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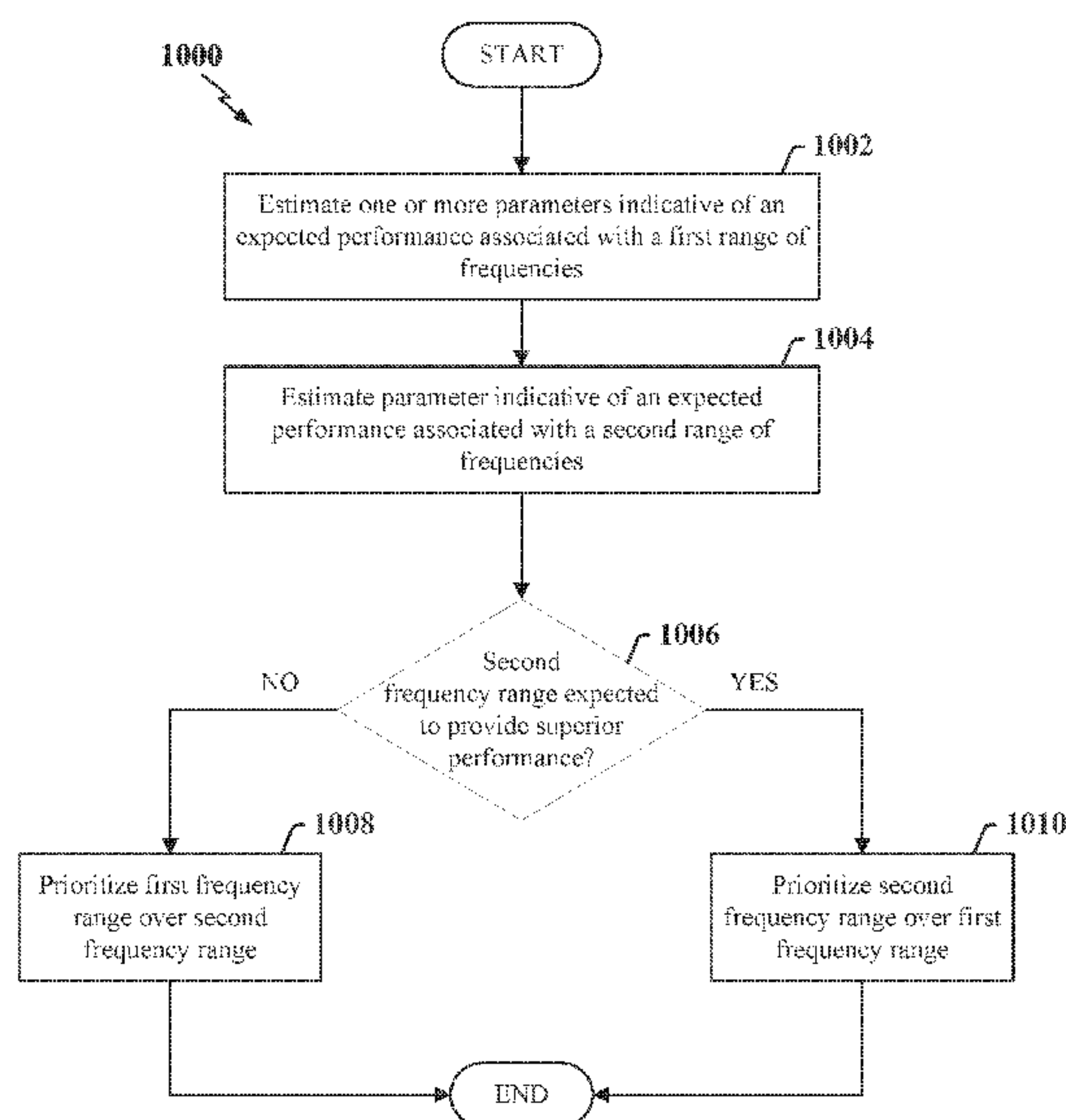


FIG. 10

(57) Abstract: Aspects of the disclosure relate to prioritizing neighbor cell measurement reporting. In an example operation, a device performs a first measurement of at least one synchronization signal transmitted on a first range of frequencies and performs a second measurement of at least one synchronization signal transmitted on a second range of frequencies. The device can prioritize reporting of the second measurement to a network over reporting of the first measurement to the network. The device can report the second measurement to the network prior to the first measurement based on the prioritization. Other aspects and features are also claimed and described.

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PRIORITIZING SCHEDULING AND REPORTING OF NEIGHBOR CELL MEASUREMENTS IN CELLULAR NETWORKS

PRIORITY CLAIM

[0001] This application claims priority to and the benefit of provisional patent application no. 62/938,215 filed in the United States Patent and Trademark Office on November 20, 2019, the entire content of which is incorporated herein by reference as if fully set forth below in its entirety and for all applicable purposes.

TECHNICAL FIELD

[0002] The technology discussed below relates generally to wireless communication systems, and more particularly, to prioritizing scheduling and reporting of neighbor cell measurements in cellular networks.

INTRODUCTION

[0003] 3rd Generation Partnership Project (3GPP) New Radio (NR) specifications, often referred to as 5G NR, utilize a variety of different frequency bands. Frequency allocations may be located in a variety of areas of the radio spectrum. Two different frequency ranges available for 5G NR wireless technology are designated as frequency range 1 (FR1) and frequency range 2 (FR2). FR1 may range from 450 to 6000 MHz. FR2 may range from 24250 to 52600 MHz.

[0004] The frequency bands in FR1 (also referred to as Sub-6) are aimed to carry most traditional cellular communications traffic. The higher frequency bands in FR2 (also referred to as mmWave) are aimed at providing short range very high data rate capability for 5G NR. As the demand for 5G NR to carry higher speed data increases, the additional bandwidth of these higher frequency bands will be needed.

[0005] Apart from frequency range, 5G NR bands may be classified into three categories: 1) Frequency Division Duplex (FDD) bands; 2) Time Division Duplex (TDD) bands; and 3) Supplementary bands, such as Supplementary Downlink (SDL) bands and Supplementary Uplink (SUL) bands.

[0006] As the demand for mobile broadband access continues to increase, research and development continue to advance wireless communication technologies not only to meet

the growing demand for mobile broadband access, but to advance and enhance the user experience with mobile communications.

BRIEF SUMMARY OF SOME EXAMPLES

[0007] The following presents a simplified summary of one or more aspects of the present disclosure, in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated features of the disclosure, and is intended neither to identify key or critical elements of all aspects of the disclosure nor to delineate the scope of any or all aspects of the disclosure. Its sole purpose is to present some concepts of one or more aspects of the disclosure in a simplified form as a prelude to the more detailed description that is presented later.

[0008] Aspects of the disclosure relate to prioritizing scheduling and reporting of neighbor cell measurements in cellular networks. In one example, a method of prioritizing neighbor cell measurement reporting at a device is disclosed. The method includes performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies, performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network, reporting the second measurement to the network prior to the first measurement based on the prioritization, and receiving a serving cell reconfiguration from the network based on the reporting of the second measurement.

[0009] In another example, a device for prioritizing neighbor cell measurement reporting is disclosed. The device includes at least one processor, a transceiver communicatively coupled to the at least one processor, and a memory communicatively coupled to the at least one processor. The at least one processor is configured to perform a first measurement of at least one synchronization signal transmitted on a first range of frequencies, perform a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritize reporting of the second measurement to a network over reporting of the first measurement to the network, report the second measurement to the network prior to the first measurement based on the prioritization, and receive a serving cell reconfiguration from the network based on the reporting of the second measurement.

[0010] In a further example, a device for prioritizing neighbor cell measurement reporting is disclosed. The device includes means for performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies, means for performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies, means for prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network, means for reporting the second measurement to the network prior to the first measurement based on the prioritization, and means for receiving a serving cell reconfiguration from the network based on the reporting of the second measurement.

[0011] In another example, a non-transitory computer-readable medium storing computer-executable code at a device for prioritizing neighbor cell measurement reporting is disclosed. The non-transitory computer-readable medium includes code for causing a computer to perform a first measurement of at least one synchronization signal transmitted on a first range of frequencies, perform a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritize reporting of the second measurement to a network over reporting of the first measurement to the network, and report the second measurement to the network prior to the first measurement based on the prioritization.

[0012] In one example, a method of prioritizing neighbor cell measurement scheduling at a device is disclosed. The method includes scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies, scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritizing the scheduling of the second measurement over the scheduling of the first measurement, and performing the second measurement prior to the first measurement based on the prioritization.

[0013] In another example, a device for prioritizing neighbor cell measurement scheduling is disclosed. The device includes at least one processor, a transceiver communicatively coupled to the at least one processor, and a memory communicatively coupled to the at least one processor. The at least one processor is configured to schedule a first measurement of at least one synchronization signal transmitted on a first range of frequencies, schedule a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritize the scheduling of the second measurement over the scheduling of the first measurement, and perform the second measurement prior to the first measurement based on the prioritization.

[0014] In a further example, a device for prioritizing neighbor cell measurement scheduling is disclosed. The device includes means for scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies, means for scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies, means for prioritizing the scheduling of the second measurement over the scheduling of the first measurement, and means for performing the second measurement prior to the first measurement based on the prioritization.

[0015] In another example, a non-transitory computer-readable medium storing computer-executable code at a device for prioritizing neighbor cell measurement scheduling is disclosed. The non-transitory computer-readable medium includes code for causing a computer to schedule a first measurement of at least one synchronization signal transmitted on a first range of frequencies, schedule a second measurement of at least one synchronization signal transmitted on a second range of frequencies, prioritize the scheduling of the second measurement over the scheduling of the first measurement, and perform the second measurement prior to the first measurement based on the prioritization.

[0016] In some other examples, other communication devices and methods can facilitate wireless communication. Generally, some devices can be configured to and/or methods may include obtaining one or more measurements and reporting based on these measurements. Measurements can be sampled in real time and/or obtained from memory (or as component output). Sample measurements can include a first or initial measurement for a first frequency range and another or subsequent measurement for another frequency range. Specially, measurements may indicate link quality by sampling one or more reference signals. In some scenarios, for example, these measurements can include measuring or sampling data associated with synchronization signals. Additionally, and/or alternatively, measured or obtained samples may be compared against other or known values to aid in quality indication via relative comparison or relation. Reporting can occur based on the measurements and in some instances, reporting priority can occur. Priority may be based on one or more of a number of factors in some scenarios (e.g., priority can be based on link quality and/or measurement data).

[0017] These and other aspects of the invention will become more fully understood upon a review of the detailed description, which follows. Other aspects, features, and embodiments of the present invention will become apparent to those of ordinary skill in the art, upon reviewing the following description of specific, exemplary embodiments of

the present invention in conjunction with the accompanying figures. While features of the present invention may be discussed relative to certain embodiments and figures below, all embodiments of the present invention can include one or more of the advantageous features discussed herein. In other words, while one or more embodiments may be discussed as having certain advantageous features, one or more of such features may also be used in accordance with the various embodiments of the invention discussed herein. In similar fashion, while exemplary embodiments may be discussed below as device, system, or method embodiments it should be understood that such exemplary embodiments can be implemented in various devices, systems, and methods.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a schematic illustration of a wireless communication system in accordance with some aspects.

[0019] FIG. 2 is a conceptual illustration of an example of a radio access network in accordance with some aspects.

[0020] FIG. 3 is a block diagram illustrating a wireless communication system supporting multiple-input multiple-output (MIMO) communication in accordance with some aspects.

[0021] FIG. 4 is a schematic illustration of an organization of wireless resources in an air interface utilizing orthogonal frequency divisional multiplexing (OFDM) in accordance with some aspects.

[0022] FIG. 5 is a flow chart illustrating an exemplary process for prioritizing neighbor cell measurement reporting at a device in accordance with some aspects of the present disclosure.

[0023] FIG. 6 is a diagram illustrating adaptive measurement reporting delay in accordance with some aspects of the present disclosure.

[0024] FIG. 7 is a block diagram illustrating an example of a hardware implementation for a device employing a processing system in accordance with some aspects of the present disclosure.

[0025] FIG. 8 is a flow chart illustrating an exemplary process for prioritizing neighbor cell measurement reporting at a device in accordance with some aspects of the present disclosure.

[0026] FIG. 9 is a flow chart illustrating an exemplary process for prioritizing neighbor cell measurement scheduling at a device in accordance with some aspects of the present disclosure.

[0027] FIG. 10 is a flow chart illustrating an exemplary process for determining whether to prioritize a second frequency range over a first frequency range in accordance with some aspects of the present disclosure.

DETAILED DESCRIPTION

[0028] The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practiced without these specific details. In some instances, well known structures and components are shown in block diagram form in order to avoid obscuring such concepts.

[0029] While aspects and embodiments are described in this application by illustration to some examples, those skilled in the art will understand that additional implementations and use cases may come about in many different arrangements and scenarios. Innovations described herein may be implemented across many differing platform types, devices, systems, shapes, sizes, packaging arrangements. For example, embodiments and/or uses may come about via integrated chip embodiments and other non-module-component based devices (e.g., end-user devices, vehicles, communication devices, computing devices, industrial equipment, retail/purchasing devices, medical devices, AI-enabled devices, etc.). While some examples may or may not be specifically directed to use cases or applications, a wide assortment of applicability of described innovations may occur. Implementations may range a spectrum from chip-level or modular components to non-modular, non-chip-level implementations and further to aggregate, distributed, or OEM devices or systems incorporating one or more aspects of the described innovations. In some practical settings, devices incorporating described aspects and features may also necessarily include additional components and features for implementation and practice of claimed and described embodiments. For example, transmission and reception of wireless signals necessarily includes a number of components for analog and digital

purposes (e.g., hardware components including antenna, RF-chains, power amplifiers, modulators, buffer, processor(s), interleaver, adders/summers, etc.). It is intended that innovations described herein may be practiced in a wide variety of devices, chip-level components, systems, distributed arrangements, end-user devices, etc. of varying sizes, shapes and constitution.

[0030] The various concepts presented throughout this disclosure may be implemented across a broad variety of telecommunication systems, network architectures, and communication standards. Referring now to FIG. 1, as an illustrative example without limitation, various aspects of the present disclosure are illustrated with reference to a wireless communication system 100. The wireless communication system 100 includes three interacting domains: a core network 102, a radio access network (RAN) 104, and a user equipment (UE) 106. By virtue of the wireless communication system 100, the UE 106 may be enabled to carry out data communication with an external data network 110, such as (but not limited to) the Internet.

[0031] The RAN 104 may implement any suitable wireless communication technology or technologies to provide radio access to the UE 106. As one example, the RAN 104 may operate according to 3rd Generation Partnership Project (3GPP) New Radio (NR) specifications, often referred to as 5G. As another example, the RAN 104 may operate under a hybrid of 5G NR and Evolved Universal Terrestrial Radio Access Network (eUTRAN) standards, often referred to as LTE. For example, RAN 104 may operate as a hybrid RAN that 3GPP refers to as a next-generation RAN, or NG-RAN. As another example, RAN 104 may operate as a hybrid RAN that 3GPP refers to as eUTRA-NR Dual Connectivity (EN-DC), in which an LTE base station (e.g., an eNode B) acts as a master node, and an NR node (e.g., an gNode B) acts as a secondary node (e.g., as described in 3GPP technical specification 37.340). Of course, many other examples may be utilized within the scope of the present disclosure.

[0032] As illustrated, the RAN 104 includes a plurality of base stations 108. Broadly, a base station is a network element in a radio access network responsible for radio transmission and reception in one or more cells to or from a UE. In different technologies, standards, or contexts, a base station may variously be referred to by those skilled in the art as a base transceiver station (BTS), a radio base station, a radio transceiver, a transceiver function, a basic service set (BSS), an extended service set (ESS), an access point (AP), a Node B (NB), an eNode B (eNB), a gNode B (gNB), or some other suitable terminology.

[0033] The radio access network 104 is further illustrated supporting wireless communication for multiple mobile apparatuses. A mobile apparatus may be referred to as user equipment (UE) in 3GPP standards, but may also be referred to by those skilled in the art as a mobile station (MS), a subscriber station, a mobile unit, a subscriber unit, a wireless unit, a remote unit, a mobile device, a wireless device, a wireless communications device, a remote device, a mobile subscriber station, an access terminal (AT), a mobile terminal, a wireless terminal, a remote terminal, a handset, a terminal, a user agent, a mobile client, a client, or some other suitable terminology. A UE may be an apparatus that provides a user with access to network services.

[0034] Within the present document, a “mobile” apparatus need not necessarily have a capability to move, and may be stationary. The term mobile apparatus or mobile device broadly refers to a diverse array of devices and technologies. UEs may include a number of hardware structural components sized, shaped, and arranged to help in communication; such components can include antennas, antenna arrays, RF chains, amplifiers, one or more processors, etc. electrically coupled to each other. For example, some non-limiting examples of a mobile apparatus include a mobile, a cellular (cell) phone, a smart phone, a session initiation protocol (SIP) phone, a laptop, a personal computer (PC), a notebook, a netbook, a smartbook, a tablet, a personal digital assistant (PDA), and a broad array of embedded systems, e.g., corresponding to an “Internet of things” (IoT). A mobile apparatus may additionally be an automotive or other transportation vehicle, a remote sensor or actuator, a robot or robotics device, a satellite radio, a global positioning system (GPS) device, an object tracking device, a drone, a multi-copter, a quad-copter, a remote control device, a consumer and/or wearable device, such as eyewear, a wearable camera, a virtual reality device, a smart watch, a health or fitness tracker, a digital audio player (e.g., MP3 player), a camera, a game console, etc. A mobile apparatus may additionally be a digital home or smart home device such as a home audio, video, and/or multimedia device, an appliance, a vending machine, intelligent lighting, a home security system, a smart meter, etc. A mobile apparatus may additionally be a smart energy device, a security device, a solar panel or solar array, a municipal infrastructure device controlling electric power (e.g., a smart grid), lighting, water, etc.; an industrial automation and enterprise device; a logistics controller; agricultural equipment; military defense equipment, vehicles, aircraft, ships, and weaponry, etc. Still further, a mobile apparatus may provide for connected medicine or telemedicine support, e.g., health care at a distance. Telehealth devices may include telehealth monitoring devices and telehealth administration devices,

whose communication may be given preferential treatment or prioritized access over other types of information, e.g., in terms of prioritized access for transport of critical service data, and/or relevant QoS for transport of critical service data.

[0035] Wireless communication between a RAN 104 and a UE 106 may be described as utilizing an air interface. Transmissions over the air interface from a base station (e.g., base station 108) to one or more UEs (e.g., UE 106) may be referred to as downlink (DL) transmission. In accordance with certain aspects of the present disclosure, the term downlink may refer to a point-to-multipoint transmission originating at a scheduling entity (described further below; e.g., base station 108). Another way to describe this scheme may be to use the term broadcast channel multiplexing. Transmissions from a UE (e.g., UE 106) to a base station (e.g., base station 108) may be referred to as uplink (UL) transmissions. In accordance with further aspects of the present disclosure, the term uplink may refer to a point-to-point transmission originating at a scheduled entity (described further below; e.g., UE 106).

[0036] In some examples, access to the air interface may be scheduled, wherein a scheduling entity (e.g., a base station 108) allocates resources for communication among some or all devices and equipment within its service area or cell. Within the present disclosure, as discussed further below, the scheduling entity may be responsible for scheduling, assigning, reconfiguring, and releasing resources for one or more scheduled entities. That is, for scheduled communication, UEs 106, which may be scheduled entities, may utilize resources allocated by the base station/scheduling entity 108.

[0037] Base stations 108 are not the only entities that may function as scheduling entities. That is, in some examples, a UE may function as a scheduling entity, scheduling resources for one or more scheduled entities (e.g., one or more other UEs).

[0038] As illustrated in FIG. 1, a base station 108 may broadcast downlink traffic 112 to one or more UEs 106. Broadly, the base station 108 is a node or device responsible for scheduling traffic in a wireless communication network, including the downlink traffic 112 and, in some examples, uplink traffic 116 from one or more UEs 106 to the base station 108. On the other hand, the UE 106 is a node or device that receives downlink control information 114, including but not limited to scheduling information (e.g., a grant), synchronization or timing information, or other control information from another entity in the wireless communication network such as the base station 108.

[0039] In general, base stations 108 may include a backhaul interface for communication with a backhaul portion 120 of the wireless communication system. The backhaul 120

may provide a link between a base station 108 and the core network 102. Further, in some examples, a backhaul network may provide interconnection between the respective base stations 108. Various types of backhaul interfaces may be employed, such as a direct physical connection, a virtual network, or the like using any suitable transport network.

[0040] The core network 102 may be a part of the wireless communication system 100, and may be independent of the radio access technology used in the RAN 104. In some examples, the core network 102 may be configured according to 5G standards (e.g., 5GC). In other examples, the core network 102 may be configured according to a 4G evolved packet core (EPC), or any other suitable standard or configuration.

[0041] Referring now to FIG. 2, by way of example and without limitation, a schematic illustration of a RAN 200 is provided. In some examples, the RAN 200 may be the same as the RAN 104 described above and illustrated in FIG. 1. The geographic area covered by the RAN 200 may be divided into cellular regions (cells) that can be uniquely identified by a user equipment (UE) based on an identification broadcasted from one access point or base station. FIG. 2 illustrates macrocells 202, 204, and 206, and a small cell 208, each of which may include one or more sectors (not shown). A sector is a sub-area of a cell. All sectors within one cell are served by the same base station. A radio link within a sector can be identified by a single logical identification belonging to that sector. In a cell that is divided into sectors, the multiple sectors within a cell can be formed by groups of antennas with each antenna responsible for communication with UEs in a portion of the cell.

[0042] In FIG. 2, two base stations 210 and 212 are shown in cells 202 and 204; and a third base station 214 is shown controlling a remote radio head (RRH) 216 in cell 206. That is, a base station can have an integrated antenna or can be connected to an antenna or RRH by feeder cables. In the illustrated example, the cells 202, 204, and 206 may be referred to as macrocells, as the base stations 210, 212, and 214 support cells having a large size. Further, a base station 218 is shown in the small cell 208 (e.g., a microcell, picocell, femtocell, home base station, home Node B, home eNode B, etc.) which may overlap with one or more macrocells. In this example, the cell 208 may be referred to as a small cell, as the base station 218 supports a cell having a relatively small size. Cell sizing can be done according to system design as well as component constraints.

[0043] It is to be understood that the radio access network 200 may include any number of wireless base stations and cells. Further, a relay node may be deployed to extend the size or coverage area of a given cell. The base stations 210, 212, 214, 218 provide wireless

access points to a core network for any number of mobile apparatuses. In some examples, the base stations 210, 212, 214, and/or 218 may be the same as the base station/scheduling entity 108 described above and illustrated in FIG. 1.

[0044] FIG. 2 further includes a quadcopter or drone 220, which may be configured to function as a base station. That is, in some examples, a cell may not necessarily be stationary, and the geographic area of the cell may move according to the location of a mobile base station such as the quadcopter 220.

[0045] Within the RAN 200, the cells may include UEs that may be in communication with one or more sectors of each cell. Further, each base station 210, 212, 214, 218, and 220 may be configured to provide an access point to a core network 102 (see FIG. 1) for all the UEs in the respective cells. For example, UEs 222 and 224 may be in communication with base station 210; UEs 226 and 228 may be in communication with base station 212; UEs 230 and 232 may be in communication with base station 214 by way of RRH 216; UE 234 may be in communication with base station 218; and UE 236 may be in communication with mobile base station 220. In some examples, the UEs 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, and/or 242 may be the same as the UE/scheduled entity 106 described above and illustrated in FIG. 1.

[0046] In some examples, a mobile network node (e.g., quadcopter 220) may be configured to function as a UE. For example, the quadcopter 220 may operate within cell 202 by communicating with base station 210.

[0047] In a further aspect of the RAN 200, sidelink signals may be used between UEs without necessarily relying on scheduling or control information from a base station. For example, two or more UEs (e.g., UEs 226 and 228) may communicate with each other using peer to peer (P2P) or sidelink signals 227 without relaying that communication through a base station (e.g., base station 212). In a further example, UE 238 is illustrated communicating with UEs 240 and 242. Here, the UE 238 may function as a scheduling entity or a primary sidelink device, and UEs 240 and 242 may function as a scheduled entity or a non-primary (e.g., secondary) sidelink device. In still another example, a UE may function as a scheduling entity in a device-to-device (D2D), peer-to-peer (P2P), or vehicle-to-vehicle (V2V) network, and/or in a mesh network. In a mesh network example, UEs 240 and 242 may optionally communicate directly with one another in addition to communicating with the scheduling entity 238. Thus, in a wireless communication system with scheduled access to time-frequency resources and having a cellular configuration, a

P2P configuration, or a mesh configuration, a scheduling entity and one or more scheduled entities may communicate utilizing the scheduled resources.

[0048] In the radio access network 200, the ability for a UE to communicate while moving, independent of its location, is referred to as mobility. The various physical channels between the UE and the radio access network are generally set up, maintained, and released under the control of an access and mobility management function (AMF, not illustrated, part of the core network 102 in FIG. 1), which may include a security context management function (SCMF) that manages the security context for both the control plane and the user plane functionality, and a security anchor function (SEAF) that performs authentication.

[0049] In various implementations, the air interface in the radio access network 200 may utilize licensed spectrum, unlicensed spectrum, or shared spectrum. Licensed spectrum provides for exclusive use of a portion of the spectrum, generally by virtue of a mobile network operator purchasing a license from a government regulatory body. Unlicensed spectrum provides for shared use of a portion of the spectrum without need for a government-granted license. While compliance with some technical rules is generally still required to access unlicensed spectrum, generally, any operator or device may gain access. Shared spectrum may fall between licensed and unlicensed spectrum, wherein technical rules or limitations may be required to access the spectrum, but the spectrum may still be shared by multiple operators and/or multiple RATs. For example, the holder of a license for a portion of licensed spectrum may provide licensed shared access (LSA) to share that spectrum with other parties, e.g., with suitable licensee-determined conditions to gain access.

[0050] The air interface in the radio access network 200 may utilize one or more duplexing algorithms. Duplex refers to a point-to-point communication link where both endpoints can communicate with one another in both directions. Full duplex means both endpoints can simultaneously communicate with one another. Half duplex means only one endpoint can send information to the other at a time. In a wireless link, a full duplex channel generally relies on physical isolation of a transmitter and receiver, and suitable interference cancellation technologies. Full duplex emulation is frequently implemented for wireless links by utilizing frequency division duplex (FDD) or time division duplex (TDD). In FDD, transmissions in different directions operate at different carrier frequencies. In TDD, transmissions in different directions on a given channel are separated from one another using time division multiplexing. That is, at some times the

channel is dedicated for transmissions in one direction, while at other times the channel is dedicated for transmissions in the other direction, where the direction may change very rapidly, e.g., several times per slot.

[0051] In some aspects of the disclosure, the base station/scheduling entity and/or UE/scheduled entity may be configured for beamforming and/or multiple-input multiple-output (MIMO) technology. FIG. 3 illustrates an example of a wireless communication system 300 supporting MIMO. In a MIMO system, a transmitter 302 includes multiple transmit antennas 304 (e.g., N transmit antennas) and a receiver 306 includes multiple receive antennas 308 (e.g., M receive antennas). Thus, there are $N \times M$ signal paths 310 from the transmit antennas 304 to the receive antennas 308. Each of the transmitter 302 and the receiver 306 may be implemented, for example, within a base station/scheduling entity 108, a UE/scheduled entity 106, or any other suitable wireless communication device.

[0052] The use of such multiple antenna technology enables the wireless communication system to exploit the spatial domain to support spatial multiplexing, beamforming, and transmit diversity. Spatial multiplexing may be used to transmit different streams of data, also referred to as layers, simultaneously on the same time-frequency resource. The data streams may be transmitted to a single UE to increase the data rate or to multiple UEs to increase the overall system capacity, the latter being referred to as multi-user MIMO (MU-MIMO). This is achieved by spatially precoding each data stream (i.e., multiplying the data streams with different weighting and phase shifting) and then transmitting each spatially precoded stream through multiple transmit antennas on the downlink. The spatially precoded data streams arrive at the UE(s) with different spatial signatures, which enables each of the UE(s) to recover the one or more data streams destined for that UE. On the uplink, each UE transmits a spatially precoded data stream, which enables the base station to identify the source of each spatially precoded data stream.

[0053] The number of data streams or layers corresponds to the rank of the transmission. In general, the rank of the MIMO system 300 is limited by the number of transmit or receive antennas 304 or 308, whichever is lower. In addition, the channel conditions at the UE, as well as other considerations, such as the available resources at the base station, may also affect the transmission rank. For example, the rank (and therefore, the number of data streams) assigned to a particular UE on the downlink may be determined based on the rank indicator (RI) transmitted from the UE to the base station. The RI may be determined based on the antenna configuration (e.g., the number of transmit and receive

antennas) and a measured signal-to-interference-and-noise ratio (SINR) on each of the receive antennas. The RI may indicate, for example, the number of layers that may be supported under the current channel conditions. The base station may use the RI, along with resource information (e.g., the available resources and amount of data to be scheduled for the UE), to assign a transmission rank to the UE.

[0054] In Time Division Duplex (TDD) systems, the UL and DL may be reciprocal, in that each uses different time slots of the same frequency bandwidth. Therefore, in TDD systems, the base station may assign the rank for DL MIMO transmissions based on UL SINR measurements (e.g., based on a Sounding Reference Signal (SRS) transmitted from the UE or other pilot signal). Based on the assigned rank, the base station may then transmit the CSI-RS with separate C-RS sequences for each layer to provide for multi-layer channel estimation. From the CSI-RS, the UE may measure the channel quality across layers and resource blocks and feedback the CQI and RI values to the base station for use in updating the rank and assigning REs for future downlink transmissions.

[0055] In the simplest case, as shown in FIG. 3, a rank-2 spatial multiplexing transmission on a 2x2 MIMO antenna configuration will transmit one data stream from each transmit antenna 304. Each data stream reaches each receive antenna 308 along a different signal path 310. The receiver 306 may then reconstruct the data streams using the received signals from each receive antenna 308.

[0056] In order for transmissions over the radio access network 200 to obtain a low block error rate (BLER) while still achieving very high data rates, channel coding may be used. That is, wireless communication may generally utilize a suitable error correcting block code. In a typical block code, an information message or sequence is split up into code blocks (CBs), and an encoder (e.g., a CODEC) at the transmitting device then mathematically adds redundancy to the information message. Exploitation of this redundancy in the encoded information message can improve the reliability of the message, enabling correction for any bit errors that may occur due to the noise.

[0057] The air interface in the radio access network 200 may utilize one or more multiplexing and multiple access algorithms to enable simultaneous communication of the various devices. For example, 5G NR specifications provide multiple access for UL transmissions from UEs 222 and 224 to base station 210, and for multiplexing for DL transmissions from base station 210 to one or more UEs 222 and 224, utilizing orthogonal frequency division multiplexing (OFDM) with a cyclic prefix (CP). In addition, for UL transmissions, 5G NR specifications provide support for discrete Fourier transform-

spread-OFDM (DFT-s-OFDM) with a CP (also referred to as single-carrier FDMA (SC-FDMA)). However, within the scope of the present disclosure, multiplexing and multiple access are not limited to the above schemes, and may be provided utilizing time division multiple access (TDMA), code division multiple access (CDMA), frequency division multiple access (FDMA), sparse code multiple access (SCMA), resource spread multiple access (RSMA), or other suitable multiple access schemes. Further, multiplexing DL transmissions from the base station 210 to UEs 222 and 224 may be provided utilizing time division multiplexing (TDM), code division multiplexing (CDM), frequency division multiplexing (FDM), orthogonal frequency division multiplexing (OFDM), sparse code multiplexing (SCM), or other suitable multiplexing schemes.

[0058] Various aspects of the present disclosure will be described with reference to an OFDM waveform, schematically illustrated in FIG. 4. It should be understood by those of ordinary skill in the art that the various aspects of the present disclosure may be applied to a DFT-s-OFDMA waveform in substantially the same way as described herein below. That is, while some examples of the present disclosure may focus on an OFDM link for clarity, it should be understood that the same principles may be applied as well to DFT-s-OFDMA waveforms.

[0059] Within the present disclosure, a frame may refer to a duration of 10 ms for wireless transmissions, with each frame consisting of 10 subframes of 1 ms each. On a given carrier, there may be one set of frames in the UL, and another set of frames in the DL. Referring now to FIG. 4, an expanded view of an exemplary DL subframe 402 is illustrated, showing an OFDM resource grid 404. However, as those skilled in the art will readily appreciate, the PHY transmission structure for any particular application may vary from the example described here, depending on any number of factors. Here, time is in the horizontal direction with units of OFDM symbols; and frequency is in the vertical direction with units of subcarriers or tones.

[0060] The resource grid 404 may be used to schematically represent time–frequency resources for a given antenna port. That is, in a MIMO implementation with multiple antenna ports available, a corresponding multiple number of resource grids 404 may be available for communication. The resource grid 404 is divided into multiple resource elements (REs) 406. An RE, which is 1 subcarrier $\times$ 1 symbol, is the smallest discrete part of the time–frequency grid, and contains a single complex value representing data from a physical channel or signal. Depending on the modulation utilized in a particular implementation, each RE may represent one or more bits of information. In some

examples, a block of REs may be referred to as a physical resource block (PRB) or more simply a resource block (RB) 408, which contains any suitable number of consecutive subcarriers in the frequency domain. In one example, an RB may include 12 subcarriers, a number independent of the numerology used. In some examples, depending on the numerology, an RB may include any suitable number of consecutive OFDM symbols in the time domain. Within the present disclosure, it is assumed that a single RB such as the RB 408 entirely corresponds to a single direction of communication (either transmission or reception for a given device).

[0061] A UE generally utilizes only a subset of the resource grid 404. An RB may be the smallest unit of resources that can be allocated to a UE. Thus, the more RBs scheduled for a UE, and the higher the modulation scheme chosen for the air interface, the higher the data rate for the UE.

[0062] In this illustration, the RB 408 is shown as occupying less than the entire bandwidth of the subframe 402, with some subcarriers illustrated above and below the RB 408. In a given implementation, the subframe 402 may have a bandwidth corresponding to any number of one or more RBs 408. Further, in this illustration, the RB 408 is shown as occupying less than the entire duration of the subframe 402, although this is merely one possible example.

[0063] Each 1 ms subframe 402 may consist of one or multiple adjacent slots. In the example shown in FIG. 4, one subframe 402 includes four slots 410, as an illustrative example. In some examples, a slot may be defined according to a specified number of OFDM symbols with a given cyclic prefix (CP) length. For example, a slot may include 7 or 14 OFDM symbols with a nominal CP. Additional examples may include mini-slots having a shorter duration (e.g., one or two OFDM symbols). These mini-slots may in some cases be transmitted occupying resources scheduled for ongoing slot transmissions for the same or for different UEs.

[0064] An expanded view of one of the slots 410 illustrates the slot 410 including a control region 412 and a data region 414. In general, the control region 412 may carry control channels (e.g., PDCCH), and the data region 414 may carry data channels (e.g., PDSCH or PUSCH). Of course, a slot may contain all DL, all UL, or at least one DL portion and at least one UL portion. The simple structure illustrated in FIG. 4 is merely exemplary in nature, and different slot structures may be utilized, and may include one or more of each of the control region(s) and data region(s).

[0065] Although not illustrated in FIG. 4, the various REs 406 within a RB 408 may be scheduled to carry one or more physical channels, including control channels, shared channels, data channels, etc. Other REs 406 within the RB 408 may also carry pilots or reference signals, including but not limited to a demodulation reference signal (DMRS), a control reference signal (CRS), or a sounding reference signal (SRS). These pilots or reference signals may provide for a receiving device to perform channel estimation of the corresponding channel, which may enable coherent demodulation/detection of the control and/or data channels within the RB 408.

[0066] In a DL transmission, the transmitting device (e.g., the base station 108) may allocate one or more REs 406 (e.g., within a control region 412) to carry DL control information 114 including one or more DL control channels that generally carry information originating from higher layers, such as a physical broadcast channel (PBCH), a physical downlink control channel (PDCCH), etc., to one or more UEs 106. In addition, DL REs may be allocated to carry DL physical signals that generally do not carry information originating from higher layers. These DL physical signals may include a primary synchronization signal (PSS); a secondary synchronization signal (SSS); demodulation reference signals (DM-RS); phase-tracking reference signals (PT-RS); channel-state information reference signals (CSI-RS); etc.

[0067] The synchronization signals PSS and SSS (collectively referred to as SS), and in some examples, the PBCH, may be transmitted in an SS block that includes 4 consecutive OFDM symbols, numbered via a time index in increasing order from 0 to 3. In the frequency domain, the SS block may extend over 240 contiguous subcarriers, with the subcarriers being numbered via a frequency index in increasing order from 0 to 239. Of course, the present disclosure is not limited to this specific SS block configuration. Other nonlimiting examples may utilize greater or fewer than two synchronization signals; may include one or more supplemental channels in addition to the PBCH; may omit a PBCH; and/or may utilize nonconsecutive symbols for an SS block, within the scope of the present disclosure.

[0068] The PDCCH may carry downlink control information (DCI) for one or more UEs in a cell, including but not limited to power control commands, scheduling information, a grant, and/or an assignment of REs for DL and UL transmissions.

[0069] In an UL transmission, the transmitting device (e.g., the UE 106) may utilize one or more REs 406 to carry UL control information 118 originating from higher layers via one or more UL control channels, such as a physical uplink control channel (PUCCH), a

physical random access channel (PRACH), etc., to the base station 108. Further, UL REs may carry UL physical signals that generally do not carry information originating from higher layers, such as demodulation reference signals (DM-RS), phase-tracking reference signals (PT-RS), sounding reference signals (SRS), etc. In some examples, the control information 118 may include a scheduling request (SR), i.e., a request for the base station 108 to schedule uplink transmissions. Here, in response to the SR transmitted on the control channel 118, the base station 108 may transmit downlink control information 114 that may schedule resources for uplink packet transmissions. UL control information may also include hybrid automatic repeat request (HARQ) feedback such as an acknowledgment (ACK) or negative acknowledgment (NACK), channel state information (CSI), or any other suitable UL control information. HARQ is a technique well-known to those of ordinary skill in the art, wherein the integrity of packet transmissions may be checked at the receiving side for accuracy, e.g., utilizing any suitable integrity checking mechanism, such as a checksum or a cyclic redundancy check (CRC). If the integrity of the transmission confirmed, an ACK may be transmitted, whereas if not confirmed, a NACK may be transmitted. In response to a NACK, the transmitting device may send a HARQ retransmission, which may implement chase combining, incremental redundancy, etc.

[0070] In addition to control information, one or more REs 406 (e.g., within the data region 414) may be allocated for user data or traffic data. Such traffic may be carried on one or more traffic channels, such as, for a DL transmission, a physical downlink shared channel (PDSCH); or for an UL transmission, a physical uplink shared channel (PUSCH).

[0071] In order for a UE to gain initial access to a cell, the RAN may provide system information (SI) characterizing the cell. This system information may be provided utilizing minimum system information (MSI), and other system information (OSI). The MSI may be periodically broadcast over the cell to provide the most basic information required for initial cell access, and for acquiring any OSI that may be broadcast periodically or sent on-demand. In some examples, the MSI may be provided over two different downlink channels. For example, the PBCH may carry a master information block (MIB), and the PDSCH may carry a system information block type 1 (SIB1). In the art, SIB1 may be referred to as the remaining minimum system information (RMSI).

[0072] OSI may include any SI that is not broadcast in the MSI. In some examples, the PDSCH may carry a plurality of SIBs, not limited to SIB1, discussed above. Here, the OSI may be provided in these SIBs, e.g., SIB2 and above.

[0073] The channels or carriers described above and illustrated in FIGs. 1 and 4 are not necessarily all the channels or carriers that may be utilized between a base station 108 and UEs 106, and those of ordinary skill in the art will recognize that other channels or carriers may be utilized in addition to those illustrated, such as other traffic, control, and feedback channels.

[0074] These physical channels described above are generally multiplexed and mapped to transport channels for handling at the medium access control (MAC) layer. Transport channels carry blocks of information called transport blocks (TB). The transport block size (TBS), which may correspond to a number of bits of information, may be a controlled parameter, based on the modulation and coding scheme (MCS) and the number of RBs in a given transmission.

[0075] A UE (e.g., the UE 106, UE 222, 226, 228, 230, 232, 236, etc.) may be capable of communicating with multiple base stations (e.g., base stations 108, base stations 210, 212, 214, and 218, etc.) using one or more frequency ranges and/or communicating with a particular base station using different frequency ranges. The UE may measure signals (e.g., reference signals) transmitted by one or more base stations and/or using various frequency ranges. The measurement may be indicative of the quality of a link used to communicate a particular signal from the base station to the UE. For example, the UE may receive any suitable reference signal or combination of reference signals (e.g., a channel state information reference signal (CSI-RS), a demodulation reference signal (DM-RS), phase-tracking reference signals (PT-RS), etc.). Each base station may transmit reference signals at preconfigured times and/or using preconfigured resources, which may be conveyed to UEs using a system information block (e.g., system information block type 1 (SIB1)).

[0076] The UE may receive an RS using any suitable technique or combination of techniques. For example, the UE may sample and buffer a received wireless signal, and apply suitable processing to the buffered signal such as energy detection, demodulation, decoding, etc. The UE may estimate the quality of a link using various measurements indicative of signal quality. For example, the UE may calculate a reference signal received power (RSRP) based on an average (e.g., a linear average) received power of resources (e.g., resource elements) that carried the RS. In such an example, RSRP may be measured in watts (e.g., in the linear domain), in decibel-milliwatts (dBm) (e.g., in the log domain), and/or using any other suitable unit of measurement. As another example, the UE may calculate a reference signal received quality (RSRQ) based on a ratio of RSRP to an

indicator of a signal strength observed in certain resources (e.g., a received signal strength indicator (RSSI) measured over certain OFDM symbols). In such an example, RSRQ may be measured in decibels (dB). As yet another example, the UE may calculate a reference signal signal-to-interference-and-noise (RS-SINR) based on a ratio of average (e.g., linear average) power of resources (e.g., resource elements) that carried the RS to an average (e.g., linear average) of noise and interference power contributions over resources (e.g., resource elements) carrying the RS.

[0077] The UE may report one or more measurements indicative of quality of the link periodically (e.g., with a particular periodicity, at times indicated by a base station, etc.), and/or in response to a particular event. Such reports may be periodic reports or event triggered reports, in which the UE may report a measurement in response to various events occurring (e.g., in response to a measurement reporting event). For example, the UE may report a measurement when a triggering condition has been satisfied.

[0078] In a more particular example, a triggering condition may be satisfied if signal quality of a cell currently serving the UE (e.g., a serving cell) becomes better than a particular threshold (e.g., an RSRP threshold, an RSRQ threshold, an RS-SINR threshold, etc.). Such a condition is sometimes referred to as an A1 event in published specifications for 5G NR. As another more particular example, another triggering condition may be satisfied if signal quality of the serving cell the UE if signal quality of the serving cell becomes worse than a particular threshold, if signal quality of a neighboring cell becomes better than a special cell (e.g., a primary serving cell of a master cell group (MCG) or a secondary cell group (SCG)). Such a condition is sometimes referred to as an A2 event in published specifications for 5G NR. The following table includes various examples of events that may be satisfied (e.g., events described in published specifications for 5G NR).

Event	Condition
A1	Serving cell becomes better than a threshold
A2	Serving cell becomes worse than a threshold
A3	Neighbor cell becomes better than a special cell (e.g., by a particular offset)
A4	Neighbor cell becomes better than a threshold
A5	Special cell becomes worse than a first threshold and neighbor becomes better than a second threshold
A6	Neighbor becomes better than a secondary cell (e.g., by a particular offset)

B1	Inter-radio access technology (Inter-RAT) neighbor becomes better than a threshold
B2	Primary serving cell becomes worse than a first threshold and Inter-RAT neighbor becomes better than a second threshold

[0079] In some examples, the UE may determine that a value is better than a threshold when the value is better than the threshold by a particular amount, and/or the UE may determine that a value is worse than a threshold when the value is worse than the threshold by a particular amount. Such a predetermined amount may be a hysteresis amount (or hysteresis parameter). In a particular example, the UE may reduce the likelihood that reports are sent repeatedly when the value is near the threshold by transmitting a report when the value is better than the threshold by a hysteresis value and/or when the value is worse than the threshold by a hysteresis value (note that the two hysteresis values may be the same or different, and may be set based on a value received in a report configuration associated with a particular event). Additionally or alternatively, in some examples, the UE may add (or subtract) an offset to a value (e.g., an RSRP value) associated with a particular signal and/or a particular threshold, and may use the offset value when determining whether a condition has been satisfied.

[0080] In some examples, a threshold (or thresholds), hysteresis, and/or offset associated with each event may be set based on a value received in a report configuration associated with a particular event.

[0081] In some aspects of the present disclosure, each triggering event may be associated with a measurement ID. The measurement ID may identify a measurement event that triggered a particular report. For example, each measurement ID may be based on a reference signal received by the UE in a particular frequency range and/or using a particular radio access technology. For example, each measurement ID may be based on a reference signal received power (RSRP), a reference signal received quality (RSRQ), a reference signal signal-to-interference-and-noise ratio (RS-SINR), or any other suitable measurement indicative of signal power and/or signal quality.

[0082] The UE may report measurements associated with various measurement IDs to one or more base stations to coordinate handover between cells, to coordinate scheduling of resources, and/or for any other suitable purpose. For example, as described above, the UE may report when a neighbor cell (e.g., an Intra-RAT neighbor or an Inter-RAT neighbor) has become better than a serving cell. In such an example, a base station may

determine that a handover to the neighbor cell is appropriate. As another example, the UE may report signal quality associated with resources associated with a frequency range (e.g., one or more bandwidth parts of the frequency range), and the base station may schedule resources for the UE based on the report(s) received from the UE.

[0083] In some examples, a UE may not transmit a report unless a particular event is maintained over a predetermined period of time. For example, if a UE determines that an event has been satisfied, the UE may measure a value(s) associated with the event one or more additional times. If the UE determines that the event is satisfied in the subsequent measurement(s), the UE may transmit a report associated with the event. Such a predetermined time period is sometimes referred to herein as a time to trigger (TTT). The UE may start a TTT associated with a particular event (e.g., a particular measurement ID) in response to a condition associated with the event being satisfied. The UE may determine that the TTT has expired when a time that has elapsed since the TTT was started equals or exceeds the predetermined period of time associated with the event.

[0084] In areas where 5G NR frequency range 1 (FR1 or Sub-6) coverage is on a low frequency, a UE may report FR1 measurements (synchronization signal measurements on FR1) to a network ahead of 5G NR frequency range 2 (FR2 or mmWave) measurements (synchronization signal measurements on FR2) when both FR1 and FR2 technologies are deployed. Accordingly, the network may configure the UE for FR1 cells. However, this may degrade a user experience as FR1 cells (for both frequency division duplex (FDD) and time division duplex (TDD)) have significantly lower data throughput speeds as compared to FR2 (e.g., Mbps vs. Gbps). Moreover, the UE may be limited in performing FR2 measurements while operating on FR1. As such, the UE may remain in an FR1 serving cell for a very long time resulting in delays or lags during heavy data use cases (e.g., streaming or gaming). To reduce or mitigate this issue, aspects of the present disclosure relate to prioritizing scheduling and reporting of neighbor cell measurements in cellular networks.

[0085] In an aspect of the disclosure, neighbor cell measurement reporting (reporting of synchronization signal measurements) is prioritized in a specific (e.g., predetermined) order. For example, the reporting of FR2 measurements may be prioritized over the reporting of FR1 measurements for TDD (FR1-TDD), which may be prioritized over the reporting of FR1 measurements for FDD (FR1-FDD). The prioritization may be achieved based on: 1) Time to trigger (TTT) expiry; 2) Modifying B1/B2 thresholds; or 3) Adaptive FR1 reporting delay.

[0086] Prioritizing FR2 over FR1 is merely an example. In some aspects of the disclosure, a UE may prioritize any frequency range, duplexing type, and/or radio access technology (RAT) that is expected to provide an enhanced user experience relative to another available frequency range, duplexing type, and/or RAT. For example, in an EN-DC RAN, a UE may prioritize cell measurement reporting of NR measurements associated with a secondary cell group (SCG) over cell measurement reporting of LTE measurements associated with a master cell group. As another example, if a UE is power-limited, the UE may prioritize a frequency range that utilizes less power, (e.g., FR1 FDD), over a frequency range that utilizes more power (e.g., FR2). As yet another example, a UE may prioritize cell measurement reporting of a first bandwidth part within a frequency range (e.g., FR1, FR2, etc.) over another bandwidth part within the same frequency range.

[0087] In an aspect, prioritizing neighbor cell measurement reporting may be based on TTT expiry. Once an NR UE satisfies a triggering condition outlined by the network for Bx (e.g., B1 or B2) events, the UE may be configured to report FR2 measurements to the network prior to any FR1 measurements. This may be achieved in the UE by manipulating a TTT aspect as described with respect to FIG. 5 below.

[0088] FIG. 5 is a flow chart illustrating an exemplary process 500 for prioritizing neighbor cell measurement reporting at a device in accordance with some aspects of the present disclosure. As described below, some or all illustrated features may be omitted in a particular implementation within the scope of the present disclosure, and some illustrated features may not be required for implementation of all embodiments. In some examples, the process 500 may be carried out by a UE (e.g., device 700 illustrated in FIG. 7). In some examples, the process 500 may be carried out by any suitable apparatus or means for carrying out the functions or algorithm described below.

[0089] At block 502, the UE processes all measurement IDs and checks the measurement IDs against network configured thresholds for event trigger. For example, the UE may determine whether a triggering event associated with each measurement ID has occurred. In an aspect, a measurement ID is configured at the network and is a combination of a measurement frequency (or measurement object) and a reporting event. When the reporting event occurs (e.g., cell goes higher than a certain threshold), a measurement report for the associated measurement frequency is triggered.

[0090] At block 504, the UE determines whether any measurement IDs satisfy a threshold condition. If no measurement IDs satisfy the condition, the UE proceeds back to block 502. However, if any measurement IDs that satisfy the condition exist, the UE proceeds

to block 506 where a time to trigger (TTT) is started. In some examples, the UE may omit block 506 for a measurement ID(s) that is already running (e.g., a measurement ID that was already started and has not yet expired).

[0091] At block 508, after starting the TTT, the UE determines whether any measurement IDs have an expired TTT. As described above, the UE may determine that the TTT has expired when a time that has elapsed since the TTT was started equals or exceeds a predetermined period of time associated with the event that triggered the TTT. If no measurement IDs have an expired TTT, the UE proceeds back to block 502. But if measurement IDs with an expired TTT exist, the UE proceeds to block 510.

[0092] At block 510, the UE determines whether an expired TTT is for FR1. A TTT may be a TTT for FR1 (e.g., a TTT associated with FR1) if the event that triggered the TTT is based on only measurements associated with FR1 (e.g., based on RSRP values estimated from signals with a frequency in FR1). Additionally or alternatively, a TTT may be a TTT for FR1 if a report transmitted when the TTT expires may cause a base station to initiate a handover of the UE to a cell associated with FR1 and/or cancel a handover when the UE is already associated with FR1. For example, a TTT associated with event A1, event A2, or event A4 may be for FR1. If the expired TTT is for FR1, the UE proceeds to block 512. If the expired TTT is not for FR1, the UE proceeds to block 516.

[0093] At block 512, if the expired TTT is for FR1, the UE determines whether any TTTs for FR2 are running. A TTT may be a TTT for FR2 (e.g., a TTT associated with FR2) if the event that triggered the TTT is based on at least one measurement associated with FR2 (e.g., based on RSRP values estimated from signals with a frequency in FR2). Additionally or alternatively, a TTT may be a TTT for FR2 if a report transmitted when the TTT expires may cause a base station to initiate a handover of the UE to a cell associated with FR2 and/or cancel a handover when the UE is already associated with FR2. For example, a TTT associated with event B1 or event B2 may be a TTT for FR2. If no TTT for FR2 is running, the UE sends a measurement report for FR1 to the network (block 522). However, if a running TTT for FR2 exists, the UE proceeds to block 514. At block 514, the UE expires (terminates) the TTT for FR2 and further adds an additional delay to the TTT for FR1 to continue running the TTT for FR1. Thereafter, the UE sends a measurement report for FR2 to the network (block 522). The UE also sends a measurement report for FR1 to the network after the additional delay for the FR1 TTT expires (block 522).

[0094] At block 516, if the expired TTT is not for FR1, the UE determines whether the expired TTT is for FR2. If the expired TTT is not for FR2, the UE may send a measurement report associated with the expired TTT to the network (block 522).

[0095] At block 518, if the expired TTT is for FR2, the UE determines whether a TTT for FR1 is running. If the TTT for FR1 is not running, the UE sends a measurement report for FR2 to the network (block 522). However, if the TTT for FR1 is running, the UE proceeds to block 520. At block 520, the UE adds an additional delay to the running TTT for FR1 and ensures that the FR1 TTT expires later (e.g., later than a time needed for the network to receive and process an FR2 measurement report). Thereafter, the UE sends a measurement report for FR2 to the network (block 522). The UE also sends a measurement report for FR1 to the network after the additional delay for the FR1 TTT expires (block 522). Note that although process 500 is described in connection with FR1 and FR2, this is merely an example, and process 500 may be used to prioritize reporting associated with any suitable frequency ranges and/or radio access technologies.

[0096] As described above, a B1 event may occur when a neighbor cell (e.g., an inter-radio access technology (IRAT) neighbor) becomes better than (e.g., neighbor cell synchronization signal measurement is greater than) a threshold (e.g., B1 threshold). Moreover a B2 event occurs when a serving cell becomes worse than (e.g., serving cell synchronization signal measurement is less than) a first threshold (e.g., first B2 threshold) and a neighbor cell (e.g., an IRAT neighbor) becomes better than a second threshold (e.g., second B2 threshold). In an aspect, the UE may prioritize neighbor cell measurement reporting based on modifying B1/B2 thresholds. As such, a UE may be able to satisfy B1 or B2 event reporting criteria for FR2 before satisfying B1 or B2 event reporting criteria for FR1. For example, the UE may bias/adjust B1/B2 thresholds to help trigger the sending of FR2 measurement reports to the network before sending FR1 measurement reports. Alternatively, the UE may adjust a frequency specific offset for FR2/FR1 in order to trigger the sending of the FR2 measurement reports before the FR1 measurement reports.

[0097] In an aspect, prioritizing neighbor cell measurement reporting may be based on adaptive FR1 reporting delay. FIG. 6 is a diagram 600 illustrating adaptive measurement reporting delay in accordance with some aspects of the present disclosure.

[0098] Referring to FIG. 6, a UE may delay transmission of a measurement report for FR1 (FR1 MR1) by a certain amount of time (e.g., delay D) to allow the network to

process a measurement report for FR2 (FR2 MR1) sent by the UE and react accordingly (e.g., network sends FR2 serving cell reconfiguration).

[0099] In an aspect, a UE may implement an adaptive delay D in triggering FR1 reports. The UE may calculate the adaptive delay D taking into account network parameters such as infrastructure (e.g., base station), cell site location, operators, etc. In a further aspect, the UE may prioritize FR1 based on the network parameters if FR2 coverage is poor. For example, the UE may modify delay based on a reporting interval for FR1 and a number of reports the network processes to add a serving cell (e.g., an NR primary serving cell (Pscell)).

[0100] In an aspect, the UE may adapt the delay D based on historical data in a cell site, a public land mobile network (PLMN), a tracking area code (TAC), and/or crowd sourced information for a cell/operator. The UE may adapt the delay D if multiple measurement reports are required by the network.

[0101] In another aspect of the disclosure, the UE may prioritize neighbor cell measurement scheduling (scheduling of synchronization signal measurements). That is, the UE may prioritize measurement objects (measurement frequencies) in a specific order based on available channel bandwidths and capacity. For example, at the UE, the scheduling of FR2 measurements is prioritized over the scheduling of FR1 measurements for TDD (FR1-TDD), which is prioritized over the scheduling of FR1 measurements for FDD (FR1-FDD).

[0102] FIG. 7 is a block diagram illustrating an example of a hardware implementation for a device 700 employing a processing system 714. For example, the device 700 may be a user equipment (UE) as illustrated in any one or more of FIGs. 1 and/or 2.

[0103] The device 700 may be implemented with a processing system 714 that includes one or more processors 704. Examples of processors 704 include microprocessors, microcontrollers, digital signal processors (DSPs), field programmable gate arrays (FPGAs), programmable logic devices (PLDs), state machines, gated logic, discrete hardware circuits, and other suitable hardware configured to perform the various functionality described throughout this disclosure. In various examples, the device 700 may be configured to perform any one or more of the functions described herein. That is, the processor 704, as utilized in the device 700, may be used to implement any one or more of the processes and procedures described below and illustrated in FIGs. 8 and 9.

[0104] In this example, the processing system 714 may be implemented with a bus architecture, represented generally by the bus 702. The bus 702 may include any number

of interconnecting buses and bridges depending on the specific application of the processing system 714 and the overall design constraints. The bus 702 communicatively couples together various circuits including one or more processors (represented generally by the processor 704), a memory 705, and computer-readable media (represented generally by the computer-readable medium 706). The bus 702 may also link various other circuits such as timing sources, peripherals, voltage regulators, and power management circuits, which are well known in the art, and therefore, will not be described any further. A bus interface 708 provides an interface between the bus 702 and a transceiver 710. The transceiver 710 provides a communication interface or means for communicating with various other apparatus over a transmission medium. Depending upon the nature of the apparatus, a user interface 712 (e.g., keypad, display, speaker, microphone, joystick) may also be provided. Of course, such a user interface 712 is optional, and may be omitted in some examples, such as a base station.

[0105] In some aspects of the disclosure, the processor 704 may include measurement processing circuitry 740 configured for various functions, including, for example, performing a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies, performing a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies, scheduling a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies, scheduling a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies, and performing the second measurement prior to the first measurement based on the prioritization. For example, the measurement processing circuitry 740 may be configured to implement one or more of the functions described below in relation to FIG. 8, including, e.g., blocks 802 and 804 and FIG. 9, including, e.g., blocks 902, 904, and 908. The processor 704 may also include prioritizing circuitry 742 configured for various functions, including, for example, prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network and prioritizing the scheduling of the second measurement over the scheduling of the first measurement. For example, the prioritizing circuitry 742 may be configured to implement one or more of the functions described below in relation to FIG. 8, including, e.g., block 806 and FIG. 9, including, e.g., block 906. The processor 704 may also include reporting circuitry 744 configured for various functions, including, for example, reporting the first measurement to the network and reporting the second measurement to the

network prior to the first measurement based on the prioritization. For example, the prioritizing circuitry 744 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., block808. The processor 704 may also include reconfiguration processing circuitry 746 configured for various functions, including, for example, receiving a serving cell reconfiguration from the network based on the reporting of the second measurement. For example, the reconfiguration processing circuitry 746 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., block810.

[0106] The processor 704 is responsible for managing the bus 702 and general processing, including the execution of software stored on the computer-readable medium 706. The software, when executed by the processor 704, causes the processing system 714 to perform the various functions described below for any particular apparatus. The computer-readable medium 706 and the memory 705 may also be used for storing data that is manipulated by the processor 704 when executing software.

[0107] One or more processors 704 in the processing system may execute software. Software shall 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, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise. The software may reside on a computer-readable medium 706. The computer-readable medium 706 may be a non-transitory computer-readable medium. A non-transitory computer-readable medium includes, by way of example, a magnetic storage device (e.g., hard disk, floppy disk, magnetic strip), an optical disk (e.g., a compact disc (CD) or a digital versatile disc (DVD)), a smart card, a flash memory device (e.g., a card, a stick, or a key drive), a random access memory (RAM), a read only memory (ROM), a programmable ROM (PROM), an erasable PROM (EPROM), an electrically erasable PROM (EEPROM), a register, a removable disk, and any other suitable medium for storing software and/or instructions that may be accessed and read by a computer. The computer-readable medium 706 may reside in the processing system 714, external to the processing system 714, or distributed across multiple entities including the processing system 714. The computer-readable medium 706 may be embodied in a computer program product. By way of example, a computer program product may include a computer-readable medium in packaging materials. Those skilled in the art will recognize

how best to implement the described functionality presented throughout this disclosure depending on the particular application and the overall design constraints imposed on the overall system.

[0108] In one or more examples, the computer-readable storage medium 706 may include measurement processing instructions 750 configured for various functions, including, for example, performing a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies, performing a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies, scheduling a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies, scheduling a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies, and performing the second measurement prior to the first measurement based on the prioritization. For example, the measurement processing instructions 750 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., blocks802 and804 and FIG. 9, including, e.g., blocks 902, 904, and 908. The computer-readable storage medium 706 may also include prioritizing instructions 752 configured for various functions, including, for example, prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network and prioritizing the scheduling of the second measurement over the scheduling of the first measurement. For example, the prioritizing instructions 752 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., block 806, and FIG. 9, including, e.g., block 906. The computer-readable storage medium 706 may also include reporting instructions 754 configured for various functions, including, for example, reporting the first measurement to the network and reporting the second measurement to the network prior to the first measurement based on the prioritization. For example, the prioritizing instructions 754 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., block808. The computer-readable storage medium 706 may also include reconfiguration processing instructions 756 configured for various functions, including, for example, receiving a serving cell reconfiguration from the network based on the reporting of the second measurement. For example, the reconfiguration processing instructions 756 may be configured to implement one or more of the functions described below in relation to FIG.8, including, e.g., block810.

[0109] In one configuration, the device 700 includes means for performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies, means for performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies, means for prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network, means for reporting the second measurement to the network prior to the first measurement based on the prioritization, and means for receiving a serving cell reconfiguration from the network based on the reporting of the second measurement. In one aspect, the aforementioned means may be the processor(s) 704 shown in FIG. 7 configured to perform the functions recited by the aforementioned means. In another aspect, the aforementioned means may be a circuit or any apparatus configured to perform the functions recited by the aforementioned means.

[0110] Of course, in the above examples, the circuitry included in the processor 704 is merely provided as an example, and other means for carrying out the described functions may be included within various aspects of the present disclosure, including but not limited to the instructions stored in the computer-readable storage medium 706, or any other suitable apparatus or means described in any one of the FIGs. 1, 2, 5, and/or 6, and utilizing, for example, the processes and/or algorithms described herein in relation to FIG. 8.

[0111] In one configuration, the device 700 includes means for scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies, means for scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies, means for prioritizing the scheduling of the second measurement over the scheduling of the first measurement, and means for performing the second measurement prior to the first measurement based on the prioritization. In one aspect, the aforementioned means may be the processor(s) 704 shown in FIG. 7 configured to perform the functions recited by the aforementioned means. In another aspect, the aforementioned means may be a circuit or any apparatus configured to perform the functions recited by the aforementioned means.

[0112] Of course, in the above examples, the circuitry included in the processor 704 is merely provided as an example, and other means for carrying out the described functions may be included within various aspects of the present disclosure, including but not limited to the instructions stored in the computer-readable storage medium 706, or any other suitable apparatus or means described in any one of the FIGs. 1, 2, 5, and/or 6, and

utilizing, for example, the processes and/or algorithms described herein in relation to FIG. 9.

[0113] In one configuration, the device 700 includes means for measuring one or more parameters indicative of expected performance of a particular frequency range and/or RAT, means for estimating one or more parameters, means for determining a current geographic location of the device 700, and/or means for selecting a frequency range to prioritize. In one aspect, the aforementioned means may be the processor(s) 704 shown in FIG. 7 configured to perform the functions recited by the aforementioned means. In another aspect, the aforementioned means may be a circuit or any apparatus configured to perform the functions recited by the aforementioned means.

[0114] Of course, in the above examples, the circuitry included in the processor 704 is merely provided as an example, and other means for carrying out the described functions may be included within various aspects of the present disclosure, including but not limited to the instructions stored in the computer-readable storage medium 706, or any other suitable apparatus or means described in any one of the FIGs. 1, 2, 5, and/or 6, and utilizing, for example, the processes and/or algorithms described herein in relation to FIG. 10.

[0115] FIG. 8 is a flow chart illustrating an exemplary process 800 for prioritizing neighbor cell measurement reporting at a device in accordance with some aspects of the present disclosure. As described below, some or all illustrated features may be omitted in a particular implementation within the scope of the present disclosure, and some illustrated features may not be required for implementation of all embodiments. In some examples, the process 800 may be carried out by the device 700 illustrated in FIG. 7. In some examples, the process 800 may be carried out by any suitable apparatus or means for carrying out the functions or algorithm described below.

[0116] At block 802, the device performs a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies and/or using a first radio access technology (RAT). The device may perform the first measurement using any suitable technique or combination of techniques. For example, the device may sample and buffer the synchronization signal transmitted on the first range of frequencies, and apply suitable processing to the buffered signal such as energy detection, demodulation, decoding, etc. As described above, the device may estimate the quality of a link over the first range of frequencies using various measurements indicative of signal quality (e.g., RSRP, RSRQ, RS-SINR, etc.). The device may receive the

synchronization signal using any suitable communication interface, such as a transceiver (e.g., transceiver 710).

[0117] At block 804, the device performs a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies and/or using a second RAT. The device may perform the second measurement using any suitable technique or combination of techniques. For example, the device may sample and buffer the synchronization signal transmitted on the second range of frequencies, and apply suitable processing to the buffered signal such as energy detection, demodulation, decoding, etc. As described above, the device may estimate the quality of a link using various measurements indicative of signal quality (e.g., RSRP, RSRQ, RS-SINR, etc.). The device may receive the synchronization signal using any suitable communication interface, such as a transceiver (e.g., transceiver 710).

[0118] In an aspect, the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2). In an aspect, the first range of frequencies is associated with an eNB (e.g., an LTE cell), and the second range of frequencies is associated with a gNB (e.g., a NR cell).

[0119] At block 806, the device prioritizes reporting of the second measurement to a network over reporting of the first measurement to the network. As described below in connection with FIG. 10, the device may prioritize reporting of the second measurement over the first measurement based on any suitable factor or combination of factors, such as a determination that a frequency range and/or RAT associated with the second measurement is expected to provide higher throughput, better serving cell performance, higher link reliability, etc. In an aspect, the device prioritizes the reporting by first determining whether a first time to trigger (TTT) for reporting the first measurement has expired. If the first TTT has expired, the device determines whether a second TTT for reporting the second measurement is running. If the second TTT is running, the device terminates the second TTT and adds a delay to the expired first TTT to continue running the first TTT past a time for a network to receive and process the second measurement and trigger serving cell reconfiguration.

[0120] In a further aspect, if the first TTT has not expired, the device prioritizes the reporting by determining whether the second TTT has expired and determining whether the first TTT is running if the second TTT has expired. If the first TTT is determined to be running, the device adds a delay to the running first TTT to continue running the first

TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

[0121] In an aspect, reporting of the first measurement is triggered based on the first measurement satisfying a first threshold and reporting of the second measurement is triggered based on the second measurement satisfying a second threshold. Accordingly, the device prioritizes the reporting by adjusting at least one of the first threshold or the second threshold to trigger the reporting of the second measurement before the reporting of the first measurement.

[0122] In an aspect, the device prioritizes the reporting by delaying the reporting of the first measurement by a time delay D to allow the network to receive and process the second measurement. The time delay D may be based on network parameters including an infrastructure, a cell site location, and an operator. The time delay D may be further based on a reporting interval for the first measurement, a number of reports the network processes to add a serving cell, historical data in the cell site location, a public land mobile network (PLMN), a tracking area code (TAC), and or crowd sourced information for a cell or operator.

[0123] At block 808, the device reports the second measurement to the network prior to the first measurement based on the prioritization. The device may report the second measurement using any suitable technique or combination of techniques. For example, the device may transmit a report associated with the second measurement to the network. The device may transmit the request using any suitable communication network (e.g., via a RAN, such as RAN 100 or RAN 204, using one or more UL slots, etc.). The device may transmit the report using any suitable communication interface, such as a transceiver (e.g., transceiver 710).

[0124] At block 810, the device receives a serving cell (e.g., primary serving cell, secondary cell, etc.) reconfiguration from the network based on the reporting of the second measurement. The device may receive the serving cell reconfiguration using any suitable technique or combination of techniques, and/or encoded in any suitable message. For example, the device may receive a handover command (e.g., an NR RRC reconfiguration message) that includes identifying information of a new cell. The device may sample and buffer a signal encoded with the handover command, and apply suitable processing to the buffered signal such as energy detection, demodulation, decoding, etc. The device may receive the message encoded with the serving cell reconfiguration using any suitable communication interface, such as a transceiver (e.g., transceiver 710).

[0125] FIG. 9 is a flow chart illustrating an exemplary process 900 for prioritizing neighbor cell measurement scheduling at a device in accordance with some aspects of the present disclosure. As described below, some or all illustrated features may be omitted in a particular implementation within the scope of the present disclosure, and some illustrated features may not be required for implementation of all embodiments. In some examples, the process 900 may be carried out by the device 700 illustrated in FIG. 7. In some examples, the process 900 may be carried out by any suitable apparatus or means for carrying out the functions or algorithm described below.

[0126] At block 902, the device schedules a first measurement of at least one synchronization signal (associated with a cell) transmitted on a first range of frequencies and/or a first RAT. The device may schedule the first measurement using any suitable technique or combination of techniques, and/or based on information received from the network (e.g., via a cell associated with the first range of frequencies). For example, the device may schedule the first measurement based on information included in a SIB1 from the cell that identifies resources that are scheduled to be used to transmit the synchronization signal transmitted on the first range of frequencies. The device may receive SIB1 messages from multiple cells associated with the first range of frequencies, and may schedule a measurement associated with one or more of the cells. The device may identify times at which the synchronization signal(s) is to be transmitted on the first range of frequencies (e.g., based on the information in the SIB1 message(s) received from cells associated with the second range of frequencies), and may schedule multiple times at which the first measurement is to be carried out based on the identified times.

[0127] At block 904, the device schedules a second measurement of at least one synchronization signal (associated with a cell) transmitted on a second range of frequencies and/or a second RAT. The device may schedule the second measurement using any suitable technique or combination of techniques, and/or based on information received from the network (e.g., via a cell associated with the second range of frequencies). For example, the device may schedule the first measurement based on information included in a SIB1 from the cell that identifies resources that are scheduled to be used to transmit the synchronization signal transmitted on the second range of frequencies. The device may receive SIB1 messages from multiple cells associated with the second range of frequencies, and may schedule a measurement associated with one or more of the cells. The device may identify times at which the synchronization signal(s) is to be transmitted on the second range of frequencies (e.g., based on the information in the

SIB1 message(s) received from cells associated with the second range of frequencies), and may schedule multiple times at which the second measurement is to be carried out based on the identified times.

[0128] In an aspect, the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2). In an aspect, the first range of frequencies is associated with an eNB (e.g., an LTE cell), and the second range of frequencies is associated with a gNB (e.g., a NR cell). In some aspects, the first measurement and/or the second measurement may be any suitable measurement, such as an RSRP, an RSRQ, an RS-SINR, etc.

[0129] At block 906, the device prioritizes the scheduling of the second measurement over the scheduling of the first measurement. As described below in connection with FIG. 10, the device may prioritize scheduling of the second measurement over the first measurement based on any suitable factor or combination of factors, such as a determination that a frequency range and/or RAT associated with the second measurement is expected to provide higher throughput, better serving cell performance, higher link reliability, etc. The device may prioritize the scheduling of the second measurement over the scheduling of the first measurement using any suitable technique or combination of techniques. For example, the device may compare a time at which the first measurement is scheduled to a time at which the second measurement is scheduled. If the first measurement is scheduled before the second measurement, the device may inhibit the first measurement from being performed at the scheduled time (e.g., by delaying the first measurement, by canceling and/or rescheduling any scheduled first measurements that occur before the second measurement, etc.). In some aspects, the device may prioritize second measurements associated with any cell associated with the second range of frequencies over all measurements associated with any cell associated with the first range of frequencies. For example, the device may cancel and/or reschedule any first measurement that occurs before all second measurements are scheduled to be performed.

[0130] At block 908, the device performs the second measurement prior to the first measurement based on the prioritization. The device may perform the second measurement at the scheduled time(s) using any suitable technique or combination of techniques, such as techniques described above in connection with block 804. The device may receive the synchronization signal using any suitable communication interface, such as a transceiver (e.g., transceiver 710).

[0131] FIG. 10 is a flow chart illustrating an exemplary process 1000 for determining whether to prioritize a second frequency range over a first frequency range in accordance with some aspects of the present disclosure. As described below, some or all illustrated features may be omitted in a particular implementation within the scope of the present disclosure, and some illustrated features may not be required for implementation of all embodiments. In some examples, the process 1000 may be carried out by the device 700 illustrated in FIG. 7. In some examples, the process 1000 may be carried out by any suitable apparatus or means for carrying out the functions or algorithm described below.

[0132] At block 1002, the device estimates one or more parameters indicative of expected performance associated with a first range of frequencies and/or a first RAT. In an aspect, the first range of frequencies is a new radio (NR) frequency range 1 (FR1). In an aspect, the first range of frequencies is associated with an eNB (e.g., an LTE cell).

[0133] Performance may be characterized based on different metrics, which may not be correlated. For example, a frequency range that provides relatively high throughput and/or a relatively high peak data rate may be less reliable than a frequency range that provides a relatively lower throughput and/or relatively low peak data rate. As another example, a frequency range that provides relatively high throughput and/or a relatively high peak data rate may be associated with higher power use than a frequency range that provides a relatively lower throughput and/or relatively low peak data rate. In some aspects of the present disclosure, the device may determine which parameter or parameters to use to prioritize a particular frequency range and/or RAT based on a current state of the device. For example, if the device is streaming video and/or uploading video, the device may use one or more parameters indicative of data rate and/or throughput to determine which frequency range to prioritize. As another example, if the device is power limited (e.g., if the device has relatively low battery power remaining, if the device is in a power conserving state, etc.), the device may use one or more parameters indicative of power use to determine which frequency range to prioritize. As yet another example, the device may use a parameter indicative of whether the device is moving to determine which frequency range to prioritize, as some frequency ranges and/or RATs may be less reliable when the device is moving.

[0134] The device may estimate one or more parameters indicative of expected performance associated with the first range of frequencies using any suitable technique or combination of techniques. In some aspects of the present disclosure, the one or more parameters estimated by the device may be any suitable value that the device may use to

determine an expected performance associated with a particular frequency range and/or RAT. For example, the device may estimate a potential throughput associated with a frequency range and/or a peak data rate associated with a frequency range. The device may use any suitable parameter, combination of parameters, and/or other suitable information to estimate the potential throughput and/or a peak data rate, such as band, bandwidth, bandwidth part bandwidth, an indication of whether carrier aggregation is supported, maximum number of layers supported, uplink/downlink configuration (e.g., for TDD), estimated data rate based on RSRP, synchronization signal (SS)-SINR, scheduling rate based on time of day, cell loading, historical data when utilizing another cell under similar conditions, and/or any other suitable parameter. In a particular example, the device may estimate throughput and/or peak data rate based on a band and/or a system bandwidth. For example, the device can determine that band N40 at 100 Mhz bandwidth is expected to have less throughput and/or lower peak data rates than band N257 at 400 Mhz bandwidth. As another example, the device may estimate a quality of a serving cell associated with a particular frequency range and/or RAT. The device may use any suitable parameter, combination of parameters, and/or other suitable information to estimate the quality of the serving cell, such as RSRP, RSRQ, signal to noise ratio (SNR), current throughput, etc. In a more particular example, the device may estimate one or more values associated with criterion S (e.g., as described in 3GPP technical specification 38.304), such as S_{rxlev} (e.g., based on RSRP) and/or S_{qual} (e.g., based on RSRQ). In such an example, the device may evaluate whether the serving cell is fulfilled (e.g., cell selection criterion S is fulfilled when $S_{rxlev} > 0$ AND $S_{qual} > 0$). As yet another example, the device may estimate a reliability of a link to a serving cell associated with a particular frequency range and/or RAT. The device may use any suitable parameter, combination of parameters, and/or other suitable information to estimate the reliability of the serving cell, such as radio link failure (RLF) rate, radio link monitoring (RLM) timer triggers, band, operating physical downlink shared channel block error ratio (BLER), residual BLER, cell size and deployment type (e.g., rural/urban), service cell channel state feedback (CSF) information (e.g., channel quality information (CQI), rank indication (RI), precoding matrix indicator (PMI)), etc. In a more particular example, the device may determine a current deployment scenario (e.g., rural, dense urban, etc.). In such an example, the device may determine that a link in FR2 is likely to be less reliable in a dense urban environment than in a rural environment. As another more particular example, the device may determine a current rate of mobility, which can be indicative of

channel coherence time. In such an example, the device may determine that link is less reliable at a higher mobility rate.

[0135] In some aspects of the present disclosure, in addition to, or in lieu of, estimating a parameter(s) indicative of expected performance, the device may use an explicit indication of which frequency range and/or RAT to prioritize based on one or more characteristics of the device. For example, if the device is being utilized to make a voice call (e.g., using voice over internet protocol (VOIP)), the device may prioritize a frequency range and/or RAT that provides more reliable VOIP performance (e.g., based on a lookup table).

[0136] As another example, the device may use historical data associated with a current geographic location and/or cell site location. In such an example, the device may estimate a current geographic location of the device (e.g., using a global positioning system (GPS) receiver (not shown), based on reference signals received, via transceiver 710, from transmitters (e.g., eNBs, gNBs) associated with known locations (e.g., using triangulation and/or multilateration techniques), etc.), and may determine which frequency range and/or RAT to prioritize based on stored information associated with the current geographic location that is indicative of performance of one or more frequency ranges and/or RATs. In such an example, the information associated with the current geographic location may be stored locally (e.g., based on previous measurements taken by the device), and/or remotely (e.g., based on previous measurements taken by the device and/or other devices).

[0137] In a particular example, the device may record measurements indicative of performance in connection with a geographic location of the device when the measurements were made (e.g., in memory 705). Additionally or alternatively, the device may record which frequency range and/or RAT was selected for prioritization at a particular geographic location, and any other suitable information, such as a performance indicator (e.g., throughput, reliability, etc.) was used to determine which frequency range and/or RAT to prioritize. The device may determine whether the current geographic location is associated with a stored measurement(s) and/or a recorded selected prioritization(s), and if so, may access the stored measurement(s) and/or recorded prioritization. In such an example, the device may provide the recorded measurements and/or selected prioritization to a remote system (e.g., a server). The server may be configured to aggregate measurements and/or selected prioritizations from many devices, and provide access to the aggregated measurements and/or selected prioritizations to

devices (e.g., the server may be configured to provide crowd-sourced information that the device may use to determine a prioritization based on the current geographic location). The server may be administered by (or on behalf of) a network operator. Alternatively, the server may be administered by a third party.

[0138] As yet another example, the device may estimate a current velocity and/or average velocity of the device (e.g., using an accelerometer (not shown), using a gyroscope (not shown), using a GPS receiver (not shown), using triangulation and/or multilateration techniques, etc.). If the device is moving relatively quickly (e.g., has an average velocity over a threshold), the device may prioritize a frequency range and/or RAT that is more reliable for moving devices (e.g., FR1 FDD over FR1 TDD, FR1 over FR2, etc.). The velocity threshold can be based on historical data and/or crowd sources data. For example, the device and/or other devices can determine times at which reliability is low (and/or high) for each type of link, an associated velocity, an associated location, etc. In such an example, the device can estimate a velocity at which reliability is unacceptably impacted, and use a value based on the estimate as a velocity threshold. Otherwise, if the device is relatively stationary (e.g., has an average velocity that does not exceed a threshold), the device may prioritize a frequency range and/or RAT that is expected to provide higher throughput, a higher peak data rate, lower latency, etc.

[0139] At block 1004, the device estimates one or more parameters indicative of expected performance associated with a second range of frequencies and/or a second RAT. In an aspect, the second range of frequencies is an NR frequency range 2 (FR2). In an aspect, the second range of frequencies is associated with a gNB (e.g., a NR cell). The device may estimate the one or more parameters indicative of expected performance associated with the second range of frequencies using any suitable technique or combination of techniques, such as techniques described above in connection with block 1002.

[0140] At block 1006, the device may determine whether the second frequency range and/or second RAT is expected to provide performance that is superior (e.g., based on activities currently being performed by the device). The device may determine whether the second frequency range and/or second RAT is expected to provide performance that is superior using any suitable technique or combination of techniques, such as techniques described above in connection with block 1002. For example, as described above in connection with block 1002, the device may compare a value of a parameter associated with the first range of frequencies with a parameter associated with the second range of frequencies, and determine that the second frequency range and/or second RAT is

expected to provide performance that is superior when a performance indicator associated with the second frequency range is better than the performance indicator associated with the second frequency. In a more particular example, if a performance indicator associated with the one or more parameters is related to data transmission (e.g., throughput, peak data rate, reliability etc.), the device may determine that the second frequency range and/or second RAT is expected to provide performance that is superior when the second range or frequencies and/or second RAT provides higher throughput, higher peak data rate, higher reliability, etc. As another more particular example, if a performance indicator associated with the one or more parameters is related to power use, the device may determine that the second frequency range and/or second RAT is expected to provide performance that is superior when the second range or frequencies and/or second RAT is expected to cause the device to use less power.

[0141] As another example, as described above in connection with block 1002, the device may compare a value of a parameter to a threshold (e.g., an average velocity threshold), to determine whether the second frequency range and/or second RAT is expected to provide performance that is superior when the device is moving at the average velocity indicated by the parameter. As yet another example, as described above in connection with block 1002, the device may receive an explicit indication that the second frequency range and/or second RAT is expected to provide superior performance (or vice versa). In such an example, block 1002 and/or block 1004 may be omitted, and the device may receive the explicit indication that is used at block 1006.

[0142] If the device determines that the second frequency range and/or second RAT is not expected to provide superior performance ("NO" at block 1006), at block 1008 the device may prioritize the first frequency range and/or first RAT over the second frequency range and/or second RAT. The device may use any suitable technique or combination of techniques to prioritize the first frequency range and/or first RAT over the second frequency range and/or second RAT, such as techniques described above in connection with FIGS. 5 and 6, in connection with block 806 of FIG. 8, and/or in connection with block 906 of FIG. 9. Alternatively, block 1008 may be omitted (e.g., the device may not explicitly prioritize the first frequency), and process 1000 may end.

[0143] If the device determines that the second frequency range and/or second RAT is expected to provide superior performance ("YES" at block 1006), at block 1010 the device may prioritize the second frequency range and/or second RAT over the first frequency range and/or first RAT. The device may use any suitable technique or

combination of techniques to prioritize the second frequency range and/or second RAT over the first frequency range and/or first RAT, such as techniques described above in connection with FIGS. 5 and 6, in connection with block 806 of FIG. 8, and/or in connection with block 906 of FIG. 9.

Further Aspects Having a Variety of Features:

- [0144] Aspect 1: A method of wireless communication, comprising: performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies; performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies; prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network; and reporting the second measurement to the network prior to the first measurement based on the prioritization.
- [0145] Aspect 2: The method of wireless communication of Aspect 1, further comprising receiving a serving cell reconfiguration from the network based on the reporting of the second measurement.
- [0146] Aspect 3: The method of wireless communication of any of Aspects claim 1 or 2, wherein the prioritizing comprises: determining whether a first time to trigger (TTT) for reporting the first measurement has expired; and if the first TTT has expired: determining that a second TTT for reporting the second measurement is running, terminating the second TTT, and adding a delay to the expired first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.
- [0147] Aspect 4: The method of wireless communication of Aspect 3, wherein if the first TTT has not expired, the prioritizing comprises: determining that the second TTT has expired; determining whether the first TTT is running; and if the first TTT is determined to be running, adding a delay to the running first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.
- [0148] Aspect 5: The method of wireless communication of any of Aspects 1 to 4, wherein the reporting of the first measurement is triggered based on the first measurement satisfying a first threshold and the reporting of the second measurement is triggered based on the second measurement satisfying a second threshold, wherein the prioritizing comprises: adjusting at least one of the first threshold or the second threshold to trigger the reporting of the second measurement before the reporting of the first measurement.

- [0149] Aspect 6: The method of wireless communication of any of Aspects 1 to 5, wherein the prioritizing comprises: delaying the reporting of the first measurement by a time delay D to allow the network to receive and process the second measurement and trigger serving cell reconfiguration.
- [0150] Aspect 7: The method of wireless communication of Aspect 6, wherein the time delay D is based on at least one of: network parameters including an infrastructure, a cell site location, and an operator; a reporting interval for the first measurement; a number of reports the network processes to add a serving cell; historical data in the cell site location; a public land mobile network (PLMN); a tracking area code (TAC); or crowd sourced information for a cell or operator.
- [0151] Aspect 8: The method of wireless communication of any of Aspects 1 to 7, further comprising: selecting the second range of frequencies for prioritization over the first range of frequencies based on at least one parameter.
- [0152] Aspect 9: The method of wireless communication of Aspect 8, wherein the at least one parameter comprises: a first parameter indicative of an expected performance associated with the first range of frequencies; and a second parameter indicative of an expected performance associated with the second range of frequencies.
- [0153] Aspect 10: The method of wireless communication of Aspect 9, further comprising: estimating the first parameter indicative of an expected performance associated with the first range of frequencies; estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and in response to determining that the second range of frequencies is expected to provide superior performance, selecting the second range of frequencies for prioritization.
- [0154] Aspect 11: The method of wireless communication of any of Aspects 9 or 10, wherein the first parameter comprises one or more of: a parameter indicative of expected throughput using the first range of frequencies; a parameter indicative of expected peak data rate using the first range of frequencies; a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or a parameter indicative of a reliability of a link established using the first range of frequencies.
- [0155] Aspect 12: The method of wireless communication of any of Aspects 8 to 11, wherein the at least one parameter comprises a current geographic location of the device,

and wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on historical data associated with the current geographic location.

[0156] Aspect 13: The method of wireless communication of any of Aspects 8 to 12, wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on the average velocity being below a threshold velocity.

[0157] Aspect 14: The method of wireless communication of any of Aspects 1 to 13, further comprising: scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies; scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies; prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and performing the second measurement prior to the first measurement based on the prioritization.

[0158] Aspect 15: A method of wireless communication, comprising: scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies; scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies; prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and performing the second measurement prior to the first measurement based on the prioritization.

[0159] Aspect 16: The method of wireless communication of any of Aspects 1 to 15, wherein the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2).

[0160] Aspect 17: The method of wireless communication of any of Aspects 1 to 15, wherein the first range of frequencies is associated with a first radio access technology (RAT), and the second range of frequencies is associated with a second RAT.

[0161] Aspect 18: The method of wireless communication of Aspect 17, wherein the first RAT is LTE, and the second RAT is an NR RAT.

[0162] Aspect 19: The method of wireless communication of any of Aspects 14 to 18, further comprising: selecting measurements of the second range of frequencies for prioritization over measurements of the first range of frequencies based on at least one parameter.

[0163] Aspect 20: The method of wireless communication of Aspect 19, wherein the at least one parameter comprises: a first parameter indicative of an expected performance associated with the first range of frequencies; and a second parameter indicative of an expected performance associated with the second range of frequencies.

[0164] Aspect 21: The method of wireless communication of Aspect 20, further comprising: estimating the first parameter indicative of an expected performance associated with the first range of frequencies; estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and in response to determining that the second range of frequencies is expected to provide superior performance, selecting measurement of the second range of frequencies for prioritization.

[0165] Aspect 22: The method of wireless communication of any of Aspects 20 or 21, wherein the first parameter comprises one or more of: a parameter indicative of expected throughput using the first range of frequencies; a parameter indicative of expected peak data rate using the first range of frequencies; a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or a parameter indicative of a reliability of a link established using the first range of frequencies.

[0166] Aspect 23: The method of wireless communication of any of Aspects 19 to 22, wherein the at least one parameter comprises a current geographic location of the device, and wherein the selecting measurement of the second range of frequencies for prioritization over measurement of the first range of frequencies is based on historical data associated with the current geographic location.

[0167] Aspect 24: The method of wireless communication of any of Aspects 19 to 23, wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and wherein the selecting measurement of the second range of frequencies for prioritization over measurement of the first range of frequencies is based on the average velocity being below a threshold velocity.

[0168] Aspect 25: A device for wireless communication, comprising: means for performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies; means for performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies; means for prioritizing reporting of the second measurement to a network over reporting of the first

measurement to the network; and means for reporting the second measurement to the network prior to the first measurement based on the prioritization.

[0169] Aspect 26: The device for wireless communication of Aspect 25, further comprising means for receiving a serving cell reconfiguration from the network based on the reporting of the second measurement.

[0170] Aspect 27: The device for wireless communication of any of Aspects 25 or 26, wherein the prioritizing comprises: means for determining whether a first time to trigger (TTT) for reporting the first measurement has expired; and if the first TTT has expired: determining that a second TTT for reporting the second measurement is running, terminating the second TTT, and adding a delay to the expired first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

[0171] Aspect 28: The device for wireless communication of Aspect 27, wherein if the first TTT has not expired, the prioritizing comprises: means for determining that the second TTT has expired; means determining whether the first TTT is running; and means for adding a delay to the running first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration if the first TTT is determined to be running,.

[0172] Aspect 29: The device for wireless communication of any of Aspects 25 to 28, wherein the reporting of the first measurement is triggered based on the first measurement satisfying a first threshold and the reporting of the second measurement is triggered based on the second measurement satisfying a second threshold, wherein the prioritizing comprises: means for adjusting at least one of the first threshold or the second threshold to trigger the reporting of the second measurement before the reporting of the first measurement.

[0173] Aspect 30: The device for wireless communication of any of Aspects 25 to 29, wherein the means for prioritizing comprises: means for delaying the reporting of the first measurement by a time delay D to allow the network to receive and process the second measurement and trigger serving cell reconfiguration.

[0174] Aspect 31: The device for wireless communication of Aspect 30, wherein the time delay D is based on at least one of: network parameters including an infrastructure, a cell site location, and an operator; a reporting interval for the first measurement; a number of reports the network processes to add a serving cell; historical data in the cell site location;

a public land mobile network (PLMN); a tracking area code (TAC); or crowd sourced information for a cell or operator.

[0175] Aspect 32: The device for wireless communication of any of Aspects 25 to 31, further comprising: means for selecting the second range of frequencies for prioritization over the first range of frequencies based on at least one parameter.

[0176] Aspect 33: The device for wireless communication of Aspect 32, wherein the at least one parameter comprises: a first parameter indicative of an expected performance associated with the first range of frequencies; and a second parameter indicative of an expected performance associated with the second range of frequencies.

[0177] Aspect 34: The device for wireless communication of Aspect 33, further comprising: means for estimating the first parameter indicative of an expected performance associated with the first range of frequencies; means for estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and means for determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and means for selecting the second range of frequencies for prioritization responsive to a determination that the second range of frequencies is expected to provide superior performance.

[0178] Aspect 35: The device for wireless communication of any of Aspects 33 or 34, wherein the first parameter comprises one or more of: a parameter indicative of expected throughput using the first range of frequencies; a parameter indicative of expected peak data rate using the first range of frequencies; a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or a parameter indicative of a reliability of a link established using the first range of frequencies.

[0179] Aspect 36: The device for wireless communication of any of Aspects 32 to 35, wherein the at least one parameter comprises a current geographic location of the device, and wherein the means for selecting the second range of frequencies for prioritization over the first range of frequencies selects the second range of frequencies for prioritization based on historical data associated with the current geographic location.

[0180] Aspect 37: The device for wireless communication of any of Aspects 32 to 36, wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and wherein the means for selecting the second range of frequencies for prioritization over the first range of frequencies selects the second range

of frequencies for prioritization based on the average velocity being below a threshold velocity.

[0181] Aspect 38: The device for wireless communication of any of Aspects 25 to 37, further comprising: means for scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies; means for scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies; means for prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and means for performing the second measurement prior to the first measurement based on the prioritization.

[0182] Aspect 39: A device for wireless communication, comprising: means for scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies; means for scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies; means for prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and means for performing the second measurement prior to the first measurement based on the prioritization.

[0183] Aspect 40: The device for wireless communication of any of Aspects 25 to 39, wherein the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2).

[0184] Aspect 41: The device for wireless communication of any of Aspects 25 to 39, wherein the first range of frequencies is associated with a first radio access technology (RAT), and the second range of frequencies is associated with a second RAT.

[0185] Aspect 42: The device for wireless communication of Aspect 41, wherein the first RAT is LTE, and the second RAT is an NR RAT.

[0186] Aspect 43: The device for wireless communication of any of Aspects 38 to 42, further comprising: means for selecting measurements of the second range of frequencies for prioritization over measurements of the first range of frequencies based on at least one parameter.

[0187] Aspect 44: The device for wireless communication of Aspect 43, wherein the at least one parameter comprises: a first parameter indicative of an expected performance associated with the first range of frequencies; and a second parameter indicative of an expected performance associated with the second range of frequencies.

[0188] Aspect 45: The device for wireless communication of Aspect 44, further comprising: means for estimating the first parameter indicative of an expected

performance associated with the first range of frequencies; means for estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and means for determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and means for selecting measurement of the second range of frequencies for prioritization responsive to a determination that the second range of frequencies is expected to provide superior performance.

[0189] Aspect 46: The device for wireless communication of any of Aspects 44 or 45, wherein the first parameter comprises one or more of: a parameter indicative of expected throughput using the first range of frequencies; a parameter indicative of expected peak data rate using the first range of frequencies; a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or a parameter indicative of a reliability of a link established using the first range of frequencies.

[0190] Aspect 47: The device for wireless communication of any of Aspects 43 to 46, wherein the at least one parameter comprises a current geographic location of the device, and wherein the means for selecting measurement of the second range of frequencies for prioritization over measurement of the first range of frequencies selects measurement of the second range of frequencies for prioritization based on historical data associated with the current geographic location.

[0191] Aspect 48: The device for wireless communication of any of Aspects 43 to 47, wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and wherein the selecting measurement of the second range of frequencies for prioritization over measurement of the first range of frequencies selects the second range measurement of frequencies for prioritization based on the average velocity being below a threshold velocity.

[0192] Aspect 49: An apparatus for wireless communication, comprising: a processor; and a memory communicatively coupled to the at least one processor, wherein the processor and memory are configured to: perform a method of any of Aspects 1 to 24.

[0193] Aspect 50: A non-transitory computer-readable medium storing computer-executable code, comprising code for causing a computer to cause a processor to: perform a method of any of Aspects 1 to 24.

[0194] Aspect 51: An apparatus for wireless communication, comprising: comprising: at least one means for carrying out a method of any of Aspects 1 to 24.

[0195] Several aspects of a wireless communication network have been presented with reference to an exemplary implementation. As those skilled in the art will readily appreciate, various aspects described throughout this disclosure may be extended to other telecommunication systems, network architectures and communication standards.

[0196] By way of example, various aspects may be implemented within other systems defined by 3GPP, such as Long-Term Evolution (LTE), the Evolved Packet System (EPS), the Universal Mobile Telecommunication System (UMTS), and/or the Global System for Mobile (GSM). Various aspects may also be extended to systems defined by the 3rd Generation Partnership Project 2 (3GPP2), such as CDMA2000 and/or Evolution-Data Optimized (EV-DO). Other examples may be implemented within systems employing IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Ultra-Wideband (UWB), Bluetooth, and/or other suitable systems. The actual telecommunication standard, network architecture, and/or communication standard employed will depend on the specific application and the overall design constraints imposed on the system.

[0197] Within the present disclosure, the word “exemplary” is used to mean “serving as an example, instance, or illustration.” Any implementation or aspect described herein as “exemplary” is not necessarily to be construed as preferred or advantageous over other aspects of the disclosure. Likewise, the term “aspects” does not require that all aspects of the disclosure include the discussed feature, advantage or mode of operation. The term “coupled” is used herein to refer to the direct or indirect coupling between two objects. For example, if object A physically touches object B, and object B touches object C, then objects A and C may still be considered coupled to one another—even if they do not directly physically touch each other. For instance, a first object may be coupled to a second object even though the first object is never directly physically in contact with the second object. The terms “circuit” and “circuitry” are used broadly, and intended to include both hardware implementations of electrical devices and conductors that, when connected and configured, enable the performance of the functions described in the present disclosure, without limitation as to the type of electronic circuits, as well as software implementations of information and instructions that, when executed by a processor, enable the performance of the functions described in the present disclosure.

[0198] One or more of the components, steps, features and/or functions illustrated in FIGs. 1–10 may be rearranged and/or combined into a single component, step, feature or function or embodied in several components, steps, or functions. Additional elements, components, steps, and/or functions may also be added without departing from novel

features disclosed herein. The apparatus, devices, and/or components illustrated in FIGs. 1–10 may be configured to perform one or more of the methods, features, or steps described herein. The novel algorithms described herein may also be efficiently implemented in software and/or embedded in hardware.

[0199] It is to be understood that the specific order or hierarchy of steps in the methods disclosed is an illustration of exemplary processes. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the methods may be rearranged. The accompanying method claims present elements of the various steps in a sample order, and are not meant to be limited to the specific order or hierarchy presented unless specifically recited therein.

[0200] The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean “one and only one” unless specifically so stated, but rather “one or more.” Unless specifically stated otherwise, the term “some” refers to one or more. 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 and b; a and c; b and c; and a, b and c. All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be construed under the provisions of 35 U.S.C. §112(f) unless the element is expressly recited using the phrase “means for” or, in the case of a method claim, the element is recited using the phrase “step for.”

CLAIMS

What is claimed is:

1. A method of prioritizing neighbor cell measurement reporting at a device, comprising:

performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network; and

reporting the second measurement to the network prior to the first measurement based on the prioritization.

2. The method of claim 1, further comprising receiving a serving cell reconfiguration from the network based on the reporting of the second measurement.

3. The method of claim 1, wherein the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2).

4. The method of claim 1, wherein the first range of frequencies is associated with a first radio access technology (RAT), and the second range of frequencies is associated with a second RAT.

5. The method of claim 4, wherein the first RAT is LTE, and the second RAT is an NR RAT.

6. The method of claim 1, wherein the prioritizing comprises:
determining whether a first time to trigger (TTT) for reporting the first measurement has expired; and
if the first TTT has expired:
determining that a second TTT for reporting the second measurement is running,
terminating the second TTT, and
adding a delay to the expired first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

7. The method of claim 6, wherein if the first TTT has not expired, the prioritizing comprises:
determining that the second TTT has expired;
determining whether the first TTT is running; and
if the first TTT is determined to be running, adding a delay to the running first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

8. The method of claim 1, wherein the reporting of the first measurement is triggered based on the first measurement satisfying a first threshold and the reporting of the second measurement is triggered based on the second measurement satisfying a second threshold, wherein the prioritizing comprises:

adjusting at least one of the first threshold or the second threshold to trigger the reporting of the second measurement before the reporting of the first measurement.

9. The method of claim 1, wherein the prioritizing comprises:
delaying the reporting of the first measurement by a time delay D to allow the network to receive and process the second measurement and trigger serving cell reconfiguration.

10. The method of claim 9, wherein the time delay D is based on at least one of:

network parameters including an infrastructure, a cell site location, and an operator;

a reporting interval for the first measurement;

a number of reports the network processes to add a serving cell;

historical data in the cell site location;

a public land mobile network (PLMN);

a tracking area code (TAC); or

crowd sourced information for a cell or operator.

11. The method of claim 1, further comprising:

selecting the second range of frequencies for prioritization over the first range of frequencies based on at least one parameter.

12. The method of claim 11, wherein the at least one parameter comprises:

a first parameter indicative of an expected performance associated with the first range of frequencies; and

a second parameter indicative of an expected performance associated with the second range of frequencies.

13. The method of claim 12, further comprising:

estimating the first parameter indicative of an expected performance associated with the first range of frequencies;

estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and

determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and

in response to determining that the second range of frequencies is expected to provide superior performance, selecting the second range of frequencies for prioritization.

14. The method of claim 12, wherein the first parameter comprises one or more of:

a parameter indicative of expected throughput using the first range of frequencies;

a parameter indicative of expected peak data rate using the first range of frequencies;

a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or

a parameter indicative of a reliability of a link established using the first range of frequencies.

15. The method of claim 11,

wherein the at least one parameter comprises a current geographic location of the device, and

wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on historical data associated with the current geographic location.

16. The method of claim 11,

wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and

wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on the average velocity being below a threshold velocity.

17. A device for prioritizing neighbor cell measurement reporting, comprising:

at least one processor;

a transceiver communicatively coupled to the at least one processor; and

a memory communicatively coupled to the at least one processor, wherein the at least one processor is configured to:

perform a first measurement of at least one synchronization signal transmitted on a first range of frequencies,

perform a second measurement of at least one synchronization signal transmitted on a second range of frequencies,

prioritize reporting of the second measurement to a network over reporting of the first measurement to the network, and

report the second measurement to the network prior to the first measurement based on the prioritization.

18. The device of claim 17, wherein the at least one processor is further configured to receive a serving cell reconfiguration from the network based on the reporting of the second measurement.

19. The device of claim 17, wherein the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2).

20. The device of claim 17, wherein the first range of frequencies is associated with a first radio access technology (RAT), and the second range of frequencies is associated with a second RAT.

21. The device of claim 20, wherein the first RAT is LTE, and the second RAT is an NR RAT.

22. The device of claim 17, wherein the at least one processor configured to prioritize is configured to:

determine whether a first time to trigger (TTT) for reporting the first measurement has expired; and

if the first TTT has expired:

determine that a second TTT for reporting the second measurement is running,

terminate the second TTT, and

add a delay to the expired first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

23. The device of claim 22, wherein if the first TTT has not expired, the at least one processor configured to prioritize is configured to:

determine that the second TTT has expired;

determine whether the first TTT is running; and

if the first TTT is determined to be running, add a delay to the running first TTT to continue running the first TTT past a time for the network to receive and process the second measurement and trigger serving cell reconfiguration.

24. The device of claim 17, wherein the reporting of the first measurement is triggered based on the first measurement satisfying a first threshold and the reporting of the second measurement is triggered based on the second measurement satisfying a second threshold, wherein the at least one processor configured to prioritize is configured to:

adjust at least one of the first threshold or the second threshold to trigger the reporting of the second measurement before the reporting of the first measurement.

25. The device of claim 17, wherein the at least one processor configured to prioritize is configured to:

delay the reporting of the first measurement by a time delay D to allow the network to receive and process the second measurement and trigger serving cell reconfiguration.

26. The device of claim 25, wherein the time delay D is based on at least one of:

network parameters including an infrastructure, a cell site location, and an operator;

a reporting interval for the first measurement;

a number of reports the network processes to add a serving cell;

historical data in the cell site location;

a public land mobile network (PLMN);

a tracking area code (TAC); or

crowd sourced information for a cell or operator.

27. The device of claim 17, wherein the at least one processor is further configured to select the second range of frequencies for prioritization over the first range of frequencies based on at least one parameter.

28. The device of claim 27, wherein the at least one parameter comprises:
a first parameter indicative of an expected performance associated with the first range of frequencies; and
a second parameter indicative of an expected performance associated with the second range of frequencies.

29. The device of claim 28, wherein the at least one processor is further configured to:

estimate the first parameter indicative of an expected performance associated with the first range of frequencies;

estimate the second parameter indicative of an expected performance associated with the second range of frequencies; and

determine which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and

in response to determining that the second range of frequencies is expected to provide superior performance, select the second range of frequencies for prioritization.

30. The device of claim 28, wherein the first parameter comprises one or more of:

a parameter indicative of expected throughput using the first range of frequencies;

a parameter indicative of expected peak data rate using the first range of frequencies;

a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or

a parameter indicative of a reliability of a link established using the first range of frequencies.

31. The device of claim 27,

wherein the at least one parameter comprises a current geographic location of the device, and

wherein the at least one processor is configured to select the second range of frequencies for prioritization over the first range of frequencies selects the second range of frequencies for prioritization based on historical data associated with the current geographic location.

32. The device of claim 27,

wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and

wherein the at least one processor is configured to select the second range of frequencies for prioritization over the first range of frequencies selects the second range of frequencies for prioritization based on the average velocity being below a threshold velocity.

33. A device for prioritizing neighbor cell measurement reporting, comprising:

means for performing a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

means for performing a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

means for prioritizing reporting of the second measurement to a network over reporting of the first measurement to the network; and

means for reporting the second measurement to the network prior to the first measurement based on the prioritization.

34. A non-transitory computer-readable medium storing computer-executable code at a device for prioritizing neighbor cell measurement reporting, comprising code for causing a computer to:

perform a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

perform a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

prioritize reporting of the second measurement to a network over reporting of the first measurement to the network; and

report the second measurement to the network prior to the first measurement based on the prioritization.

35. A method of prioritizing neighbor cell measurement scheduling at a device, comprising:

scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and

performing the second measurement prior to the first measurement based on the prioritization.

36. The method of claim 35, wherein the first range of frequencies is a new radio (NR) frequency range 1 (FR1) and the second range of frequencies is a NR frequency range 2 (FR2).

37. The method of claim 35, wherein the first range of frequencies is associated with a first radio access technology (RAT), and the second range of frequencies is associated with a second RAT.

38. The method of claim 37, wherein the first RAT is LTE, and the second RAT is an NR RAT.

39. The method of claim 35, further comprising:

selecting the second range of frequencies for prioritization over the first range of frequencies based on at least one parameter.

40. The method of claim 39, wherein the at least one parameter comprises:
a first parameter indicative of an expected performance associated with the first range of frequencies; and
a second parameter indicative of an expected performance associated with the second range of frequencies.

41. The method of claim 40, further comprising:
estimating the first parameter indicative of an expected performance associated with the first range of frequencies;
estimating the second parameter indicative of an expected performance associated with the second range of frequencies; and
determining which of the first range of frequencies and the second range of frequencies is expected to provide superior performance based on the first parameter and the second parameter; and
in response to determining that the second range of frequencies is expected to provide superior performance, selecting the second range of frequencies for prioritization.

42. The method of claim 40, wherein the first parameter comprises one or more of:
a parameter indicative of expected throughput using the first range of frequencies;
a parameter indicative of expected peak data rate using the first range of frequencies;
a parameter indicative of service cell quality of a cell associated with the first range of frequencies; or
a parameter indicative of a reliability of a link established using the first range of frequencies.

43. The method of claim 39,
wherein the at least one parameter comprises a current geographic location of the device, and
wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on historical data associated with the current geographic location.

44. The method of claim 39,

wherein the at least one parameter comprises an average velocity of the device over a predetermined period of time; and

wherein the selecting the second range of frequencies for prioritization over the first range of frequencies is based on the average velocity being below a threshold velocity.

45. A device for prioritizing neighbor cell measurement scheduling, comprising:

at least one processor;

a transceiver communicatively coupled to the at least one processor; and

a memory communicatively coupled to the at least one processor, wherein the at least one processor is configured to:

schedule a first measurement of at least one synchronization signal transmitted on a first range of frequencies,

schedule a second measurement of at least one synchronization signal transmitted on a second range of frequencies,

prioritize the scheduling of the second measurement over the scheduling of the first measurement, and

perform the second measurement prior to the first measurement based on the prioritization.

46. A device for prioritizing neighbor cell measurement scheduling, comprising:

means for scheduling a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

means for scheduling a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

means for prioritizing the scheduling of the second measurement over the scheduling of the first measurement; and

means for performing the second measurement prior to the first measurement based on the prioritization.

47. A non-transitory computer-readable medium storing computer-executable code at a device for prioritizing neighbor cell measurement scheduling, comprising code for causing a computer to:

- schedule a first measurement of at least one synchronization signal transmitted on a first range of frequencies;

- schedule a second measurement of at least one synchronization signal transmitted on a second range of frequencies;

- prioritize the scheduling of the second measurement over the scheduling of the first measurement; and

- perform the second measurement prior to the first measurement based on the prioritization.

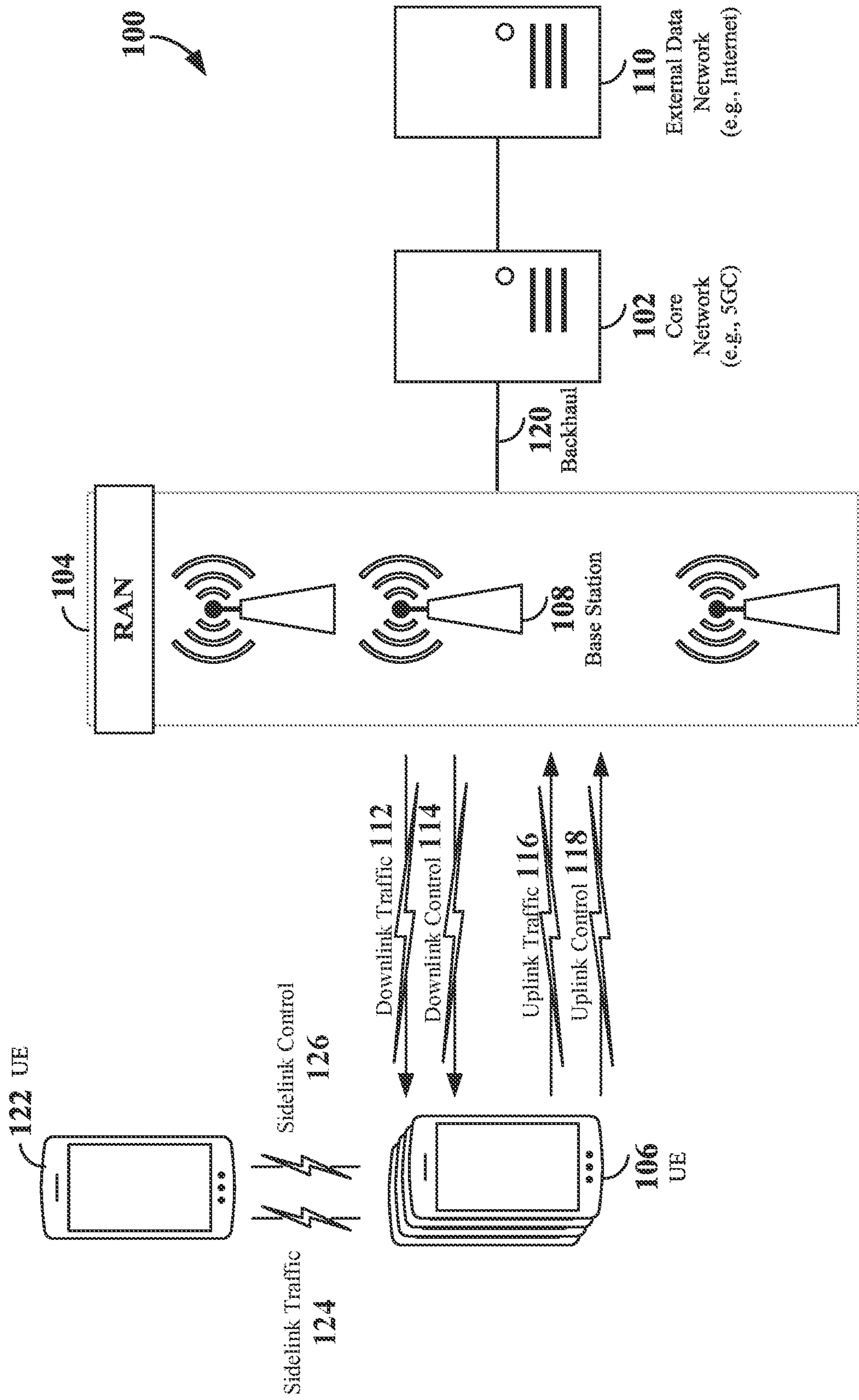


FIG. 1

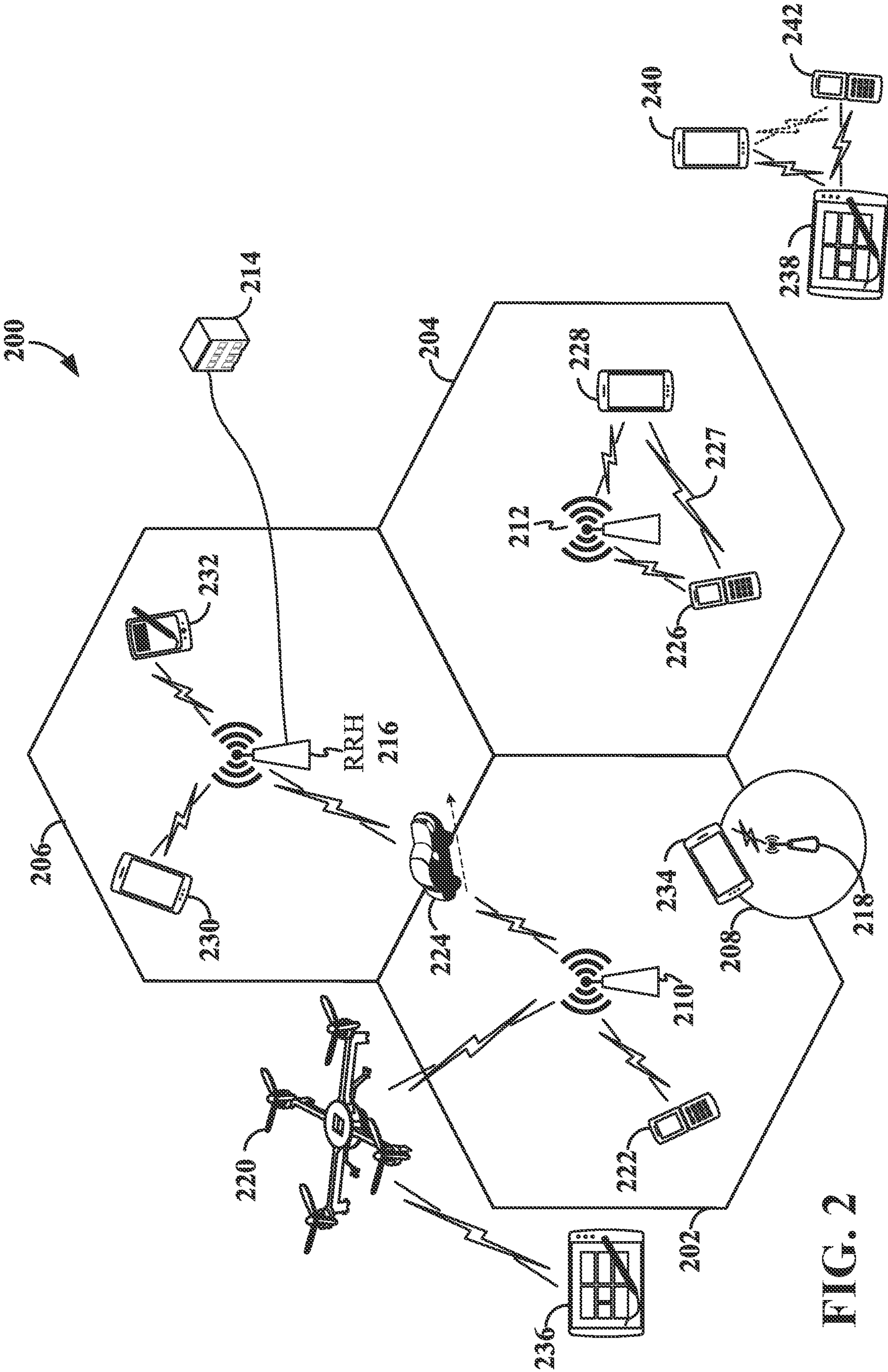


FIG. 2

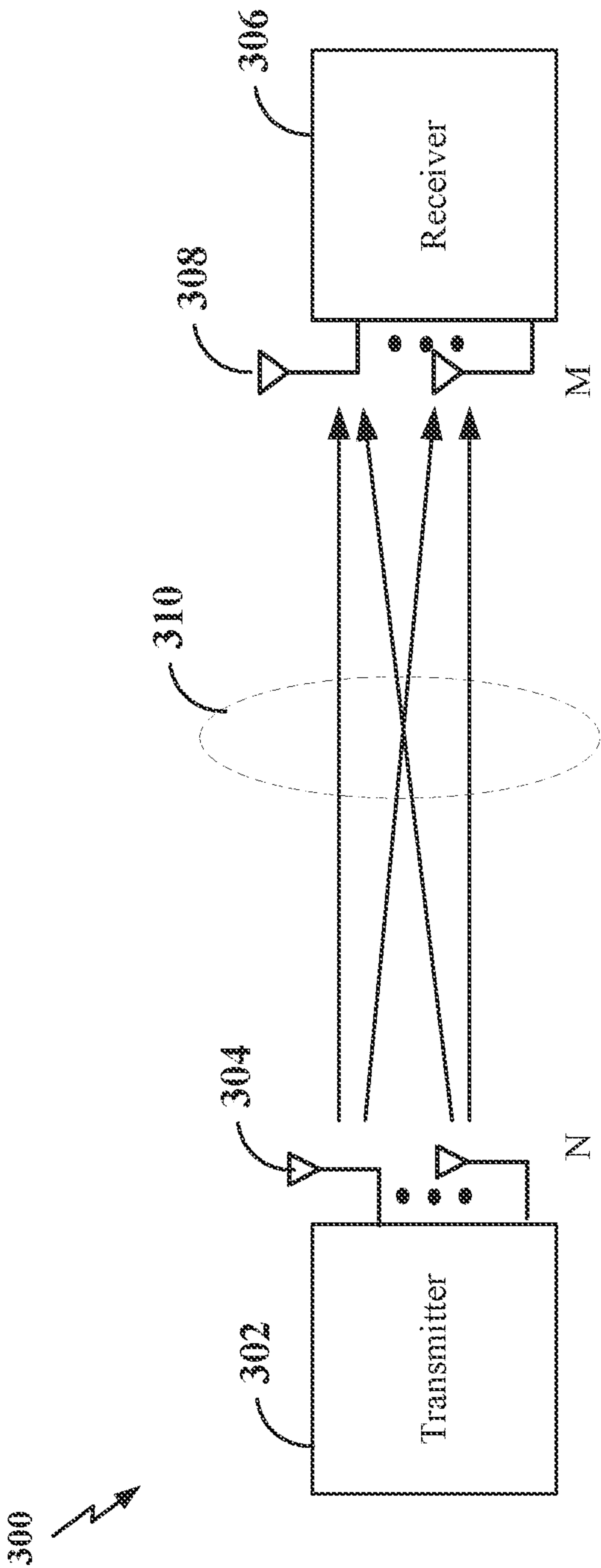


FIG. 3

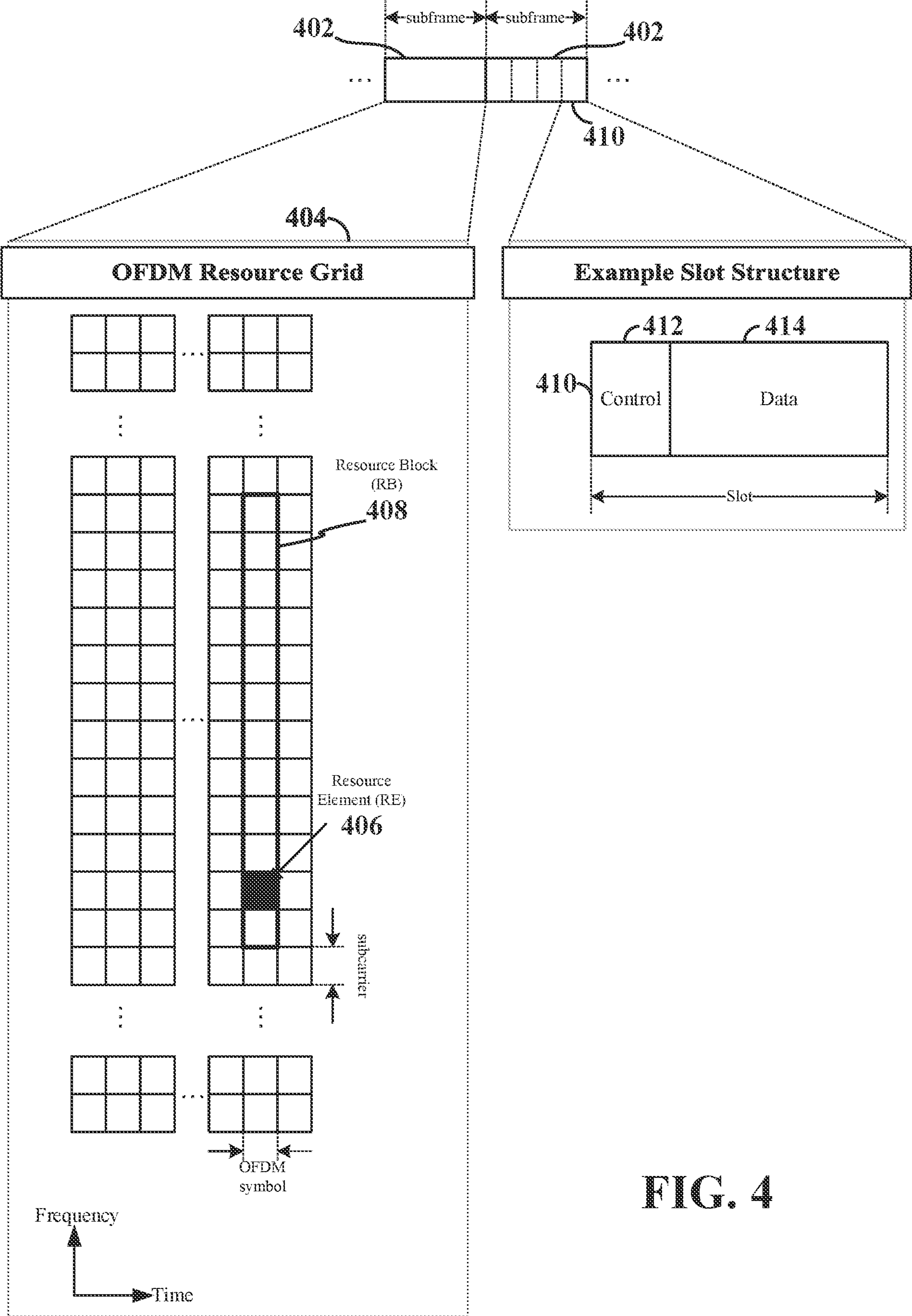


FIG. 4

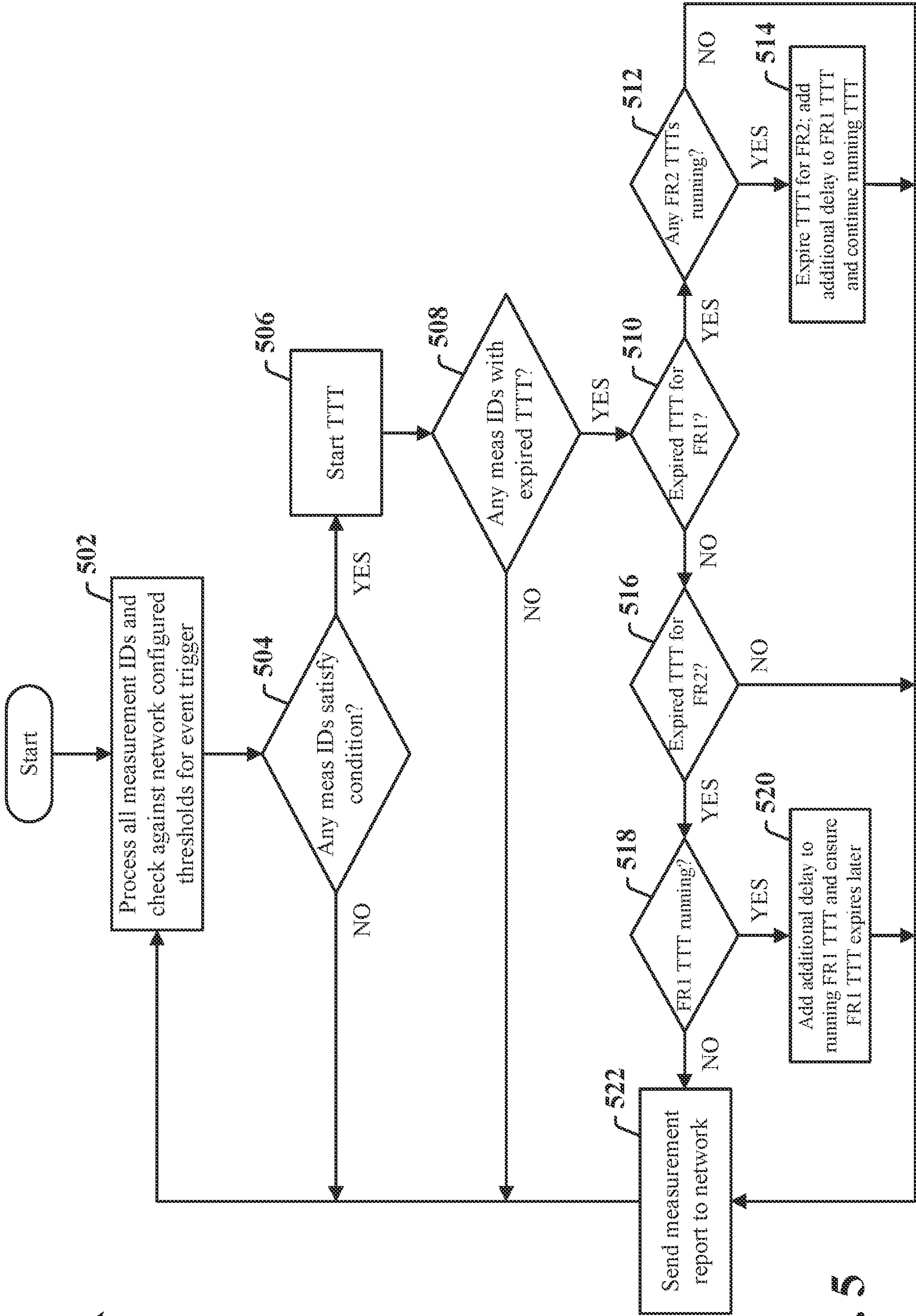


FIG. 5

600

B1/B2 Event Reporting

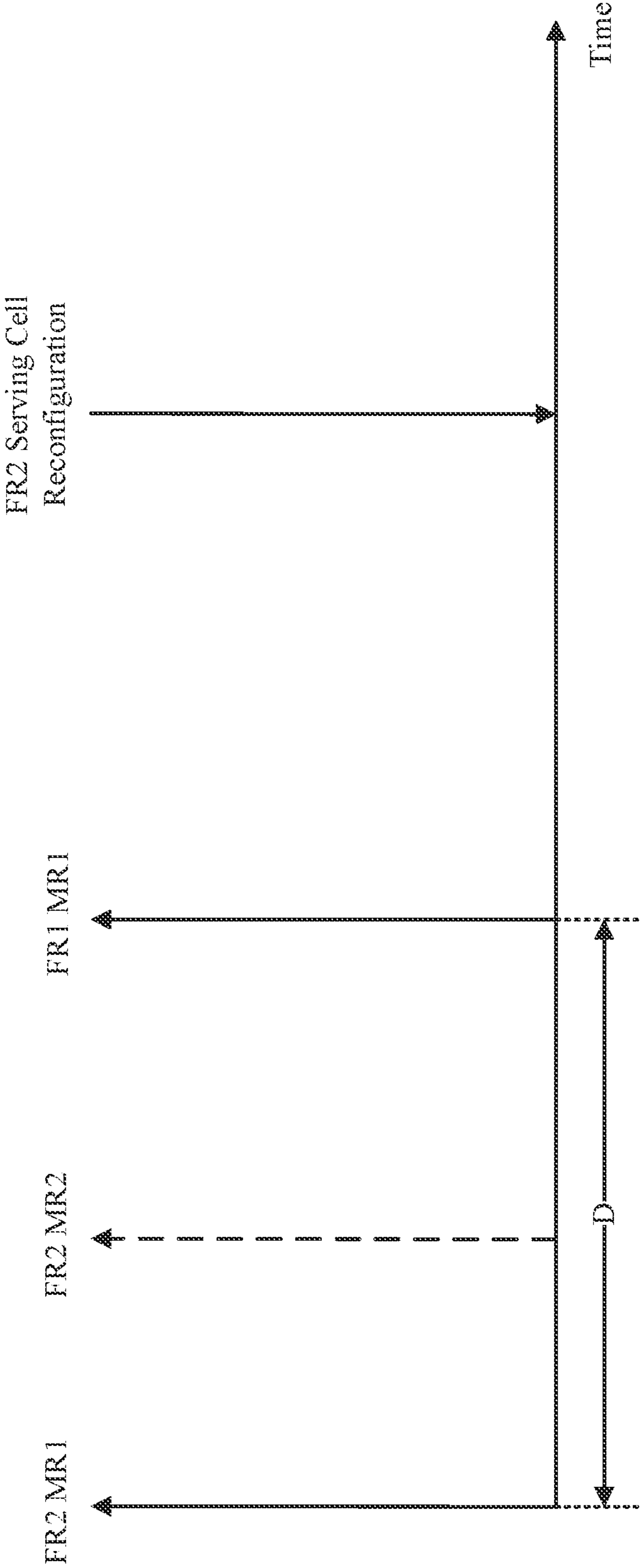


FIG. 6

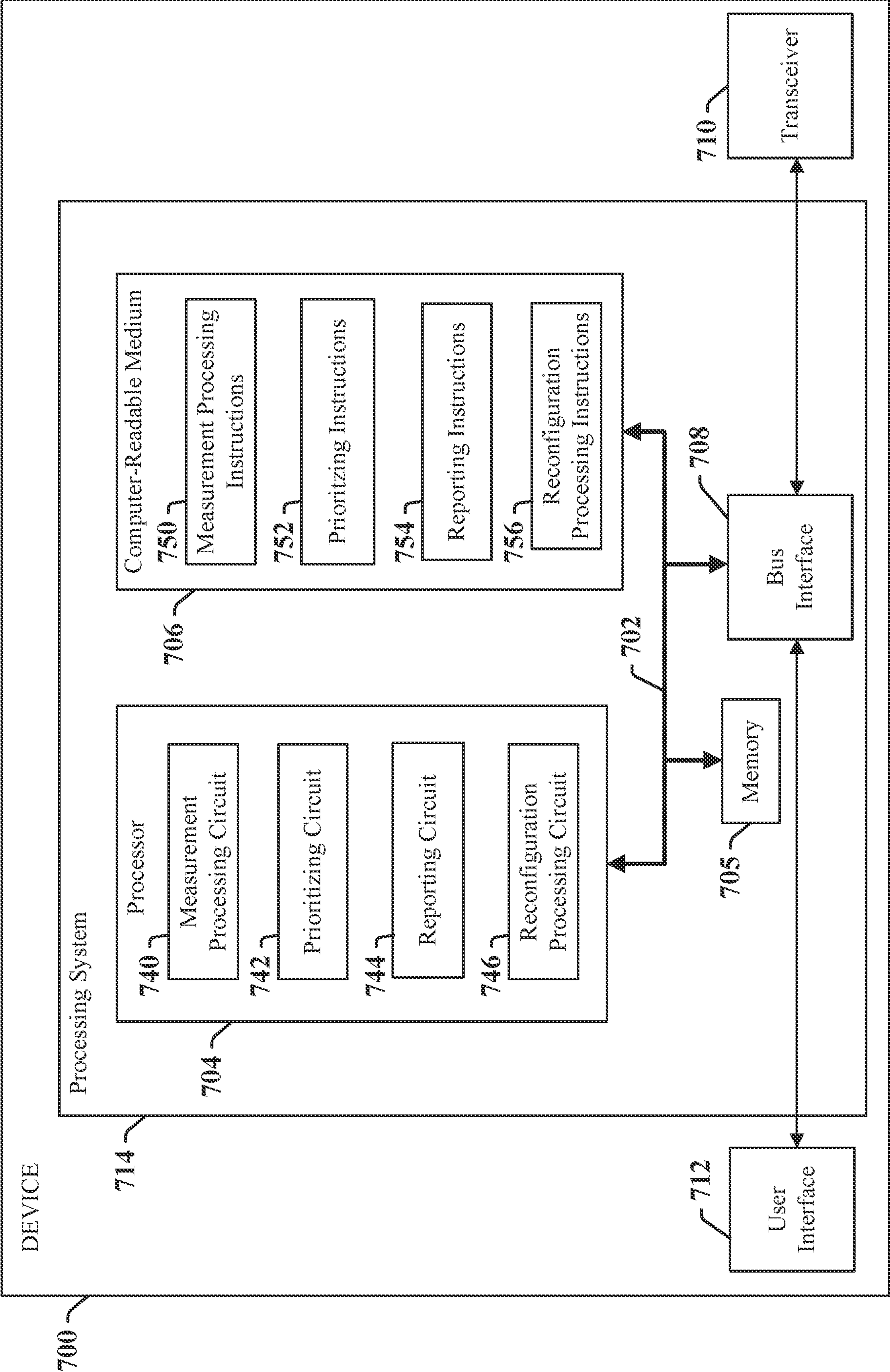
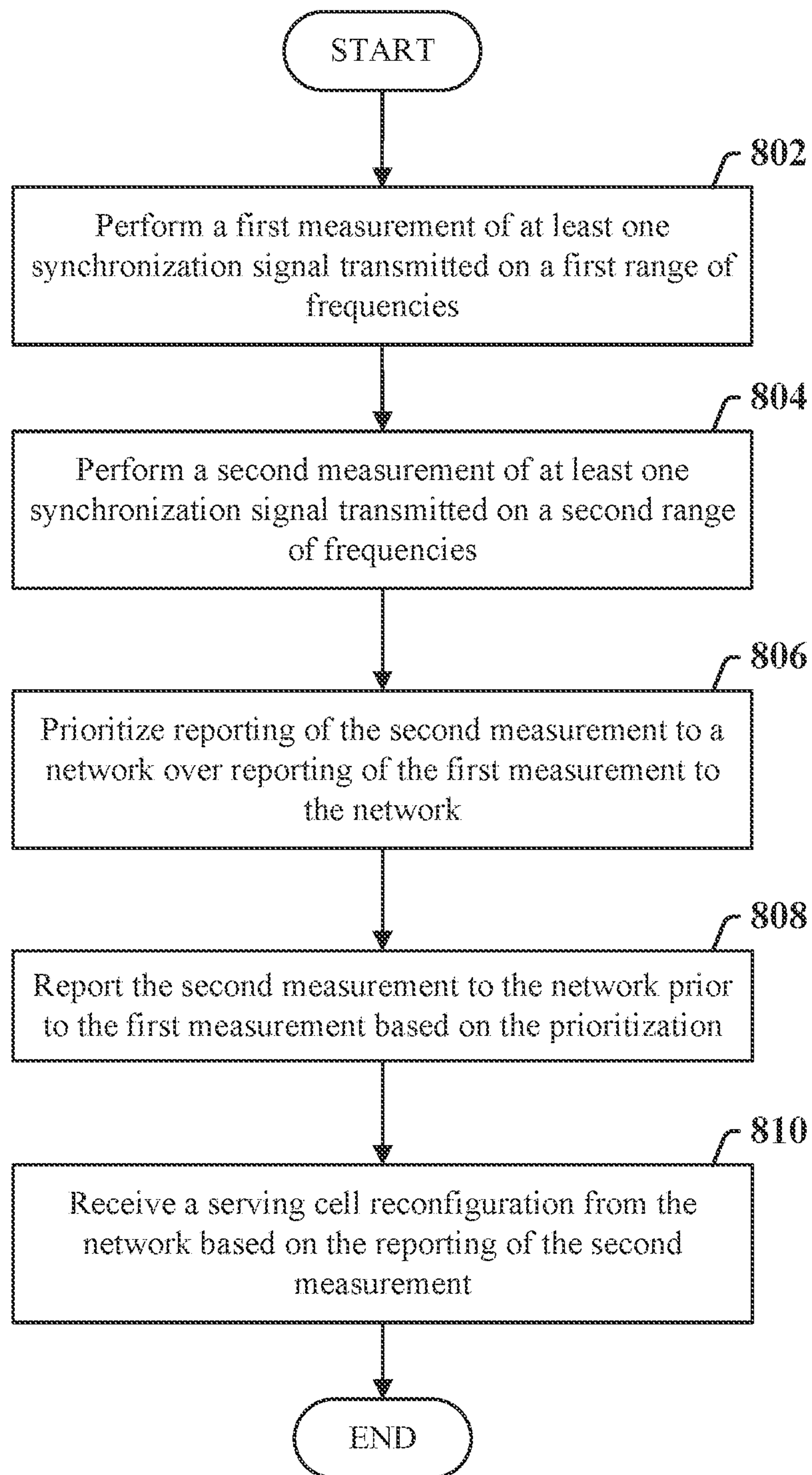


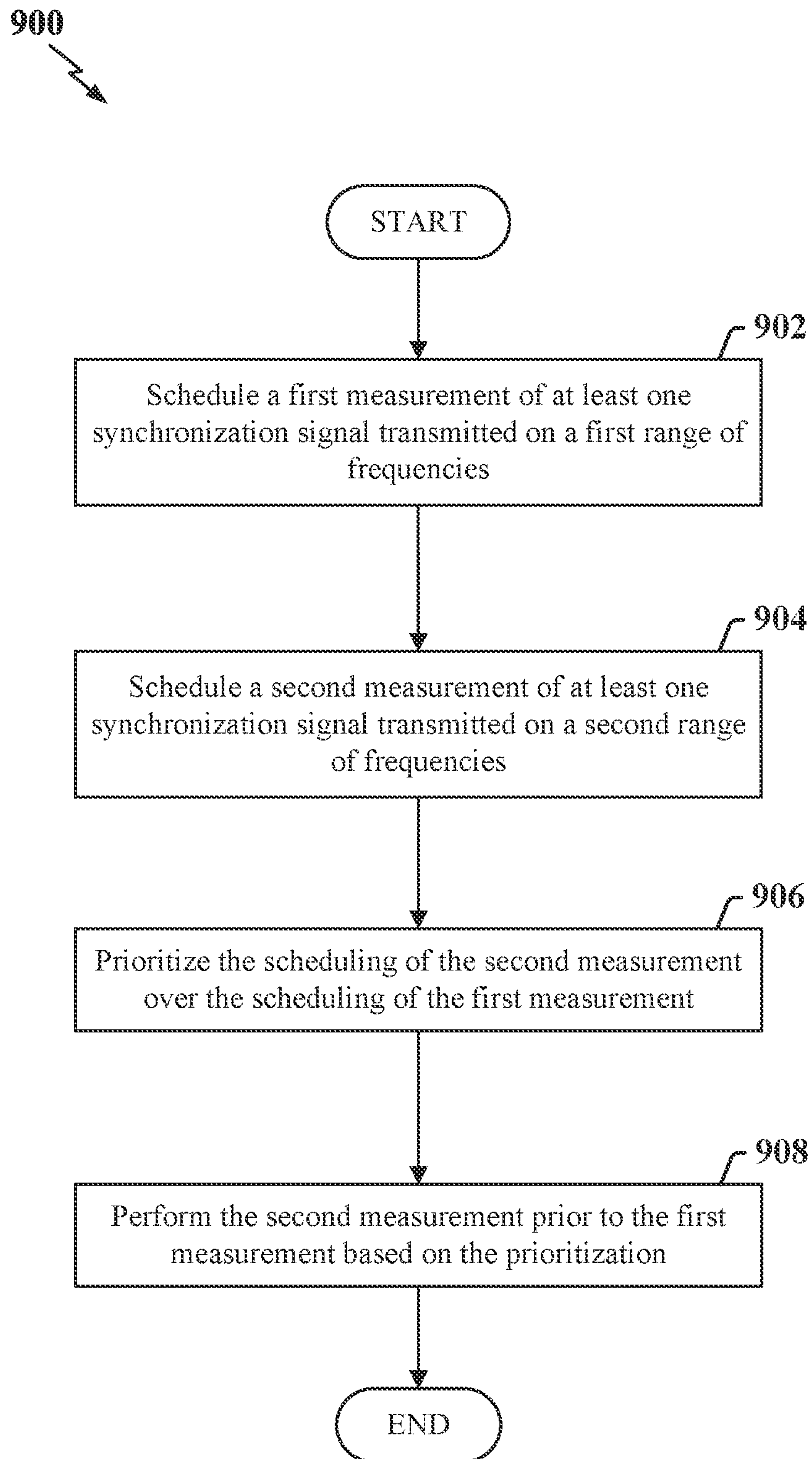
FIG. 7

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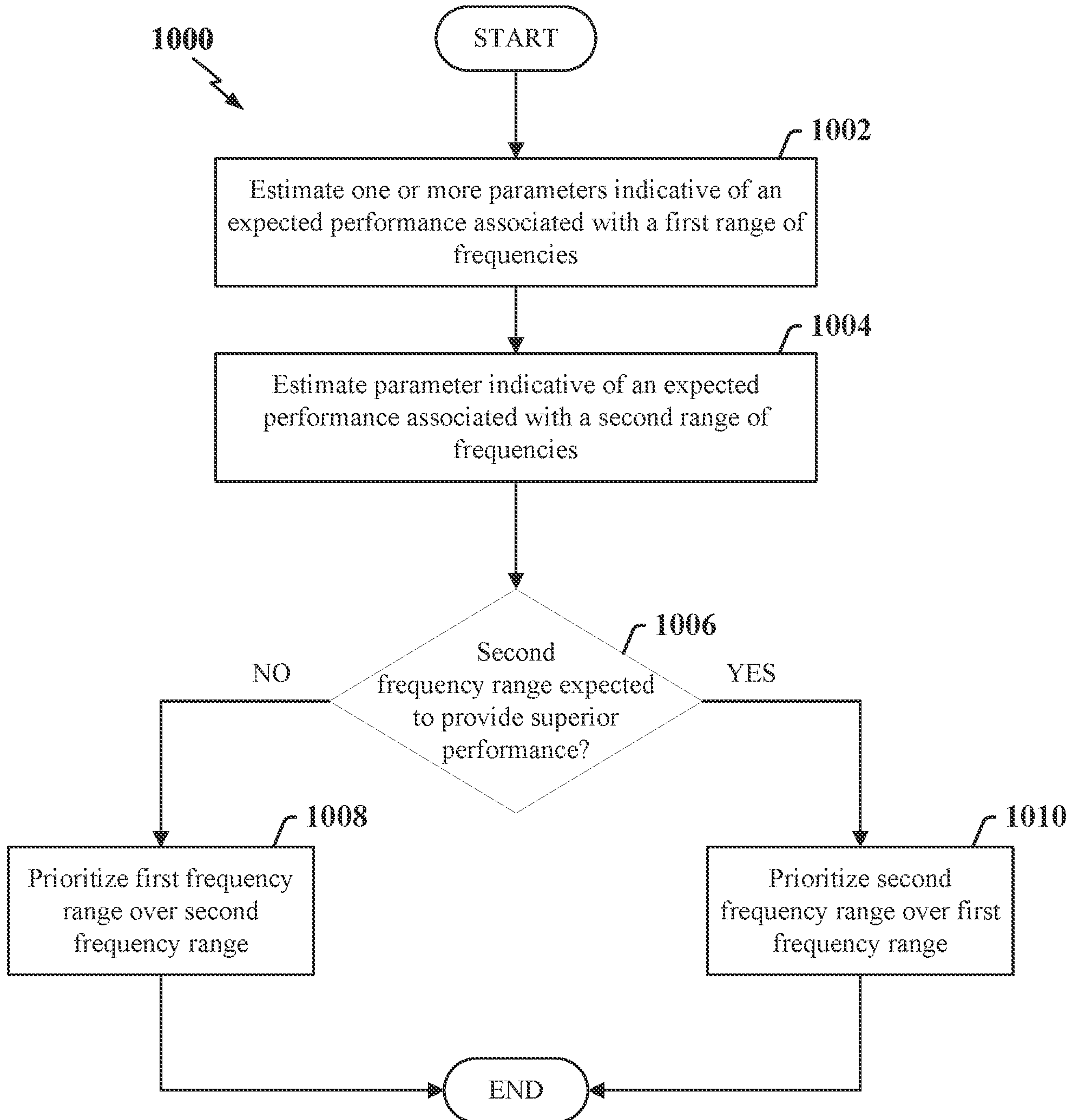
800

**FIG. 8**

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**FIG. 9**

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**FIG. 10**