A relay station may also be a UE that can relay transmissions for other UEs. In the example shown in Fig. 1, a relay station 110d may communicate with macro BS 110a and a UE 120d in order to facilitate communication between BS 110a and UE 120d. A relay station may also be referred to as a relay BS, a relay base station, a relay, and/or the like.

[0026] Wireless network 100 may be a heterogeneous network that includes BSs of different types, e.g., macro BSs, pico BSs, femto BSs, relay BSs, and/or the like. These different types of BSs may have different transmit power levels, different coverage areas, and different impacts on interference in wireless network 100. For example, macro BSs may have a high transmit power level (e.g., 5 to 40 watts) whereas pico BSs, femto BSs, and relay BSs may have lower transmit power levels (e.g., 0.1 to 2 watts).

[0027] A network controller 130 may couple to a set of BSs and may provide coordination and control for these BSs. Network controller 130 may communicate with the BSs via a backhaul. The BSs may also communicate with one another, e.g., directly or indirectly via a wireless or wireline backhaul.

[0028] UEs 120 (e.g., 120a, 120b, 120c) may be dispersed throughout wireless network 100, and each UE may be stationary or mobile. A UE may also be referred to as an access terminal, a terminal, a mobile station, a subscriber unit, a station, and/or the like. A UE may be a cellular phone (e.g., a smart phone), a personal digital assistant (PDA), a wireless modem, a wireless communication device, a handheld device, a laptop computer, a cordless phone, a wireless local loop (WLL) station, a tablet, a camera, a gaming device, a netbook, a smartbook, an ultrabook, a medical device or equipment, biometric sensors/devices, wearable devices (smart watches, smart clothing, smart glasses, smart wrist bands, smart jewelry (e.g., smart ring, smart bracelet)), an entertainment device (e.g., a music or video device, or a satellite radio), a vehicular component or sensor, smart meters/sensors, industrial manufacturing equipment, a global positioning system device, or any other suitable device that is configured to communicate via a wireless or wired medium.

[0029] Some UEs may be considered machine-type communication (MTC) or evolved or enhanced machine-type communication (eMTC) UEs. MTC and eMTC UEs include, for example, robots, drones, remote devices, sensors, meters, monitors, location tags, and/or the like, that may communicate with a base station, another device (e.g., remote device), or some other entity. A wireless node may provide, for example, connectivity for or to a network (e.g., a wide area network such as Internet or a cellular network) via a wired or wireless communication link. Some UEs may be considered Internet-of-Things (IoT) devices, and/or may be implemented as NB-IoT (narrowband internet of things) devices. Some UEs may be considered a Customer Premises Equipment (CPE). UE 120 may be included inside a housing that houses components of UE 120, such as processor components, memory components, and/or the like. In

some aspects, the processor components and the memory components may be coupled together. For example, the processor components (e.g., one or more processors) and the memory components (e.g., a memory) may be operatively coupled, communicatively coupled, electronically coupled, electrically coupled, and/or the like.

[0030] In general, any number of wireless networks may be deployed in a given geographic area. Each wireless network may support a particular radio access technology (RAT) and may operate on one or more frequencies. A RAT may also be referred to as a radio technology, an air interface, and/or the like. A frequency may also be referred to as a carrier, a frequency channel, and/or the like. Each frequency may support a single RAT in a given geographic area in order to avoid interference between wireless networks of different RATs. In some cases, NR or 5G RAT networks may be deployed.

[0031] In some aspects, two or more UEs 120 (e.g., shown as UE 120a and UE 120e) may communicate directly using one or more sidelink channels (e.g., without using a base station 110 as an intermediary to communicate with one another). For example, the UEs 120 may communicate using peer-to-peer (P2P) communications, device-to-device (D2D) communications, a vehicle-to-everything (V2X) protocol (e.g., which may include a vehicle-to-vehicle (V2V) protocol, a vehicle-to-infrastructure (V2I) protocol, and/or the like), a mesh network, and/or the like. In this case, the UE 120 may perform scheduling operations, resource selection operations, and/or other operations described elsewhere herein as being performed by the base station 110.

[0032] As indicated above, Fig. 1 is provided as an example. Other examples may differ from what is described with regard to Fig. 1.

[0033] Fig. 2 shows a block diagram of a design 200 of base station 110 and UE 120, which may be one of the base stations and one of the UEs in Fig. 1. Base station 110 may be equipped with T antennas 234a through 234t, and UE 120 may be equipped with R antennas 252a through 252r, where in general $T \geq 1$ and $R \geq 1$.

[0034] At base station 110, a transmit processor 220 may receive data from a data source 212 for one or more UEs, select one or more modulation and coding schemes (MCS) for each UE based at least in part on channel quality indicators (CQIs) received from the UE, process (e.g., encode and modulate) the data for each UE based at least in part on the MCS(s) selected for the UE, and provide data symbols for all UEs. Transmit processor 220 may also process system information (e.g., for semi-static resource partitioning information (SRPI) and/or the like) and control information (e.g., CQI

requests, grants, upper layer signaling, and/or the like) and provide overhead symbols and control symbols. Transmit processor 220 may also generate reference symbols for reference signals (e.g., the cell-specific reference signal (CRS)) and synchronization signals (e.g., the primary synchronization signal (PSS) and secondary synchronization signal (SSS)). A transmit (TX) multiple-input multiple-output (MIMO) processor 230 may perform spatial processing (e.g., precoding) on the data symbols, the control symbols, the overhead symbols, and/or the reference symbols, if applicable, and may provide T output symbol streams to T modulators (MODs) 232a through 232t. Each modulator 232 may process a respective output symbol stream (e.g., for OFDM and/or the like) to obtain an output sample stream. Each modulator 232 may further process (e.g., convert to analog, amplify, filter, and upconvert) the output sample stream to obtain a downlink signal. T downlink signals from modulators 232a through 232t may be transmitted via T antennas 234a through 234t, respectively. According to various aspects described in more detail below, the synchronization signals can be generated with location encoding to convey additional information.

[0035] At UE 120, antennas 252a through 252r may receive the downlink signals from base station 110 and/or other base stations and may provide received signals to demodulators (DEMODs) 254a through 254r, respectively. Each demodulator 254 may condition (e.g., filter, amplify, downconvert, and digitize) a received signal to obtain input samples. Each demodulator 254 may further process the input samples (e.g., for OFDM and/or the like) to obtain received symbols. A MIMO detector 256 may obtain received symbols from all R demodulators 254a through 254r, perform MIMO detection on the received symbols if applicable, and provide detected symbols. A receive processor 258 may process (e.g., demodulate and decode) the detected symbols, provide decoded data for UE 120 to a data sink 260, and provide decoded control information and system information to a controller/processor 280. A channel processor may determine reference signal received power (RSRP), received signal strength indicator (RSSI), reference signal received quality (RSRQ), channel quality indicator (CQI), and/or the like. In some aspects, one or more components of UE 120 may be included in a housing.

[0036] Network controller 130 may include communication unit 294, controller/processor 290, and memory 292. Network controller 130 may include, for example, one or more devices in a core network. Network controller 130 may communicate with base station 110 via communication unit 294.

[0037] On the uplink, at UE 120, a transmit processor 264 may receive and process data from a data source 262 and control information (e.g., for reports comprising RSRP, RSSI, RSRQ, CQI, and/or the like) from controller/processor 280. Transmit processor 264 may also generate reference symbols for one or more reference signals. The symbols from transmit processor 264 may be precoded by a TX MIMO processor 266 if applicable, further processed by modulators 254a through 254r (e.g., for DFT-s-OFDM, CP-OFDM, and/or the like), and transmitted to base station 110. In some aspects, the UE 120 includes a transceiver. The transceiver may include any combination of antenna(s) 252, modulators and/or demodulators 254, MIMO detector 256, receive processor 258, transmit processor 264, and/or TX MIMO processor 266. The transceiver may be used by a processor (e.g., controller/processor 280) and memory 282 to perform aspects of any of the methods described herein, for example, as described with reference to Figs. 3-5.

[0038] At base station 110, the uplink signals from UE 120 and other UEs may be received by antennas 234, processed by demodulators 232, detected by a MIMO detector 236 if applicable, and further processed by a receive processor 238 to obtain decoded data and control information sent by UE 120. Receive processor 238 may provide the decoded data to a data sink 239 and the decoded control information to controller/processor 240. Base station 110 may include communication unit 244 and communicate to network controller 130 via communication unit 244. In some aspects, the base station 110 includes a transceiver. The transceiver may include any combination of antenna(s) 234, modulators and/or demodulators 232, MIMO detector 236, receive processor 238, transmit processor 220, and/or TX MIMO processor 230. The transceiver may be used by a processor (e.g., controller/processor 240) and memory 242 to perform aspects of any of the methods described herein, for example, as described with reference to Figs. 3-5.

[0039] Controller/processor 240 of base station 110, controller/processor 280 of UE 120, and/or any other component(s) of Fig. 2 may perform one or more techniques associated with resolving a radio link failure (RLF) due to a UE capability, as described in more detail elsewhere herein. For example, controller/processor 240 of base station 110, controller/processor 280 of UE 120, and/or any other component(s) of Fig. 2 may perform or direct operations of, for example, process 400 of Fig. 4, process 500 of Fig. 5, and/or other processes as described herein. Memories 242 and 282 may store data and program codes for base station 110 and UE 120, respectively. In some aspects,

memory 242 and/or memory 282 may comprise a non-transitory computer-readable medium storing one or more instructions for wireless communication. For example, the one or more instructions, when executed (e.g., directly, or after compiling, converting, interpreting, and/or the like) by one or more processors of the base station 110 and/or the UE 120, may perform or direct operations of, for example, process 400 of Fig. 4, process 500 of Fig. 5, and/or other processes as described herein. In some aspects, executing instructions may include running the instructions, converting the instructions, compiling the instructions, interpreting the instructions, and/or the like. A scheduler 246 may schedule UEs for data transmission on the downlink and/or uplink.

[0040] In some aspects, UE 120 may include means for determining, while registered in a non-standalone (NSA) mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, means for transmitting an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell, and/or the like. In some aspects, such means may include one or more components of UE 120 described in connection with Fig. 2, such as controller/processor 280, transmit processor 264, TX MIMO processor 266, MOD 254, antenna 252, DEMOD 254, MIMO detector 256, receive processor 258, and/or the like.

[0041] In some aspects, UE 120 may include means for determining, while registered in an NSA mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for an NR data service, means for transmitting a tracking area update (TAU) request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell, and/or the like. In some aspects, such means may include one or more components of UE 120 described in connection with Fig. 2, such as controller/processor 280, transmit processor 264, TX MIMO processor 266, MOD 254, antenna 252, DEMOD 254, MIMO detector 256, receive processor 258, and/or the like.

[0042] As indicated above, Fig. 2 is provided as an example. Other examples may differ from what is described with regard to Fig. 2.

[0043] An NSA network may be supported by existing LTE infrastructure and may provide access to the Internet for the UE. A UE may attach to an LTE cell (e.g., LTE anchor cell) and transfer data in a packet switched data transfer state. The UE may seek

to enhance a user experience by accessing a 5G (NR) data service, which is faster and has additional capabilities. The UE may access the NR data service by registering with an NR 5G cell. This may include establishing a radio resource control (RRC) connection with the NR 5G cell and transmitting a registration request for the NR data service. However, the UE may receive a registration failure message (e.g., RRC reconfiguration message) from the NR 5G cell. The registration failure message may indicate that registration failed due to a mismatch of a UE capability of the UE and a UE capability at the network. The UE capability may be associated with an antenna and/or beam configuration, such as a multiple input multiple output (MIMO) configuration. The MIMO configuration may be for carrier aggregation.

[0044] The UE may not be able to set up an NR 5G connection, while the UE is able to register with an NR 5G cell. A cause for radio link failure may be that a network wrongly configures a UE capability for a UE. For example, the UE may only support B2A(2*2MIMO)+B66C(2*2MIMO)+N71(2*2MIMO). Meanwhile, the network configures B2A(2*2MIMO)+B66C(4*4MIMO)+N71(2*2MIMO), so UE experiences a radio link failure (RLF).

[0045] A log snippet may indicate the following parameters or information:
15:36:02.231,lte_rrc_llcdb.c,38059,E,CC with freq 66930, TM Mode 4, 4L? 1,
num_mimo_lyr 4 is invalid for this CA [carrier aggregation] Combo,Sub-ID:1,
15:36:02.231,EVENT_LTE_RRC_RADIO_LINK_FAILURE_STAT,RLF Count since
RRC Connected = 1, RLF Count since LTE Active = 1, RLF Cause = CFG
FAILURE,Sub-ID:1.

[0046] According to some aspects, the UE may trigger a detach/attach process or a TAU procedure if a UE capability for the UE does not match a network UE capability and RLF occurs. For example, when the UE receives a radio resource control (RRC) reconfiguration message (with wrong CA combo) from the network, the UE triggers an ATTACH or TAU process to force the network to update the UE capability. As a result, the UE recovers from RLF, and the UE may access the NR data service.

[0047] Fig. 3 is a diagram illustrating an example 300 of resolving an RLF due to a UE capability, in accordance with various aspects of the present disclosure. Fig. 3 shows a signaling diagram for a UE (e.g., a UE 120 depicted in Figs. 1 and 2) registered in an NSA mode. Fig. 3 shows a UE that tries to attach to a cell (e.g., LTE Anchor Cell 1) but there is an RLF due to an incorrect CA combo (UE CA capability and network

CA mismatch). The UE may trigger an attach procedure or a TAU procedure to correct a CA combo configuration.

[0048] As indicated above, Fig. 3 is provided as an example. Other examples may differ from what is described with regard to Fig. 3.

[0049] Fig. 4 is a diagram illustrating an example process 400 performed, for example, by a UE, in accordance with various aspects of the present disclosure. Example process 400 is an example where the UE (e.g., UE 120 and/or the like) performs operations associated with resolving an RLF due to a UE capability.

[0050] As shown in Fig. 4, in some aspects, process 400 may include determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service (block 410). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service, as described above.

[0051] As further shown in Fig. 4, in some aspects, process 400 may include transmitting an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell (block 420). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may transmit an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell, as described above.

[0052] Process 400 may include additional aspects, such as any single aspect or any combination of aspects described below and/or in connection with one or more other processes described elsewhere herein.

[0053] In a first aspect, the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell exceeds a MIMO value for the UE capability of the UE.

[0054] In a second aspect, alone or in combination with the first aspect, the determining that the MIMO value for the antenna configuration received from the cell

exceeds the MIMO value for the UE capability of the UE includes determining that a quantity of MIMO layers for the antenna configuration received from the cell exceeds a quantity of MIMO layers for the UE capability of the UE.

[0055] In a third aspect, alone or in combination with one or more of the first and second aspects, the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is greater than 2.

[0056] In a fourth aspect, alone or in combination with one or more of the first through third aspects, the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is 4.

[0057] In a fifth aspect, alone or in combination with one or more of the first through fourth aspects, the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell does not match a MIMO value for the UE capability of the UE.

[0058] In a sixth aspect, alone or in combination with one or more of the first through fifth aspects, the antenna configuration received from the cell includes a carrier aggregation configuration.

[0059] Although Fig. 4 shows example blocks of process 400, in some aspects, process 400 may include additional blocks, fewer blocks, different blocks, or differently arranged blocks than those depicted in Fig. 4. Additionally, or alternatively, two or more of the blocks of process 400 may be performed in parallel.

[0060] Fig. 5 is a diagram illustrating an example process 500 performed, for example, by a UE, in accordance with various aspects of the present disclosure. Example process 500 is an example where the UE (e.g., UE 120 and/or the like) performs operations associated with resolving an RLF due to a UE capability.

[0061] As shown in Fig. 5, in some aspects, process 500 may include determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on

transmitting a service request to the cell for a New Radio data service (block 510). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service, as described above.

[0062] As further shown in Fig. 5, in some aspects, process 500 may include transmitting a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell (block 520). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may transmit a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell, as described above.

[0063] Process 500 may include additional aspects, such as any single aspect or any combination of aspects described below and/or in connection with one or more other processes described elsewhere herein.

[0064] In a first aspect, the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell exceeds a MIMO value for the UE capability of the UE.

[0065] In a second aspect, alone or in combination with the first aspect, the determining that the MIMO value for the antenna configuration received from the cell exceeds the MIMO value for the UE capability of the UE includes determining that a quantity of MIMO layers for the antenna configuration received from the cell exceeds a quantity of MIMO layers for the UE capability of the UE.

[0066] In a third aspect, alone or in combination with one or more of the first and second aspects, the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is greater than 2.

[0067] In a fourth aspect, alone or in combination with one or more of the first through third aspects, the determining that the quantity of MIMO layers for the antenna

configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is 4.

[0068] In a fifth aspect, alone or in combination with one or more of the first through fourth aspects, the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell does not match a MIMO value for the UE capability of the UE.

[0069] In a sixth aspect, alone or in combination with one or more of the first through fifth aspects, the antenna configuration received from the cell includes a carrier aggregation configuration.

[0070] Although Fig. 5 shows example blocks of process 500, in some aspects, process 500 may include additional blocks, fewer blocks, different blocks, or differently arranged blocks than those depicted in Fig. 5. Additionally, or alternatively, two or more of the blocks of process 500 may be performed in parallel.

[0071] The foregoing disclosure provides illustration and description, but is not intended to be exhaustive or to limit the aspects to the precise form disclosed.

Modifications and variations may be made in light of the above disclosure or may be acquired from practice of the aspects.

[0072] As used herein, the term “component” is intended to be broadly construed as hardware, software, and/or a combination of hardware and software. As used herein, a processor is implemented in hardware, software, and/or a combination of hardware and software. Software is to be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software modules, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, and/or the like, whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise.

[0073] As used herein, satisfying a threshold may, depending on the context, refer to a value being greater than the threshold, greater than or equal to the threshold, less than the threshold, less than or equal to the threshold, equal to the threshold, not equal to the threshold, and/or the like.

[0074] It will be apparent that systems and/or methods described herein may be implemented in different forms of hardware, software, and/or a combination of hardware and software. The actual specialized control hardware or software code used to implement these systems and/or methods is not limiting of the aspects. Thus, the operation and behavior of the systems and/or methods were described herein without reference to specific software code—it being understood that software and hardware can be designed to implement the systems and/or methods based, at least in part, on the description herein.

[0075] Even though particular combinations of features are recited in the claims and/or disclosed in the specification, these combinations are not intended to limit the disclosure of various aspects. In fact, many of these features may be combined in ways not specifically recited in the claims and/or disclosed in the specification. Although each dependent claim listed below may directly depend on only one claim, the disclosure of various aspects includes each dependent claim in combination with every other claim in the claim set. A phrase referring to “at least one of” a list of items refers to any combination of those items, including single members. As an example, “at least one of: a, b, or c” is intended to cover a, b, c, a-b, a-c, b-c, and a-b-c, as well as any combination with multiples of the same element (e.g., a-a, a-a-a, a-a-b, a-a-c, a-b-b, a-c-c, b-b, b-b-b, b-b-c, c-c, and c-c-c or any other ordering of a, b, and c).

[0076] No element, act, or instruction used herein should be construed as critical or essential unless explicitly described as such. Also, as used herein, the articles “a” and “an” are intended to include one or more items, and may be used interchangeably with “one or more.” Furthermore, as used herein, the terms “set” and “group” are intended to include one or more items (e.g., related items, unrelated items, a combination of related and unrelated items, and/or the like), and may be used interchangeably with “one or more.” Where only one item is intended, the phrase “only one” or similar language is used. Also, as used herein, the terms “has,” “have,” “having,” and/or the like are intended to be open-ended terms. Further, the phrase “based on” is intended to mean “based, at least in part, on” unless explicitly stated otherwise.

WHAT IS CLAIMED IS:

1. A method of wireless communication performed by a user equipment (UE), comprising:
 - determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and
 - transmitting an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.
2. The method of claim 1, wherein the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell exceeds a MIMO value for the UE capability of the UE.
3. The method of claim 2, wherein the determining that the MIMO value for the antenna configuration received from the cell exceeds the MIMO value for the UE capability of the UE includes determining that a quantity of MIMO layers for the antenna configuration received from the cell exceeds a quantity of MIMO layers for the UE capability of the UE.
4. The method of claim 3, wherein the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is greater than 2.
5. The method of claim 3, wherein the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is 4.

6. The method of claim 1, wherein the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell does not match a MIMO value for the UE capability of the UE.
7. The method of claim 1, wherein the antenna configuration received from the cell includes a carrier aggregation configuration.
8. A method of wireless communication performed by a user equipment (UE), comprising:
 - determining, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and
 - transmitting a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.
9. The method of claim 8, wherein the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell exceeds a MIMO value for the UE capability of the UE.
10. The method of claim 9, wherein the determining that the MIMO value for the antenna configuration received from the cell exceeds the MIMO value for the UE capability of the UE includes determining that a quantity of MIMO layers for the antenna configuration received from the cell exceeds a quantity of MIMO layers for the UE capability of the UE.
11. The method of claim 10, wherein the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of

MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is greater than 2.

12. The method of claim 10, wherein the determining that the quantity of MIMO layers for the antenna configuration received from the cell exceeds the quantity of MIMO layers for the UE capability of the UE includes determining that the quantity of MIMO layers for the UE capability of the UE is 2 and that the quantity of MIMO layers for the antenna configuration received from the cell is 4.

13. The method of claim 8, wherein the determining that the UE capability of the UE does not support the antenna configuration received from the cell includes determining that a multiple input multiple output (MIMO) value for the antenna configuration received from the cell does not match a MIMO value for the UE capability of the UE.

14. The method of claim 8, wherein the antenna configuration received from the cell includes a carrier aggregation configuration.

15. A non-transitory computer-readable medium storing one or more instructions for wireless communication, the one or more instructions, when executed by one or more processors of a user equipment (UE), cause the UE to:

determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

transmit an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

16. A non-transitory computer-readable medium storing one or more instructions for wireless communication, the one or more instructions, when executed by one or more processors of a user equipment (UE), cause the UE to:

determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a

cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

transmit a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

17. A user equipment (UE) for wireless communication, comprising:

a memory; and

one or more processors operatively coupled to the memory, the memory including instructions executable by the one or more processors to cause the UE to:

determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

transmit an attach request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

18. A user equipment (UE) for wireless communication, comprising:

a memory; and

one or more processors operatively coupled to the memory, the memory including instructions executable by the one or more processors to cause the UE to:

determine, while registered in a non-standalone mode, that a UE capability of the UE does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

transmit a tracking area update request to the cell based at least in part on the determining that the UE capability of the UE does not support the antenna configuration received from the cell.

19. An apparatus for wireless communication, comprising:

means for determining, while registered in a non-standalone mode, that a user equipment (UE) capability of the apparatus does not support an antenna configuration

received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

means for transmitting an attach request to the cell based at least in part on the determining that the UE capability of the apparatus does not support the antenna configuration received from the cell.

20. An apparatus for wireless communication, comprising:

means for determining, while registered in a non-standalone mode, that a user equipment (UE) capability of the apparatus does not support an antenna configuration received from a cell, based at least in part on transmitting a service request to the cell for a New Radio data service; and

means for transmitting a tracking area update request to the cell based at least in part on the determining that the UE capability of the apparatus does not support the antenna configuration received from the cell.

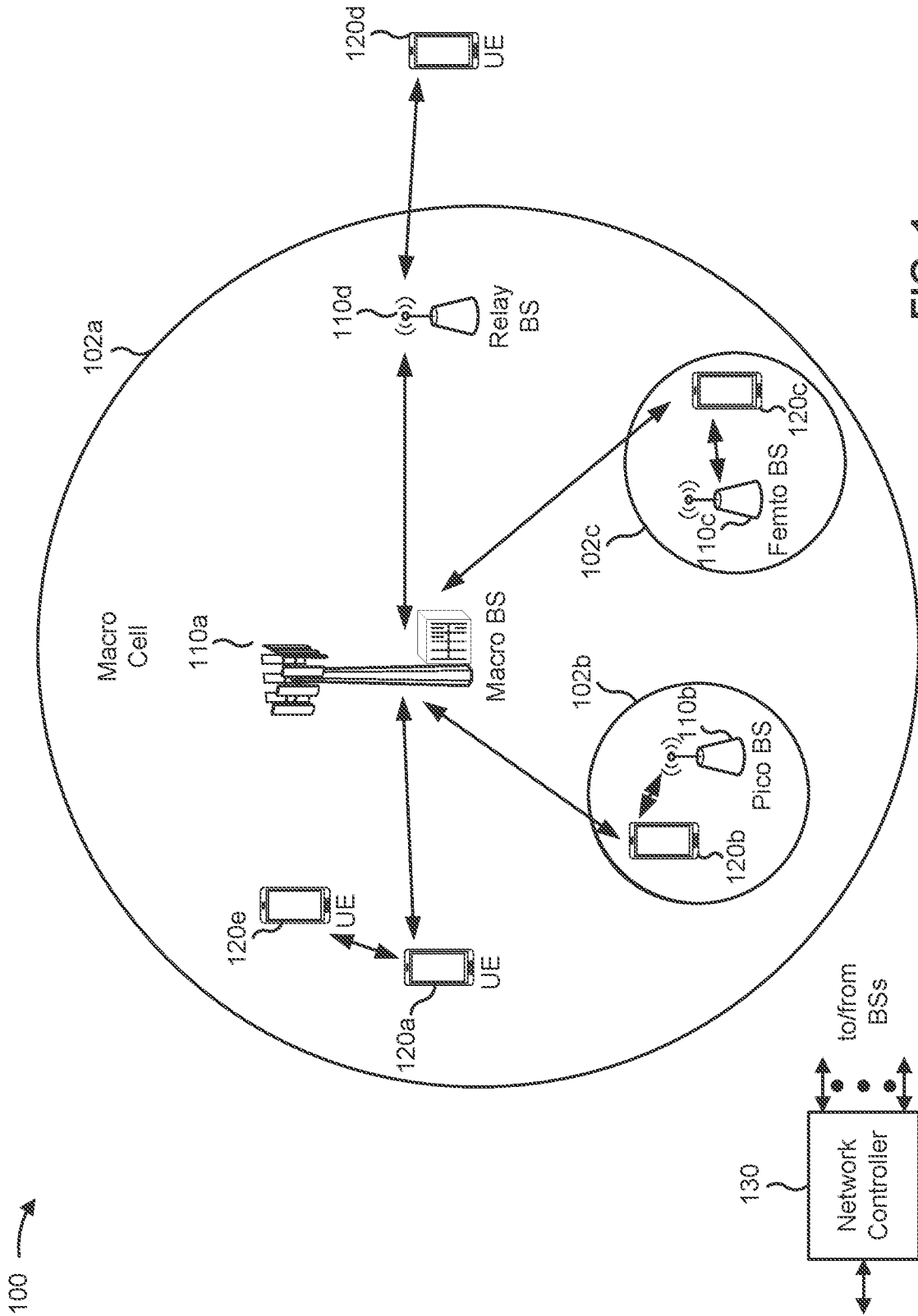


FIG. 1

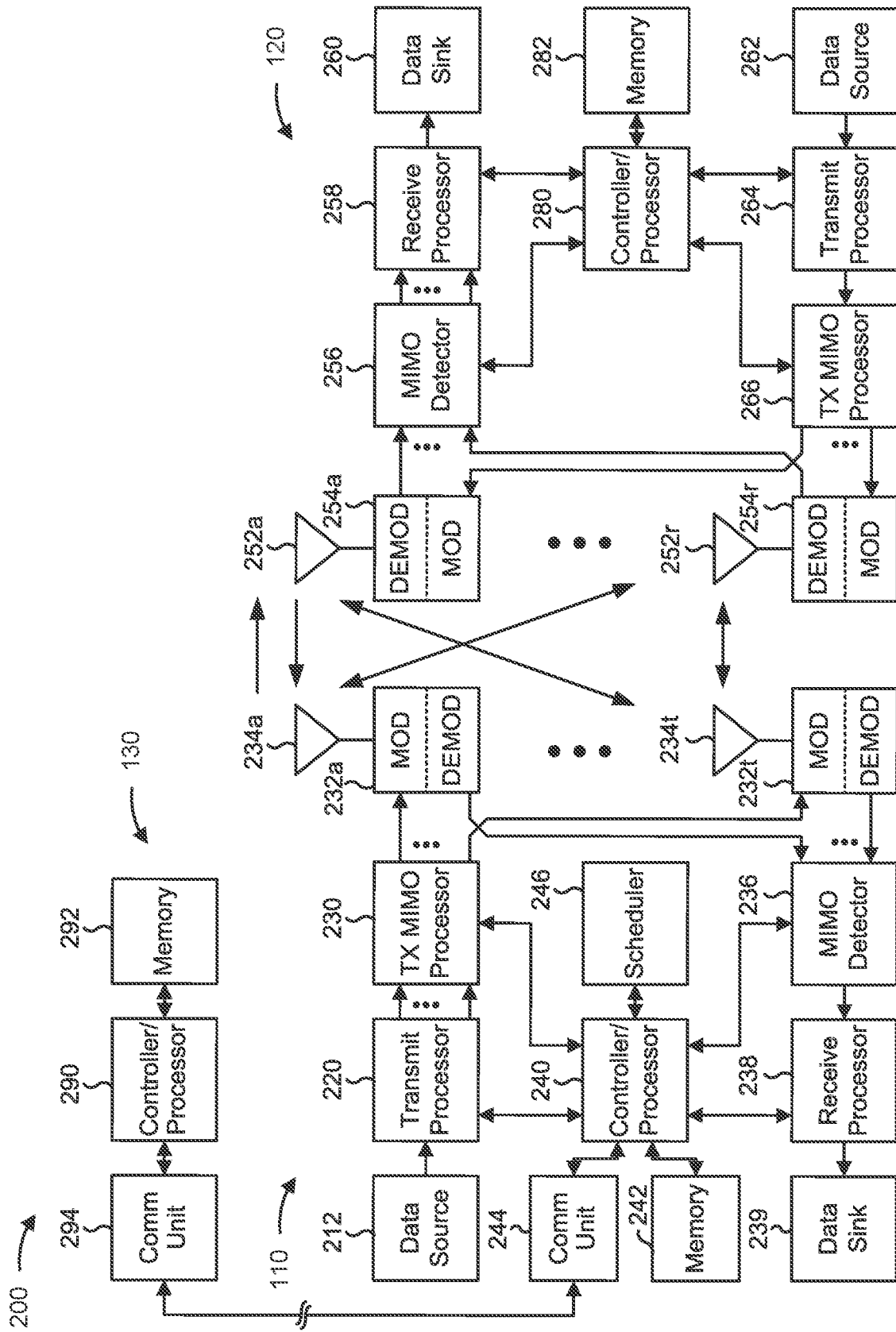


FIG. 2

300 →

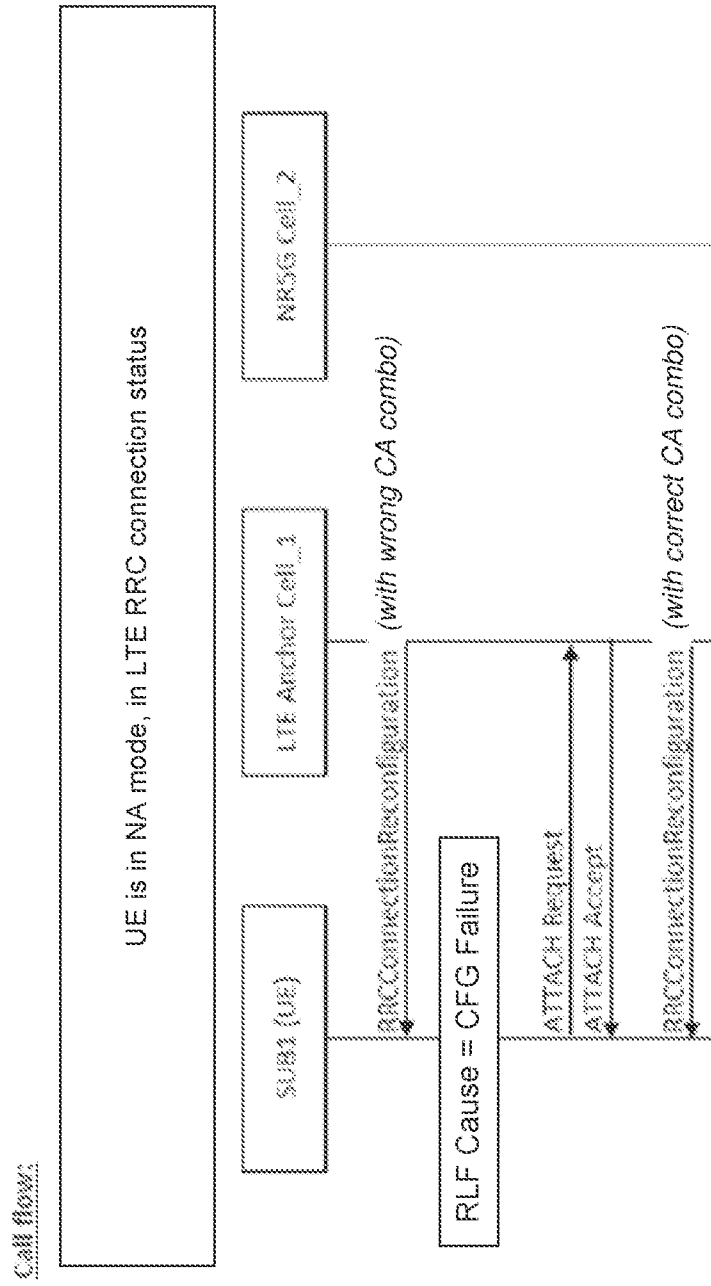


FIG. 3

400 →

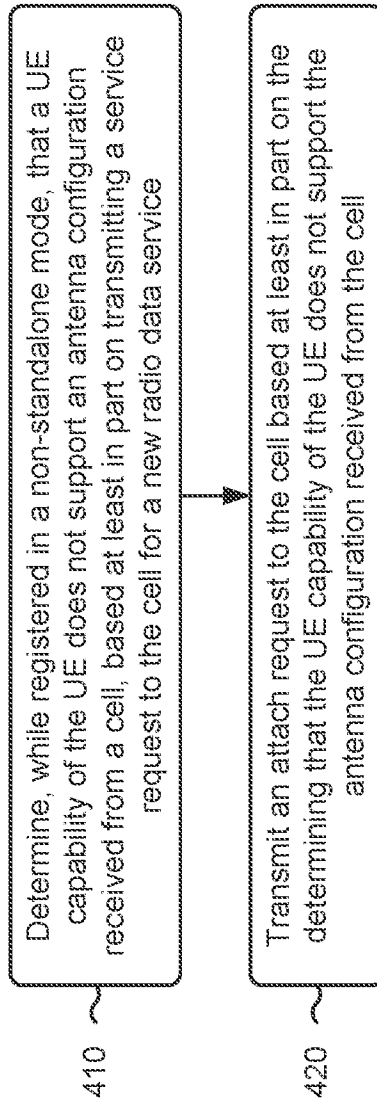


FIG. 4

500 →

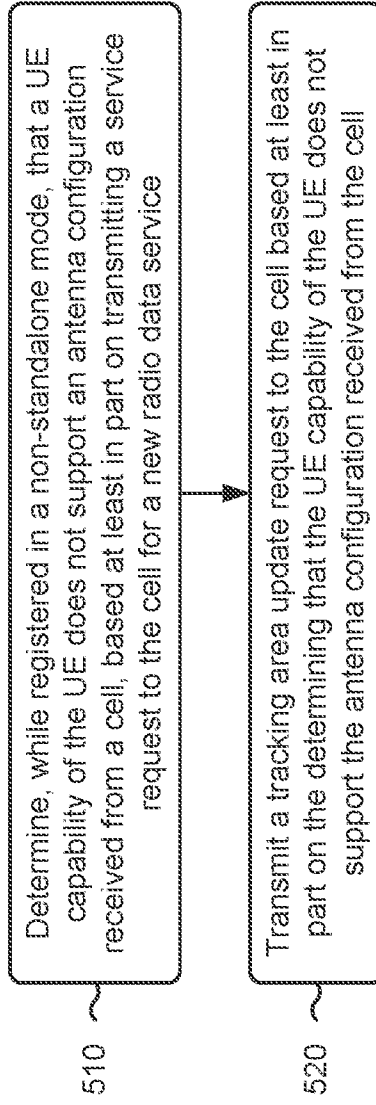


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/093282

A. CLASSIFICATION OF SUBJECT MATTER H04W 72/04(2009.01)i; H04B 7/0413(2017.01)i 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) H04W; H04B; H04L Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS;CNTXT;CNKI;VEN;EPTXT;USTXT;WOTXT;3GPP: RLF, radio link failure, capability, UE, equipment, device, support, match, configuration, NSA, non-standalone, NR, new radio, attach, TAU, tracking area update, request,MIMO		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 106954280 A (ZTE CORP) 14 July 2017 (2017-07-14) claims 1-16	1-20
A	CN 111052838 A (QUALCOMM INC) 21 April 2020 (2020-04-21) the whole document	1-20
A	CN 109039398 A (SAMSUNG ELECTRONICS CO LTD) 18 December 2018 (2018-12-18) the whole document	1-20
A	WO 2016140599 A1 (ERICSSON TELEFON AB L M PUBL) 09 September 2016 (2016-09-09) the whole document the whole document	1-20
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“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)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> <p>“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</p> <p>“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</p> <p>“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</p> <p>“&” document member of the same patent family</p>		
Date of the actual completion of the international search 03 February 2021		Date of mailing of the international search report 18 February 2021
Name and mailing address of the ISA/CN National Intellectual Property Administration, PRC 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451		Authorized officer XIE, Lin Telephone No. 86-(010)-62089150

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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				EP	3266272	B1	26 August 2020