



## (51) International Patent Classification:

H04W 60/00 (2009.01)

H04W 88/06 (2009.01)

H04W 76/18 (2018.01)

Diego, California 92121-1714 (US). **HONG, Jie** [CN/CN];  
5775 Morehouse Drive, San Diego, California 92121-1714  
(US).

## (21) International Application Number:

PCT/CN2020/093286

(74) **Agent: SHANGHAI PATENT & TRADEMARK LAW  
OFFICE, LLC**; 435 Guiping Road, Shanghai 200233  
(CN).

## (22) International Filing Date:

29 May 2020 (29.05.2020)

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

## (25) Filing Language:

English

## (26) Publication Language:

English

(71) **Applicant: QUALCOMM INCORPORATED** [US/US];  
5775 Morehouse Drive, San Diego, California 92121-1714  
(US).

## (72) Inventors; and

(71) **Applicants (for US only): LIN, Tianya** [CN/CN]; 5775  
Morehouse Drive, San Diego, California 92121-1714 (US).  
**ZHANG, Hao** [CN/CN]; 5775 Morehouse Drive, San

(54) **Title:** RESOLUTION OF NEW RADIO REGISTRATION FAILURE FOR DUAL SUBSCRIBER IDENTITY MODULES

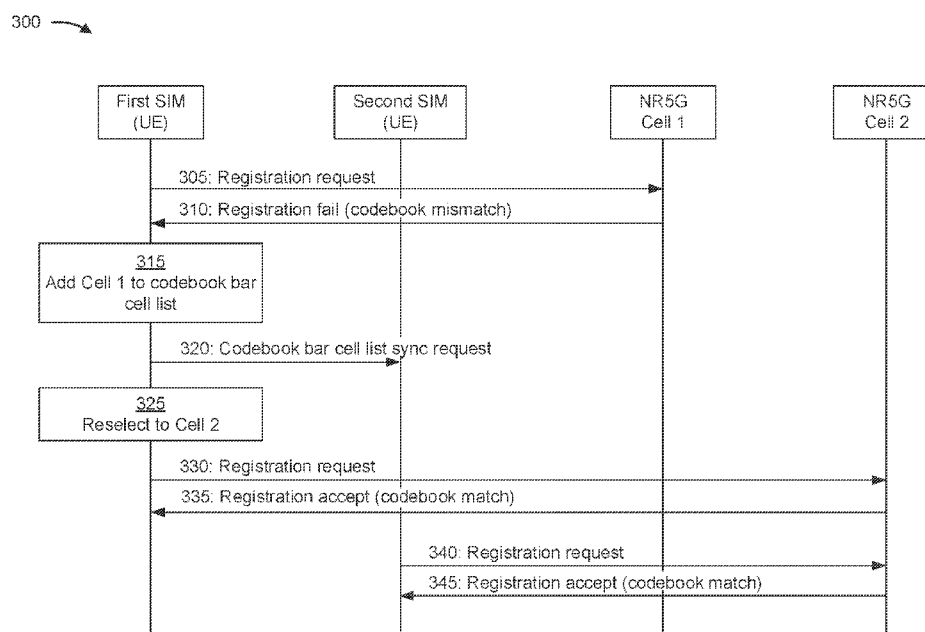


FIG. 3

(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) registered in a non-standalone mode, that a codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell. The UE may add, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred. The UE may determine, for a second SIM of the UE, that the first cell is on the list, and transmit, for the second SIM, a registration request to a second cell that is not on the list. Numerous other aspects are provided.



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

**Declarations under Rule 4.17:**

— *of inventorship (Rule 4.17(iv))*

**Published:**

— *with international search report (Art. 21(3))*

## RESOLUTION OF NEW RADIO REGISTRATION FAILURE 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 New Radio registration failure for 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 codebook configuration for first cell is incorrect for the UE, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell, and adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE. The method may include determining, for a second SIM of the UE, that the first cell is on the list, and transmitting, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is on the list.

[0006] 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 UE to determine, for a first SIM registered in an NSA mode, that a codebook configuration for first cell is incorrect for the UE, based at least in part on transmitting a registration request for a NR data service to the first cell, and add, for the

first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE. The memory may include instructions executable by the one or more processors to cause the UE to determine, for a second SIM of the UE, that the first cell is on the list, and transmit, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is on the list.

[0007] In some aspects, an apparatus for wireless communication may include means for determining, for a first SIM registered in an NSA mode, that a codebook configuration for first cell is incorrect for the UE, based at least in part on transmitting a registration request for a NR data service to the first cell, means for adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the apparatus; means for determining, for a second SIM of the apparatus, that the first cell is on the list, and means for transmitting, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is on the list.

[0008] 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.

[0009] 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

[0010] 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.

[0011] Fig. 1 is a block diagram conceptually illustrating an example of a wireless communication network, in accordance with various aspects of the present disclosure.

[0012] 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.

[0013] Fig. 3 is a diagram illustrating an example of resolving New Radio registration failure for dual subscriber identity modules, in accordance with various aspects of the present disclosure.

[0014] Fig. 4 is a diagram illustrating an example process performed, for example, by a UE, in accordance with various aspects of the present disclosure.

### DETAILED DESCRIPTION

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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).

[0023] 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.

[0024] 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.

**[0025]** 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.

**[0026]** 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.

**[0027]** 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.

[0028] As indicated above, Fig. 1 is provided as an example. Other examples may differ from what is described with regard to Fig. 1.

[0029] 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  $R \geq 1$ .

[0030] 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.

**[0031]** 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.

**[0032]** 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.

**[0033]** 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. 3-4.

**[0034]** 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. 3-4.

**[0035]** 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 NR registration failure for 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 400 of Fig. 4, 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, 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.

**[0036]** In some aspects, UE 120 may include means for determining, for a first SIM registered in an NSA mode, that a codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for an NR data service to the first cell, means for adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is

incorrect for UE 120, means for determining, for a second SIM of UE 120, that the first cell is on the list, means for transmitting, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is 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.

[0037] As indicated above, Fig. 2 is provided as an example. Other examples may differ from what is described with regard to Fig. 2.

[0038] 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 codebook configuration mismatch. For example, a transmission configuration for a PUSCH may indicate to use a codebook, and a usage configuration for an SRS (or for an SRS resource set) may indicate to not use a codebook, or the PUSCH does not use a codebook and the SRS uses a codebook. A codebook is a set of predetermined weight matrix candidates for precoding, which increases a quality of signal reception by multiplying signals before transmission with weights. The codebook may be used to increase spectral efficiency (number of data bits that can be transmitted per unit time and unit frequency band) for uplink transmissions by the UE. Codebook-based precoding may accommodate up to 12 layers of multi-user multiple input multiple output uplink transmissions. Non-codebook based transmissions are designed to assume that beam reciprocity (transmitting beam is based on information derived from received beam) is supported by the UE. The UE may transmit another registration request and receive another registration failure message.

[0039] In some aspects, the UE may resolve registration failure due to codebook configuration mismatches by barring the cell from registration requests for the NR data service for a period of time. For example, the UE may add the cell to a codebook bar

cell list, or a list of cells to which the UE will not transmit registration requests for the NR data service. By using the codebook bar cell list, the UE may avoid repeated registration requests to a particular cell. If the UE determines that a cell is on the codebook bar cell list, the UE may reselect to an NR 5G cell that is not on the codebook bar cell list and transmit a registration request to that cell for the NR data service. However, the UE may have a dual SIM modem. If a first SIM of the UE experiences registration failure with the cell, a second SIM of the UE may also experience such difficulty with registration with the cell. For example, if the second SIM transmits a registration request for the NR data service, the second SIM may receive a rejection failure message, unaware that a codebook configuration at the cell is incorrect for the UE. The second SIM may fail to obtain the NR data service and may cause the UE to waste time, power, processing resources, and signaling resources transmitting registration requests that are unsuccessful.

**[0040]** According to various aspects described herein, the first SIM may share information about the list with the second SIM. In this way, the second SIM (or the UE for the second SIM) may determine whether a cell has an incorrect codebook configuration for the UE. If the cell has an incorrect codebook configuration for the UE, the second SIM (or the UE for the second SIM) may transmit a registration request for NR data service to another cell. The UE may resolve the registration failure for the first SIM and the second SIM, and the first SIM and the second SIM may access the NR data service. As a result, the UE may save time, power, processing resources, and signaling resources. In some aspects, cells on the codebook bar cell list may be removed from the list after a specified amount of time.

**[0041]** Fig. 3 is a diagram illustrating an example 300 of resolving NR registration failure for dual SIMs, 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) configured with a dual modem and registered in an NSA mode. The UE includes a first SIM and a 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. While actions may be described herein as being performed by the first SIM or the second SIM, this

includes the UE performing the action for the first SIM or for the second SIM. In some cases, an application protocol/application processor of the UE may direct switching between the first SIM and the second SIM or other operations.

**[0042]** The first SIM (or the UE for the first SIM) may determine to register with an NR 5G cell (e.g., Cell 1). The first SIM may have established an RRC connection with Cell 1. The UE may transmit, for the first SIM, a registration request for an NR data service to Cell 1, as shown by reference number 305. However, there may be an issue with Cell 1, and the UE may determine, for the first SIM, that a codebook configuration for the cell is incorrect for the UE, as shown by reference number 310. For example, the first SIM may receive a registration failure message, indicating a codebook mismatch. In some aspects, the first SIM may receive codebook configuration information from Cell 1 and determine that a codebook configuration for the cell is incorrect for the UE based at least in part on a result of comparing a codebook configuration received for a PUSCH and a codebook configuration received for an SRS. The first SIM may receive the codebook configuration (or information indicating the codebook configuration) for the PUSCH in the same RRC message or a different RRC message as the codebook configuration for the SRS.

**[0043]** In some aspects, a codebook configuration is incorrect if there is a mismatch between codebook usage (codebook or non-codebook) for the PUSCH and codebook usage (codebook or non-codebook) for the SRS (or SRS resource sets). If there is a codebook configuration mismatch (one of the PUSCH or the SRS is codebook, the other is non-codebook), the first SIM may add Cell 1 to the codebook bar cell list, as shown by reference number 315. The UE may determine, for the first SIM, to reselect to another cell (Cell 2) based at least in part on adding Cell 1 to the codebook bar cell list, as shown by reference number 325. As shown by reference number 330, the first SIM (or the UE for the first SIM) may transmit a registration request to Cell 2, and receive a registration accept message (codebook match), as shown by reference number 335. In some aspects, this may involve establishing an RRC connection to Cell 2.

**[0044]** As shown by reference number 320, the first SIM may signal information about the codebook bar cell list to the second SIM. In some aspects, the information may include a request to synchronize a codebook bar cell list of the second SIM with the codebook bar cell list of the first SIM.

**[0045]** As shown by reference number 340, the second SIM (or the UE for the second SIM) may transmit a registration request to Cell 2, based at least in part on

receiving the information from the first SIM. The second SIM may receive a registration accept message (codebook match), as shown by reference number 345. In some aspects, this may involve establishing an RRC connection to Cell 2.

**[0046]** In some aspects, the UE may remove a cell from the codebook bar cell list upon expiration of a timer for being on the codebook bar cell list. The timer may be set to a specified time duration. In some aspects, the UE may remove a cell from the codebook 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 codebook bar cell list if the UE is powered off, rebooted, or if a SIM card is removed from the UE.

**[0047]** As indicated above, Fig. 3 is provided as an example. Other examples may differ from what is described with respect to Fig. 3.

**[0048]** 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., a UE 120 depicted in Figs. 1 and 2, the UE depicted in Fig. 3, and/or the like) performs operations associated with resolving of NR registration failure for dual SIMs.

**[0049]** As shown in Fig. 4, in some aspects, process 400 may include determining, for a first SIM registered in an NSA mode, that a codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for an NR data service to the first cell (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, for a first SIM registered in an NSA mode, that a codebook configuration for the first cell is incorrect for the UE, based at least in part on transmitting a registration request for an NR data service to the first cell, as described above.

**[0050]** As further shown in Fig. 4, in some aspects, process 400 may include adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE (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 add, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE, as described above.

[0051] As further shown in Fig. 4, in some aspects, process 400 may include determining, for a second SIM of the UE, that the first cell is on the list (block 430). 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 the first cell is on the list, as described above.

[0052] As further shown in Fig. 4, in some aspects, process 400 may include transmitting, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is on the list (block 440). 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 registration request to a second cell that is not on the list based at least in part on the determining that the first cell is on the list, as described above.

[0053] 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.

[0054] In a first aspect, process 400 includes causing the first SIM to signal information for the list to the second SIM.

[0055] In a second aspect, alone or in combination with the first aspect, process 400 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.

[0056] In a third aspect, alone or in combination with one or more of the first and second aspects, the determining that the codebook configuration is incorrect includes receiving a registration failure message from the first cell indicating an incorrect codebook configuration for the UE.

[0057] In a fourth aspect, alone or in combination with one or more of the first through third aspects, the determining that the codebook configuration is incorrect includes receiving a registration failure message from the first cell indicating a codebook configuration mismatch.

[0058] In a fifth aspect, alone or in combination with one or more of the first through fourth aspects, the determining that the codebook configuration is incorrect includes determining that a codebook configuration received for a PUSCH does not match a codebook configuration received for a SRS.

[0059] In a sixth aspect, alone or in combination with one or more of the first through fifth aspects, the determining that the codebook configuration received for the

PUSCH does not match the codebook configuration received for the SRS includes determining that a transmission configuration for the PUSCH indicates to use a codebook and a usage configuration for the SRS indicates not to use a codebook.

[0060] In a seventh aspect, alone or in combination with one or more of the first through sixth aspects, the determining that the codebook configuration received for the PUSCH does not match the codebook configuration received for the SRS includes determining that a transmission configuration for the PUSCH indicates not to use a codebook and a usage configuration for the SRS indicates to use a codebook.

[0061] In an eighth aspect, alone or in combination with one or more of the first through seventh aspects, process 400 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.

[0062] In a ninth aspect, alone or in combination with one or more of the first through eighth aspects, process 400 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.

[0063] In a tenth aspect, alone or in combination with one or more of the first through ninth aspects, process 400 includes 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.

[0064] In an eleventh aspect, alone or in combination with one or more of the first through tenth aspects, process 400 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.

[0065] In a twelfth aspect, alone or in combination with one or more of the first through eleventh aspects, process 400 includes comprising transmitting, for the first SIM, a registration request to the second cell based at least in part on adding the first cell to the list.

[0066] 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.

[0067] 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.

**[0068]** 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.

**[0069]** 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.

**[0070]** 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.

**[0071]** 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).

[0072] 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 codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell;
  - adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE;
  - determining, for a second SIM of the UE, that the first cell is on the list; and
  - transmitting, for the second SIM, a registration request to a second cell that is not on the list based at least in part on the determining that the first cell is 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 1, wherein the determining that the codebook configuration is incorrect includes receiving a registration failure message from the first cell indicating an incorrect codebook configuration for the UE.
5. The method of claim 1, wherein the determining that the codebook configuration is incorrect includes receiving a registration failure message from the first cell indicating a codebook configuration mismatch.
6. The method of claim 1, wherein the determining that the codebook configuration is incorrect includes determining that a codebook configuration received for a physical uplink shared channel (PUSCH) does not match a codebook configuration received for a sounding reference signal (SRS).

7. The method of claim 6, wherein the determining that the codebook configuration received for the PUSCH does not match the codebook configuration received for the SRS includes determining that a transmission configuration for the PUSCH indicates to use a codebook and a usage configuration for the SRS indicates not to use a codebook.
8. The method of claim 6, wherein the determining that the codebook configuration received for the PUSCH does not match the codebook configuration received for the SRS includes determining that a transmission configuration for the PUSCH indicates not to use a codebook and a usage configuration for the SRS indicates to use a codebook.
9. 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.
10. 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.
11. 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.
12. 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.
13. The method of claim 1, further comprising transmitting, for the first SIM, a registration request to the second cell based at least in part on adding the first cell to the list.
14. 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, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell;

add, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE;

determine, for a second SIM of the UE, that the first cell is on the list;  
and

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

15. 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, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a codebook configuration for a first cell is incorrect for the UE, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell;

add, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the UE;

determine, for a second SIM of the UE, that the first cell is on the list;  
and

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

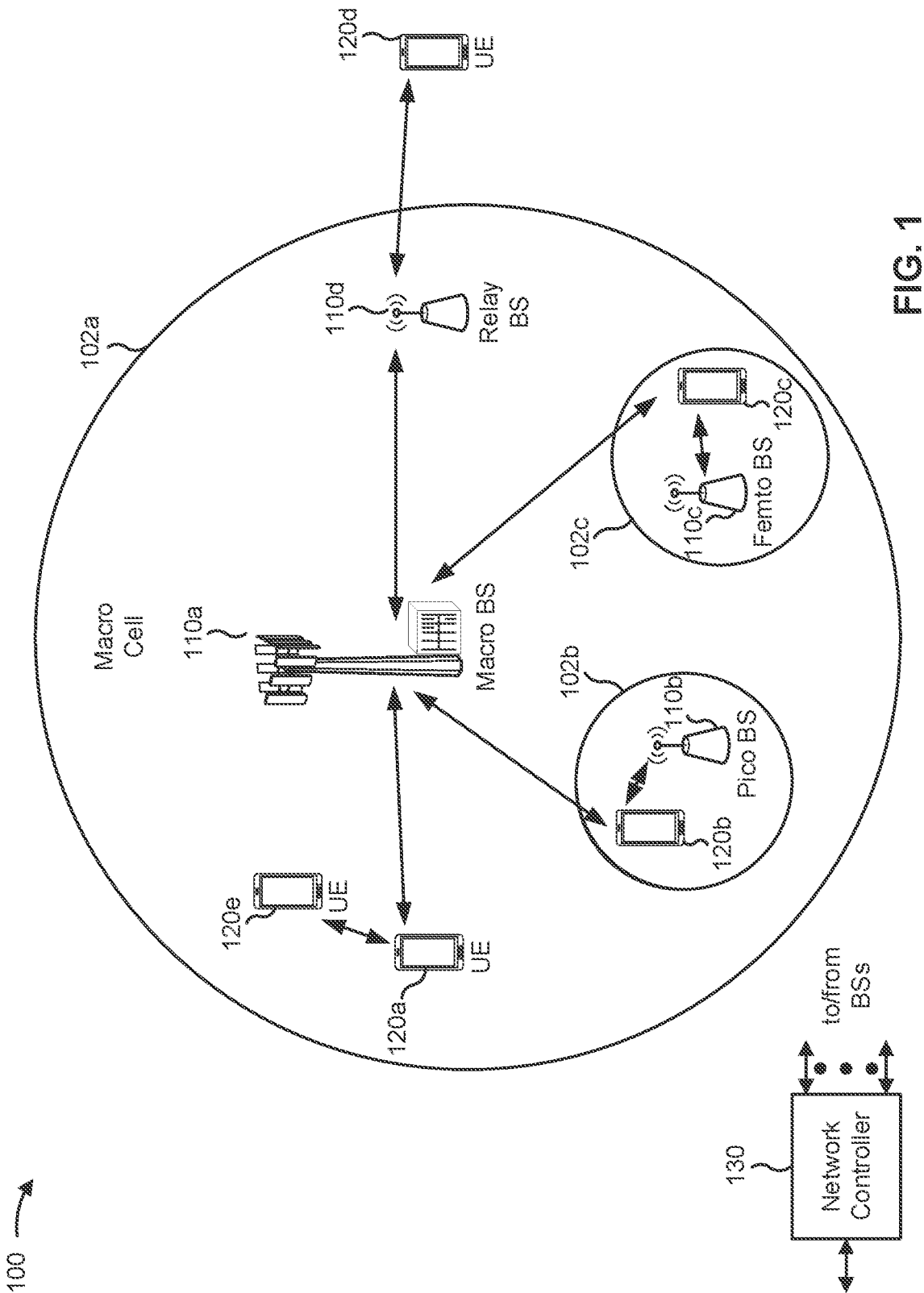
16. An apparatus for wireless communication, comprising:

means for determining, for a first subscriber identity module (SIM) registered in a non-standalone (NSA) mode, that a codebook configuration for a first cell is incorrect for the apparatus, based at least in part on transmitting a registration request for a New Radio (NR) data service to the first cell;

means for adding, for the first SIM, the first cell to a list of one or more cells to which registration requests for the NR data service are barred, based at least in part on the determining that the codebook configuration for the first cell is incorrect for the apparatus;

means for determining, for a second SIM of the apparatus, that the first cell is on the list; and

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



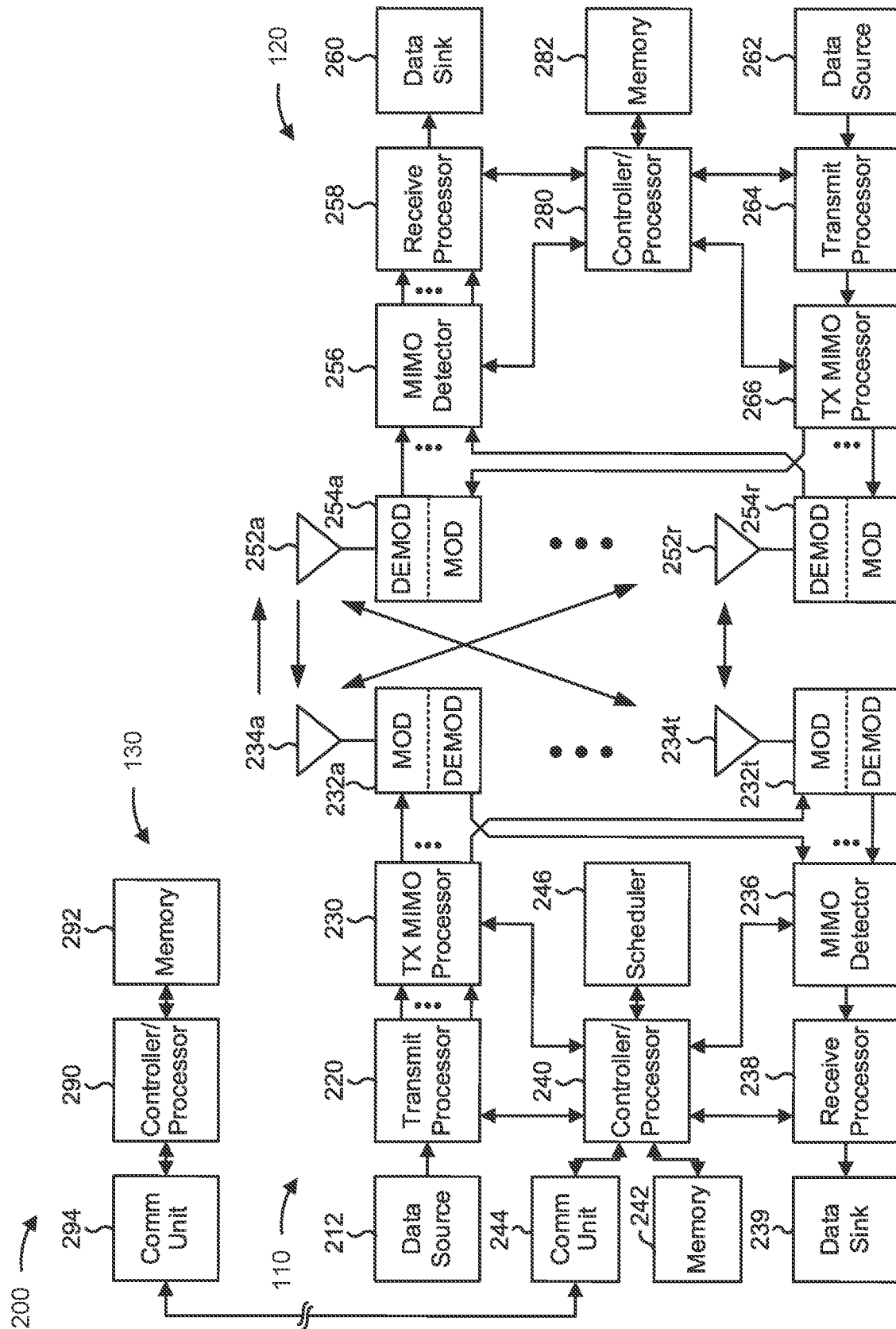


FIG. 2

300 →

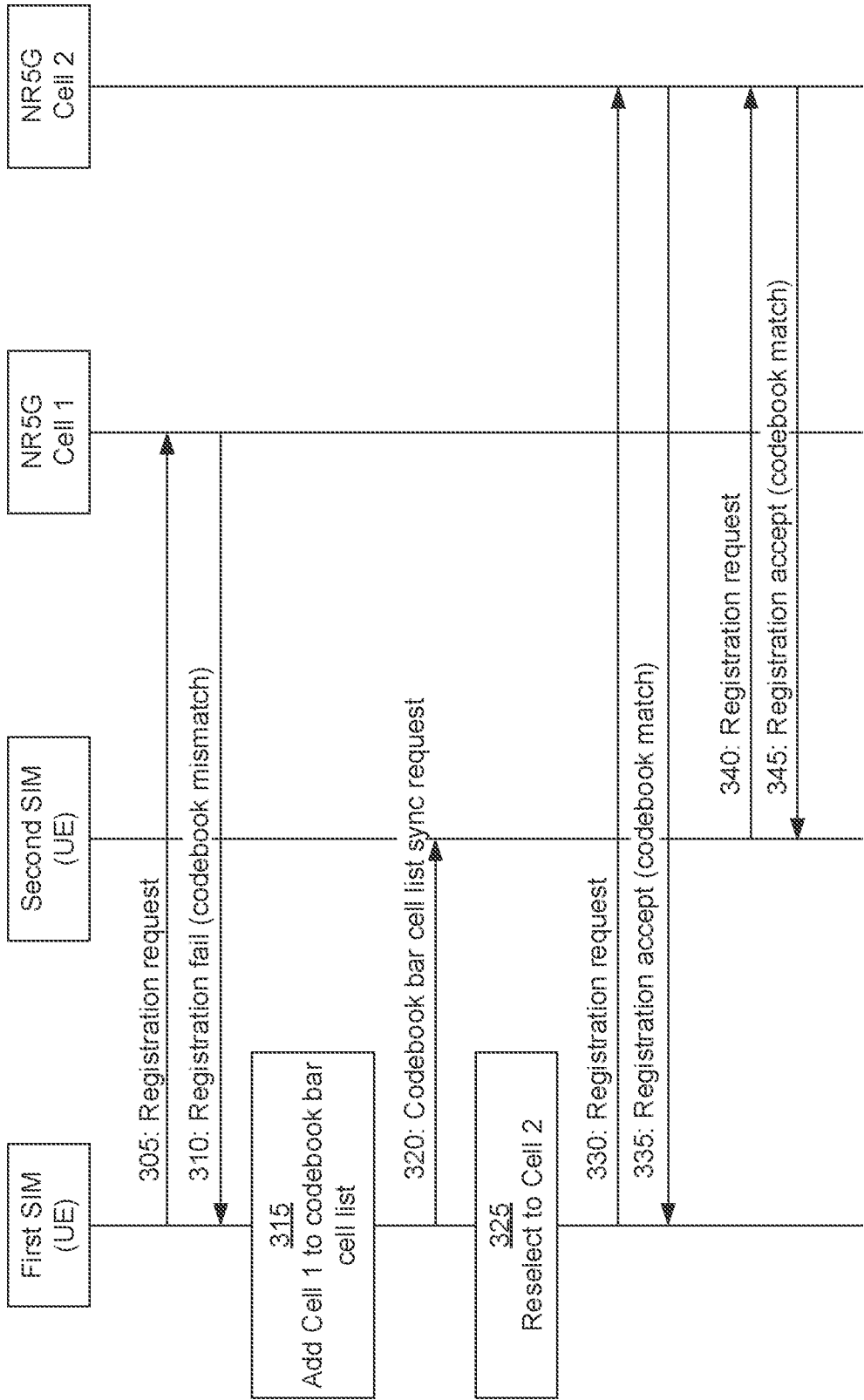


FIG. 3

400 →

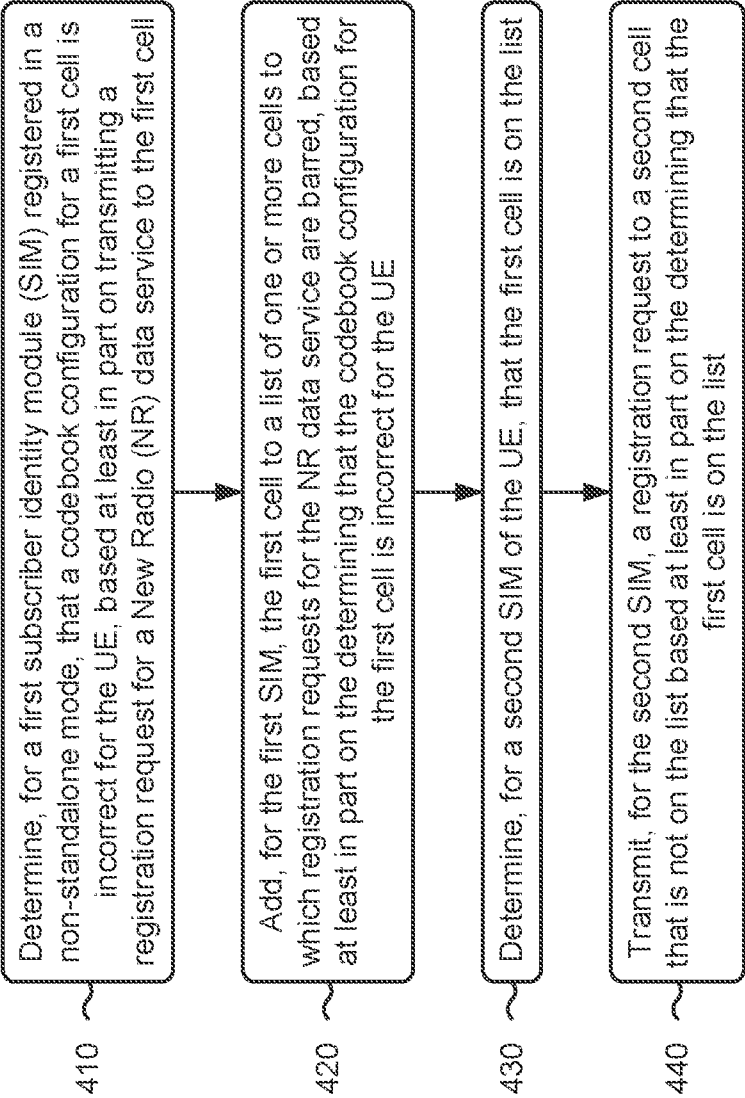


FIG. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/093286

**A. CLASSIFICATION OF SUBJECT MATTER**

H04W 60/00(2009.01)i; H04W 76/18(2018.01)i; H04W 88/06(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, 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,USTXT,EPTXT,WOTXT,3GPP:NR, UE, cell, registration, register, non-standalone, noncodebook, non-codebook, incorrect, mismatch, failure, reject+, attach, tracking, bar, forbidden, list, configuration, PUSCH, SRS, first, second, dual, multi+, SIM, subscriber identity module, card

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                              | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | WO 2018013405 A1 (QUALCOMM INC.) 18 January 2018 (2018-01-18)<br>see the whole document                                                                                         | 1-16                  |
| A         | CN 110149714 A (TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY RESEARCH INSTITUTE CO., LTD.) 20 August 2019 (2019-08-20)<br>see the whole document                                   | 1-16                  |
| A         | CN 109996315 A (BEIJING PINECONE ELECTRONICS CO., LTD.) 09 July 2019 (2019-07-09)<br>see the whole document                                                                     | 1-16                  |
| A         | US 2020053657 A1 (LENOVO SINGAPORE PTE LTD.) 13 February 2020 (2020-02-13)<br>see the whole document                                                                            | 1-16                  |
| A         | NTT DOCOMO INC. "Codebook and non-codebook based transmission for uplink"<br>3GPP TSG-RAN WG1 Meeting #88bis, R1-1705717, 24 March 2017 (2017-03-24),<br>see the whole document | 1-16                  |



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

08 February 2021

Date of mailing of the international search report

20 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

Authorized officer

HAN,Zheng

Facsimile No. (86-10)62019451

Telephone No. 86-(010)-62089454

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/CN2020/093286**

| Patent document<br>cited in search report |            |    | Publication date<br>(day/month/year) | Patent family member(s) |              |    | Publication date<br>(day/month/year) |
|-------------------------------------------|------------|----|--------------------------------------|-------------------------|--------------|----|--------------------------------------|
| WO                                        | 2018013405 | A1 | 18 January 2018                      | US                      | 2018020417   | A1 | 18 January 2018                      |
|                                           |            |    |                                      | EP                      | 3485680      | B1 | 27 May 2020                          |
|                                           |            |    |                                      | TW                      | 201804870    | A  | 01 February 2018                     |
|                                           |            |    |                                      | IN                      | 201817045596 | A  | 01 February 2019                     |
|                                           |            |    |                                      | CN                      | 109479252    | A  | 15 March 2019                        |
|                                           |            |    |                                      | EP                      | 3485680      | A1 | 22 May 2019                          |
|                                           |            |    |                                      | BR                      | 112019000596 | A2 | 24 April 2019                        |
|                                           |            |    |                                      | JP                      | 2019525584   | A  | 05 September 2019                    |
|                                           |            |    |                                      | CA                      | 3027239      | A1 | 18 January 2018                      |
|                                           |            |    |                                      | KR                      | 20190028696  | A  | 19 March 2019                        |
|                                           |            |    |                                      | US                      | 10251145     | B2 | 02 April 2019                        |
| CN                                        | 110149714  | A  | 20 August 2019                       | None                    |              |    |                                      |
| CN                                        | 109996315  | A  | 09 July 2019                         | None                    |              |    |                                      |
| US                                        | 2020053657 | A1 | 13 February 2020                     | US                      | 10660077     | B2 | 19 May 2020                          |