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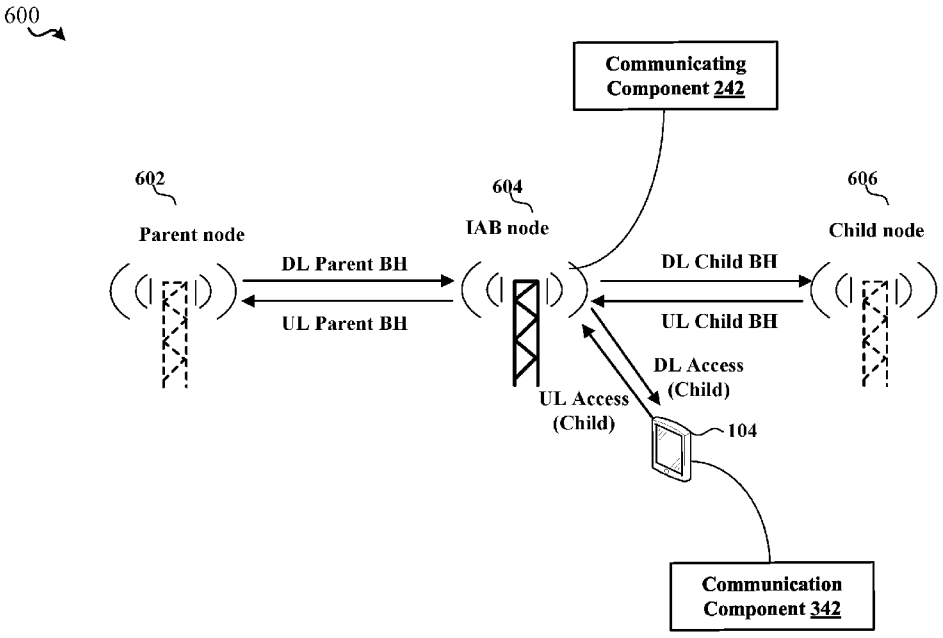

FIG. 6

(57) Abstract: Aspects described herein relate to bi-direction preemption indication transmissions. In one example, a node such as an integrated access and backhaul (IAB) node may determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission, and transmit, to a user equipment (UE), the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission. In another example, a UE may receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission, and perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

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TECHNIQUES FOR BI-DIRECTION PREEMPTION INDICATION TRANSMISSIONS

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 62/900,370, entitled "TECHNIQUES FOR BI-DIRECTION PREEMPTION INDICATION TRANSMISSIONS" and filed on September 13, 2019, and U.S. Patent Application No. 16/998,775, entitled "TECHNIQUES FOR BI-DIRECTION PREEMPTION INDICATION TRANSMISSIONS" and filed on August 20, 2020, which are expressly incorporated by reference herein in their entirety.

BACKGROUND

[0002] Aspects of the present disclosure relate generally to wireless communication systems, and more particularly, to bi-direction preemption indication transmissions.

[0003] Wireless communication systems are widely deployed to provide various types of communication content such as voice, video, packet data, messaging, broadcast, and so on. These systems may be multiple-access systems capable of supporting communication with multiple users by sharing the available system resources (e.g., time, frequency, and power). Examples of such multiple-access systems include code-division multiple access (CDMA) systems, time-division multiple access (TDMA) systems, frequency-division multiple access (FDMA) systems, and orthogonal frequency-division multiple access (OFDMA) systems, and single-carrier frequency division multiple access (SC-FDMA) systems.

[0004] These multiple access technologies have been adopted in various telecommunication standards to provide a common protocol that enables different wireless devices to communicate on a municipal, national, regional, and even global level. For example, a fifth generation (5G) wireless communications technology (which can be referred to as NR) is envisaged to expand and support diverse usage scenarios and applications with respect to current mobile network generations. In an aspect, 5G communications technology can include: enhanced mobile broadband addressing human-centric use cases for access to multimedia content, services and data; ultra-reliable-low latency communications (URLLC) with certain specifications for latency and reliability; and massive machine type communications, which can allow a very large number of

connected devices and transmission of a relatively low volume of non-delay-sensitive information.

[0005] For example, for various communications technology such as, but not limited to NR, full duplex communication with respect to integrated access and backhaul (IAB) implementations may increase transmission speed and flexibility but also transmission complexity. Thus, improvements in wireless communication operations may be desired.

SUMMARY

[0006] The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated aspects, and is intended to neither identify key or critical elements of all aspects nor delineate the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

[0007] According to an example, a method of wireless communication at a user equipment (UE) is provided. The method may include receiving a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The method may further include performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0008] In a further aspect, the present disclosure includes an apparatus for wireless communication including a memory and at least one processor coupled to the memory. The at least one processor may be configured to receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The at least one processor may be configured to perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0009] In an additional aspect, the present disclosure includes an apparatus for wireless communication including means for receiving a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The apparatus may further include means for

performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0010] In yet another aspect, the present disclosure includes a non-transitory computer-readable medium storing computer executable code, the code when executed by a processor cause the processor to receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission, and perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0011] According to another example, a method of wireless communication at a node is provided. The method may include determining that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The method further include transmitting, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0012] In a further aspect, the present disclosure includes an apparatus for wireless communication including a memory and at least one processor coupled to the memory. The at least one processor may be configured to determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The at least one processor may be configured to transmit, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0013] In an additional aspect, the present disclosure includes an apparatus for wireless communication including means for determining that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The apparatus further includes means for transmitting, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0014] In yet another aspect, the present disclosure includes a non-transitory computer-readable medium storing computer executable code, the code when executed by a processor cause the processor to determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission, and

transmit, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0015] To the accomplishment of the foregoing and related ends, the one or more aspects comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative features of the one or more aspects. These features are indicative, however, of but a few of the various ways in which the principles of various aspects may be employed, and this description is intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The disclosed aspects will hereinafter be described in conjunction with the appended drawings, provided to illustrate and not to limit the disclosed aspects, wherein like designations denote like elements, and in which:

[0017] FIG. 1 illustrates an example of a wireless communication system, in accordance with various aspects of the present disclosure;

[0018] FIG. 2 is a block diagram illustrating an example of a network entity (also referred to as a base station), in accordance with various aspects of the present disclosure;

[0019] FIG. 3 is a block diagram illustrating an example of a user equipment (UE), in accordance with various aspects of the present disclosure;

[0020] FIG. 4 is a diagram of an example integrated access and backhaul (IAB) system, in accordance with various aspects of the present disclosure;

[0021] FIG. 5 is a flow chart illustrating an example of a method for wireless communications at a UE, in accordance with various aspects of the present disclosure;

[0022] FIG. 6 is a flow chart illustrating an example of a method for wireless communications at a node such as an IAB node in accordance with various aspects of the present disclosure;

[0023] FIG. 7 is a block diagram illustrating an example of a MIMO communication system including a base station and a UE, in accordance with various aspects of the present disclosure.

DETAILED DESCRIPTION

[0024] Various aspects are now described with reference to the drawings. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more aspects. It may be evident, however, that such aspect(s) may be practiced without these specific details.

[0025] The described features generally relate to bi-direction preemption indication transmissions in an integrated access and backhaul (IAB) system where one or more nodes employ full-duplex communication. Specifically, base stations may include a backhaul interface for communication with a backhaul portion of the network. The backhaul may provide a link between a base station and a core network, and in some examples, the backhaul may provide interconnection between the respective base stations. The core network is a part of a wireless communication system that is generally independent of the radio access technology used in the radio access network.

[0026] 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. Some base stations may be configured as IAB nodes, where the wireless spectrum may be used both for access links (i.e., wireless links with user equipments (UEs)), and for backhaul links, which may be referred to as wireless self-backhauling. By using wireless self-backhauling, rather than requiring each new base station deployment to be outfitted with its own hard-wired backhaul connection, the wireless spectrum utilized for communication between the base station and UE may be leveraged for backhaul communication, enabling fast and easy deployment of highly dense small cell networks.

[0027] Further, network entities such as base stations and UEs may employ full-duplex operations, where such entities may both receive and transmit signals simultaneously. Specifically, a common or same frequency and time resource may be used for downlink and uplink transmission. For example, as shown in FIG. 6, in an IAB system, for a full-duplex slot, the full-duplex IAB node can simultaneously transmit uplink data towards the parent-node, and receive the uplink data from the UE and/or child node. The IAB node may also transmit downlink data towards the child node, and receive the downlink data from the parent node.

[0028] In previous implementations, downlink preemption indication may be introduced to signal to the UE that no downlink transmissions on an indicated time/frequency

resource of an indicated cell may occur. The transmissions may be used for ultra reliable low latency communication (URLLC). In some aspects, downlink preemption indications of up to nine cells may be carried in a group control PDCCH (GC-PDCCH) scrambled by an interruption radio network temporary identifier (INT-RNTI), which may identify a pre-emption in the downlink. This GC-PDCCH may have configurable monitoring periodicity, which can be multiple of slots with minimum of one slot. Further, the downlink preemption indication per cell may be fourteen bits, indicating the cell's time/frequency resource having no downlink transmission between two adjacent monitoring occasions. However, in the case of full-duplex operation, each end simultaneously performs reception and transmission. In this case, it would be desirable to extend bi-direction preemption indication transmissions to signal to the UE that no downlink and uplink transmissions will occur on an indicated set of resources.

[0029] In one implementation, a UE in an IAB system may receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The UE may further perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0030] In another implementation, a node such as an IAB node in an IAB system may determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. The node may further transmit, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0031] The described features will be presented in more detail below with reference to FIGS. 1-7.

[0032] As used in this application, the terms "component," "module," "system" and the like are intended to include a computer-related entity, such as but not limited to hardware, software, a combination of hardware and software, or software in execution. For example, a component may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a computing device and the computing device can be a component. One or more components can reside within a process and/or thread of execution and a component can be localized on one

computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components can communicate by way of local and/or remote processes such as in accordance with a signal having one or more data packets, such as data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems by way of the signal. 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.

[0033] Techniques described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, SC-FDMA, and other systems. The terms "system" and "network" may often be used interchangeably. A CDMA system may implement a radio technology such as CDMA2000, Universal Terrestrial Radio Access (UTRA), etc. CDMA2000 covers IS-2000, IS-95, and IS-856 standards. IS-2000 Releases 0 and A are commonly referred to as CDMA2000 1X, 1X, etc. IS-856 (TIA-856) is commonly referred to as CDMA2000 1xEV-DO, High Rate Packet Data (HRPD), etc. UTRA includes Wideband CDMA (WCDMA) and other variants of CDMA. A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Ultra Mobile Broadband (UMB), Evolved UTRA (E-UTRA), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM™, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE) and LTE-Advanced (LTE-A) are new releases of UMTS that use E-UTRA. UTRA, E-UTRA, UMTS, LTE, LTE-A, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). CDMA2000 and UMB are described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). The techniques described herein may be used for the systems and radio technologies mentioned above as well as other systems and radio technologies, including cellular (e.g., LTE) communications over a shared radio frequency spectrum band. The description below, however, describes an LTE/LTE-A

system for purposes of example, and LTE terminology is used in much of the description below, although the techniques are applicable beyond LTE/LTE-A applications (e.g., to fifth generation (5G) NR networks or other next generation communication systems).

[0034] The following description provides examples, and is not limiting of the scope, applicability, or examples set forth in the claims. Changes may be made in the function and arrangement of elements discussed without departing from the scope of the disclosure. Various examples may omit, substitute, or add various procedures or components as appropriate. For instance, the methods described may be performed in an order different from that described, and various steps may be added, omitted, or combined. Also, features described with respect to some examples may be combined in other examples.

[0035] Various aspects or features will be presented in terms of systems that can include a number of devices, components, modules, and the like. It is to be understood and appreciated that the various systems can include additional devices, components, modules, etc. and/or may not include all of the devices, components, modules etc. discussed in connection with the figures. A combination of these approaches can also be used.

[0036] **FIG. 1** is a diagram illustrating an example of a wireless communications system and an access network 100. The wireless communications system (also referred to as a wireless wide area network (WWAN)) can include base stations 102, UEs 104, an Evolved Packet Core (EPC) 160, and/or a 5G Core (5GC) 190. The base stations 102, which may also be referred to as network entities, may include macro cells (high power cellular base station) and/or small cells (low power cellular base station). The macro cells can include base stations. The small cells can include femtocells, picocells, and microcells. In an example, the base stations 102 may also include gNBs 180, as described further herein.

[0037] In one example, some nodes such as UE 104 of the wireless communication system may have a modem 340 and communicating component 342 for performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication, as described herein. In another example, some nodes acting as an IAB node, such as base station 102/gNB 180, may have a modem 240 and communicating component 242 for bi-direction preemption indication transmissions, as described herein. Though a UE 104 is

shown as having the modem 340 and communicating component 342 and a base station 102/gNB 180 is shown as having the modem 240 and communicating component 242, this is one illustrative example, and substantially any node or type of node acting as an IAB node may include a modem 240 and communicating component 242 for providing corresponding functionalities described herein.

[0038] The base stations 102 configured for 4G LTE (which can collectively be referred to as Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (E-UTRAN)) may interface with the EPC 160 through backhaul links 132 (e.g., using an S1 interface). The base stations 102 configured for 5G NR (which can collectively be referred to as Next Generation RAN (NG-RAN)) may interface with 5GC 190 through backhaul links 184. In addition to other functions, the base stations 102 may perform one or more of the following functions: transfer of user data, radio channel ciphering and deciphering, integrity protection, header compression, mobility control functions (e.g., handover, dual connectivity), inter-cell interference coordination, connection setup and release, load balancing, distribution for non-access stratum (NAS) messages, NAS node selection, synchronization, radio access network (RAN) sharing, multimedia broadcast multicast service (MBMS), subscriber and equipment trace, RAN information management (RIM), paging, positioning, and delivery of warning messages. The base stations 102 may communicate directly or indirectly (e.g., through the EPC 160 or 5GC 190) with each other over backhaul links 134 (e.g., using an X2 interface). The backhaul links 132, 134 and/or 184 may be wired or wireless.

[0039] The base stations 102 may wirelessly communicate with one or more UEs 104. Each of the base stations 102 may provide communication coverage for a respective geographic coverage area 110. There may be overlapping geographic coverage areas 110. For example, the small cell 102' may have a coverage area 110' that overlaps the coverage area 110 of one or more macro base stations 102. A network that includes both small cell and macro cells may be referred to as a heterogeneous network. A heterogeneous network may also include Home Evolved Node Bs (eNBs) (HeNBs), which may provide service to a restricted group, which can be referred to as a closed subscriber group (CSG). The communication links 120 between the base stations 102 and the UEs 104 may include uplink (UL) (also referred to as reverse link) transmissions from a UE 104 to a base station 102 and/or downlink (DL) (also referred to as forward link) transmissions from a base station 102 to a UE 104. The communication links 120 may use multiple-input and

multiple-output (MIMO) antenna technology, including spatial multiplexing, beamforming, and/or transmit diversity. The communication links may be through one or more carriers. The base stations 102 / UEs 104 may use spectrum up to Y MHz (e.g., 5, 10, 15, 20, 100, 400, etc. MHz) bandwidth per carrier allocated in a carrier aggregation of up to a total of Yx MHz (e.g., for x component carriers) used for transmission in the DL and/or the UL direction. The carriers may or may not be adjacent to each other. Allocation of carriers may be asymmetric with respect to DL and UL (e.g., more or less carriers may be allocated for DL than for UL). The component carriers may include a primary component carrier and one or more secondary component carriers. A primary component carrier may be referred to as a primary cell (PCell) and a secondary component carrier may be referred to as a secondary cell (SCell).

[0040] In another example, certain UEs 104 may communicate with each other using device-to-device (D2D) communication link 158. The D2D communication link 158 may use the DL/UL WWAN spectrum. The D2D communication link 158 may use one or more sidelink channels, such as a physical sidelink broadcast channel (PSBCH), a physical sidelink discovery channel (PSDCH), a physical sidelink shared channel (PSSCH), and a physical sidelink control channel (PSCCH). D2D communication may be through a variety of wireless D2D communications systems, such as for example, FlashLinQ, WiMedia, Bluetooth, ZigBee, Wi-Fi based on the IEEE 802.11 standard, LTE, or NR.

[0041] The wireless communications system may further include a Wi-Fi access point (AP) 150 in communication with Wi-Fi stations (STAs) 152 via communication links 154 in a 5 GHz unlicensed frequency spectrum. When communicating in an unlicensed frequency spectrum, the STAs 152 / AP 150 may perform a clear channel assessment (CCA) prior to communicating in order to determine whether the channel is available.

[0042] The small cell 102' may operate in a licensed and/or an unlicensed frequency spectrum. When operating in an unlicensed frequency spectrum, the small cell 102' may employ NR and use the same 5 GHz unlicensed frequency spectrum as used by the Wi-Fi AP 150. The small cell 102', employing NR in an unlicensed frequency spectrum, may boost coverage to and/or increase capacity of the access network.

[0043] A base station 102, whether a small cell 102' or a large cell (e.g., macro base station), may include an eNB, gNodeB (gNB), or other type of base station. Some base stations, such as gNB 180 may operate in a traditional sub 6 GHz spectrum, in millimeter

wave (mmW) frequencies, and/or near mmW frequencies in communication with the UE 104. When the gNB 180 operates in mmW or near mmW frequencies, the gNB 180 may be referred to as an mmW base station. Extremely high frequency (EHF) is part of the RF in the electromagnetic spectrum. EHF has a range of 30 GHz to 300 GHz and a wavelength between 1 millimeter and 10 millimeters. Radio waves in the band may be referred to as a millimeter wave. Near mmW may extend down to a frequency of 3 GHz with a wavelength of 100 millimeters. The super high frequency (SHF) band extends between 3 GHz and 30 GHz, also referred to as centimeter wave. Communications using the mmW / near mmW radio frequency band has extremely high path loss and a short range. The mmW base station 180 may utilize beamforming 182 with the UE 104 to compensate for the extremely high path loss and short range. A base station 102 referred to herein can include a gNB 180.

[0044] The EPC 160 may include a Mobility Management Entity (MME) 162, other MMEs 164, a Serving Gateway 166, a Multimedia Broadcast Multicast Service (MBMS) Gateway 168, a Broadcast Multicast Service Center (BM-SC) 170, and a Packet Data Network (PDN) Gateway 172. The MME 162 may be in communication with a Home Subscriber Server (HSS) 174. The MME 162 is the control node that processes the signaling between the UEs 104 and the EPC 160. Generally, the MME 162 provides bearer and connection management. All user Internet protocol (IP) packets are transferred through the Serving Gateway 166, which itself is connected to the PDN Gateway 172. The PDN Gateway 172 provides UE IP address allocation as well as other functions. The PDN Gateway 172 and the BM-SC 170 are connected to the IP Services 176. The IP Services 176 may include the Internet, an intranet, an IP Multimedia Subsystem (IMS), a PS Streaming Service, and/or other IP services. The BM-SC 170 may provide functions for MBMS user service provisioning and delivery. The BM-SC 170 may serve as an entry point for content provider MBMS transmission, may be used to authorize and initiate MBMS Bearer Services within a public land mobile network (PLMN), and may be used to schedule MBMS transmissions. The MBMS Gateway 168 may be used to distribute MBMS traffic to the base stations 102 belonging to a Multicast Broadcast Single Frequency Network (MBSFN) area broadcasting a particular service, and may be responsible for session management (start/stop) and for collecting eMBMS related charging information.

[0045] The 5GC 190 may include a Access and Mobility Management Function (AMF) 192, other AMFs 193, a Session Management Function (SMF) 194, and a User Plane Function (UPF) 195. The AMF 192 may be in communication with a Unified Data Management (UDM) 196. The AMF 192 can be a control node that processes the signaling between the UEs 104 and the 5GC 190. Generally, the AMF 192 can provide QoS flow and session management. User Internet protocol (IP) packets (e.g., from one or more UEs 104) can be transferred through the UPF 195. The UPF 195 can provide UE IP address allocation for one or more UEs, as well as other functions. The UPF 195 is connected to the IP Services 197. The IP Services 197 may include the Internet, an intranet, an IP Multimedia Subsystem (IMS), a PS Streaming Service, and/or other IP services.

[0046] The base station may also be referred to as a gNB, Node B, evolved Node B (eNB), an access point, a base transceiver station, a radio base station, a radio transceiver, a transceiver function, a basic service set (BSS), an extended service set (ESS), a transmit reception point (TRP), or some other suitable terminology. The base station 102 provides an access point to the EPC 160 or 5GC 190 for a UE 104. Examples of UEs 104 include a cellular phone, a smart phone, a session initiation protocol (SIP) phone, a laptop, a personal digital assistant (PDA), a satellite radio, a positioning system (e.g., satellite, terrestrial), a multimedia device, a video device, a digital audio player (e.g., MP3 player), a camera, a game console, a tablet, a smart device, robots, drones, an industrial/manufacturing device, a wearable device (e.g., a smart watch, smart clothing, smart glasses, virtual reality goggles, a smart wristband, smart jewelry (e.g., a smart ring, a smart bracelet)), a vehicle/a vehicular device, a meter (e.g., parking meter, electric meter, gas meter, water meter, flow meter), a gas pump, a large or small kitchen appliance, a medical/healthcare device, an implant, a sensor/actuator, a display, or any other similar functioning device. Some of the UEs 104 may be referred to as IoT devices (e.g., meters, pumps, monitors, cameras, industrial/manufacturing devices, appliances, vehicles, robots, drones, etc.). IoT UEs may include MTC/enhanced MTC (eMTC, also referred to as CAT-M, Cat M1) UEs, NB-IoT (also referred to as CAT NB1) UEs, as well as other types of UEs. In the present disclosure, eMTC and NB-IoT may refer to future technologies that may evolve from or may be based on these technologies. For example, eMTC may include FeMTC (further eMTC), eFeMTC (enhanced further eMTC), mMTC (massive MTC), etc., and NB-IoT may include eNB-IoT (enhanced NB-IoT), FeNB-IoT (further

enhanced NB-IoT), etc. The UE 104 may also be referred to as a station, a mobile station, 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, a mobile terminal, a wireless terminal, a remote terminal, a handset, a user agent, a mobile client, a client, or some other suitable terminology.

[0047] Turning now to **FIGS. 2-5**, aspects are depicted with reference to one or more components and one or more methods that may perform the actions or operations described herein, where aspects in dashed line may be optional. Although the operations described below in FIGS. 4 and 5 are presented in a particular order and/or as being performed by an example component, it should be understood that the ordering of the actions and the components performing the actions may be varied, depending on the implementation. Moreover, it should be understood that the following actions, functions, and/or described components may be performed by a specially-programmed processor, a processor executing specially-programmed software or computer-readable media, or by any other combination of a hardware component and/or a software component capable of performing the described actions or functions.

[0048] Referring to **FIG. 2**, one example of an implementation of a node acting as an IAB node, such as base station 102 (e.g., a base station 102 and/or gNB 180, as described above) may include a variety of components, some of which have already been described above and are described further herein, including components such as one or more processors 212 and memory 216 and transceiver 202 in communication via one or more buses 344, which may operate in conjunction with modem 240 and/or communicating component 242 for bi-direction preemption indication transmissions. In some aspects, the communicating component 242 may include a bi-direction preemption indication 244 (for transmission) indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission. The communicating component 242 may also include a full duplex indication that identifies support for a full duplex mode. The communicating component 242 may further include re-interpretation indicator 250 indicating to re-interpret the uplink preemption indication and the downlink preemption indication as a bi-direction preemption indication 244.

[0049] In an aspect, the one or more processors 212 can include a modem 240 and/or can be part of the modem 240 that uses one or more modem processors. Thus, the various

functions related to communicating component 242 may be included in modem 240 and/or processors 212 and, in an aspect, can be executed by a single processor, while in other aspects, different ones of the functions may be executed by a combination of two or more different processors. For example, in an aspect, the one or more processors 212 may include any one or any combination of a modem processor, or a baseband processor, or a digital signal processor, or a transmit processor, or a receiver processor, or a transceiver processor associated with transceiver 202. In other aspects, some of the features of the one or more processors 212 and/or modem 240 associated with communicating component 242 may be performed by transceiver 202.

[0050] Also, memory 216 may be configured to store data used herein and/or local versions of applications 275 or communicating component 242 and/or one or more of its subcomponents being executed by at least one processor 212. Memory 216 can include any type of computer-readable medium usable by a computer or at least one processor 212, such as random access memory (RAM), read only memory (ROM), tapes, magnetic discs, optical discs, volatile memory, non-volatile memory, and any combination thereof. In an aspect, for example, memory 216 may be a non-transitory computer-readable storage medium that stores one or more computer-executable codes defining communicating component 242 and/or one or more of its subcomponents, and/or data associated therewith, when base station 102 is operating at least one processor 212 to execute communicating component 242 and/or one or more of its subcomponents.

[0051] Transceiver 202 may include at least one receiver 206 and at least one transmitter 208. Receiver 206 may include hardware and/or software executable by a processor for receiving data, the code comprising instructions and being stored in a memory (e.g., computer-readable medium). Receiver 206 may be, for example, a radio frequency (RF) receiver. In an aspect, receiver 206 may receive signals transmitted by at least one base station 102. Additionally, receiver 206 may process such received signals, and also may obtain measurements of the signals, such as, but not limited to, Ec/Io, signal-to-noise ratio (SNR), reference signal received power (RSRP), received signal strength indicator (RSSI), etc. Transmitter 208 may include hardware and/or software executable by a processor for transmitting data, the code comprising instructions and being stored in a memory (e.g., computer-readable medium). A suitable example of transmitter 208 may including, but is not limited to, an RF transmitter.

[0052] Moreover, in an aspect, base station 102 may include RF front end 288, which may operate in communication with one or more antennas 265 and transceiver 202 for receiving and transmitting radio transmissions, for example, wireless communications transmitted by at least one base station 102 or wireless transmissions transmitted by UE 104. RF front end 288 may be connected to one or more antennas 265 and can include one or more low-noise amplifiers (LNAs) 290, one or more switches 292, one or more power amplifiers (PAs) 298, and one or more filters 296 for transmitting and receiving RF signals. The antennas 265 may include one or more antennas, antenna elements, and/or antenna arrays.

[0053] In an aspect, LNA 290 can amplify a received signal at a desired output level. In an aspect, each LNA 290 may have a specified minimum and maximum gain values. In an aspect, RF front end 288 may use one or more switches 292 to select a particular LNA 290 and its specified gain value based on a desired gain value for a particular application.

[0054] Further, for example, one or more PA(s) 298 may be used by RF front end 288 to amplify a signal for an RF output at a desired output power level. In an aspect, each PA 298 may have specified minimum and maximum gain values. In an aspect, RF front end 288 may use one or more switches 292 to select a particular PA 298 and its specified gain value based on a desired gain value for a particular application.

[0055] Also, for example, one or more filters 296 can be used by RF front end 288 to filter a received signal to obtain an input RF signal. Similarly, in an aspect, for example, a respective filter 296 can be used to filter an output from a respective PA 298 to produce an output signal for transmission. In an aspect, each filter 296 can be connected to a specific LNA 290 and/or PA 298. In an aspect, RF front end 288 can use one or more switches 292 to select a transmit or receive path using a specified filter 296, LNA 290, and/or PA 298, based on a configuration as specified by transceiver 202 and/or processor 212.

[0056] As such, transceiver 202 may be configured to transmit and receive wireless signals through one or more antennas 265 via RF front end 288. In an aspect, transceiver may be tuned to operate at specified frequencies such that UE 104 can communicate with, for example, one or more base stations 102 or one or more cells associated with one or more base stations 102. In an aspect, for example, modem 240 can configure transceiver 202 to operate at a specified frequency and power level based on the UE configuration of the UE 104 and the communication protocol used by modem 240.

[0057] In an aspect, modem 240 can be a multiband-multimode modem, which can process digital data and communicate with transceiver 202 such that the digital data is sent and received using transceiver 202. In an aspect, modem 240 can be multiband and be configured to support multiple frequency bands for a specific communications protocol. In an aspect, modem 240 can be multimode and be configured to support multiple operating networks and communications protocols. In an aspect, modem 240 can control one or more components of UE 104 (e.g., RF front end 288, transceiver 202) to enable transmission and/or reception of signals from the network based on a specified modem configuration. In an aspect, the modem configuration can be based on the mode of the modem and the frequency band in use. In another aspect, the modem configuration can be based on UE configuration information associated with UE 104 as provided by the network during cell selection and/or cell reselection.

[0058] In an aspect, the processor(s) 212 may correspond to one or more of the processors described in connection with the UE in FIG. 7. Similarly, the memory 216 may correspond to the memory described in connection with the UE in FIG. 7.

[0059] Referring to **FIG. 3**, one example of an implementation of UE 104 may include a variety of components, some of which have already been described above and are described further herein, including components such as one or more processors 312 and memory 316 and transceiver 302 in communication via one or more buses 344, which may operate in conjunction with modem 340 and/or communication component 342 for performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication 244.

[0060] The transceiver 302, receiver 306, transmitter 308, one or more processors 312, memory 316, applications 375, buses 344, RF front end 388, LNAs 390, switches 392, filters 396, PAs 398, and one or more antennas 365 may be the same as or similar to the corresponding components of base station 102, as described above, but configured or otherwise programmed for base station operations as opposed to base station operations.

[0061] In an aspect, the processor(s) 312 may correspond to one or more of the processors described in connection with the base station in FIG. 7. Similarly, the memory 316 may correspond to the memory described in connection with the base station in FIG. 7.

[0062] Turning now to **FIGS. 4 and 5**, aspects are depicted with reference to one or more components and one or more methods that may perform the actions or operations

described herein, where aspects in dashed line may be optional. Although the operations described below in FIGS. 4 and 5 are presented in a particular order and/or as being performed by an example component, it should be understood that the ordering of the actions and the components performing the actions may be varied, depending on the implementation. Moreover, it should be understood that the following actions, functions, and/or described components may be performed by reference to one or more components of FIGS. 2, 3 and/or 7, as described herein, a specially-programmed processor, a processor executing specially-programmed software or computer-readable media, or by any other combination of a hardware component and/or a software component capable of performing the described actions or functions.

[0063] FIG. 4 illustrates a flow chart of an example of a method 400 for wireless communication at a UE. In an example, a UE 104 can perform the functions described in method 400 using one or more of the components described in FIGS. 1, 3, and 7.

[0064] At block 402, the method 400 may receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. In an aspect, the communication component 342, e.g., in conjunction with processor(s) 312, memory 316, and/or transceiver 302, may be configured to receive a bi-direction preemption indication 244 indicating that a set of one or more resources 246 are preempted for use for both an uplink transmission and a downlink transmission. Thus, the UE 104, the processor(s) 312, the communication component 342 or one of its subcomponents may define the means for receiving a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission.

[0065] At block 404, the method 400 may performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication. In an aspect, the communication component 342, e.g., in conjunction with processor(s) 312, memory 316, and/or transceiver 302, may be configured to perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources 246 indicated by the bi-direction preemption indication 244. For example, the communication component 342 may exclude the set of one or more resources 246 from a set of resources to be used for both the uplink transmission and the downlink transmission. Thus, the UE 104, the processor(s) 312, the communication component 342 or one of its

subcomponents may define the means for performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0066] In some aspects, the set of one or more resources 246 may be in time, frequency, spatial domain, or any combination thereof.

[0067] In some aspects, the rate matching for the downlink transmission may include demodulating and decoding of information bits on resources not overlapping with the set of one or more (preempted) resources 246 (which are not used for downlink transmission).

[0068] In some aspects, the rate matching for the uplink transmission may include modulating and encoding of information bits on resources not overlapping with the set of one or more (preempted) resources 246 (which are not used for uplink transmission).

[0069] In some aspects, receiving the bi-direction preemption indication 244 may include receiving a GC-PDCCH scrambled by a unique RNTI associated with the bi-direction preemption indication 244.

[0070] In some aspects, the bi-direction preemption indication 244 may be one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

[0071] In some aspects, a monitoring periodicity of the GC-PDCCH may be configurable.

[0072] In some aspects, receiving the bi-direction preemption indication 244 may include receiving a GC-PDCCH including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

[0073] In some aspects, receiving the bi-direction preemption indication 244 may include receiving the bi-direction preemption indication having a unique bit that identifies the corresponding preemption indication as the bi-direction preemption indication.

[0074] In some aspects, receiving the bi-direction preemption indication 244 may include receiving on a dedicated control resource set associated with the bi-direction preemption indication within a search space.

[0075] In some aspects, receiving the bi-direction preemption indication 244 may include receiving on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

[0076] In some aspects, receiving the bi-direction preemption indication 244 may include receiving during a current monitoring occasion, and wherein the set of one or more

time/frequency resources 246 is between the current monitoring occasion and a next monitoring occasion.

[0077] Although not shown, in some aspects, the method 400 may include determining that a current mode of communication is a full duplex mode, identifying that the bi-direction preemption indication 244 comprises an uplink preemption indication or a downlink preemption indication, and determining that the bi-direction preemption indication 244 indicates that the set of one or more resources 246 are preempted for use for both of the uplink transmission and the downlink transmission in response to determining the current mode is the full duplex mode.

[0078] Although not shown, in some aspects, the method 400 may include receiving a full duplex indication via at least one of a radio resource connection (RRC) message, a media access control (MAC) control element (CE), or downlink control information (DCI), where determining that the current mode of communication is the full duplex mode is based on the full duplex indication.

[0079] Although not shown, in some aspects, the method 400 may include transmitting a full duplex capability indication 248 that identifies support for the full duplex mode, and where receiving the full duplex indication is in response to the transmitting of the full duplex capability indication.

[0080] Although not shown, in some aspects, the method 400 may include receiving a preemption indication re-interpretation indicator 250 indicating to re-interpret the uplink preemption indication and the downlink preemption indication as the bi-direction preemption indication 244, where determining that the bi-direction preemption indication indicates that the set of one or more resources 246 are preempted for use for both of the uplink transmission and the downlink transmission further in response to the receiving of the preemption indication re-interpretation indicator 250.

[0081] In some aspects, the UE may be a node in an IAB system.

[0082] **FIG. 5** illustrates a flow chart of an example of a method 500 for wireless communication at a node, which may be an IAB node. In an example, a base station 102 can perform the functions described in method 500 using one or more of the components described in FIGS. 1, 2, and 7.

[0083] At block 502, the method 500 may determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. In one example, the data can be associated with a priority level. In an aspect, the

communicating component 242, e.g., in conjunction with processor(s) 212, memory 216, and/or transceiver 202, may be configured to determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. In one example, the data can be associated with a priority level. Thus, the base station 102, the processor(s) 212, the communicating component 242 or one of its subcomponents may define the means for determining that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission. In one example, the data can be associated with a priority level.

[0084] At block 504, the method 500 may transmit, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission. In an aspect, the communicating component 242, e.g., in conjunction with processor(s) 212, memory 216, and/or transceiver 202, may be configured to transmit, to a UE, the bi-direction preemption indication 244 indicating that the set of one or more resources 246 are preempted for use for both of the uplink transmission and the downlink transmission. Thus, the base station 102, the processor(s) 212, the communicating component 242 or one of its subcomponents may define the means for transmitting, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[0085] In some aspects, the bi-direction preemption indication 244 may trigger rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources 246.

[0086] In some aspects, the set of one or more resources 246 may be in time, frequency, spatial domain, or any combination thereof.

[0087] In some aspects, transmitting the preemption indication 244 may include transmitting a GC-PDCCH scrambled by a unique RNTI associated with the bi-direction preemption indication 244.

[0088] In some aspects, the bi-direction preemption indication 244 may be one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

[0089] In some aspects, a monitoring periodicity of the GC-PDCCH is configurable.

[0090] In some aspects, transmitting the bi-direction preemption indication 244 may include transmitting a GC-PDCCH including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

[0091] In some aspects, transmitting the bi-direction preemption indication 244 may include transmitting the bi-direction preemption indication having a unique bit that identifies the corresponding preemption indication as a bi-direction preemption indication.

[0092] In some aspects, transmitting the bi-direction preemption indication 244 may include transmitting on a dedicated control resource set associated with the bi-direction preemption indication within a search space.

[0093] In some aspects, transmitting the bi-direction preemption indication 244 may include transmitting on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

[0094] In some aspects, transmitting the bi-direction preemption indication 244 may include transmitting during a current monitoring occasion, and wherein the set of one or more time/frequency resources is between the current monitoring occasion and a next monitoring occasion.

[0095] In some aspects, although not shown, the method 500 may further include transmitting a full duplex indication via at least one of a RRC message, a MAC CE, or DCI, and receiving a full duplex capability indication 248 that identifies support for a full duplex mode.

[0096] In some aspects, although not shown, the method 500 may further include transmitting a preemption indication re-interpretation indicator 250 indicating to re-interpret the uplink preemption indication and the downlink preemption indication as a bi-direction preemption indication.

[0097] Further, **FIG. 6** is a diagram of an uplink and downlink communication scheme in an IAB system 600, as described herein. In one example, the IAB system 600 may include an IAB node 604, which may be similar to or the same as the base station 102. The IAB system 600 may further include a parent node 602, a child node 606, and a UE 104. For example, in an IAB system, for a full-duplex slot, the full-duplex IAB node 604 can simultaneously transmit uplink data towards the parent node 602, and receive the uplink data from the UE 104 and/or child node 606. The IAB node 604 may also transmit

downlink data towards the child node 606, and receive the downlink data from the parent node 602.

[0098] The IAB node 604 may include the communicating component 242, which may be configured to determine that a set of one or more resources 246 are preempted for use for both an uplink transmission and a downlink transmission, and to transmit, to a UE, the bi-direction preemption indication 244 indicating that the set of one or more resources 246 are preempted for use for both of the uplink transmission and the downlink transmission. Further, the UE 104 may include the communication component 342, which may be configured to receive a bi-direction preemption indication 244 indicating that a set of one or more resources 246 are preempted for use for both an uplink transmission and a downlink transmission, and perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[0099] In some aspects, in case of bi-direction communications, e.g. full duplex operation, bi-direction preemption indication can be introduced to signal UE no downlink and uplink transmission on indicated resources, which may be reserved for URLLC traffic. The bi-direction preemption indication of multiple cells can be carried in a GC-PDCCH scrambled by a special RNTI. This GC-PDCCH has configurable monitoring periodicity, e.g. multiple of slots with minimum of 1 slot, and may be sent over any serving cell or a dedicated cell, e.g. PCell.

[00100] The bi-direction preemption indication per cell indicates the cell's time/frequency resource having no downlink and uplink transmission, where the indicated resource can be between current and next monitoring occasions. The bi-direction preemption indication can be differentiated from downlink or uplink preemption indication by using a different RNTI or by a dedicated bit in the bi-direction preemption indication or in GC-PDCCH.

[00101] In some aspects, in case of full duplex operation, downlink or uplink preemption indication can be re-interpreted as the bi-direction preemption indication with no downlink or uplink transmission on resources indicated by downlink or uplink preemption indication. Full duplex operation may be indicated by gNB via RRC/MAC-CE/DCI. Full duplex operation may be indicated only for UEs indicating support of full duplex operation. Re-interpretation may be dynamically indicated by gNB via RRC/MAC-CE/DCI.

[00102] **FIG. 7** is a block diagram of a MIMO communication system 700 including a base station 102, which may be acting as an IAB node or a parent node, and a UE 104. The MIMO communication system 900 may illustrate aspects of the wireless communication access network 100 described with reference to FIG. 1. The base station 102 may be an example of aspects of the base station 102 described with reference to FIG. 1. The base station 102 may be equipped with antennas 734 and 735, and the UE 104 may be equipped with antennas 752 and 753. In the MIMO communication system 700, the base station 102 may be able to send data over multiple communication links at the same time. Each communication link may be called a "layer" and the "rank" of the communication link may indicate the number of layers used for communication. For example, in a 2x2 MIMO communication system where base station 102 transmits two "layers," the rank of the communication link between the base station 102 and the UE 104 is two.

[00103] At the base station 102, a transmit (Tx) processor 720 may receive data from a data source. The transmit processor 720 may process the data. The transmit processor 720 may also generate control symbols or reference symbols. A transmit MIMO processor 730 may perform spatial processing (e.g., precoding) on data symbols, control symbols, or reference symbols, if applicable, and may provide output symbol streams to the transmit modulator/demodulators 732 and 733. Each modulator/demodulator 732 through 733 may process a respective output symbol stream (e.g., for OFDM, etc.) to obtain an output sample stream. Each modulator/demodulator 732 through 733 may further process (e.g., convert to analog, amplify, filter, and upconvert) the output sample stream to obtain a DL signal. In one example, DL signals from modulator/demodulators 732 and 733 may be transmitted via the antennas 734 and 735, respectively.

[00104] The UE 104 may be an example of aspects of the UEs 104 described with reference to FIGS. 1 and 2. At the UE 104, the UE antennas 752 and 753 may receive the DL signals from the base station 102 and may provide the received signals to the modulator/demodulators 754 and 755, respectively. Each modulator/demodulator 754 through 755 may condition (e.g., filter, amplify, downconvert, and digitize) a respective received signal to obtain input samples. Each modulator/demodulator 754 through 755 may further process the input samples (e.g., for OFDM, etc.) to obtain received symbols. A MIMO detector 756 may obtain received symbols from the modulator/demodulators 754 and 755, perform MIMO detection on the received symbols, if applicable, and

provide detected symbols. A receive (Rx) processor 758 may process (e.g., demodulate, deinterleave, and decode) the detected symbols, providing decoded data for the UE 104 to a data output, and provide decoded control information to a processor 980, or memory 982.

[00105] The processor 780 may in some cases execute stored instructions to instantiate a communicating component 242 (see e.g., FIGS. 1 and 2).

[00106] On the uplink (UL), at the UE 104, a transmit processor 764 may receive and process data from a data source. The transmit processor 764 may also generate reference symbols for a reference signal. The symbols from the transmit processor 764 may be precoded by a transmit MIMO processor 766 if applicable, further processed by the modulator/demodulators 754 and 755 (e.g., for SC-FDMA, etc.), and be transmitted to the base station 102 in accordance with the communication parameters received from the base station 102. At the base station 102, the UL signals from the UE 104 may be received by the antennas 734 and 735, processed by the modulator/demodulators 732 and 733, detected by a MIMO detector 736 if applicable, and further processed by a receive processor 738. The receive processor 738 may provide decoded data to a data output and to the processor 740 or memory 742.

[00107] The components of the UE 104 may, individually or collectively, be implemented with one or more ASICs adapted to perform some or all of the applicable functions in hardware. Each of the noted modules may be a means for performing one or more functions related to operation of the MIMO communication system 900. Similarly, the components of the base station 102 may, individually or collectively, be implemented with one or more ASICs adapted to perform some or all of the applicable functions in hardware. Each of the noted components may be a means for performing one or more functions related to operation of the MIMO communication system 900.

SOME FURTHER EXAMPLES

[00108] In one example, a method of wireless communications by a user equipment (UE), comprises receiving a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission, and performing rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

[00109] One or more of the above examples can further include wherein the set of one or more resources are in time, frequency, spatial domain, or any combination thereof.

[00110] One or more of the above examples can further include wherein the rate matching for the downlink transmission includes demodulating and decoding of information bits on resources not overlapping with the set of one or more resources.

[00111] One or more of the above examples can further include wherein the rate matching for the uplink transmission includes modulating and encoding of information bits on resources not overlapping with the set of one or more resources.

[00112] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving a group common physical downlink control channel (GC-PDCCH) scrambled by a unique radio network temporary identifier (RNTI) associated with the bi-direction preemption indication.

[00113] One or more of the above examples can further include wherein the bi-direction preemption indication is one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

[00114] One or more of the above examples can further include wherein a monitoring periodicity of the GC-PDCCH is configurable.

[00115] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving a GC-PDCCH including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

[00116] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving the bi-direction preemption indication having a unique bit that identifies the corresponding preemption indication as the bi-direction preemption indication.

[00117] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving on a dedicated control resource set associated with the bi-direction preemption indication within a search space.

[00118] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

[00119] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving during a current monitoring

occasion, and wherein the set of one or more time/frequency resources is between the current monitoring occasion and a next monitoring occasion.

[00120] One or more of the above examples can further include determining that a current mode of communication is a full duplex mode; identifying that the bi-direction preemption indication comprises an uplink preemption indication or a downlink preemption indication; and determining that the bi-direction preemption indication indicates that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission in response to determining the current mode is the full duplex mode.

[00121] One or more of the above examples can further include receiving a full duplex indication via at least one of a radio resource connection (RRC) message, a media access control (MAC) control element (CE), or downlink control information (DCI); wherein determining that the current mode of communication is the full duplex mode based on the full duplex indication.

[00122] One or more of the above examples can further include transmitting a full duplex capability indication that identifies support for the full duplex mode; and wherein receiving the full duplex indication is in response to the transmitting of the full duplex capability indication.

[00123] One or more of the above examples can further include receiving a preemption indication re-interpretation indicator indicating to re-interpret the uplink preemption indication and the downlink preemption indication as the bi-direction preemption indication; and wherein determining that the bi-direction preemption indication indicates that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission further in response to the receiving of the preemption indication re-interpretation indicator.

[00124] In another example, a method of wireless communications by a node, comprising determining that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission; transmitting, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

[00125] One or more of the above examples can further include wherein the bi-direction preemption indication triggers rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources.

[00126] One or more of the above examples can further include wherein the set of one or more resources are in time, frequency, spatial domain, or any combination thereof.

[00127] One or more of the above examples can further include wherein receiving the preemption indication includes receiving a GC-PDCCH scrambled by a unique RNTI associated with the bi-direction preemption indication.

[00128] One or more of the above examples can further include wherein the bi-direction preemption indication is one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

[00129] One or more of the above examples can further include wherein a monitoring periodicity of the GC-PDCCH is configurable.

[00130] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving a GC-PDCCH including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

[00131] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving the bi-direction preemption indication having a unique bit that identifies the corresponding preemption indication as a bi-direction preemption indication.

[00132] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving on a dedicated control resource set associated with the bi-direction preemption indication within a search space.

[00133] One or more of the above examples can further include wherein receiving the bi-direction preemption indication includes receiving on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

[00134] One or more of the above examples can further include receiving the bi-direction preemption indication includes receiving during a current monitoring occasion, and wherein the set of one or more time/frequency resources is between the current monitoring occasion and a next monitoring occasion.

[00135] One or more of the above examples can further include transmitting a full duplex indication via at least one of: a RRC message, a MAC CE, or DCI; and receiving a full duplex capability indication that identifies support for a full duplex mode.

[00136] One or more of the above examples can further include transmitting a preemption indication re-interpretation indicator indicating to re-interpret the uplink

preemption indication and the downlink preemption indication as a bi-direction preemption indication.

[00137] One or more of the above examples can further include wherein the node is an IAB node in an IAB system.

[00138] The above detailed description set forth above in connection with the appended drawings describes examples and does not represent the only examples that may be implemented or that are within the scope of the claims. The term "example," when used in this description, means "serving as an example, instance, or illustration," and not "preferred" or "advantageous over other examples." The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some instances, well-known structures and apparatuses are shown in block diagram form in order to avoid obscuring the concepts of the described examples.

[00139] Information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, computer-executable code or instructions stored on a computer-readable medium, or any combination thereof.

[00140] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed with a specially-programmed device, such as but not limited to a processor, a digital signal processor (DSP), an ASIC, a FPGA or other programmable logic device, a discrete gate or transistor logic, a discrete hardware component, or any combination thereof designed to perform the functions described herein. A specially-programmed processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A specially-programmed processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[00141] The functions described herein may be implemented in hardware, software, or any combination thereof. If implemented in software executed by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a

non-transitory computer-readable medium. Other examples and implementations are within the scope and spirit of the disclosure and appended claims. For example, due to the nature of software, functions described above can be implemented using software executed by a specially programmed processor, hardware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations. Moreover, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or." That is, unless specified otherwise, or clear from the context, the phrase, for example, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, for example the phrase "X employs A or B" is satisfied by any of the following instances: X employs A; X employs B; or X employs both A and B. Also, as used herein, including in the claims, "or" as used in a list of items prefaced by "at least one of" indicates a disjunctive list such that, for example, a list of "at least one of A, B, or C" means A or B or C or AB or AC or BC or ABC (A and B and C).

[00142] Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage medium may be any available medium that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, include compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data

optically with lasers. Combinations of the above are also included within the scope of computer-readable media.

[00143] The previous description of the disclosure is provided to enable a person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the common principles defined herein may be applied to other variations without departing from the spirit or scope of the disclosure. Furthermore, although elements of the described aspects and/or embodiments may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated. Additionally, all or a portion of any aspect and/or embodiment may be utilized with all or a portion of any other aspect and/or embodiment, unless stated otherwise. Thus, the disclosure is not to be limited to the examples and designs described herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

CLAIMS

WHAT IS CLAIMED IS:

1. A method of wireless communications by a user equipment (UE), comprising:

receiving a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission; and

performing rate matching for both of the uplink transmission and the downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

2. The method of claim 1, wherein the rate matching for the downlink transmission includes demodulating and decoding of information bits on resources not overlapping with the set of one or more resources.

3. The method of claim 1, wherein the rate matching for the uplink transmission includes modulating and encoding of information bits on resources not overlapping with the set of one or more resources.

4. The method of claim 1, wherein receiving the bi-direction preemption indication includes receiving a group common physical downlink control channel (GC-PDCCH) scrambled by a unique radio network temporary identifier (RNTI) associated with the bi-direction preemption indication.

5. The method of claim 4, wherein the bi-direction preemption indication is one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

6. The method of claim 4, wherein a monitoring periodicity of the GC-PDCCH is configurable.

7. The method of claim 1, wherein receiving the bi-direction preemption indication includes receiving a group common physical downlink control channel (GC-PDCCH) including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

8. The method of claim 1, wherein receiving the bi-direction preemption indication includes receiving the bi-direction preemption indication having a unique bit that identifies the bi-direction preemption indication.

9. The method of claim 1, wherein receiving the bi-direction preemption indication includes:

receiving on a dedicated control resource set associated with the bi-direction preemption indication within a search space, or

receiving on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

10. The method of claim 1, wherein the bi-direction preemption indication is received during a current monitoring occasion, and wherein the set of one or more resources is between the current monitoring occasion and a next monitoring occasion.

11. The method of claim 1, further comprising:

determining that a current mode of communication is a full duplex mode;

identifying that the bi-direction preemption indication comprises an uplink preemption indication or a downlink preemption indication; and

determining that the bi-direction preemption indication indicates that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission in response to determining the current mode is the full duplex mode.

12. The method of claim 11, further comprising:

receiving a full duplex indication via at least one of:

a radio resource connection (RRC) message,

a media access control (MAC) control element (CE), or

downlink control information (DCI),

wherein determining that the current mode of communication is the full duplex mode based on the full duplex indication.

13. The method of claim 12, further comprising:

transmitting a full duplex capability indication that identifies support for the full duplex mode; and

wherein receiving the full duplex indication is in response to the transmitting of the full duplex capability indication.

14. The method of claim 11, further comprising:

receiving a preemption indication re-interpretation indicator indicating to re-interpret the uplink preemption indication and the downlink preemption indication as the bi-direction preemption indication; and

wherein determining that the bi-direction preemption indication indicates that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission further in response to the receiving of the preemption indication re-interpretation indicator.

15. A method of wireless communications by a node, comprising:

determining that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission; and

transmitting, to a user equipment (UE), a bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

16. The method of claim 15, wherein the bi-direction preemption indication triggers rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources.

17. The method of claim 15, wherein transmitting the preemption indication includes transmitting a group common physical downlink control channel (GC-PDCCH) scrambled by a unique radio network temporary identifier (RNTI) associated

with the bi-direction preemption indication, and wherein a monitoring periodicity of the GC-PDCCH is configurable.

18. The method of claim 17, wherein the bi-direction preemption indication is one of a plurality of different bi-direction preemption indications for a plurality of cells carried by the GC-PDCCH.

19. The method of claim 15, wherein transmitting the bi-direction preemption indication includes transmitting a group common physical downlink control channel (GC-PDCCH) including a unique bit that identifies each preemption indication carried by the GC-PDCCH as a bi-direction preemption indication.

20. The method of claim 15, wherein transmitting the bi-direction preemption indication includes transmitting the bi-direction preemption indication having a unique bit that identifies the bi-direction preemption indication.

21. The method of claim 15, wherein transmitting the bi-direction preemption indication includes:

transmitting on a dedicated control resource set associated with the bi-direction preemption indication within a search space, or

transmitting on a control resource set within a dedicated search space associated with the bi-direction preemption indication.

22. The method of claim 15, wherein transmitting the bi-direction preemption indication includes transmitting during a current monitoring occasion, and wherein the set of one or more resources is between the current monitoring occasion and a next monitoring occasion.

23. The method of claim 15, further comprising:

transmitting a full duplex indication via at least one of:

a radio resource connection (RRC) message,

a media access control (MAC) control element (CE), or

downlink control information (DCI), and

receiving a full duplex capability indication that identifies support for a full duplex mode.

24. The method of claim 15, further comprising transmitting a preemption indication re-interpretation indicator indicating to re-interpret the uplink preemption indication and the downlink preemption indication as a bi-direction preemption indication.

25. An apparatus for wireless communication, comprising:

a transceiver;

a memory configured to store instructions; and

at least one processor communicatively coupled with the transceiver and the memory, wherein the at least one processor is configured to:

receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission; and

perform rate matching for both of the uplink transmission and the downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication.

26. The apparatus of claim 25, wherein the rate matching for the downlink transmission includes demodulating and decoding of information bits on resources not overlapping with the set of one or more resources.

27. The apparatus of claim 25, wherein to receive the bi-direction preemption indication, the at least one processor is further configured to receive a group common physical downlink control channel (GC-PDCCH) scrambled by a unique radio network temporary identifier (RNTI) associated with the bi-direction preemption indication.

28. An apparatus for wireless communication, comprising:

a transceiver;

a memory configured to store instructions; and

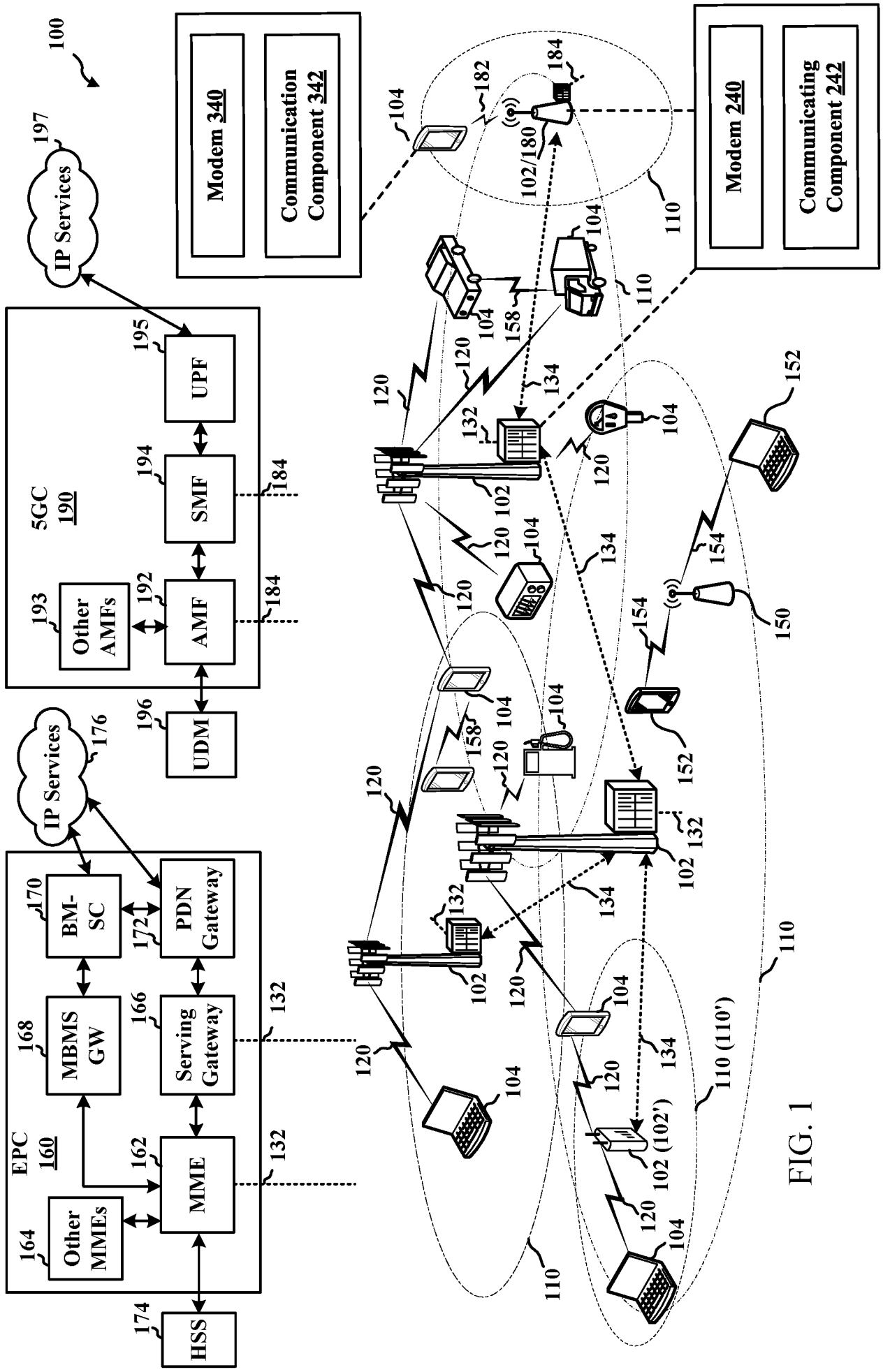
at least one processor communicatively coupled with the transceiver and the memory, wherein the at least one processor is configured to:

determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission; and

transmit, to a user equipment (UE), a bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission.

29. The apparatus of claim 28, wherein the bi-direction preemption indication triggers rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources.

30. The apparatus of claim 28, wherein to transmit the preemption indication, the at least one processor is further configured to transmit a group common physical downlink control channel (GC-PDCCH) scrambled by a unique radio network temporary identifier (RNTI) associated with the bi-direction preemption indication, and wherein a monitoring periodicity of the GC-PDCCH is configurable.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5GC
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UPF
195
SMF
194
AMF
192
Other AMFs
193
UDM
196
184
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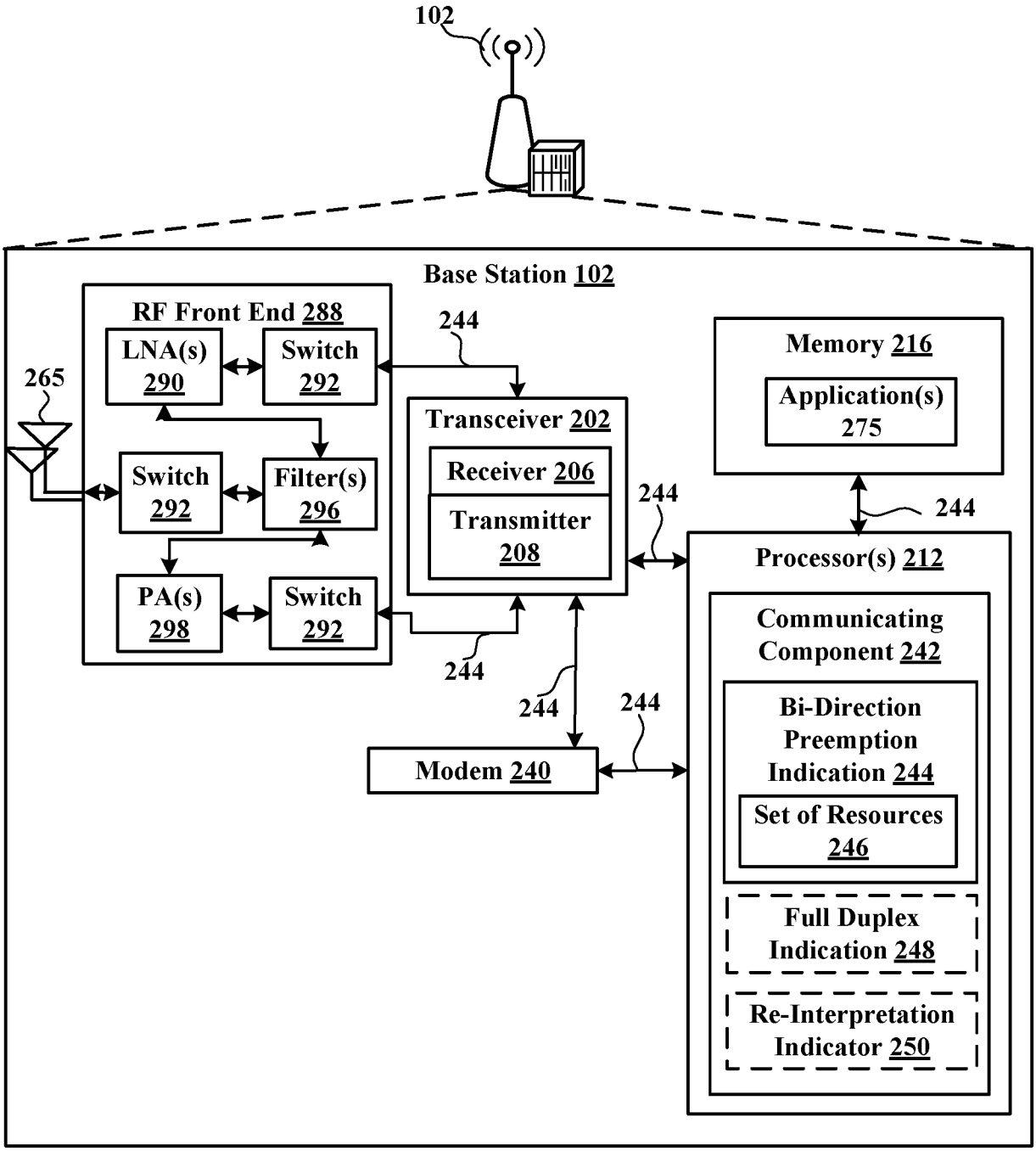
176
EPC
160
BM-SC
170
PDN Gateway
172
MBMS GW
168
Serving Gateway
166
MME
162
Other MMEs
164
HSS
174
132
Modem 340
Communication Component 342
Modem 240
Communicating Component 242
102/180
182
184
104
102
102 (102')
110
110 (110')
120
132
134
150
152
154
158

FIG. 1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Base Station 102
RF Front End 288
LNA(s) 290
Switch 292
Switch 292
Filter(s) 296
PA(s) 298
Switch 292
265
244
Transceiver 202
Receiver 206
Transmitter 208
244
244
244
244
Memory 216
Application(s) 275
244
Processor(s) 212
Communicating Component 242
Bi-Direction Preemption Indication 244
Set of Resources 246
Full Duplex Indication 248
Re-Interpretation Indicator 250
Modem 240

FIG. 2

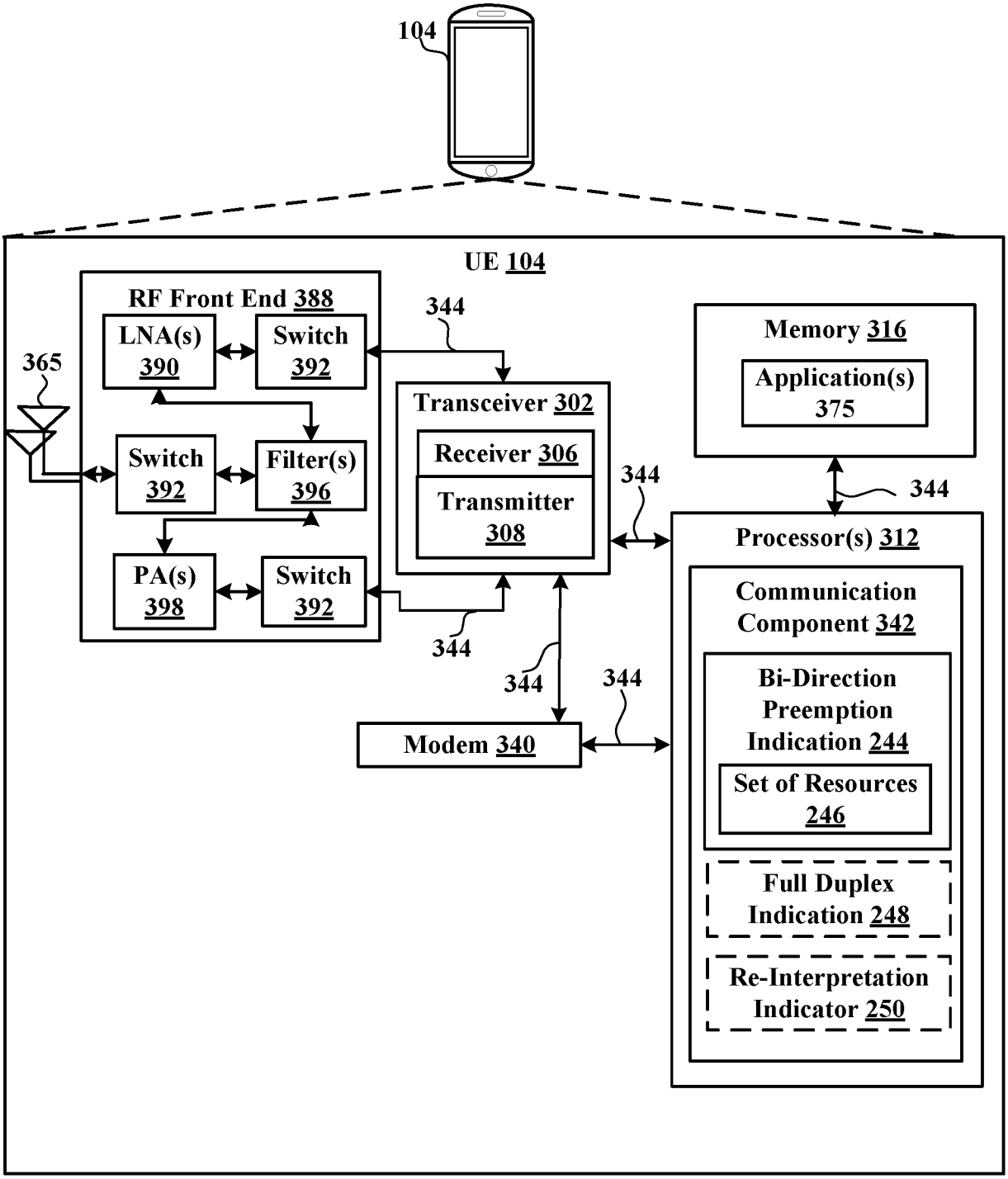
104
UE 104
RF Front End 388
LNA(s) 390
Switch 392
365
Switch 392
Filter(s) 396
PA(s) 398
Switch 392
344
Transceiver 302
Receiver 306
Transmitter 308
344
344
344
344
Modem 340
Memory 316
Application(s) 375
344
Processor(s) 312
Communication Component 342
Bi-Direction Preemption Indication 244
Set of Resources 246
Full Duplex Indication 248
Re-Interpretation Indicator 250

FIG. 3

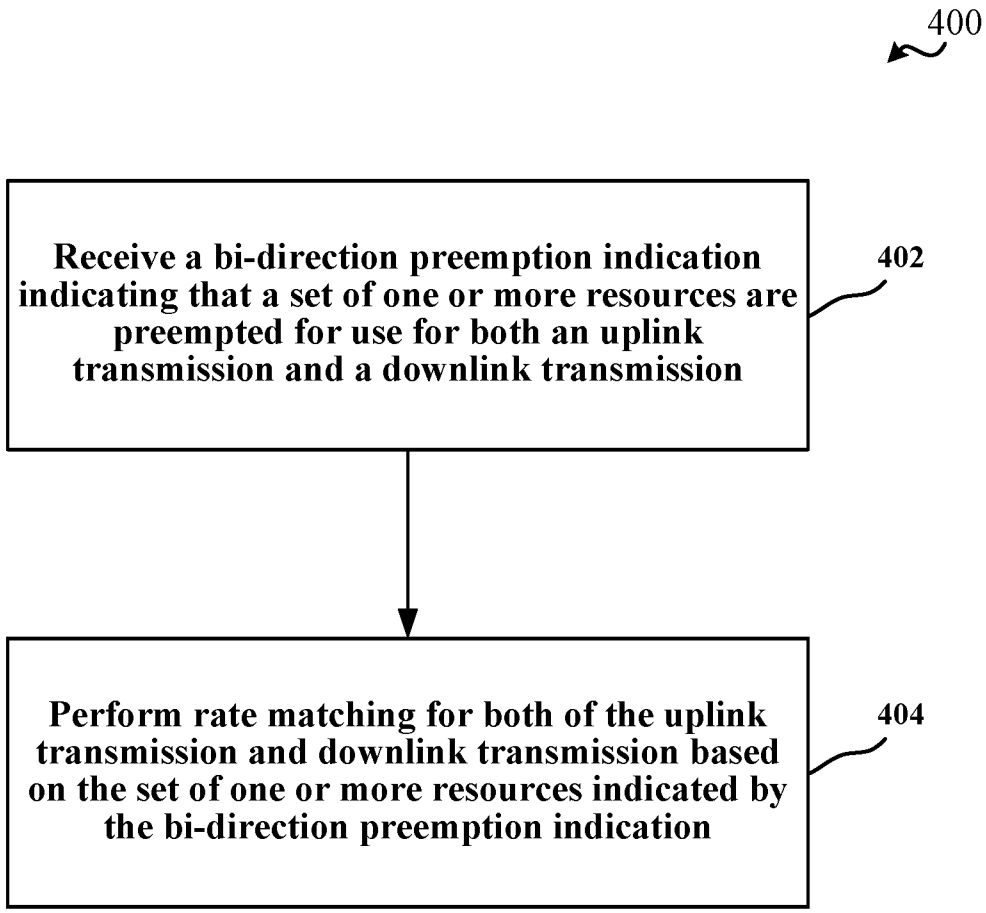
400
Receive a bi-direction preemption indication indicating that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission
402
Perform rate matching for both of the uplink transmission and downlink transmission based on the set of one or more resources indicated by the bi-direction preemption indication
404

FIG. 4

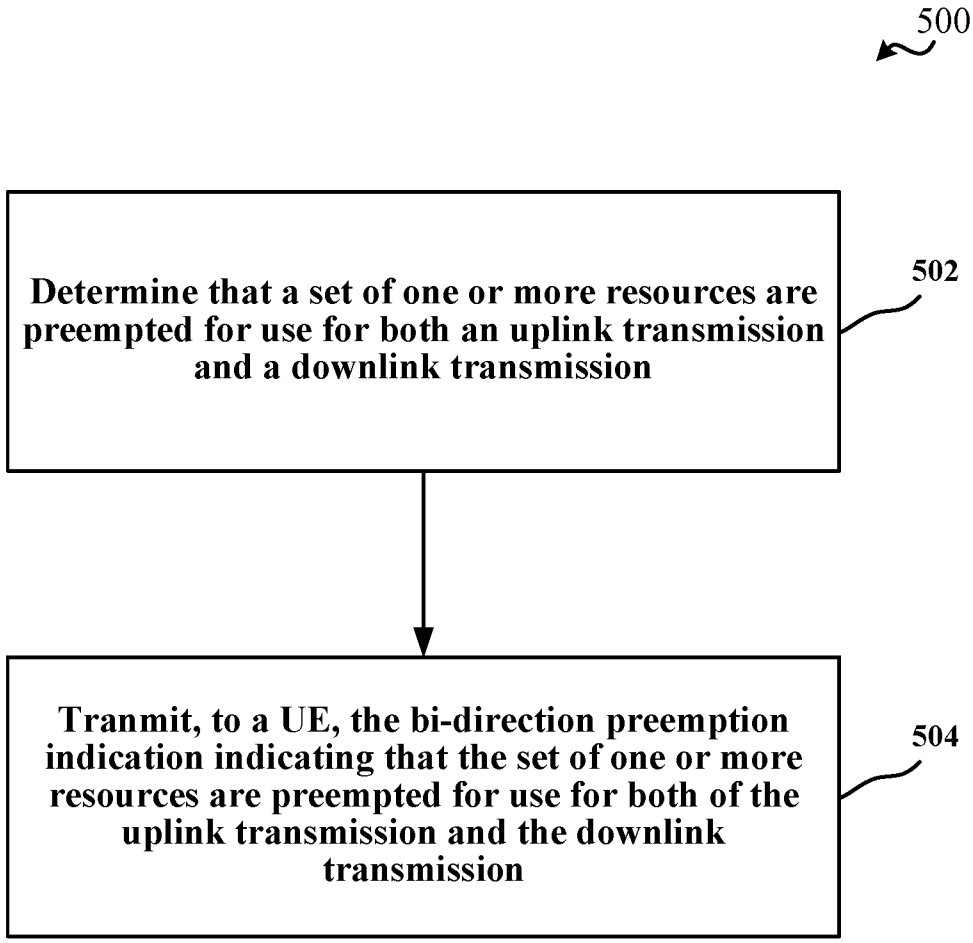
500
Determine that a set of one or more resources are preempted for use for both an uplink transmission and a downlink transmission
502
Tranmit, to a UE, the bi-direction preemption indication indicating that the set of one or more resources are preempted for use for both of the uplink transmission and the downlink transmission
504

FIG. 5

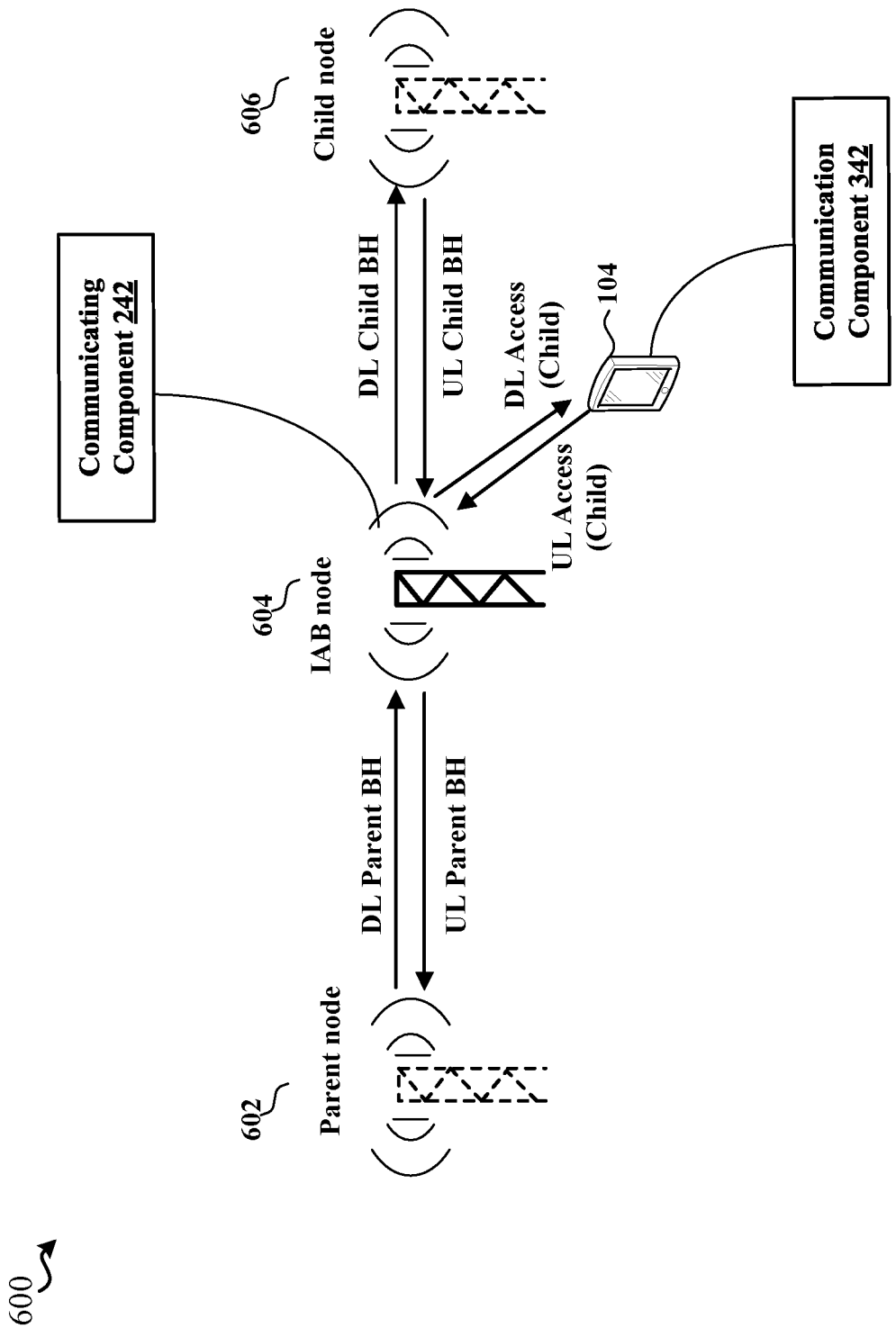
600
602
Parent node
604
IAB node
606
Child node
DL Parent BH
UL Parent BH
DL Child BH
UL Child BH
DL Access (Child)
UL Access (Child)
104
Communicating Component 242
Communication Component 342

FIG. 6

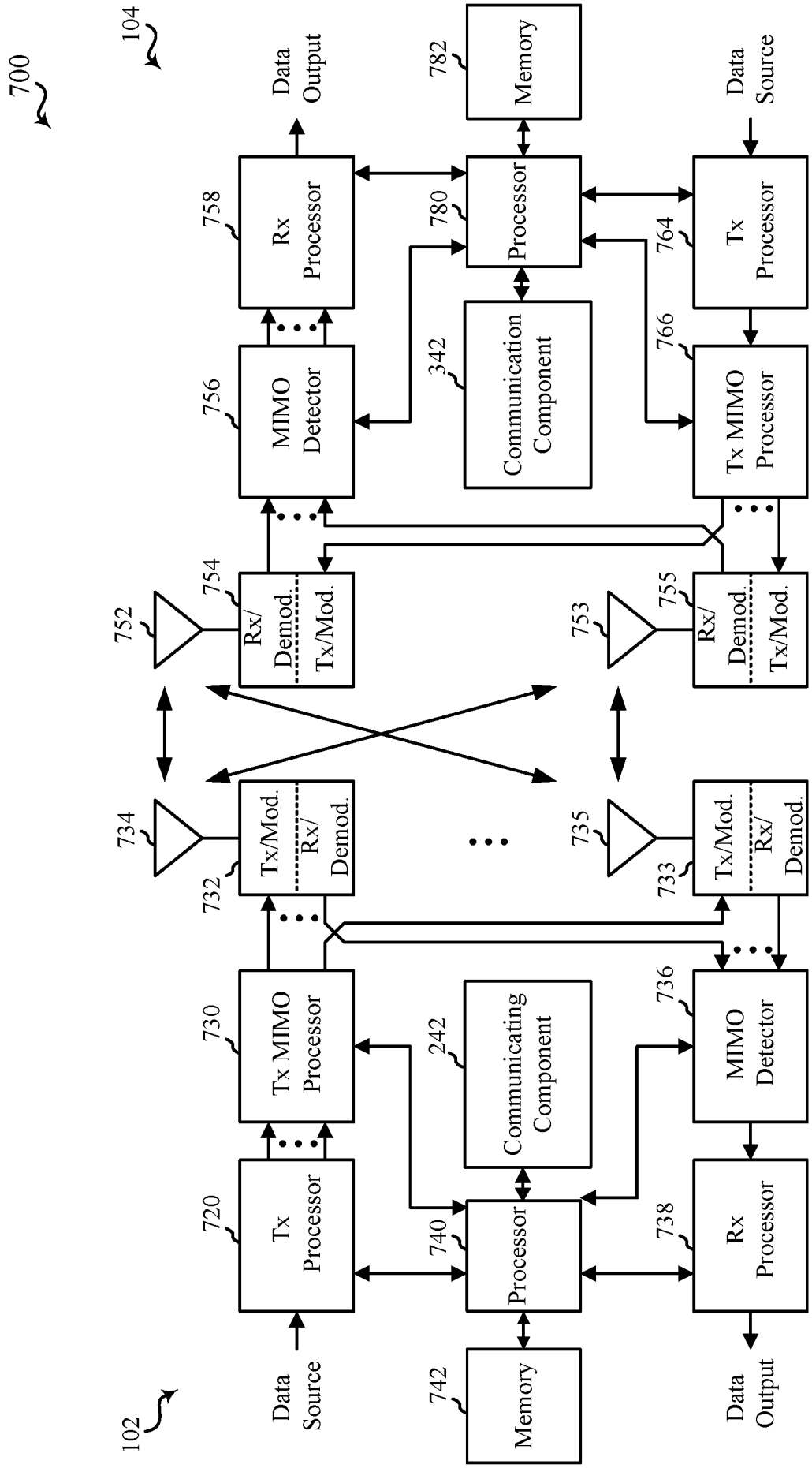
700
104
102
Data Source
Tx Processor
720
Tx MIMO Processor
730
Tx/Mod.
Rx/ Demod.
732
734
752
Rx/ Demod.
Tx/Mod.
754
MIMO Detector
756
Rx Processor
758
Data Output
Memory
782
Processor
780
Communication Component
342
Communicating Component
242
Processor
740
Memory
742
Tx/Mod.
Rx/ Demod.
733
735
753
Rx/ Demod.
Tx/Mod.
755
Tx MIMO Processor
766
Tx Processor
764
Data Source
MIMO Detector
736
Rx Processor
738
Data Output

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/047385

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L1/00 H04L5/00 H04L5/14 H04W72/04 H04W72/10
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L H04W

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2019/142512 A1 (SONY CORP [JP]) 25 July 2019 (2019-07-25)	1-3, 8-12, 14-16, 20-22, 24-26, 28,29
Y	paragraph [0001] - paragraph [0006] paragraph [0022] - paragraph [0031] paragraph [0065] - paragraph [0100] paragraph [0132] - paragraph [0133] paragraph [0157] figures 1-4, 7, 8, 10	4-7,13, 17-19, 23,27,30

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 November 2020	20/11/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vucic, Nikola

1

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/047385

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NOKIA ET AL: "UL inter-UE eMBB and URLLC multiplexing enhancements", 3GPP DRAFT; R1-1908970 NR_URLLC_UL_MULTIPLEXING_FINAL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Prague, CZ; 20190826 - 20190830 16 August 2019 (2019-08-16), XP051765575, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_98/Docs/R1-1908970.zip [retrieved on 2019-08-16]	4-7, 17-19, 23,27,30
A	Sections 2.3-2.5; page 4 - page 8 figures 2-4	9,21

Y	US 2015/382375 A1 (BHUSHAN NAGA [US] ET AL) 31 December 2015 (2015-12-31) paragraph [0174]	13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2020/047385

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2019142512 A1	25-07-2019	TW 201933911 A	16-08-2019
		WO 2019142512 A1	25-07-2019
US 2015382375 A1	31-12-2015	BR 112016030026 A2	22-08-2017
		CA 2950160 A1	30-12-2015
		CN 106465399 A	22-02-2017
		EP 3162144 A1	03-05-2017
		JP 6584435 B2	02-10-2019
		JP 2017523687 A	17-08-2017
		KR 20170020813 A	24-02-2017
		US 2015382375 A1	31-12-2015
		WO 2015199942 A1	30-12-2015