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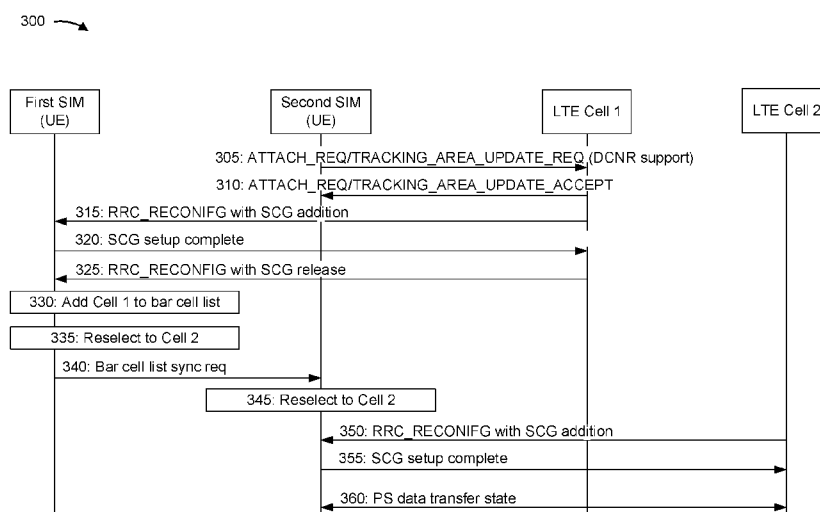


FIG. 3

(57) Abstract: Various aspects of the present disclosure generally relate to wireless communication. In some aspects, a user equipment (UE) may determine, for a first subscriber identity module (SIM), that a count of secondary cell group (SCG) releases from a first cell satisfies a count threshold, based at least in part on transmitting service requests to add an SCG. The UE may add, for the first SIM, the first cell to a list of cells to which service requests to add the SCG are barred. The UE may determine, for a second SIM of the UE, that a second cell is not on the list, and transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list. Numerous other aspects are provided.

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RESOLUTION OF SECONDARY CELL GROUP RELEASES FOR DUAL SUBSCRIBER IDENTITY MODULES

FIELD OF THE DISCLOSURE

[0001] Aspects of the present disclosure generally relate to wireless communication and to techniques and apparatuses for resolving secondary cell group releases with dual subscriber identity modules.

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, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a count of secondary cell group (SCG) releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell, and adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold. The method may include determining, for a second SIM of the UE, that a second cell is not on the list, and transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

[0006] In some aspects, a non-transitory computer-readable medium may store one or more instructions for wireless communication that, when executed by one or more processors of a UE, may cause the UE to determine, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell, and add, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining

that the count of SCG releases satisfies the count threshold. The instructions, when executed by one or more processors of a UE, may cause the UE determine, for a second SIM of the UE, that a second cell is not on the list, and transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

[0007] In some aspects, a UE for wireless communication may include memory, one or more processors operatively coupled to the memory, and instructions stored in the memory. The instructions in the memory may be operable, when executed by the one or more processors, to cause the UE to determine, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell, and add, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold. The instructions in the memory may be operable, when executed by the one or more processors, to cause the UE to determine, for a second SIM of the UE, that a second cell is not on the list, and transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

[0008] In some aspects, an apparatus for wireless communication may include means for determining, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell, means for adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold, means for determining, for a second SIM of the apparatus, that a second cell is not on the list, and means for transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

[0009] 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.

[0010] 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

[0011] 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.

[0012] Fig. 1 is a block diagram conceptually illustrating an example of a wireless communication network, in accordance with various aspects of the present disclosure.

[0013] 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.

[0014] Fig. 3 is a diagram illustrating an example of resolving secondary cell group (SCG) releases with dual subscriber identity modules (SIMs), in accordance with various aspects of the present disclosure.

[0015] Fig. 4 is a diagram illustrating an example of resolving SCG releases with dual SIMs, in accordance with various aspects of the present disclosure.

[0016] 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

[0017] A user equipment (UE) may be attached to a cell and registered in a non-standalone (NSA) mode. The UE may attempt to access a New Radio (NR) data service, which involves adding a secondary cell group (SCG). The UE may transmit a service request to the cell and an SCG may be added. However, the SCG may be released soon after the SCG is added. The UE may continue adding and dropping the SCG, while preventing any other data service. One solution to address this is to add the cell to a list of cells (e.g., NSA bar cell list) to which the UE is barred from transmitting service requests. The UE may refrain from transmitting service requests to any cells on the list.

[0018] In some aspects, the UE may be configured with a dual subscriber identity modem (SIM) modem. If a first SIM of the UE experiences SCG releases with a cell, a second SIM of the UE may also experience SCG releases with the cell. If the second SIM requests an SCG for the NR data service, but is unaware of the SCG releases that occur with the cell, the second SIM may cause the UE to waste time, power, processing resources, and signaling resources repeatedly adding and dropping the SCG, while not having any data service.

[0019] According to various aspects described herein, the first SIM may signal information about the list of cells to the second SIM. In this way, if the second SIM determines to add the NR data service and the cell is on the list, the second SIM may either reselect to another cell, or try to add the SCG with the cell only once before reselecting to the other cell. As a result, the second SIM accesses the NR data service, or at least maintains some type of data service, and conserves time, power, processing resources, and signaling resources that would have otherwise been used repeatedly adding and dropping the SCG.

[0020] Various aspects of the disclosure are described more fully 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 fully 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.

[0021] 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.

[0022] 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.

[0023] 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 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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).

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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. In some aspects, UE 120 may perform operations to resolve SCG releases by a cell.

[0033] As indicated above, Fig. 1 is provided as an example. Other examples may differ from what is described with regard to Fig. 1.

[0034] 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 $R \geq 1$.

[0035] 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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 secondary cell group (SCG) releases with dual subscriber identity modules (SIMs), 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 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 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.

[0041] In some aspects, UE 120 may include means for determining, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell, means for adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold, means for determining, for a second SIM of the UE, that a second cell is not on the list, means for transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list, 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] A UE may be registered in NSA mode and attached to an LTE cell. The UE may attempt to access an NR data service, which involves adding an SCG. Accordingly, the UE may transmit a service request to the LTE cell and receive a radio resource control (RRC) reconfiguration message, indicating that an SCG is added. However, the UE may soon receive an RRC reconfiguration message indicating that the SCG was released. The UE may not only drop the SCG but may lose data service altogether. The UE may continue adding and dropping the SCG and preventing any other data service, providing a bad user experience. One solution to address this is to add the cell to a list of cells (e.g., NSA bar cell list) to which the UE is barred from transmitting service requests, if a count of SCG releases satisfies a count threshold (e.g., maximum count). The UE may refrain from transmitting service requests to any cells on the list.

[0044] In some aspects, the UE may be configured with a dual SIM modem. If a first SIM of the UE experiences SCG releases with a cell, a second SIM of the UE may also experience SCG releases with the cell. If the second SIM requests an SCG for the NR data service, but is unaware of SCG releases caused by the cell, the UE may waste

time, power, processing resources, and signaling resources repeatedly adding and dropping the SCG while not having any data service.

[0045] According to various aspects described herein, the first SIM may signal information about the list to the second SIM. The first SIM and the second SIM may synchronize lists. In this way, if the second SIM determines to add the NR data service, the second SIM may directly proceed with reselecting to another cell that is not on the list. As a result, the second SIM accesses the NR data service or at least maintains some type of data service. In some aspects, the second SIM may try once to add the SCG before reselecting to another cell.

[0046] Fig. 3 is a diagram illustrating an example 300 of restoring data service with dual SIMs, in accordance with various aspects of the present disclosure. Fig. 3 shows a signaling diagram for a first SIM and a second SIM of a UE (e.g., a UE depicted in Figs. 1 and 2, and/or the like). While actions may be described as being performed by the first SIM or the second SIM, this may mean that the UE is performing the action for the first SIM or for the second SIM. Either SIM may support dual SIM dual active or dual SIM dual standby, and either SIM may be associated with a default data subscriber (DDS) subscriber registration (e.g., NSA) or a non-DDS subscriber registration (e.g., LTE). For example, the first SIM may register with an NSA network. The NSA network may involve the infrastructure of an LTE network that provides access to the Internet. The second SIM may also register with the NSA network or an LTE network.

[0047] The first SIM may attach to a cell that may be an NSA cell, an LTE cell, an NR cell, and/or the like. In Fig. 3, the cell is shown as an LTE Cell 1. For example, as shown by reference number 305, the first SIM (or the UE for the first SIM) may transmit an attach request to LTE Cell 1 (indicating support for dual connectivity with New Radio, or DCNR). As shown by reference number 310, the first SIM (or the UE for the first SIM) may accept the attach request. In some aspects, the first SIM may transmit a tracking area update (TAU) request for a TAU procedure. The TAU procedure is a procedure applicable to LTE networks, and normally updates a location of the UE within an LTE network. If LTE cells are maintained by the same operator, the UE does not need a new registration and a TAU procedure is sufficient to attach the UE to an LTE cell.

[0048] In some aspects, the first SIM (or the UE for the first SIM) may transmit a service request to LTE Cell 1 to add an SCG for the NR data service. As shown by reference number 315, the first SIM may receive an RRC reconfiguration message

indicating that the SCG is added. The UE may transmit an SCG complete message for the first SIM, as shown by reference number 320. However, as shown by reference number 325, the first SIM may receive an RRC reconfiguration message indicating that the SCG is released. There may be some network configuration issue or problematic conditions. The first SIM (or the UE for the first SIM) may count SCG releases. In some aspects, the first SIM may count SCG releases during a specified amount of time. As shown by reference 330, if a count of SCG releases satisfies a count threshold, the first SIM may add the cell to a bar cell list, which is a list of cells to which service requests for the NR data service are barred. In some aspects, the first SIM may reselect to another cell (e.g., LTE Cell 2) that is not on the list, as shown by reference number 335. This may include transmitting a registration request, which may include an attach request or a TAU request.

[0049] However, while the first SIM (or the UE for the first SIM) reselects to LTE Cell 2, the second SIM may be unaware that LTE Cell 1 is causing SCG releases. As shown by reference number 340, the first SIM may signal to the second SIM that LTE Cell 1 has been added to a bar cell list for the first SIM. The second SIM may use the information to synchronize a bar cell list for the second SIM with the bar cell list for the first SIM. If the second SIM is to access the NR data service, the second SIM (or the UE for the second SIM) may determine that LTE Cell 1 is on the bar cell list and may proceed directly with reselecting to another cell (e.g., LTE Cell 2), as shown by reference number 345. This may include transmitting a registration request.

[0050] The second SIM (or the UE for the second SIM) may transmit a service request for the NR data service to LTE Cell 2. As shown by reference number 350, the second SIM may receive an RRC reconfiguration message from LTE Cell 2 indicating that an SCG was added. As shown by reference number 355, the second SIM may transmit an SCG complete message. The SCG may not be dropped and the UE may be in a packet switched data transfer state, as shown by reference number 360. The second SIM may help the UE to save the time, power, processing resources, and signaling resources by not repeatedly adding and dropping the SCG.

[0051] In some aspects, the UE may remove a cell from the bar cell list upon expiration of a timer for being on the bar cell list. The timer may be set to a specified time duration. In some aspects, the UE may remove a cell from the bar cell list based at least in part on an instruction from a base station to remove the cell. In some aspects,

all cells may be removed from the bar cell list if the UE is powered off, rebooted, or if a SIM card is removed from the UE.

[0052] As indicated above, Fig. 3 is provided as an example. Other examples may differ from what is described with regard to Fig. 3.

[0053] Fig. 4 is a diagram illustrating an example 400 of resolving SCG releases with dual SIMs, in accordance with various aspects of the present disclosure. Fig. 4 shows some signals from the signaling diagram of Fig. 3.

[0054] In some aspects, as shown by reference number 405, the second SIM may update a bar cell list for the second SIM based at least in part on bar cell list information signaled from the first SIM. However, instead of proceeding directly with reselecting to another cell, the second SIM (or the UE for the second SIM) may try once to add and maintain the SCG with LTE Cell 1. The second SIM (or the UE for the second SIM) may transmit a service request for the NR data service to LTE Cell 1. As shown by reference number 410, the second SIM may receive an SCG addition message. As shown by reference number 415, the second SIM may transmit an SCG complete message. However, if the second SIM receives an SCG release message, as shown by reference number 420, the second SIM may proceed with reselecting to another cell such as LTE Cell 2. In this way, the second SIM is not repeatedly adding and dropping the SCG. In some aspects, the second SIM may try one or more other times (e.g., preconfigured number of times), but still fewer times than a count threshold for adding a cell to a bar cell list.

[0055] As indicated above, Fig. 4 is provided as an example. Other examples may differ from what is described with respect to Fig. 4.

[0056] 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 SCG releases with dual SIMs.

[0057] As shown in Fig. 5, in some aspects, process 500 may include determining, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell (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, for a first SIM registered in an NSA mode, that a count of SCG releases from a first cell satisfies a count threshold, based at least in part on

transmitting one or more service requests to add an SCG with the first cell, as described above.

[0058] As further shown in Fig. 5, in some aspects, process 500 may include adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold (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 add, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold, as described above.

[0059] As further shown in Fig. 5, in some aspects, process 500 may include determining, for a second SIM of the UE, that a second cell is not on the list (block 530). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may determine, for a second SIM of the UE, that a second cell is not on the list, as described above.

[0060] As further shown in Fig. 5, in some aspects, process 500 may include transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list (block 540). For example, the UE (e.g., using receive processor 258, transmit processor 264, controller/processor 280, memory 282, and/or the like) may transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list, as described above.

[0061] 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.

[0062] In a first aspect, process 500 includes causing the first SIM to signal information for the list to the second SIM.

[0063] In a second aspect, alone or in combination with the first aspect, process 500 includes causing the second SIM to update a list of one or more cells maintained for the second SIM based at least in part on the information.

[0064] In a third aspect, alone or in combination with one or more of the first and second aspects, process 500 includes, prior to determining that the second cell is not on

the list, transmitting, for the second SIM, a service request to add the SCG with the first cell based at least in part on receiving the signal information for the list

[0065] In a fourth aspect, alone or in combination with one or more of the first through third aspects, process 500 includes causing the first SIM and the second SIM to share the list with each other.

[0066] In a fifth aspect, alone or in combination with one or more of the first through fourth aspects, determining that the count of SCG releases from the first cell satisfies the count threshold includes determining that the count of SCG releases from the first cell satisfies the count threshold within a specified amount of time.

[0067] In a sixth aspect, alone or in combination with one or more of the first through fifth aspects, process 500 includes removing the first cell from the list based at least in part on receiving an instruction to remove the first cell from the list.

[0068] In a seventh aspect, alone or in combination with one or more of the first through sixth aspects, process 500 includes removing the first cell from the list based at least in part on expiration of a specified time duration for the first cell being on the list.

[0069] In an eighth aspect, alone or in combination with one or more of the first through seventh aspects, process 500 includes starting, based at least in part on the adding the first cell to the list, a timer that indicates a specified amount of time that the first cell is to remain on the list.

[0070] In a ninth aspect, alone or in combination with one or more of the first through eighth aspects, process 500 includes removing all cells from the list based at least in part on one of the UE powering off, rebooting, or removal of one or more of the first SIM or the second SIM from the UE.

[0071] In a tenth aspect, alone or in combination with one or more of the first through ninth aspects, process 500 includes transmitting, for the first SIM, a service request to the second cell based at least in part on adding the first cell to the list.

[0072] 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.

[0073] 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.

[0074] 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.

[0075] 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.

[0076] 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.

[0077] 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-b-c, b-b, b-b-b, b-b-c, c-c, and c-c-c or any other ordering of a, b, and c).

[0078] 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, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a count of secondary cell group (SCG) releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell;

adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold;

determining, for a second SIM of the UE, that a second cell is not on the list; and
transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

2. The method of claim 1, further comprising causing the first SIM to signal information for the list to the second SIM.

3. The method of claim 2, further comprising causing the second SIM to update a list of one or more cells maintained for the second SIM based at least in part on the information.

4. The method of claim 2, further comprising, prior to determining that the second cell is not on the list, transmitting, for the second SIM, a service request to add the SCG with the first cell based at least in part on receiving the signal information for the list.

5. The method of claim 1, further comprising causing the first SIM and the second SIM to share the list with each other.

6. The method of claim 1, wherein determining that the count of SCG releases from the first cell satisfies the count threshold includes determining that the count of SCG releases from the first cell satisfies the count threshold within a specified amount of time.

7. The method of claim 1, further comprising removing the first cell from the list based at least in part on receiving an instruction to remove the first cell from the list.
8. The method of claim 1, further comprising removing the first cell from the list based at least in part on expiration of a specified time duration for the first cell being on the list.
9. The method of claim 1, further comprising starting, based at least in part on the adding the first cell to the list, a timer that indicates a specified amount of time that the first cell is to remain on the list.
10. The method of claim 1, further comprising removing all cells from the list based at least in part on one of the UE powering off, rebooting, or removal of one or more of the first SIM or the second SIM from the UE.
11. The method of claim 1, further comprising transmitting, for the first SIM, a service request to the second cell based at least in part on adding the first cell to the list.
12. A user equipment (UE) for wireless communication, comprising:
 - a memory;
 - one or more processors coupled to the memory; and
 - instructions stored in the memory and operable, when executed by the one or more processors, to cause the UE to:
 - determine, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a count of secondary cell group (SCG) releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell;
 - add, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold;
 - determine, for a second SIM of the UE, that a second cell is not on the list; and

transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

13. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to cause the first SIM to signal information for the list to the second SIM.

14. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to cause the second SIM to update a list of one or more cells maintained for the second SIM based at least in part on the information.

15. The UE of claim 14, wherein the instructions, when executed by the one or more processors, cause the UE to, prior to determining that the second cell is not on the list, transmit, for the second SIM, a service request to add the SCG with the first cell based at least in part on receiving the signal information for the list.

16. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to cause the first SIM and the second SIM to share the list with each other.

17. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to determine that the count of SCG releases from the first cell satisfies the count threshold by determining that the count of SCG releases from the first cell satisfies the count threshold within a specified amount of time.

18. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to remove the first cell from the list based at least in part on receiving an instruction to remove the first cell from the list.

19. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to remove the first cell from the list based at least in part on expiration of a specified time duration for the first cell being on the list.

20. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to start, based at least in part on the adding the first cell to the list, a timer that indicates a specified amount of time that the first cell is to remain on the list.

21. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to remove all cells from the list based at least in part on one of the UE powering off, rebooting, or removal of one or more of the first SIM or the second SIM from the UE.

22. The UE of claim 12, wherein the instructions, when executed by the one or more processors, cause the UE to transmit, for the first SIM, a service request to the second cell based at least in part on adding the first cell to the list.

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

determine, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a count of secondary cell group (SCG) releases from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell;

add, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold;

determine, for a second SIM of the UE, that a second cell is not on the list; and

transmit, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

24. An apparatus for wireless communication, comprising:

means for determining, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a count of secondary cell group (SCG) releases

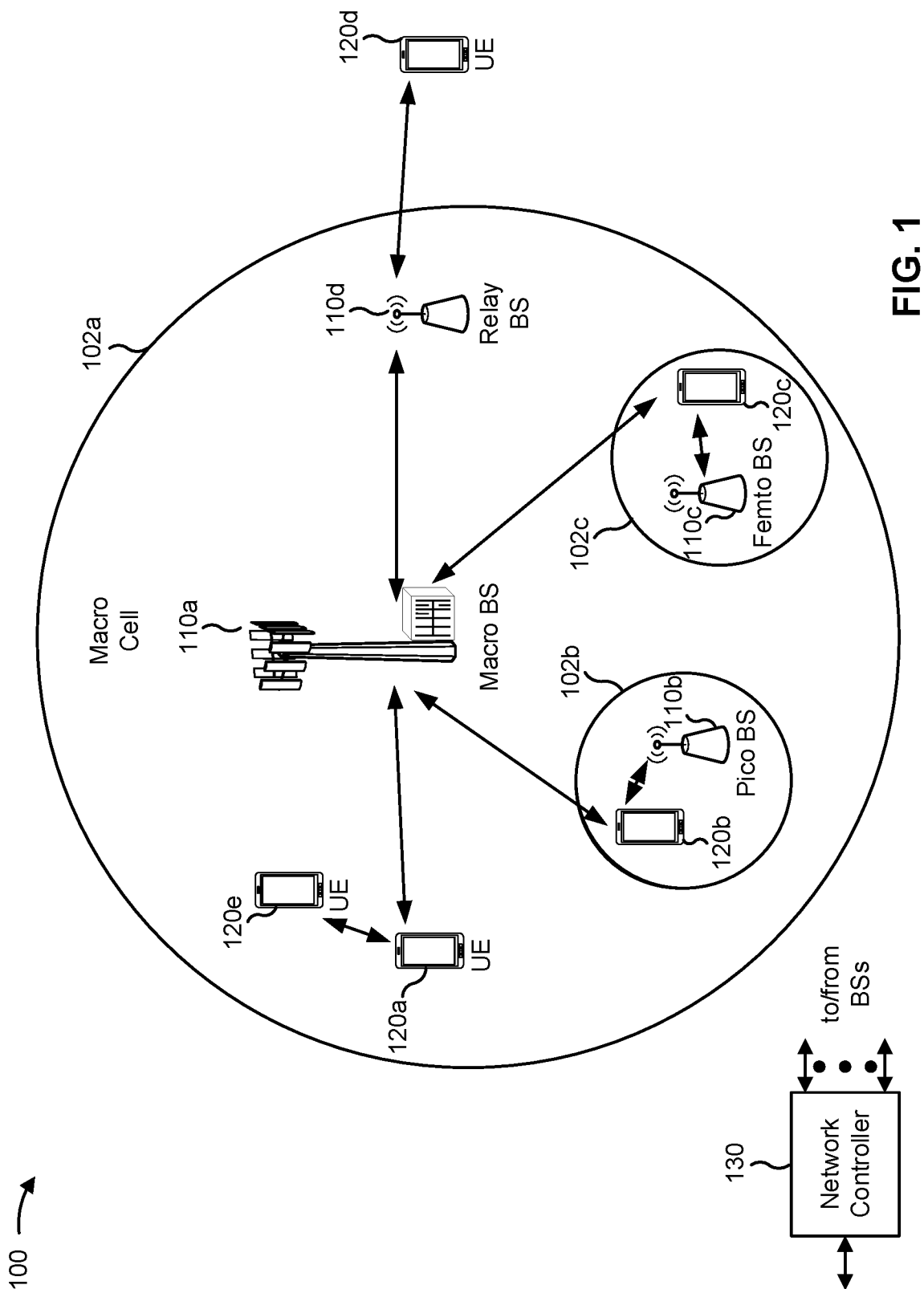
from a first cell satisfies a count threshold, based at least in part on transmitting one or more service requests to add an SCG with the first cell;

means for adding, for the first SIM, the first cell to a list of one or more cells to which service requests to add the SCG are barred, based at least in part on determining that the count of SCG releases satisfies the count threshold;

means for determining, for a second SIM of the apparatus, that a second cell is not on the list; and

means for transmitting, for the second SIM, a service request to the second cell to add the SCG based at least in part on the determining that the second cell is not on the list.

1/5



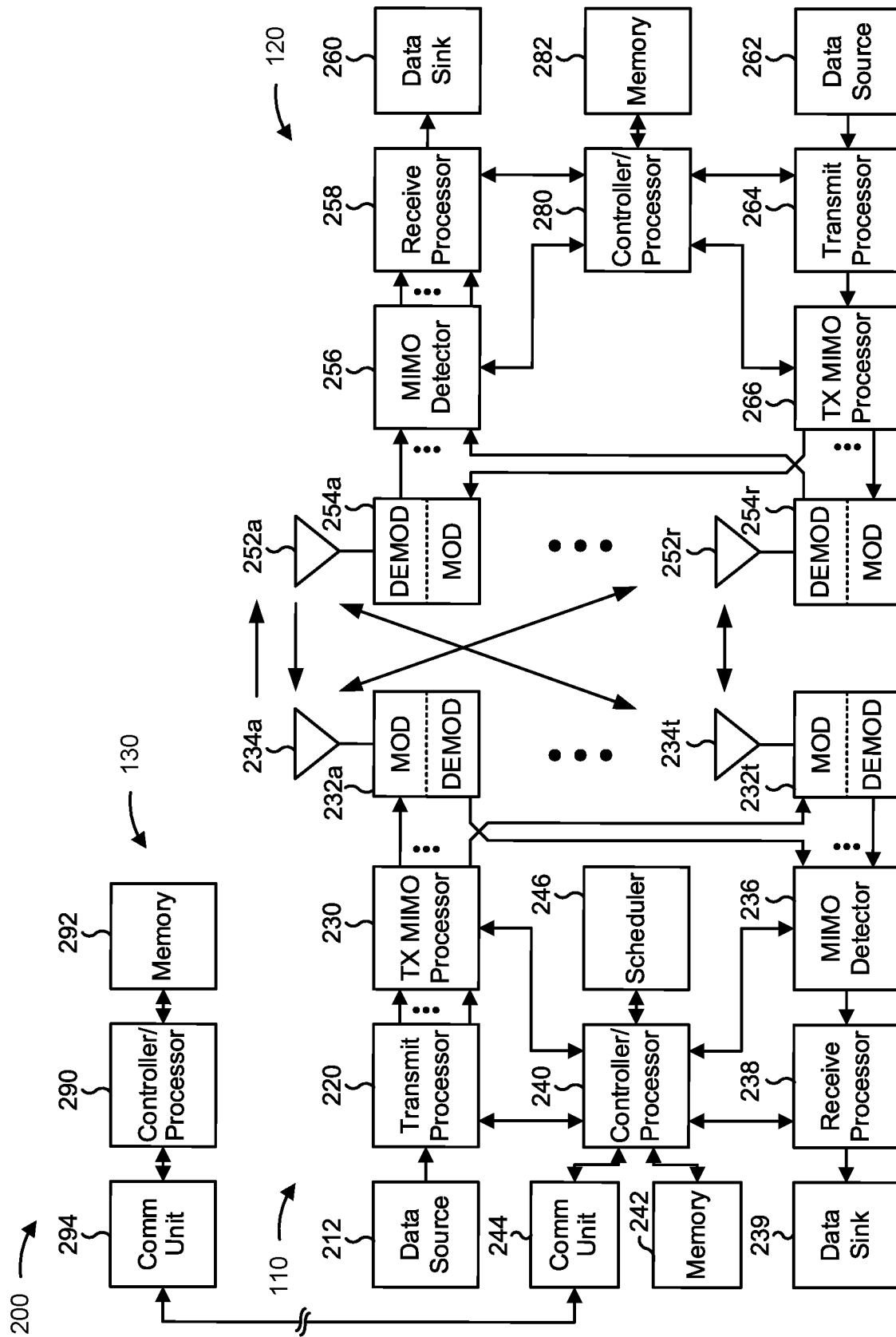


FIG. 2

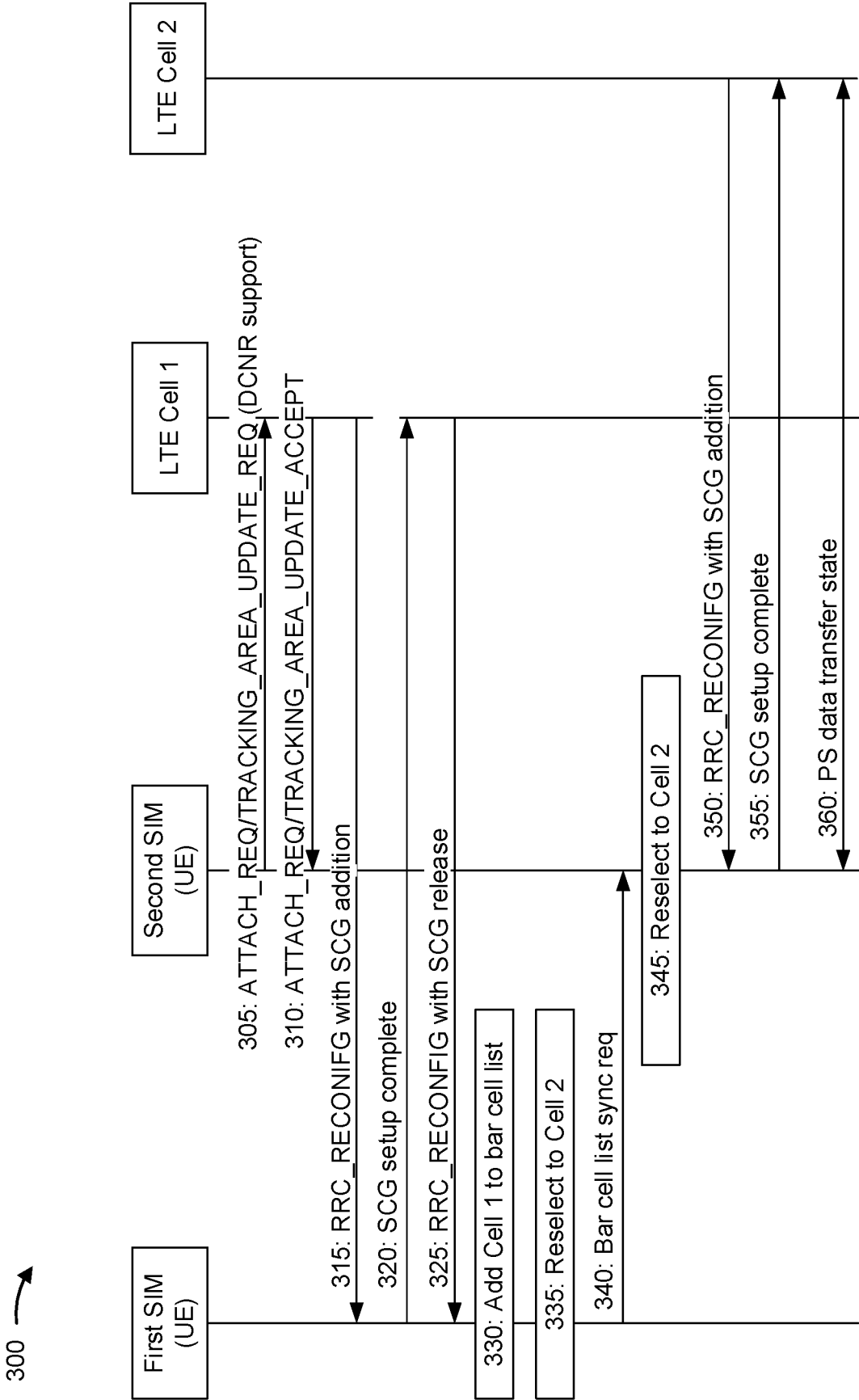


FIG. 3

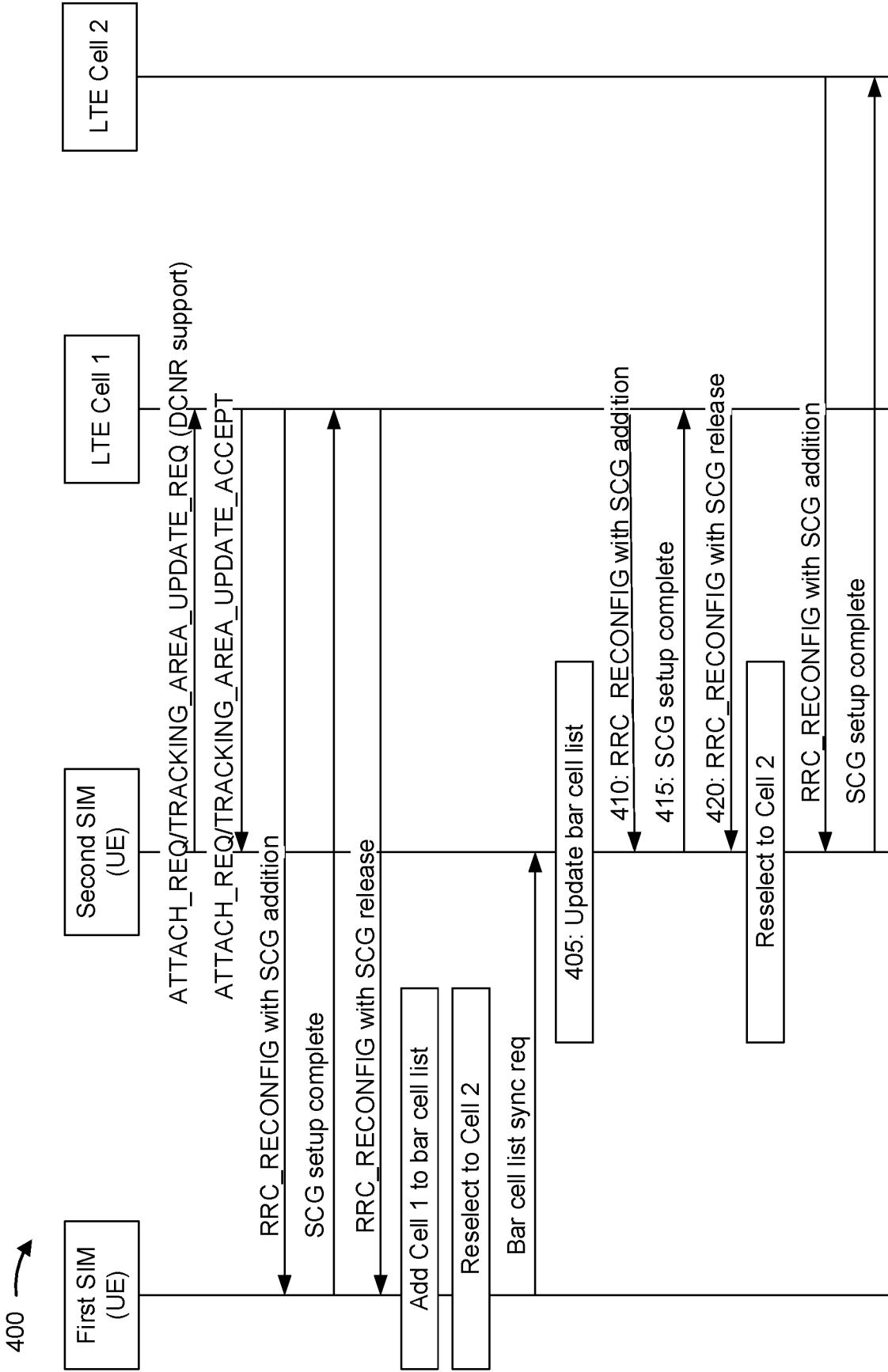


FIG. 4

500 →

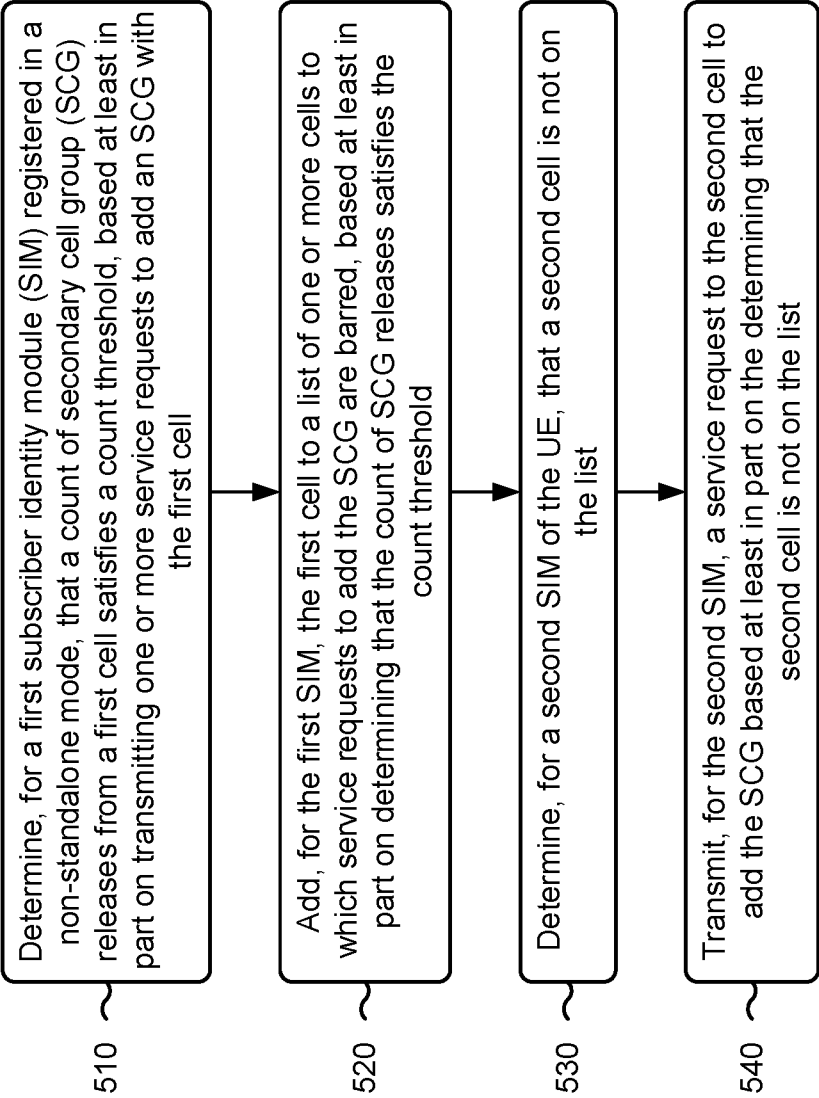


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/093089

A. CLASSIFICATION OF SUBJECT MATTER

H04W 36/00(2009.01)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; H04Q

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)

CNPAT;CNKI;WPI;EPODOC;IEEE;3GPP:non-standalone, NSA, dual connectivity, DC, SIM, SCG, secondary cell group, add+, releas+, count+, threshold, request, reselect+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 110366198 A (VIVO MOBILE COMMUNICATION CO., LTD.) 22 October 2019 (2019-10-22) paragraphs 25-396 in description	1-24
A	CN 110198550 A (VIVO MOBILE COMMUNICATION CO., LTD.) 03 September 2019 (2019-09-03) the whole document	1-24
A	CN 110249709 A (QUALCOMM INCORPORATED) 17 September 2019 (2019-09-17) the whole document	1-24
A	US 2020037213 A1 (MEDIATEK INC.) 30 January 2020 (2020-01-30) the whole document	1-24
A	ERICSSON. "Feature summary for running CRs" 3GPP TSG-RAN WG2 Meeting #109-e R2-2002042, 06 March 2020 (2020-03-06), the whole document	1-24



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

05 February 2021

Date of mailing of the international search report

01 March 2021

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/093089

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	110366198	A	22 October 2019	WO	2019184622	A1	03 October 2019
CN	110198550	A	03 September 2019	WO	2019161742	A1	29 August 2019
				US	2020396661	A1	17 December 2020
CN	110249709	A	17 September 2019	WO	2018141148	A1	09 August 2018
				CA	3047858	A1	09 August 2018
				EP	3578005	A1	11 December 2019
				WO	2018141081	A1	09 August 2018
				JP	2020505871	A	20 February 2020
				KR	20190112726	A	07 October 2019
				BR	112019015442	A2	24 March 2020
				TW	201834502	A	16 September 2018
				IN	201947023648	A	21 June 2019
				ID	201905515	A	02 August 2019
US	2020037213	A1	30 January 2020	TW	202008843	A	16 February 2020
				CN	110784896	A	11 February 2020