

HANDLING OF TRANSMISSION OR RECEPTION DURING MEASUREMENT GAP

TECHNICAL FIELD

[0001] The present disclosure relates to wireless communications, and more specifically to user equipment (UE), base station and methods for handling of transmission or reception during a measurement gap (MG).

BACKGROUND

[0002] A wireless communications system may include one or multiple network communication devices, such as base stations, which may be otherwise known as an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. Each network communication devices, such as a base station may support wireless communications for one or multiple user communication devices, which may be otherwise known as user equipment (UE), or other suitable terminology. The wireless communications system may support wireless communications with one or multiple user communication devices by utilizing resources of the wireless communication system (e.g., time resources (e.g., symbols, slots, subframes, frames, or the like) or frequency resources (e.g., subcarriers, carriers). Additionally, the wireless communications system may support wireless communications across various radio access technologies including third generation (3G) radio access technology, fourth generation (4G) radio access technology, fifth generation (5G) radio access technology, among other suitable radio access technologies beyond 5G (e.g., sixth generation (6G)).

[0003] Measurement gap configuration is a technical procedure in 5G networks that enables UEs to temporarily suspend their regular uplink transmission and downlink reception activities to perform inter-frequency or intra-frequency radio resource measurements, e.g., for handover decisions. When a UE is configured with periodical MGs for measurement, the UE is not expected to perform any transmissions or receptions of other signals/channels. Therefore, MGs can have major impact on scheduling and data transmissions.

[0004] Extended reality (XR) applications typically requires high throughput and low latency, and have a big packet size, variable data packet size and arrival jitter. When transmitting/receiving protocol data unit (PDU) sets with tight PDU set delay budget for

XR traffic, delaying data transmissions until after the MG may result in unnecessary PDU discarding, which decreases the XR capacity in cells with MGs.

[0005] Therefore, how to dynamically control uplink transmission and downlink reception during an MG needs to be studied from the perspective of efficiency and reliability.

SUMMARY

[0006] The present disclosure relates to UE, base station and methods that support handling of transmission or reception during an MG. With the UE, base station and methods, dynamic control of uplink transmission and downlink reception during an MG may be achieved. Thus, user experience and XR capacity may be improved.

[0007] Some implementations of a UE described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: receive at least one MG configuration for one or more MGs via the transceiver from a base station; and perform uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0008] In some implementations, the processor is further configured to: receive a command for the one or more MGs via the transceiver from the base station. In such implementations, the processor is configured to perform, based on the command, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG.

[0009] In some implementations, the command indicates whether the one or more MGs are to be activated or deactivated.

[0010] In some implementations, the processor is configured to perform the transmission or reception by: deactivating the at least one MG based on the command.

[0011] In some implementations, the one or more MGs is configured by the base station and allowed to be activated or deactivated based on the command. Alternatively, the one or more MGs is configured for the UE.

[0012] In some implementations, the processor is configured to activate or deactivate the at least one MG among the one or more MGs based on reception of the command. Alternatively, the processor is configured to activate or deactivate all of the one or more

MGs based on reception of the command.

[0013] In some implementations, the processor is further configured to: receive, via the transceiver from the base station, a first indication indicating that the one or more MGs are allowed to be activated or deactivated based on the command.

[0014] In some implementations, the command comprises a first bitmap, each of at least one bit in the first bitmap is associated with one of at least one MG configuration, and each of the at least one bit indicates that at least one MG associated with a respective one of the at least one MG configuration is to be activated or deactivated.

[0015] In some implementations, the at least one bit is arranged in the first bitmap in an ascending or descending order of at least one identifier of the at least one MG configuration.

[0016] In some implementations, the command comprises a second bitmap, each of at least one bit in the second bitmap is associated with one of MG types, and each of the at least one bit indicates that at least one MG with a respective one of the MG types is to be activated or deactivated.

[0017] In some implementations, the command comprises one bit, the one bit indicating that all of the one or more MGs are to be activated or deactivated.

[0018] In some implementations, the processor is further configured to: transmit, via the transceiver to the base station, a request for activating or deactivating the one or more MGs.

[0019] In some implementations, the one or more MGs is allowed to be activated or deactivated based on the command. Alternatively, the one or more MGs is configured for the UE.

[0020] In some implementations, the request comprises one bit, the one bit indicating to request that all of the one or more MGs are to be activated or deactivated.

[0021] In some implementations, the processor is configured to transmit the request for activating or deactivating the at least one gap by transmitting one of the following via the transceiver to the base station: uplink control information (UCI) comprising the request; a scheduling request; a random access request; or a layer 2 control element.

[0022] In some implementations, the request is associated with a scheduling request

configuration or a random access channel resource.

[0023] In some implementations, the processor is configured to transmit the request for activating or deactivating the at least one MG based on determining at least one of the following: a delay status report is triggered or reported; a regular buffer status report triggered or reported; a scheduling request is triggered or reported; arrival of not low importance data in buffer of the UE; arrival of the not low importance data is reported; or there will be potential data for transmission or reception during the at least one MG.

[0024] In some implementations, the command indicates that the at least one MG is to be deactivated; the processor is configured to perform the transmission or reception of data by deactivating the at least one MG based on the command; and the processor is further configured to start a timer based on reception of the command.

[0025] In some implementations, the processor is further configured to: receive a second command via the transceiver from the base station, the second command indicating that the at least one MG is to be deactivated; and restart the timer based on reception of the second command and determining that the timer is running.

[0026] In some implementations, the processor is further configured to: receive, via the transceiver from the base station, downlink control information (DCI) scheduling new transmission or retransmission of data; and restart the timer based on reception of the DCI and determining that the timer is running.

[0027] In some implementations, the processor is further configured to: activate, based on the expiration of the timer, the at least one MG which was deactivated based on the command.

[0028] In some implementations, the processor is further configured to: monitor the command based on a time window.

[0029] In some implementations, the processor is further configured to: monitor a dedicated search space for a physical downlink control channel (PDCCH) carrying the command.

[0030] In some implementations, the processor is further configured to: monitor a physical downlink control channel (PDCCH) scrambled with a dedicated radio network temporary identity (RNTI), the PDCCH carrying the command.

[0031] In some implementations, the command is included in a dedicated downlink control information (DCI) format or multiplexed in an existing DCI format.

[0032] In some implementations, the command is included in a layer 2 control element.

[0033] In some implementations, the command indicates to adjust at least one location of the at least one MG in time domain.

[0034] In some implementations, the command indicates to adjust the at least one location of the at least one MG in time domain by at least one of the following: delaying starting time of the at least one MG by an offset; advancing ending time of the at least one MG by the offset; advancing the starting time of the at least one MG by the offset; or delaying the ending time of the at least one MG by the offset.

[0035] In some implementations, the offset is predefined; or the processor is further configured to receive a configuration of the offset via the transceiver from the base station; or the command indicates the offset.

[0036] In some implementations, the processor is configured to perform, based on a rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG.

[0037] In some implementations, the resource comprises at least one of the following: a physical uplink control channel (PUCCH) resource, a configured grant, a physical downlink shared channel (PDSCH) resource associated with a semi-persistent scheduling, a dynamic uplink grant received by the UE, a downlink PDSCH assignment by the UE, at least one search space for physical downlink control channel (PDCCH), or a resource for sounding reference signal.

[0038] In some implementations, the processor is further configured to: receive a fourth indication of the resource via the transceiver from the base station.

[0039] In some implementations, the processor is further configured to: receive a third indication of the at least one MG via the transceiver from the base station.

[0040] In some implementations, the processor is configured to perform, based on the rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG by: based on determining that a timer associated with

a configured grant is running and a duration of the timer is overlapped with the at least one MG, performing the uplink transmission or downlink reception.

[0041] In some implementations, the processor is configured to perform, based on the rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG by: based on determining that the at least one MG is overlapped with a jitter range for arrival time of uplink data, performing the uplink transmission or downlink reception.

[0042] In some implementations, the processor is configured to perform, based on the rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG by: performing the uplink transmission or downlink reception based on determining one of the following: a delay status report is triggered or reported; a regular buffer status report triggered or reported; a scheduling request is triggered or reported; arrival of not low importance data is reported; downlink control information scheduling initial transmission or retransmission is received; or uplink data is transmitted.

[0043] In some implementations, the processor is configured to perform, based on the rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG by: autonomously deactivating the at least one MG.

[0044] In some implementations, the processor is further configured to: receive a fifth indication via the transceiver from the base station, the fifth indication indicating whether the one or more MGs are allowed to be autonomously activated or deactivated by the UE.

[0045] In some implementations, each of the one or more MGs is not associated with an identifier of an MG configuration.

[0046] In some implementations, each of the one or more MGs is associated with an identifier of an MG configuration.

[0047] In some implementations, the processor is configured to receive the fourth indication by: receiving a seventh bitmap, In some implementations, each of at least one bit in the seventh bitmap is associated with one of the at least one MG configuration, and each of the at least one bit indicates whether at least one MG associated with a respective one of the at least one MG configuration is allowed to be autonomously activated or deactivated by the UE.

[0048] In some implementations, the fifth indication indicates a list of one or more identifiers of one or more MG configurations, and at least one MG associated with a respective one of the one or more MG configurations is allowed to be autonomously activated or deactivated by the UE.

[0049] In some implementations, the processor is further configured to: transmit a sixth indication via the transceiver to the base station, the sixth indication indicating that the at least one MG is autonomously deactivated by the UE.

[0050] In some implementations, the processor is configured to transmit the sixth indication by transmitting one of the following via the transceiver to the base station: uplink control information (UCI) comprising the sixth indication; a scheduling request; a random access request; or a layer 2 control element.

[0051] In some implementations, the sixth indication is associated with a scheduling request configuration or a random access channel resource.

[0052] In some implementations, the processor is configured to transmit the sixth indication based on determining at least one of the following: a delay status report is triggered or reported; a regular buffer status report triggered or reported; a scheduling request is triggered or reported; arrival of not low importance data in buffer of the UE; arrival of the not low importance data is reported; or there will be potential data for transmission or reception during the at least one MG.

[0053] In some implementations, the processor is further configured to: transmit, via the transceiver to the base station, information related to at least one second MG based on which the UE does not perform measurement.

[0054] In some implementations, the processor is further configured to: receive, via the transceiver from the base station, a configuration for transmission of the information.

[0055] In some implementations, the configuration for transmission of the information indicates at least one of the following: a first period for transmission of the information, or at least one trigger event for transmission of the information.

[0056] In some implementations, the at least one trigger event is associated with at least one of the following: a first threshold for the number of MGs in a second period based on which the UE does not perform measurement, a second threshold for a duration of at least one MG in a third period based on which the UE does not perform measurement,

or a third threshold for a percentage of at least one deactivated MG in a fourth period.

[0057] Some implementations of a base station described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: transmit a command for one or more MGs via the transceiver to a UE; and perform, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0058] Some implementations of a UE described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: receive first DCI scheduling first new transmission or first retransmission of data via the transceiver from a base station; and perform, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one MG.

[0059] In some implementations, the processor is configured to perform the first new transmission or the first retransmission of data by deactivating the at least one MG based on the first DCI.

[0060] In some implementations, the processor is further configured to: start a timer based on reception of the first DCI and determining that the timer is not running.

[0061] In some implementations, the processor is further configured to: receive second DCI scheduling second new transmission or second retransmission of the data via the transceiver from the base station; and restart the timer based on reception of the second DCI and determining that the timer is running.

[0062] In some implementations, the processor is further configured to: activate, based on the expiration of the timer, the at least one MG which was deactivated based on the first DCI.

[0063] In some implementations, the timer is separate from a discontinuous reception (DRX) inactivity timer.

[0064] In some implementations, the timer is configured by the base station or predefined.

[0065] Some implementations of a method described herein may include: receiving at least one MG configuration for one or more MGs from a base station; and performing

uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0066] Some implementations of a method described herein may include: transmitting a command for one or more MGs to a UE; and performing, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0067] Some implementations of a method described herein may include: receiving first DCI scheduling first new transmission or retransmission of data from a base station; and performing, based on the first DCI, the first new transmission or the retransmission of data on at least one resource which is overlapped with at least one MG.

[0068] Some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: receive at least one MG configuration for one or more MGs via the transceiver from a base station; and perform uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0069] Some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: receive first DCI scheduling first new transmission or retransmission of data via the transceiver from a base station; and perform, based on the first DCI, the first new transmission or the retransmission of data on at least one resource which is overlapped with at least one MG.

[0070] It is to be understood that the summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0071] Fig. 1 illustrates an example of a wireless communications system that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure;

[0072] Fig. 2 illustrates a signaling diagram illustrating an example process that

supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure;

[0073] Fig. 3 illustrates an example of an MG configuration in accordance with aspects of the present disclosure;

[0074] Fig. 4 illustrates a signaling diagram illustrating another example process that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure;

[0075] Fig. 5 illustrates a signaling diagram illustrating a further example process that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure;

[0076] Fig. 6 illustrates a signaling diagram illustrating a still further example process that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure;

[0077] Fig. 7 illustrates an example of a resource which is overlapped with an MG in accordance with aspects of the present disclosure;

[0078] Fig. 8 illustrates an example of a jitter range for arrival time of uplink data in accordance with aspects of the present disclosure;

[0079] Fig. 9 illustrates an example of a device that supports handling of transmission or reception during an MG in accordance with some aspects of the present disclosure;

[0080] Fig. 10 illustrates an example of a processor that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure; and

[0081] Figs. 11, 12 and 13 illustrate a flowchart of a method that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure, respectively.

DETAILED DESCRIPTION

[0082] Principles of the present disclosure will now be described with reference to some embodiments. It is to be understood that these embodiments are described only for the purpose of illustration and help those skilled in the art to understand and implement

the present disclosure, without suggesting any limitation as to the scope of the disclosure. The disclosure described herein may be implemented in various manners other than the ones described below.

[0083] In the following description and claims, unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skills in the art to which this disclosure belongs.

[0084] References in the present disclosure to “one embodiment,” “an example embodiment,” “an embodiment,” “some embodiments,” and the like indicate that the embodiment(s) described may include a particular feature, structure, or characteristic, but it is not necessary that every embodiment includes the particular feature, structure, or characteristic. Moreover, such phrases do not necessarily refer to the same embodiment(s). Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0085] It shall be understood that although the terms “first” and “second” or the like may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. For example, a first element could also be termed as a second element, and similarly, a second element could also be termed as a first element, without departing from the scope of embodiments. As used herein, the term “and/or” includes any and all combinations of one or more of the listed terms.

[0086] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises”, “comprising”, “has”, “having”, “includes” and/or “including”, when used herein, specify the presence of stated features, elements, and/or components etc., but do not preclude the presence or addition of one or more other features, elements, components and/ or combinations thereof.

[0087] As described above, when transmitting/receiving PDU sets with tight PDU set delay budget for XR traffic, delaying data transmissions until after the MG may result in

unnecessary PDU discarding, which decreases the XR capacity in cells with MGs. Therefore, how to dynamically control uplink transmission and downlink reception during an MG needs to be studied from the perspective of efficiency and reliability.

[0088] In view of the above, the present disclosure provides a solution that supports handling of transmission or reception during an MG. In this solution, a UE receives at least one MG configuration for one or more MGs from a base station. In turn, the UE performs uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs. With this solution, dynamic control of uplink transmission and downlink reception during an MG may be achieved.

[0089] Aspects of the present disclosure are described in the context of a wireless communications system.

[0090] Fig. 1 illustrates an example of a wireless communications system 100 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The wireless communications system 100 may include one or more network entities 102 (also referred to as network equipment (NE)), one or more terminal devices or UEs 104, a core network 106, and a packet data network 108. The wireless communications system 100 may support various radio access technologies. In some implementations, the wireless communications system 100 may be a 4G network, such as an LTE network or an LTE-advanced (LTE-A) network. In some other implementations, the wireless communications system 100 may be a 5G network, such as an NR network. In other implementations, the wireless communications system 100 may be a combination of a 4G network and a 5G network, or other suitable radio access technology including institute of electrical and electronics engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20. The wireless communications system 100 may support radio access technologies beyond 5G. Additionally, the wireless communications system 100 may support technologies, such as time division multiple access (TDMA), frequency division multiple access (FDMA), or code division multiple access (CDMA), etc.

[0091] The network entities 102 may be dispersed throughout a geographic region to form the wireless communications system 100. One or more of the network entities 102 described herein may be or include or may be referred to as a network node, a base station

(BS), a network element, a radio access network (RAN) node, a base transceiver station, an access point, a NodeB, an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. A network entity 102 and a UE 104 may communicate via a communication link 110, which may be a wireless or wired connection. For example, a network entity 102 and a UE 104 may perform wireless communication (e.g., receive signaling, transmit signaling) over a Uu interface. The network entities 102 may be collectively referred to as network entities 102 or individually referred to as a network entity 102. Hereinafter, some implementations of the present disclosure will be described by taking a base station as an example of the network entity 102. Thus, the network entity 102 may be used interchangeably with the base station 102.

[0092] A network entity 102 may provide a geographic coverage area 112 for which the network entity 102 may support services (e.g., voice, video, packet data, messaging, broadcast, etc.) for one or more UEs 104 within the geographic coverage area 112. For example, a network entity 102 and a UE 104 may support wireless communication of signals related to services (e.g., voice, video, packet data, messaging, broadcast, etc.) according to one or multiple radio access technologies. In some implementations, a network entity 102 may be moveable, for example, a satellite associated with a non-terrestrial network. In some implementations, different geographic coverage areas 112 associated with the same or different radio access technologies may overlap, but the different geographic coverage areas 112 may be associated with different network entities 102. Information and signals described herein 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 description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0093] The one or more UEs 104 may be dispersed throughout a geographic region of the wireless communications system 100. A UE 104 may include or may be referred to as a mobile device, a wireless device, a remote device, a remote unit, a handheld device, or a subscriber device, or some other suitable terminology. In some implementations, the UE 104 may be referred to as a unit, a station, a terminal, or a client, among other examples. Additionally, or alternatively, the UE 104 may be referred to as an internet-of-things (IoT) device, an internet-of-everything (IoE) device, or machine-type communication (MTC) device, among other examples. In some implementations, a UE

104 may be stationary in the wireless communications system 100. In some other implementations, a UE 104 may be mobile in the wireless communications system 100.

[0094] The one or more UEs 104 may be devices in different forms or having different capabilities. Some examples of UEs 104 are illustrated in Fig. 1. A UE 104 may be capable of communicating with various types of devices, such as the network entities 102, other UEs 104, or network equipment (e.g., the core network 106, the packet data network 108, a relay device, an integrated access and backhaul (IAB) node, or another network equipment), as shown in Fig. 1. Additionally, or alternatively, a UE 104 may support communication with other network entities 102 or UEs 104, which may act as relays in the wireless communications system 100.

[0095] A UE 104 may also be able to support wireless communication directly with other UEs 104 over a communication link 114. For example, a UE 104 may support wireless communication directly with another UE 104 over a device-to-device (D2D) communication link. In some implementations, such as vehicle-to-vehicle (V2V) deployments, vehicle-to-everything (V2X) deployments, or cellular-V2X deployments, the communication link 114 may be referred to as a sidelink. For example, a UE 104 may support wireless communication directly with another UE 104 over a PC5 interface.

[0096] A network entity 102 may support communications with the core network 106, or with another network entity 102, or both. For example, a network entity 102 may interface with the core network 106 through one or more backhaul links 116 (e.g., via an S1, N2, N2, or another network interface). The network entities 102 may communicate with each other over the backhaul links 116 (e.g., via an X2, Xn, or another network interface). In some implementations, the network entities 102 may communicate with each other directly (e.g., between the network entities 102). In some other implementations, the network entities 102 may communicate with each other or indirectly (e.g., via the core network 106). In some implementations, one or more network entities 102 may include subcomponents, such as an access network entity, which may be an example of an access node controller (ANC). An ANC may communicate with the one or more UEs 104 through one or more other access network transmission entities, which may be referred to as a radio heads, smart radio heads, or transmission-reception points (TRPs).

[0097] In some implementations, a network entity 102 may be configured in a

disaggregated architecture, which may be configured to utilize a protocol stack physically or logically distributed among two or more network entities 102, such as an integrated access backhaul (IAB) network, an open radio access network (O-RAN) (e.g., a network configuration sponsored by the O-RAN Alliance), or a virtualized RAN (vRAN) (e.g., a cloud RAN (C-RAN)). For example, a network entity 102 may include one or more of a central unit (CU), a distributed unit (DU), a radio unit (RU), a RAN intelligent controller (RIC) (e.g., a near-real time RIC (Near-RT RIC), a non-real time RIC (Non-RT RIC)), a service management and orchestration (SMO) system, or any combination thereof.

[0098] An RU may also be referred to as a radio head, a smart radio head, a remote radio head (RRH), a remote radio unit (RRU), or a transmission reception point (TRP). One or more components of the network entities 102 in a disaggregated RAN architecture may be co-located, or one or more components of the network entities 102 may be located in distributed locations (e.g., separate physical locations). In some implementations, one or more network entities 102 of a disaggregated RAN architecture may be implemented as virtual units (e.g., a virtual CU (VCU), a virtual DU (VDU), a virtual RU (VRU)).

[0099] Split of functionality between a CU, a DU, and an RU may be flexible and may support different functionalities depending upon which functions (e.g., network layer functions, protocol layer functions, baseband functions, radio frequency functions, and any combinations thereof) are performed at a CU, a DU, or an RU. For example, a functional split of a protocol stack may be employed between a CU and a DU such that the CU may support one or more layers of the protocol stack and the DU may support one or more different layers of the protocol stack. In some implementations, the CU may host upper protocol layer (e.g., a layer 3 (L3), a layer 2 (L2)) functionality and signaling (e.g., radio resource control (RRC), service data adaptation protocol (SDAP), packet data convergence protocol (PDCP)). The CU may be connected to one or more DUs or RUs, and the one or more DUs or RUs may host lower protocol layers, such as a layer 1 (L1) (e.g., physical (PHY) layer) or an L2 (e.g., radio link control (RLC) layer, medium access control (MAC) layer) functionality and signaling, and may each be at least partially controlled by the CU.

[0100] Additionally, or alternatively, a functional split of the protocol stack may be employed between a DU and an RU such that the DU may support one or more layers of the protocol stack and the RU may support one or more different layers of the protocol

stack. The DU may support one or multiple different cells (e.g., via one or more RUs). In some implementations, a functional split between a CU and a DU, or between a DU and an RU may be within a protocol layer (e.g., some functions for a protocol layer may be performed by one of a CU, a DU, or an RU, while other functions of the protocol layer are performed by a different one of the CU, the DU, or the RU).

[0101] A CU may be functionally split further into CU control plane (CU-CP) and CU user plane (CU-UP) functions. A CU may be connected to one or more DUs via a midhaul communication link (e.g., F1, F1-c, F1-u), and a DU may be connected to one or more RUs via a fronthaul communication link (e.g., open fronthaul (FH) interface). In some implementations, a midhaul communication link or a fronthaul communication link may be implemented in accordance with an interface (e.g., a channel) between layers of a protocol stack supported by respective network entities 102 that are in communication via such communication links.

[0102] The core network 106 may support user authentication, access authorization, tracking, connectivity, and other access, routing, or mobility functions. The core network 106 may be an evolved packet core (EPC), or a 5G core (5GC), which may include a control plane entity that manages access and mobility (e.g., a mobility management entity (MME), an access and mobility management functions (AMF)) and a user plane entity that routes packets or interconnects to external networks (e.g., a serving gateway (S-GW), a packet data network (PDN) gateway (P-GW), or a user plane function (UPF)). In some implementations, the control plane entity may manage non-access stratum (NAS) functions, such as mobility, authentication, and bearer management (e.g., data bearers, signal bearers, etc.) for the one or more UEs 104 served by the one or more network entities 102 associated with the core network 106.

[0103] The core network 106 may communicate with the packet data network 108 over one or more backhaul links 116 (e.g., via an S1, N2, N2, or another network interface). The packet data network 108 may include an application server 118. In some implementations, one or more UEs 104 may communicate with the application server 118. A UE 104 may establish a session (e.g., a protocol data unit (PDU) session, or the like) with the core network 106 via a network entity 102. The core network 106 may route traffic (e.g., control information, data, and the like) between the UE 104 and the application server 118 using the established session (e.g., the established PDU session).

The PDU session may be an example of a logical connection between the UE 104 and the core network 106 (e.g., one or more network functions of the core network 106).

[0104] In the wireless communications system 100, the network entities 102 and the UEs 104 may use resources of the wireless communications system 100 (e.g., time resources (e.g., symbols, slots, subframes, frames, or the like) or frequency resources (e.g., subcarriers, carriers)) to perform various operations (e.g., wireless communications). In some implementations, the network entities 102 and the UEs 104 may support different resource structures. For example, the network entities 102 and the UEs 104 may support different frame structures. In some implementations, such as in 4G, the network entities 102 and the UEs 104 may support a single frame structure. In some other implementations, such as in 5G and among other suitable radio access technologies, the network entities 102 and the UEs 104 may support various frame structures (i.e., multiple frame structures). The network entities 102 and the UEs 104 may support various frame structures based on one or more numerologies.

[0105] One or more numerologies may be supported in the wireless communications system 100, and a numerology may include a subcarrier spacing and a cyclic prefix. A first numerology (e.g., $\mu=0$) may be associated with a first subcarrier spacing (e.g., 15 kHz) and a normal cyclic prefix. In some implementations, the first numerology (e.g., $\mu=0$) associated with the first subcarrier spacing (e.g., 15 kHz) may utilize one slot per subframe. A second numerology (e.g., $\mu=1$) may be associated with a second subcarrier spacing (e.g., 30 kHz) and a normal cyclic prefix. A third numerology (e.g., $\mu=2$) may be associated with a third subcarrier spacing (e.g., 60 kHz) and a normal cyclic prefix or an extended cyclic prefix. A fourth numerology (e.g., $\mu=3$) may be associated with a fourth subcarrier spacing (e.g., 120 kHz) and a normal cyclic prefix. A fifth numerology (e.g., $\mu=4$) may be associated with a fifth subcarrier spacing (e.g., 240 kHz) and a normal cyclic prefix.

[0106] A time interval of a resource (e.g., a communication resource) may be organized according to frames (also referred to as radio frames). Each frame may have a duration, for example, a 10 millisecond (ms) duration. In some implementations, each frame may include multiple subframes. For example, each frame may include 10 subframes, and each subframe may have a duration, for example, a 1 ms duration. In some implementations, each frame may have the same duration. In some implementations, each

subframe of a frame may have the same duration.

[0107] Additionally or alternatively, a time interval of a resource (e.g., a communication resource) may be organized according to slots. For example, a subframe may include a number (e.g., quantity) of slots. The number of slots in each subframe may also depend on the one or more numerologies supported in the wireless communications system 100. For instance, the first, second, third, fourth, and fifth numerologies (i.e., $\mu=0$, $\mu=1$, $\mu=2$, $\mu=3$, $\mu=4$) associated with respective subcarrier spacings of 15 kHz, 30 kHz, 60 kHz, 120 kHz, and 240 kHz may utilize a single slot per subframe, two slots per subframe, four slots per subframe, eight slots per subframe, and 16 slots per subframe, respectively. Each slot may include a number (e.g., quantity) of symbols (e.g., OFDM symbols). In some implementations, the number (e.g., quantity) of slots for a subframe may depend on a numerology. For a normal cyclic prefix, a slot may include 14 symbols. For an extended cyclic prefix (e.g., applicable for 60 kHz subcarrier spacing), a slot may include 12 symbols. The relationship between the number of symbols per slot, the number of slots per subframe, and the number of slots per frame for a normal cyclic prefix and an extended cyclic prefix may depend on a numerology. It should be understood that reference to a first numerology (e.g., $\mu=0$) associated with a first subcarrier spacing (e.g., 15 kHz) may be used interchangeably between subframes and slots.

[0108] In the wireless communications system 100, an electromagnetic (EM) spectrum may be split, based on frequency or wavelength, into various classes, frequency bands, frequency channels, etc. By way of example, the wireless communications system 100 may support one or multiple operating frequency bands, such as frequency range designations FR1 (410 MHz – 7.125 GHz), FR2 (24.25 GHz – 52.6 GHz), FR3 (7.125 GHz – 24.25 GHz), FR4 (52.6 GHz – 114.25 GHz), FR4a or FR4-1 (52.6 GHz – 71 GHz), and FR5 (114.25 GHz – 300 GHz). In some implementations, the network entities 102 and the UEs 104 may perform wireless communications over one or more of the operating frequency bands. In some implementations, FR1 may be used by the network entities 102 and the UEs 104, among other equipment or devices for cellular communications traffic (e.g., control information, data). In some implementations, FR2 may be used by the network entities 102 and the UEs 104, among other equipment or devices for short-range, high data rate capabilities.

[0109] FR1 may be associated with one or multiple numerologies (e.g., at least three

numerologies). For example, FR1 may be associated with a first numerology (e.g., $\mu=0$), which includes 15 kHz subcarrier spacing; a second numerology (e.g., $\mu=1$), which includes 30 kHz subcarrier spacing; and a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing. FR2 may be associated with one or multiple numerologies (e.g., at least 2 numerologies). For example, FR2 may be associated with a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing; and a fourth numerology (e.g., $\mu=3$), which includes 120 kHz subcarrier spacing.

[0110] Fig. 2 illustrates a signaling diagram illustrating an example process 200 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The process 200 may involve the UE 104 and the base station 102 in Fig. 1. For the purpose of discussion, the process 200 will be described with reference to Fig. 1.

[0111] As shown in Fig. 2, the base station 102 transmits 210 at least one MG configuration for one or more MGs to the UE 104. Accordingly, the UE 104 receives the at least one MG configuration for one or more MGs from the base station 102.

[0112] In turn, the UE 104 performs 220 uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0113] With the process 200, dynamic control of uplink transmission and downlink reception during an MG may be achieved.

[0114] In some implementations, each of the at least one MG may comprise or legacy configured measurement gap (e.g., introduced in NR Release 15) or pre-configured measurement gap (Pre-MG) or network controlled small gap (NCSG).

[0115] In some implementations, each of the at least one MG configuration may comprise at least one of the following:

- a type of an MG which may be represented by *gapType* (hereinafter, “a type of an MG” is also referred to as “an MG type”),
- an MG length of an MG in ms of the MG, wherein the MG length may be represented by *mgl*,
- an MG repetition period in (ms) of the MG, wherein the MG repetition period may be represented by *mgrp*,

- an MG timing advance which may be represented by *mgta*,
- a priority of the MG which may be represented by *gappriority*,
- a gap offset of the gap pattern with MGRP indicated in the field *mgrp*, where the value range is from 0 to *mgrp*-1; if *ncsgInd-r17* is present, this offset value refers to the starting point of VIL1 (the visible interruption length before the ML), or
- an identifier (ID) of the MG which may be represented by *measGapId* (hereinafter, the ID of the MG represented by *measGapId* is also referred to as a first ID of the MG).

[0116] In some implementations, a value of *gapType* may comprise one of the following:

- *perUE* which indicates that it is a per UE measurement gap,
- *perFR1* which indicates that it is an FR1 measurement gap, or
- *perFR2* which indicates that it is an FR2 measurement gap.

[0117] In some implementations, each of the at least one MG configuration may comprise a first ID of an MG and a second ID of the MG. For example, an MG associated with an MG configuration with the second ID may be allowed to be activated or deactivated based on the command. The second ID of the MG may be represented by *additionalmeasGapId*. The second ID is different from the first ID. For example, a length of the second ID is less than that of the first ID. Table 1 gives an example of mapping between the first ID and the second ID.

Table 1

<i>measGapId</i>	<i>additionalmeasGapId</i>
1	0
4	1
5	2
7	3

[0118] Alternatively, in some implementations, each of the at least one MG configuration may not comprise a first ID of an MG but comprise a second ID of the MG.

[0119] Fig. 3 illustrates an example of an MG configuration in accordance with aspects of the present disclosure. In the example of Fig. 3, a subcarrier spacing is equal

to 15kHz, and an MG length of an MG is equal to 4ms. The MG comprises durations 310 and 320 as well as an actual measurement window 330. During the durations 310 and 320, the UE 104 performs radio frequency retuning and there is no uplink transmission or downlink reception. Within the actual measurement window 330 of 3ms, the UE 104 may receive and measure synchronization signal block (SSB) #0, SSB#1, SSB#2 and SSB#3. The actual measurement window 330 may comprise an SSB-based measurement timing configuration (SMTTC) window of 2ms.

[0120] In some implementations, the uplink transmission may comprise at least one of the following: uplink data transmission or uplink signalling transmission.

[0121] In some implementations, the downlink reception may comprise at least one of the following: downlink data reception or downlink signalling reception.

[0122] In some implementations, a resource which is overlapped with an MG may comprise a resource within the MG.

[0123] Fig. 4 illustrates a signaling diagram illustrating an example process 400 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The process 400 may be considered as an example implementations of the process 200. The process 400 may involve the UE 104 and the base station 102 in Fig. 1. For the purpose of discussion, the process 400 will be described with reference to Fig. 1.

[0124] As shown in Fig. 4, the base station 102 transmits 410 at least one MG configuration for one or more MGs to the UE 104. Accordingly, the UE 104 receives the at least one MG configuration for one or more MGs from the base station 102. The action 410 is similar to the action 210 in Fig. 2. Details of this action is omitted for brevity.

[0125] The base station 102 transmits 440 a command for the one or more MGs to the UE 104. Accordingly, the UE 104 receives the command for the one or more MGs from the base station 102.

[0126] In some implementations, optionally, before transmitting the command for the one or more MGs, the base station 102 may transmit 420 an indication to the UE 104. The indication may be used to enable the UE 104 to receive and handle the command for the one or more MGs.

[0127] In turn, the UE 104 performs 450, based on the command, uplink transmission

or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0128] In some implementations, the command may indicate whether the one or more MGs are to be activated or deactivated. In other words, the command may indicate which MGs are to be activated or deactivated. In such implementations, the UE 104 may perform the uplink transmission or downlink reception by deactivating the at least one MG based on the command. In other words, the UE 104 prioritizes uplink transmission or downlink reception during at least one activated MG.

[0129] In some implementations, the base station 102 may determine to deactivate an MG based on the traffic data arrival time overlapped with the MG. For example, the base station 102 may determine to deactivate an MG according to a jitter range for arrival time of uplink data or a jitter range for arrival time of downlink data. For example, the base station 102 determines to deactivate an MG based on determining that there is data pending for transmission occurring during the MG. The data may be delay-critical or not low importance data.

[0130] In some implementations, the command may indicate, by using a bitmap, whether the one or more MGs are to be activated or deactivated.

[0131] In some implementations, the command may comprise a first bitmap. Each of at least one bit in the first bitmap is associated with one of at least one MG configuration, and each of the at least one bit indicates whether at least one MG associated with a respective one of the at least one MG configuration is to be activated or deactivated. Hereinafter, the number of the at least one bit in the first bitmap is represented by N.

[0132] In some implementations, N may be predefined. For example, N may be equal to the maximum number of IDs for MG configurations. Hereinafter, the maximum number of IDs for MG configurations is represented by maxNrofGapId.

[0133] Alternatively, in some implementations, N may be configured by the base station 102. Alternatively, N may be determined by the number of the MG configurations which are allowed to be activated or deactivated based on the command. Alternatively, N may be determined by the number of the MG configurations of the UE 104, one MAC entity of the UE 104 or an active bandwidth part (BWP) of the UE 104. Alternatively, N may be determined by the number of the activated MG of the UE 104, one MAC entity

of the UE 104 or an active BWP of the UE 104.

[0134] In some implementations, each of the at least one MG configuration may be configured with an ID. In such implementations, the at least one bit is arranged in the first bitmap in an ascending or descending order of at least one ID of the at least one MG configuration. In such implementations, N may be equal to the number of the MG configurations with the configured IDs. In such implementations, the UE 104 may consider all MGs associated with the MG configurations with the configured IDs can be activated or deactivated based on the command.

[0135] Consider a first example of the first bitmap. In the first example, the command may comprise a first field comprising the first bitmap. Hereinafter, the first field is also referred to as a G_i field. The G_i field may indicate that an MG associated with an MG configuration i is to be activated or deactivated, where i represents an ID of an MG configuration and i is in an ascending or descending order of IDs of MG configurations. The IDs of MG configurations may be the first IDs of MG configurations or the second IDs of MG configurations.

[0136] The G_i field set to 1 indicates that an MG associated with an MG configuration i is to be deactivated, i.e., the UE 104 may perform uplink transmission or downlink reception during the MG associated with the MG configuration i.

[0137] The G_i field set to 0 indicates that an MG associated with an MG configuration i is to be activated, i.e., the UE 104 may perform measurement during the MG associated with the MG configuration i. In other words, the UE 104 cannot perform uplink transmission or downlink reception during the MG associated with the MG configuration i.

[0138] In the first example, N may be equal to the number of the MG configurations which are allowed to be activated or deactivated based on the command. For example, $N=4$, i.e., $0 \leq i \leq 3$. MGs associated with MG configurations with the first IDs (i.e., *measGapId*) of 1, 4, 5 and 7 are allowed to be activated or deactivated based on the command. That is, MGs associated with MG configurations with the second IDs (i.e., *additionalmeasGapId*) of 0, 1, 2 and 3 are allowed to be activated or deactivated based on the command. Table 2 gives an example of the first field comprising the first bitmap.

[0139] In some implementations, the second ID may be configured per BWP. In other

words, the second ID is unique in a BWP. For example, the command may comprise a second ID. If the UE 104 in a BWP receives the command including the second ID, the UE 104 determines which MG configuration is indicated by the command.

[0140] In some implementations, the second ID may be configured per MAC entity of the UE 104. In other words, the ID is unique in a MAC entity of the UE 104. For example, the command may comprise a second ID. If the UE 104 receives the command including the second ID, the UE 104 determines which MG configuration is indicated by the command.

Table 2

<i>measGapId</i>	1	4	5	7
<i>additionalmeasGapId</i>	0	1	2	3
Activation/deactivation status of an MG i	1	0	0	1

[0141] Alternatively, in some implementations, the command may comprise a second bitmap. Each of at least one bit in the second bitmap is associated with one of MG types. Each of the at least one bit indicates that at least one MG with a respective one of the MG types is to be activated or deactivated. In some implementations, each of the MG types may be configured with an MG configuration ID. Alternatively, each of the MG types may not be configured with an MG configuration ID. In such implementations, the UE 104 may consider MGs associated with the MG types can be activated or deactivated based on the command.

[0142] In some implementations, each of the at least one MG configuration may be associated with inter-frequency measurement or intra-frequency measurement.

[0143] In some implementations, the UE 104 may consider all MGs associated with the MG configurations associated with inter-frequency measurement can be activated or deactivated based on the command. For example, the base station 102 configures the UE 104 may consider all MGs associated with the MG configurations only associated with inter-frequency measurement can be activated or deactivated based on the command. For example, only the at least one bit is arranged in the first bitmap for the at least one MG configuration associated with inter-frequency measurement.

[0144] In some implementations, the UE 104 may consider all MGs associated with the MG configurations associated with intra-frequency measurement can be activated or deactivated based on the command associated with intra-frequency measurement. For example, the base station 102 configures the UE 104 may consider all MGs associated with the MG configurations only associated with intra-frequency measurement can be activated or deactivated based on the command. For example, only the at least one bit is arranged in the first bitmap for the at least one MG configuration associated with intra-frequency measurement.

[0145] In some implementations, the UE 104 may consider all MGs associated with the MG configurations associated with FR2 measurement can be activated or deactivated based on the command. For example, the base station 102 configures the UE 104 may consider all MGs associated with the MG configurations only associated with FR2 measurement can be activated or deactivated based on the command. For example, only the at least one bit is arranged in the first bitmap for the at least one MG configuration associated with inter-frequency measurement.

[0146] In some implementations, the UE 104 may consider all MGs associated with the MG configurations associated with FR1 measurement can be activated or deactivated based on the command. For example, the base station 102 configures the UE 104 may consider all MGs associated with the MG configurations only associated with FR1 measurement can be activated or deactivated based on the command. For example, only the at least one bit is arranged in the first bitmap for the at least one MG configuration associated with intra-frequency measurement.

[0147] In some implementations, the at least one bit is arranged in the second bitmap in an order of a first MG type and a second MG type. For example, the first MG type may be *perFR1* and the second MG type may be *perFR2*. Alternatively, the first MG type may be *perFR2* and the second MG type may be *perFR1*.

[0148] Consider a second example of the second bitmap. In the second example, the command may comprise a second field comprising the second bitmap. Hereinafter, the second field is also referred to as a G_i field. The G_i field may indicate that at least an MG associated with an MG type i is to be activated or deactivated, where i represents an index of an MG type and i is in an order of an MG type #0 and an MG type #1. The MG type #0 may be *perFR2* and the MG type #1 may be *perFR1*. For example, if more than one

MGs are associated with MG type i , all MGs associated with the MG type i are to be activated or deactivated. Alternatively, if only part of the MGs associated with the MG type i are allowed to be activated or deactivated based on the command, then the part of the MGs associated with the MG type i which are allowed to be activated or deactivated based on the command are activated or deactivated.

[0149] The G_i field set to 1 indicates that an MG associated with an MG type i is to be deactivated, i.e., the UE 104 may perform uplink transmission or downlink reception during the MG associated with the MG type i .

[0150] The G_i field set to 0 indicates that an MG associated with an MG type i is to be activated, i.e., the UE 104 may perform measurement during the MG associated with the MG type i . In other words, the UE 104 cannot perform uplink transmission or downlink reception during the MG associated with the MG type i .

[0151] In the second example, N may be equal to the number of the MG configurations which are allowed to be activated or deactivated based on the command. For example, $N=2$, i.e., $0 \leq i \leq 1$. Table 3 gives an example of the second field comprising the second bitmap.

Table 3

MG type i	$perFR2$	$perFR1$
Activation/deactivation status of an MG i	1	0

[0152] Consider a third example of the second bitmap. In the third example, N may be equal to the number of the MG configurations which are allowed to be activated or deactivated based on the command. For example, $N=1$, i.e., the UE 104 is configured with one MG configuration. The type of the one MG configuration may be $perUE$ or $perFR1$ or $perFR2$. Table 4 gives an example of the second field comprising the second bitmap.

Table 4

MG type i	$perUE$ or $perFR1$ or $perFR2$
Activation/deactivation status of an MG i	1

[0153] Alternatively, in some implementations, a first subset of the at least one MG configuration may not be configured with an ID and a second subset of the at least one

MG configuration may be configured with an ID. In such implementations, the at least one bit is arranged in the first bitmap in an order of the first subset and the second subset. Alternatively, the at least one bit is arranged in the first bitmap in an order of the second subset and the first subset.

[0154] Consider a fourth example of the first bitmap. In the fourth example, the command may comprise a fourth field comprising the first bitmap. Hereinafter, the fourth field is also referred to as a G_i field. The G_i field may indicate that an MG associated with an MG type i or with an MG configuration i is to be activated or deactivated, where i represents an index or ID of an MG configuration.

[0155] The G_i field set to 1 indicates that an MG associated with an MG type i or with an MG configuration i is to be deactivated, i.e., the UE 104 may perform uplink transmission or downlink reception during the MG associated with an MG type i or with the MG configuration i .

[0156] The G_i field set to 0 indicates that the MG associated with the MG type i or with the MG configuration i is to be activated, i.e., the UE 104 may perform measurement during the MG associated with the MG type i or with the MG configuration i . In other words, the UE 104 cannot perform uplink transmission or downlink reception during the MG associated with the MG type i or with the MG configuration i .

[0157] In some implementations, the command comprises one bit, and the one bit indicate that all of the one or more MGs are to be activated or deactivated. In such implementations, the command does not explicitly indicate which MGs to be activated or deactivated. For example, the one or more MGs may be one or more MGs configured for the UE 104. For another example, the one or more MGs may be one or more MGs which are allowed to be activated or deactivated based on the command. Upon receiving the command, the UE 104 may activate or deactivate all of the one or more MGs. For example, the one or more MGs may be configured, by default, to be allowed to be activated or deactivated based on the command. For example, the one or more MGs may be specially configured to be allowed to be activated or deactivated based on the command.

[0158] In some implementations, the base station may configure or indicate to the UE 104 which MGs are allowed to be activated or deactivated based on the command. In such implementations, the base station may transmit a first indication to the UE 104. The first indication indicates whether the one or more MGs are allowed to be activated or

deactivated based on the command. For example, the first indication may be included in the at least one MG configuration transmitted via the action 210 or 410. For another example, the first indication may be separate from the at least one MG configuration transmitted via the action 210 or 410.

[0159] In some implementations, each of the at least one MG configuration may not be configured with an ID. In such implementations, the first indication may comprise a third bitmap. Each of at least one bit in the third bitmap is associated with one of MG types. Each of the at least one bit indicates whether at least one MG with a respective one of the MG types is allowed to be activated or deactivated. In some implementations, each of the MG associated with an MG type may be configured with an MG configuration ID. Alternatively, each of the MG associated with an MG type may not be configured with an MG configuration ID. Hereinafter, the number of the at least one bit in the third bitmap is represented by M.

[0160] In some implementations, M may be predefined. For example, M may be equal to the maximum number of IDs for MG configurations. Alternatively, M may be configured by the base station 102. Alternatively, M may be determined by the number of the MG configurations which are allowed to be activated or deactivated based on the command.

[0161] In some implementations, the at least one bit is arranged in the third bitmap in an order of a first MG type and a second MG type. For example, the first MG type may be *perFR1* and the second MG type may be *perFR2*. Alternatively, the first MG type may be *perFR2* and the second MG type may be *perFR1*.

[0162] Consider a fourth example of the third bitmap. In the fourth example, the first indication may comprise a third field comprising the third bitmap. Hereinafter, the third field is also referred to as an A_i field. The A_i field may indicate whether an MG associated with an MG type i is allowed to be activated or deactivated based on the command, where i represents an index of an MG type. For example, $M=2$ and i is in an order of an MG type #0 and an MG type #1. The MG type #0 may be *perFR2* and the MG type #1 may be *perFR1*.

[0163] The A_i field set to “allowed” indicates that an MG associated with an MG type i is allowed to be activated or deactivated based on the command. The A_i field set to “not allowed” indicates that an MG associated with an MG type i is not allowed to be activated

or deactivated based on the command.

[0164] Consider a fifth example of the third bitmap. In the fifth example, M=1, i.e., the UE 104 is configured with one MG configuration. The type of the one MG configuration may be *perUE* or *perFR1* or *perFR2*. The third bitmap may comprise one bit indicating whether an MG associated with the MG type is allowed to be activated or deactivated based on the command.

[0165] In some implementations, each of the at least one MG configuration may be configured with an ID. The first indication indicates whether an MG associated with an MG configuration with an ID is allowed to be activated or deactivated based on the command. The first indication may be included in the MG configuration transmitted from the based station 102. For example, the based station 102 may transmit the first indication via *GapConfig-r17* information element (IE) as below:

GapConfig-r17 ::=	SEQUENCE {
measGapId-r17	MeasGapId-r17,
gapType-r17	ENUMERATED {perUE, perFR1, perFR2},
gapOffset-r17	INTEGER (0..159),
mgl-r17	ENUMERATED {ms1, ms1dot5, ms2, ms3, ms3dot5,
ms4, ms5, ms5dot5, ms6, ms10, ms20},	
mgrp-r17	ENUMERATED {ms20, ms40, ms80, ms160},
mgta-r17	ENUMERATED {ms0, ms0dot25, ms0dot5,
ms0dot75},	
gapPriority-r17	GapPriority-r17
OPTIONAL, -- Need R	
...	
First indication	ENUMERATED{allowed}
}	

[0166] In some implementations, the first indication set to “allowed” indicates that an MG associated with an MG configuration with a *measGapId* is allowed to be activated or deactivated based on the command. The first indication set to “not allowed” indicates that an MG associated with an MG configuration with a *measGapId* is not allowed to be activated or deactivated based on the command.

[0167] Alternatively, in some implementations, each of the at least one MG

configuration may be configured with an ID. In such implementations, the first indication may comprise a fourth bitmap. Each of at least one bit in the fourth bitmap is associated with one of at least one MG configuration. Each of the at least one bit indicates whether at least one MG associated with a respective one of the at least one MG configuration is allowed to be activated or deactivated based on the command. Hereinafter, the number of the at least one bit in the fourth bitmap is represented by P.

[0168] In some implementations, P may be predefined. For example, P may be equal to the maximum number of IDs for MG configurations. Alternatively, P may be configured by the base station 102.

[0169] Consider a sixth example of the fourth bitmap. In the sixth example, the first indication may comprise a fourth field comprising the fourth bitmap. Hereinafter, the fourth field is also referred to as a Q_i field. The Q_i field may indicate whether an MG associated with an MG configuration i is allowed to be activated or deactivated based on the command, where i represents a first ID (i.e., *measGapId*) of an MG configuration and i is in an ascending or descending order of first IDs of MG configurations.

[0170] The Q_i field set to 1 indicates that an MG associated with an MG configuration i is allowed to be activated or deactivated based on the command. Thus, the command may indicate that the MG associated with this MG configuration is to be activated or deactivated. For example, in the first example as described above, the command may comprise the G_i field. A bit in the G_i field may indicate that the MG associated with this MG configuration is to be activated or deactivated based on the command.

[0171] The Q_i field set to 0 indicates that an MG associated with an MG configuration i is not allowed to be activated or deactivated based on the command. Thus, the command may not indicate that the MG associated with this MG configuration is to be activated or deactivated. For example, in the first example as described above, the command may comprise the G_i field. The G_i field does not comprise any bit associated with this MG configuration.

[0172] In the sixth example, P may be equal to the number of the MG configurations which are configured for the UE 104. For example, $P=8$, i.e., $0 \leq i \leq 7$.

[0173] In the sixth example, the based station 102 may transmit the first indication via *MeasGapConfig* IE as below:

```

MeasGapConfig ::= SEQUENCE {
  First indication BIT STRING (SIZE (8)),
  ...
}

```

[0174] Alternatively, in some implementations, each of the at least one MG configuration may be configured with an ID. In such implementations, the first indication may comprise a list of one or more IDs of one or more MG configurations. At least one MG associated with a respective one of the one or more MG configurations is allowed to be activated or deactivated based on the command. In such implementations, each of the one or more IDs in the list may be the first ID of a respective MG configuration.

[0175] Consider the example as shown in Table 1. In the example, MGs associated with MG configurations with *measGapIds* #1, #4, #5 and #7 are allowed to be activated or deactivated based on the command. Thus, the list may comprise *measGapIds* #1, #4, #5 and #7.

[0176] In the example, the based station 102 may transmit the first indication via *MeasGapConfig* IE as below:

```

MeasGapConfig ::= SEQUENCE {
  First indication SEQUENCE (SIZE (1..maxNrofGapId-r17)) OF MeasGapId-r17,
}

```

[0177] In some implementations, the command may be carried in a physical downlink control channel (PDCCH). For example, the command may be carried in a physical downlink control channel (PDCCH) order. Compared to the command carried in Layer 2 MAC CE or layer 3 RRC message, the transmission reliability and efficiency is higher, and the transmission latency is lower.

[0178] In such implementations, if the PHY layer receives the command, the PHY layer indicates the command to the upper layer, e.g., MAC layer or RRC layer.

[0179] For example, if the command indicates that the one or more MGs are to be deactivated, the PHY layer indicates it to the upper layer. The MAC entity deactivates an MG, and the UE 104 considers the MG is deactivated. Correspondingly, the UE 104 can perform the uplink transmission or downlink reception during the MG.

[0180] For another example, if the command indicates that the one or more MGs are to be activated, the PHY layer indicates it to the upper layer. The MAC entity activates an MG, and the UE 104 considers the MG is activated. Correspondingly, the UE 104 does not perform the uplink transmission or downlink reception during the MG. In some implementation, the uplink transmission includes transmission of at least one of the following: HARQ feedback, Schedule Request, Channel State Information, PUSCH, or Sounding Reference Signal,. In some implementation, the downlink transmission includes at least one of the transmissions of: PDCCH, PDSCH. For example, the behaviour of the UE 104 may be as below.

During an activated measurement gap, the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by *measGapConfig* as specified in TS 38.331 [5]:

- 1>not perform the transmission of HARQ feedback, SR, and CSI;
- 1>not report SRS;
- 1>not transmit on UL-SCH except for Msg3 or the MSGA payload as specified in clause 5.4.2.2;
- 1>if the *ra-ResponseWindow* or the *ra-ContentionResolutionTimer* or the *msgB-ResponseWindow* is running:
 - 2>monitor the PDCCH as specified in clauses 5.1.4 and 5.1.5.
- 1>else:
 - 2>not monitor the PDCCH;
 - 2>not receive on DL-SCH.

[0181] In some implementations, if the UE 104 receives the command indicating an MG is to be activated, a status of the MG shall be changed prior to a next MG occasion. Alternatively, if the UE 104 receives the command indicating the MG is to be activated, a status of the MG shall be changed immediately.

[0182] In some implementations, the UE 104 may monitor a dedicated or new search space for the PDCCH carrying the command. For example, the dedicated search space may be configured by the base station 102. For example, the dedicated search space

configuration may be associated with an MG configuration.

[0183] In some implementations, the UE 104 may monitor the PDCCH carrying the command and the PDCCH may be scrambled with a dedicated or new radio network temporary identity (RNTI). For example, the dedicated RNTI may be configured by the base station 102. For example, the dedicated RNTI configuration may be associated with an MG configuration.

[0184] In some implementations, the command may have no bit information about which MG configuration to be deactivated. For example, if the UE 104 receives the PDCCH scrambled by a dedicated RNTI, the UE 104 considers MG deactivation command is received. Further, if the UE 104 receives the PDCCH scrambled by a dedicated RNTI, the UE 104 deactivates the MG(s) associated with the dedicated RNTI or all MGs.

[0185] In some implementations, the command may have no bit information about which MG configuration to deactivate. For example, if UE receives the PDCCH in a dedicated search space, UE consider MG deactivation command is received. Further, if UE receives the PDCCH in a dedicated search space, UE deactivates the MG(s) associated with the dedicated search space or all MGs.

[0186] In some implementations, the command may be included in a dedicated or new downlink control information (DCI) format, e.g., DCI format 2-X. DCI format may be called as PDCCH format.

[0187] Alternatively, in some implementations, the command may be multiplexed in an existing or legacy DCI format. In such implementations, a reserved bit in the existing or legacy DCI format may indicate whether the one or more MGs are to be activated or deactivated. Alternatively, an existing or legacy bit in the existing or legacy DCI format may indicate whether the one or more MGs are to be activated or deactivated. For example, the existing or legacy DCI format may comprise one of the following: DCI format 0-0, DCI format 1-0, DCI format 0-1 or DCI format 1-1, DCI format 2-0, DCI format 2-1, DCI format 2-2, DCI format 2-3, DCI format 2-4, DCI format 2-5, or DCI format 2-6.

[0188] In some implementations, the UE 104 may monitor the command based on a time window. For example, the window is determined based on an offset. The UE 104 may monitor the command at the beginning of an offset before start of each or an MG

occasion of the at least one MG. The offset may be configured by the base station 102. For example, if the UE 104 receives the command indicating an MG is to be deactivated, the UE 104 may deactivate at least a subsequent MG occasion. For example, the offset may be configured to be associated with an MG configuration. Further, if the UE 104 receives the command indicating an MG is to be deactivated, the UE 104 deactivates the MG associated with the offset or all MGs.

[0189] Alternatively, in some implementations, the command may be included in a layer 2 control element (CE). In such implementations, the command may be included in an MAC CE. In such implementations, a dedicated or specific logical channel identifier (LCID) in the MAC sub-header associated with the MAC CE may be assigned to identify the MAC CE.

[0190] For example, upon the reception of the MAC CE for Measurement Gap Activation Command which indicates the deactivation of a configured measurement gap, the MAC entity shall deactivate the measurement gap. Upon the reception of the MAC CE for Measurement Gap Deactivation Command which indicates the activation of a configured measurement gap, the MAC entity shall activate the measurement gap and perform the procedure.

[0191] In some implementations, optionally, the UE 104 may transmit 430, to the base station 102, a request for activating or deactivating the at least one MG.

[0192] In some implementations, the request for activating or deactivating the at least one MG may comprise a request for activating or deactivating at least one MG which is allowed to be activated or deactivated based on the command. Alternatively, the request for activating or deactivating the at least one MG may comprise a request for activating or deactivating at least one MG which is configured for the UE 104.

[0193] In some implementations, the request may comprise one bit. The one bit indicates to request that all of the one or more MGs are to be activated or deactivated. For example, the one or more MGs may be one or more MGs which are allowed to be activated or deactivated based on the command. For another example, the one or more MGs may be one or more MGs which are configured for the UE 104.

[0194] In some implementations, the request may indicate whether the one or more MGs are requested to be activated or deactivated.

[0195] In some implementations, the request may indicate the information indicating time period of the one or more MGs are requested to be activated or deactivated.

[0196] In some implementations, the request may indicate the information indicating which measurement gap occasions of the one or more MGs are requested to be activated or deactivated. If the request does not indicate the information, the UE 104 implicitly requests the next MG occasions or all subsequent MG occasions to be activated or deactivated. In some implementations, the request may indicate the information indicating the start timing of measurement gap occasions of the one or more MGs are requested to be activated or deactivated. If the request does not indicate the information, the UE 104 implicitly requests the start timing of next MG occasions or all subsequent MG occasions to be activated or deactivated.

[0197] In some implementations, the request may indicate the information indicating the end timing of measurement gap occasions of the one or more MGs are requested to be activated or deactivated. If the request does not indicate the information, the UE 104 implicitly requests the start timing of next MG occasions or all subsequent MG occasions to be activated or deactivated.

[0198] In some implementations, similar to the command, the request may indicate, by using a bitmap, whether the one or more MGs are requested to be activated or deactivated.

[0199] In some implementations, the request may comprise a fifth bitmap. Each of at least one bit in the fifth bitmap is associated with one of at least one MG configuration, and each of the at least one bit indicates that at least one MG associated with a respective one of the at least one MG configuration is requested to be activated or deactivated.

[0200] Alternatively, in some implementations, the request may comprise a sixth bitmap. Each of at least one bit in the sixth bitmap is associated with one of MG types. Each of the at least one bit indicates that at least one MG with a respective one of the MG types is requested to be activated or deactivated. In some implementations, each of the MG associated with an MG type may be configured with an MG configuration ID. Alternatively, each of the MG associated with an MG type may not be configured with an MG configuration ID.

[0201] In some implementations, the UE 104 may transmit the request for activating

or deactivating the at least one MG by transmitting a scheduling request (SR) to the base station 102. In such implementations, a resource for the SR may be configured separately from the legacy SR resource for other purpose. In such implementations, an SR configuration is associated with one or more MGs. In other words, the request is associated with the SR configuration.

[0202] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG by transmitting a random access (RA) request to the base station 102. In such implementations, the request is associated with a random access channel (RACH) resource. In such implementations, an RA resource is associated with one or more MGs. For example, the RACH resource may comprise a preamble and/or RA occasion. The preamble may be configured as contention free based preamble separately from legacy for other purpose.

[0203] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG by transmitting uplink control information (UCI) comprising the request. For example, the UCI may comprise the fifth bitmap or the sixth bitmap. The UCI may be transmitted on PUSCH, e.g., on a configured grant configured by the base station 102. For example, which configured grant allowed to transmit the UCI may be configured by the based station 102. Alternatively, the UCI may be transmitted on PUCCH.

[0204] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG by transmitting a layer 2 control element comprising the request. For example, the layer 2 control element may comprise the fifth bitmap or the sixth bitmap. Alternatively, the layer 2 control element may comprise one bit. The one bit indicates to request that all of the one or more MGs are to be activated or deactivated.

[0205] In some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that a delay status report is triggered or reported. For example, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that a delay status report for any or one specific logical channel group (LCG) configured by the base station 102 is triggered or reported.

[0206] Alternatively, in some implementations, the UE 104 may transmit the request

for activating or deactivating the at least one MG based on determining that a regular buffer status report triggered or reported. For example, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that a regular buffer status report for any or one specific LCG configured by the base station 102 is triggered or reported.

[0207] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that a scheduling request is triggered or reported. For example, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that a scheduling request for any or one specific LCH configured by the base station 102 is triggered or reported.

[0208] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that arrival of not low importance data in buffer of the UE.

[0209] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that arrival of the not low importance data is reported.

[0210] Alternatively, in some implementations, the UE 104 may transmit the request for activating or deactivating the at least one MG based on determining that there will be potential data for transmission or reception during the at least one MG.

[0211] In some implementations, if the UE 104 receives the command indicating that the at least one MG is to be deactivated for a period of time, the UE 104 may deactivate the at least one MG for the period of time (e.g., a number of measurement gap repetition period). For example, the period of time may be represented by the number of MG repetition periods.

[0212] In some implementations, if the UE 104 receives the command indicating that the at least one MG is to be deactivated, the UE 104 may deactivate the at least one MG for a period of time, the UE 104 may start a timer based on reception of the command if the timer is not running. For example, the period of time may be represented by the number of MG repetition periods.

[0213] In some implementations, the UE 104 may receive a second command from

the base station 102. The second command indicates that the at least one MG is to be deactivated. In turn, if the timer is running, the UE 104 may restart the timer based on reception of the second command. In such implementations, if the timer expires, the UE 104 may activate the at least one MG which was deactivated based on the command.

[0214] In some implementations, the command may indicate the information indicating time period of the one or more MGs are to be deactivated.

[0215] In some implementations, the command may indicate the information indicating which measurement gap occasions of the one or more MGs are to be deactivated. If the command does not indicate the information, the base station 102 may implicitly indicate the next MG occasion or all the subsequent MG occasions to be deactivated.

[0216] In some implementations, the command may indicate the information indicating the start timing of measurement gap occasions of the one or more MGs are to be deactivated. If the command does not indicate the information, the base station 102 may implicitly indicate the start timing of next MG occasion to be deactivated.

[0217] In some implementations, the command may indicate the information indicating the end timing of measurement gap occasions of the one or more MGs are to be deactivated. If the command does not indicate the information, the base station 102 may implicitly indicate the end timing of next MG occasion to be deactivated.

[0218] Alternatively, in some implementations, the UE 104 may receive, from the base station 102, DCI scheduling new transmission or retransmission of data. In turn, if the timer is running, the UE 104 may restart the timer based on reception of the DCI. In such implementations, if the timer expires, the UE 104 may activate the at least one MG which was deactivated based on the command.

[0219] In some implementations, a duration of the timer may be configured by the base station 102.

[0220] In some implementations, a duration of the timer may be configured by the base station 102 by using at least one of the following: an MG length of an MG (represented by *mgI*), or an MG repetition period of the MG (represented by *mgrp*). For example, the duration of the timer may be configured as a multiple of *mgI* or a multiple of *mgrp*. For another example, the duration of the timer may be configured as *mgI* or *mgrp*.

[0221] In some implementations, the base station 102 may dynamically adjust at least one location of the at least one MG in time domain by using the command. In such implementations, the command may indicate to adjust at least one location of the at least one MG in time domain.

[0222] In some implementations, in order to adjust at least one location of the at least one MG in time domain, the command may indicate to advance starting time of the at least one MG by an offset. In such implementations, the starting time of the at least one MG may be advanced by the offset and ending time of the at least one MG may be unchanged.

[0223] Alternatively, in some implementations, in order to adjust at least one location of the at least one MG in time domain, the command may indicate to advance the starting time of the at least one MG by the offset and to advance the ending time of the at least one MG by the offset.

[0224] Alternatively, in some implementations, in order to adjust at least one location of the at least one MG in time domain, the command may indicate to delay the starting time of the at least one MG by the offset. In such implementations, the starting time of the at least one MG may be delayed by the offset and ending time of the at least one MG may be unchanged.

[0225] Alternatively, in some implementations, in order to adjust at least one location of the at least one MG in time domain, the command may indicate to advance the ending time of the at least one MG by the offset. In such implementations, the ending time of the at least one MG may be advanced by the offset and the starting time of the at least one MG may be unchanged.

[0226] Alternatively, in some implementations, in order to adjust at least one location of the at least one MG in time domain, the command may indicate to delay the starting time of the at least one MG by the offset and to delay the ending time of the at least one MG by the offset.

[0227] In some implementations, the offset is predefined. Alternatively, the UE 104 may receive a configuration of the offset from the base station. Alternatively, the command may indicate the offset.

[0228] Alternatively, the command may indicate a code index, and the UE 104 may

receive an RRC message indicating a step. The UE 104 may determine the offset as a product of the code index and the step, e.g., $\text{offset} = \text{code index} * \text{step}$. In some implementations, $\text{step} = \text{MGRP}$.

[0229] In some implementations, the UE 104 may receive the command indicating to adjust at least one location of the at least one MG in time domain. Upon receiving the command, a status of the MG shall be changed prior to a next MG occasion. That is, the UE 104 may adjust a location of the next MG occasion in time domain. Alternatively, the UE 104 may apply the command to all subsequent MG occasions immediately. That is, the UE 104 may adjust locations of all subsequent MG occasions in time domain. For example, the UE 104 may receive, during a first MG repetition period, the command indicating to adjust at least one location of the at least one MG in time domain. Upon receiving the command, a status of the MG shall be changed prior to a next MG occasion during a second MG repetition period immediately subsequent to the first MG repetition period.

[0230] Fig. 5 illustrates a signaling diagram illustrating an example process 500 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The process 500 may involve the UE 104 and the base station 102 in Fig. 1. For the purpose of discussion, the process 500 will be described with reference to Fig. 1.

[0231] As shown in Fig. 5, the base station 102 transmits 510, to the UE 104, first DCI scheduling first new transmission or first retransmission of data. Accordingly, the UE 104 receives the first DCI from the base station 102.

[0232] In turn, the UE 104 performs 520, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one MG.

[0233] In some implementations, the UE 104 may perform the first new transmission or the first retransmission of data by deactivating the at least one MG based on the first DCI. In such implementations, the first DCI may act as a command indicating the at least one MG is to be deactivated.

[0234] In some implementations, if the UE 104 receives the first DCI, the UE 104 may deactivate the at least one MG for a period of time. In such implementations, the UE

104 may start a timer based on reception of the first DCI if the timer is not running. If timer is running, the at least one MG is kept deactivated.

[0235] In some implementations, the UE 104 may receive, from the base station 102, second DCI scheduling second new transmission or second retransmission of the data. In turn, if the timer is running, the UE 104 may restart the timer based on reception of the second DCI. In such implementations, if the timer expires, the UE 104 may activate the at least one MG which was deactivated based on the first DCI.

[0236] In some implementations, the timer is separate from a discontinuous reception (DRX) inactivity timer.

[0237] In some implementations, a duration of the timer may be configured by the base station 102 or predefined.

[0238] In some implementations, the duration of the timer may be configured by the base station 102 by using at least one of the following: an MG length of an MG (represented by *mg_l*), or an MG repetition period of the MG (represented by *mg_{rp}*). For example, the duration of the timer may be configured as a multiple of *mg_l* or a multiple of *mg_{rp}*. For another example, the duration of the timer may be configured as *mg_l* or *mg_{rp}*.

[0239] In some implementations, the UE 104 may perform, based on a rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG. Such implementations will be described with reference to Figs. 6 to 8.

[0240] Fig. 6 illustrates a signaling diagram illustrating an example process 600 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The process 600 may be considered as another example implementations of the process 200. The process 600 may involve the UE 104 and the base station 102 in Fig. 1. For the purpose of discussion, the process 600 will be described with reference to Fig. 1.

[0241] As shown in Fig. 6, the base station 102 transmits 610 at least one MG configuration for one or more MGs to the UE 104. Accordingly, the UE 104 receives the at least one MG configuration for one or more MGs from the base station 102. The action 610 is similar to the action 210 in Fig. 2. Details of this action is omitted for brevity.

[0242] In turn, the UE 104 performs 650, based on a rule, uplink transmission or

downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs. In other words, the UE 104 prioritizes the uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG.

[0243] In some implementations, the UE 104 may perform, based on the rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG by autonomously deactivating the at least one MG.

[0244] With the process 600, the UE 104 may determine to perform uplink transmission and downlink reception during an MG. For example, the UE 104 may autonomously and dynamically control uplink transmission and downlink reception during an MG.

[0245] In some implementations, optionally, the base station 102 may transmit 620 a second indication to the UE 104. The second indication indicates to prioritize the uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG.

[0246] In some implementations, optionally, the base station 102 may transmit 630 a third indication to the UE 104. The third indication may indicate to prioritize the uplink transmission or downlink reception on at least one resource which is overlapped with which one or more MGs. In other words, the third indication may indicate one or more MGs which can be deactivated by the UE 104. For example, the third indication may indicate one or more MGs which can be autonomously deactivated by the UE 104.

[0247] For example, the third indication may indicate the one or more MGs by indicating at least one MG configuration ID. The UE 104 may prioritize the uplink transmission or downlink reception on at least one resource which is overlapped with the one or more MGs associated with the at least one MG configuration ID.

[0248] In some implementations, optionally, the base station 102 may transmit 640 a fourth indication to the UE 104. The fourth indication may indicate to prioritize the uplink transmission or downlink reception on which one or more resources which is overlapped with at least one MG. If an MG is overlapped with a resource indicated by the fourth indication, the UE 104 may prioritize the uplink transmission or downlink reception on the resource indicated by the fourth indication.

[0249] In some implementations, based on the third indication and the fourth indication, the UE 104 may determine which overlapped resource can be used during which activated MG.

[0250] In some implementations, based on the fourth indication, the UE 104 may determine which overlapped resource can be used during an activated MG or all activated MGs.

[0251] In some implementations, based on the third indication, the UE 104 may determine an overlapped resource or all overlapped resources can be used during which activated MGs.

[0252] In some implementations, based on the second indication, the UE 104 may determine an overlapped resource or all overlapped resources can be used during an activated MG or all activated MGs.

[0253] In some implementations, based on the second indication and the fourth indication, the UE 104 may determine which overlapped resource can be used during an activated MG or all activated MGs.

[0254] In some implementations, based on the second indication and the third indication, the UE 104 may determine an overlapped resource or all overlapped resources can be used during an activated MG or all activated MGs. In some implementations, optionally, the second indication may further indicate to prioritize the uplink transmission or downlink reception on at least one resource which is overlapped with which one or more activated MGs. In such implementations, the base station 102 may not transmit the third indication.

[0255] In some implementations, optionally, the second indication may further indicate to prioritize the uplink transmission or downlink reception on which one or more resources which is overlapped with at least one MG. In such implementations, the base station 102 may not transmit the fourth indication.

[0256] Fig. 7 illustrates an example of a resource which is overlapped with an MG in accordance with aspects of the present disclosure. As shown in Fig. 7, an MG configuration comprises at least the following: an MG length (*mg_l*) 312 of an MG 310, and an MG repetition period (*mg_{rp}*) 314. A resource 320 is overlapped with the MG 310. The UE 104 may perform, based on a rule, uplink transmission or downlink reception on

the resource 320 which is overlapped with the MG 310.

[0257] For example, the third indication may indicate to prioritize the uplink transmission or downlink reception on a resource which is overlapped with the MG 310. For example, the third indication may indicate the MG 310 by indicating an MG configuration ID associated with the MG 310.

[0258] For example, the fourth indication may indicate to prioritize the uplink transmission or downlink reception on the resource 320 which is overlapped with an MG. Because the MG 310 is overlapped with the resource 320 indicated by the fourth indication, the UE 104 may prioritize the uplink transmission or downlink reception on the resource 320 which is overlapped with the MG 310.

[0259] In some implementations, the resource may comprises at least one of the following:

- a physical uplink control channel (PUCCH) resource,
- a configured grant (CG),
- a physical downlink shared channel (PDSCH) resource associated with a semi-persistent scheduling,
- a dynamic uplink grant received by the UE 104,
- a downlink PDSCH assignment by the UE 104,
- at least one search space for PDCCH, or
- a resource for sounding reference signal (SRS).

[0260] The UE 104 may perform, based on the rule, the uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG. For example, the UE 104 may perform the following procedure.

[0261] In some implementations, during an activated measurement gap, the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by measGapConfig, not perform the transmission of HARQ feedback except for that on the specific PUCCH Resource.

[0262] Alternatively, in some implementations, during an activated measurement gap, the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by measGapConfig, not perform the transmission of SR except for that on the specific PUCCH Resource; or

[0263] Alternatively, in some implementations, during an activated measurement gap, the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by measGapConfig, not perform the transmission of CSI except for that on the specific PUCCH Resource; or

[0264] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station 102, not perform the transmission of SRS except for that on the specific SRS Resource.

[0265] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station, not transmit on UL-SCH except for specific CG.

[0266] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station, not transmit on UL-SCH except for dynamic UL grant scheduled by the PDCCH.

[0267] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station, not monitor the PDCCH except for the PDCCH in the specific search space (e.g., SearchSpaceId indicated in RRC).

[0268] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station, not receive on DL-SCH except for the specific SPS; or

[0269] Alternatively, in some implementations, during an activated measurement gap, the UE 104 shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by the base station, not receive on DL-SCH except for the PDSCH scheduled by the PDCCH.

[0270] In some implementations, if the UE 104 performs uplink transmission on a CG transmission occasion and if a timer is configured, the UE 104 starts the timer. If the timer is running and a duration of the timer is overlapped with the at least one MG, the

UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG. The timer may be associated with a CG. For example, the timer may be associated with a hybrid automatic repeat request (HARQ) identity (ID) of the CG transition occasion. In other words, during an activated MG, except for the CG timer is running, the UE 104 does not perform uplink transmission or downlink reception, e.g., PUSCH transmission or PDCCH/PDSCH reception.

[0271] In some implementations, if the at least one MG is overlapped with a jitter range for arrival time of uplink data, the UE 104 may perform uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG.

[0272] In some implementations, the jitter range may indicate the maximum deviation of the arrival time of the first packet of a Data Burst compared to the time indicated with burst arrival time and the periodicity of the Data Bursts.

[0273] In some implementations, the UE 104 may report, to the base station 102, the jitter range together with or separate from the burst arrival time.

[0274] Fig. 8 illustrates an example of a jitter range for arrival time of uplink data in accordance with aspects of the present disclosure. As shown in Fig. 8, a jitter range 810 is from T0 to T2. The jitter range 810 indicates the maximum deviation of the arrival time of the first packet of a Data Burst compared to the time T1 indicated with burst arrival time and the period of the Data Bursts 820.

[0275] In some implementations, if a priority of a resource is higher than or equal to a priority of an MG, the UE 104 may perform uplink transmission or downlink reception on the resource which is overlapped with the MG. In other words, during an activated MG, except for a priority of a resource is higher than or equal to a priority of the MG, the UE 104 does not perform uplink transmission or downlink reception on the resource.

[0276] In some implementations, if a priority of a resource is higher than or equal to a priority threshold, the UE 104 may perform uplink transmission or downlink reception on the resource which is overlapped with an MG. In other words, during an activated MG, except for a priority of a resource is higher than or equal to a priority threshold, the UE 104 does not perform uplink transmission or downlink reception on the resource.

[0277] In some implementations, the UE 104 may perform the uplink transmission or

downlink reception on the at least one resource which is overlapped with the at least one MG based on determining that a DSR is triggered or reported. For example, the UE 104 may perform the uplink transmission or downlink reception based on determining that a DSR for any or one specific LCG configured by the base station 102 is triggered or reported. In such implementations, the UE 104 may autonomously deactivate the at least one MG based on determining that a DSR is triggered or reported. Alternatively, in such implementations, the UE 104 may prioritize the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one activated MG based on determining that the DSR is triggered or reported.

[0278] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG based on determining that a BSR (e.g., regular BSR or refined BSR defined in TS 38.321) triggered or reported. For example, the UE 104 may perform the uplink transmission or downlink reception based on determining that a regular BSR for any or one specific LCG configured by the base station 102 is triggered or reported. In such implementations, the UE 104 may autonomously deactivate the at least one MG based on determining that the regular BSR triggered or reported. Alternatively, in such implementations, the UE 104 may prioritize the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one activated MG based on determining that the BSR is triggered or reported.

[0279] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG based on determining that a scheduling request is triggered or reported. For example, the UE 104 may perform the uplink transmission or downlink reception based on determining that a scheduling request for any or one specific LCH configured by the base station 102 is triggered or reported. In such implementations, the UE 104 may autonomously deactivate the at least one MG based on determining that a scheduling request is triggered or reported. Alternatively, in such implementations, the UE 104 may prioritize the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one activated MG based on determining that the scheduling request is triggered or reported.

[0280] Alternatively, in some implementations, the UE 104 may perform the uplink

transmission or downlink reception on the at least one resource which is overlapped with the at least one MG based on arrival of not low importance data in buffer of the UE 104. The data may be of one or more specific LCHs or Qos flows. Further, which LCHs or Qos flows may be configured by the base station 102. In such implementations, the UE 104 may autonomously deactivate the at least one MG based on arrival of not low importance data in buffer of the UE. Alternatively, in such implementations, the UE 104 may prioritize the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one activated MG based on arrival of not low importance data in buffer of the UE 104.

[0281] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG based on reception of DCI scheduling initial transmission or retransmission of data.

[0282] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG based on determining that uplink data is transmitted. For example, the UE 104 may perform the uplink transmission or downlink reception based on transmission of PUSCH.

[0283] In some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time. In some implementations, the period of time may be configured by the base station 102.

[0284] In some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after a DSR is triggered or reported, e.g., for any or one specific LCG configured by the base station 102.

[0285] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after BSR (e.g., Regular BSR or Refined BSR) is triggered or reported, e.g., for any or one specific LCG configured by the base station 102.

[0286] Alternatively, in some implementations, the UE 104 may perform the uplink

transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after a SR is triggered or reported, e.g., for any or one specific LCH configured by the base station 102.

[0287] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after not low importance data arrival with a specific Protocol Data Unit Set Importance (PSI) is triggered or reported.

[0288] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after receiving PDCCH scheduling initial transmission or retransmission.

[0289] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after receiving PDSCH.

[0290] Alternatively, in some implementations, the UE 104 may perform the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG in a period of time after transmission of PUSCH (e.g., on a configured grant or a dynamic grant) or reception of PDSCH.

[0291] In some implementations, the base station 102 may configure or indicate to the UE 104 which MGs are allowed to be autonomously activated or deactivated by the UE 104. In such implementations, the base station 102 may transmit a fifth indication to the UE 104. The fifth indication indicates whether the one or more MGs are allowed to be autonomously activated or deactivated by the UE 104. For example, the fifth indication may be included in the at least one MG configuration transmitted via the action 610. For another example, the fifth indication may be separate from the at least one MG configuration transmitted via the action 610.

[0292] In some implementations, the one or more MGs may be associated with at least one MG configuration which is not configured with an ID. In such implementations, the one or more MGs may not be associated with at least one MG configuration ID. For example, the UE 104 is configured with one MG configuration which is not configured with an ID. A type of the one MG configuration may be one of the following: *per UE*,

perFR1, or *perFR2*. For another example, the UE 104 is configured with two MG configurations which are not configured with IDs. A type of one MG configuration may be *perFR1*, and a type of the other MG configuration may be *perFR2*. For example, the base station 102 may transmit the fifth indication to the UE 104 via *GapConfig* IE as below:

GapConfig ::=	SEQUENCE {
gapOffset	INTEGER (0..159),
mgl	ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6},
mgrp	ENUMERATED {ms20, ms40, ms80, ms160},
mgta	ENUMERATED {ms0, ms0dot25, ms0dot5},
...	
Fifth indication	ENUMERATED {allowed}
}	}

[0293] In some implementations, the fifth indication set to “allowed” indicates that an MG associated with an MG configuration without a *measGapId* is allowed to be autonomously activated or deactivated by the UE 104. The fifth indication set to “not allowed” indicates that an MG associated with an MG configuration without a *measGapId* is not allowed to be autonomously activated or deactivated by the UE 104.

[0294] In some implementations, each of the at least one MG configuration may be configured with an ID. The fifth indication indicates whether an MG associated with an MG configuration with an ID is allowed to be autonomously activated or deactivated by the UE 104. The fifth indication may be included in the MG configuration transmitted from the based station 102. For example, the based station 102 may transmit the fifth indication via *GapConfig-r17* information element (IE) as below:

GapConfig-r17 ::=	SEQUENCE {
measGapId-r17	MeasGapId-r17,
gapType-r17	ENUMERATED {perUE, perFR1, perFR2},
gapOffset-r17	INTEGER (0..159),
mgl-r17	ENUMERATED {ms1, ms1dot5, ms2, ms3, ms3dot5, ms4, ms5, ms5dot5, ms6, ms10, ms20},
mgrp-r17	ENUMERATED {ms20, ms40, ms80, ms160},

mgta-r17	ENUMERATED {ms0, ms0dot25, ms0dot5, ms0dot75},
gapPriority-r17	GapPriority-r17
OPTIONAL, -- Need R	
...	
Fifth indication	ENUMERATED{allowed}
}	

[0295] In some implementations, the fifth indication set to “allowed” indicates that an MG associated with an MG configuration with a *measGapId* is allowed to be autonomously activated or deactivated by the UE 104. The fifth indication set to “not allowed” indicates that an MG associated with an MG configuration with a *measGapId* is not allowed to be autonomously activated or deactivated by the UE 104.

[0296] Alternatively, in some implementations, each of the at least one MG configuration may be configured with an ID. In such implementations, the fifth indication may comprise a seventh bitmap. Each of at least one bit in the seventh bitmap is associated with one of at least one MG configuration. Each of the at least one bit indicates whether at least one MG associated with a respective one of the at least one MG configuration is allowed to be autonomously activated or deactivated by the UE 104. Hereinafter, the number of the at least one bit in the seventh bitmap is represented by Q.

[0297] In some implementations, Q may predefined. For example, Q may be equal to the maximum number of IDs for MG configurations. Alternatively, Q may be configured by the base station 102.

[0298] Consider a seventh example of the seventh bitmap. In the seventh example, the fifth indication may comprise a fifth field comprising the seventh bitmap. Hereinafter, the fifth field is also referred to as a R_i field. The R_i field may indicate whether an MG associated with an MG configuration i is allowed to be autonomously activated or deactivated by the UE 104, where i represents a first ID (i.e., *measGapId*) of an MG configuration and i is in an ascending or descending order of first IDs of MG configurations.

[0299] The R_i field set to 1 indicates that an MG associated with an MG configuration i is allowed to be autonomously activated or deactivated by the UE 104. The R_i field set

to 0 indicates that an MG associated with an MG configuration i is not allowed to be autonomously activated or deactivated by the UE 104.

[0300] In the seventh example, Q may be equal to the number of the MG configurations which are configured for the UE 104. For example, $Q=8$, i.e., $0 \leq i \leq 7$.

[0301] In the seventh example, the based station 102 may transmit the fifth indication via *MeasGapConfig* IE as below:

```
MeasGapConfig ::= SEQUENCE {
  Fifth indication BIT STRING (SIZE (8)),
  ...
}
```

[0302] Alternatively, in some implementations, each of the at least one MG configuration may be configured with an ID. In such implementations, the fifth indication may comprise a list of one or more IDs of one or more MG configurations. At least one MG associated with a respective one of the one or more MG configurations is allowed to be autonomously activated or deactivated by the UE 104. In such implementations, each of the one or more IDs in the list may be the first ID of a respective MG configuration.

[0303] Consider the example as shown in Table 1. In the example, MGs associated with MG configurations with *measGapIds* #1, #4, #5 and #7 are allowed to be autonomously activated or deactivated by the UE 104. Thus, the list may comprise *measGapIds* #1, #4, #5 and #7.

[0304] In the example, the based station 102 may transmit the fifth indication via *MeasGapConfig* IE as below:

```
MeasGapConfig ::= SEQUENCE {
  Fifth indication SEQUENCE (SIZE (1..maxNrofGapId-r17)) OF MeasGapId-r17,
}
```

[0305] In some implementations, the UE 104 may transmit a sixth indication to the base station 102. For example, if the UE 104 determines to prioritize uplink transmission or downlink reception over measurement based on an MG, the UE 104 may transmit the sixth indication to the base station 102. The sixth indication indicates that the at least one MG is autonomously deactivated by the UE 104 or indicates that measurement based on

the at least one MG is autonomously deprioritized by the UE 104. Upon receiving the sixth indication, the base station 102 considers the at least one MG is deactivated or that measurement based on the at least one MG is autonomously deprioritized.

[0306] In some implementations, the UE 104 may transmit the sixth indication during a first MG and the sixth indication may apply prior to a second MG subsequent to the first MG. Alternatively, the sixth indication may apply immediately.

[0307] In some implementations, the UE 104 may transmit the sixth indication by transmitting an SR to the base station 102. In such implementations, a resource for the SR may be configured separately from the legacy SR resource for other purpose. In such implementations, an SR configuration is associated with one or more MGs. In other words, the request is associated with the SR configuration. For example, different SR configuration may be associated with different MG.

[0308] Alternatively, in some implementations, the UE 104 may transmit the sixth indication by transmitting an RA request to the base station 102. In such implementations, the sixth indication is associated with a RACH resource. For example, the RACH resource may comprise a preamble or RA occasion. The preamble may be configured as contention free based preamble separately from legacy for other purpose.

[0309] Alternatively, in some implementations, the UE 104 may transmit the sixth indication by transmitting UCI comprising the sixth indication. For example, the UCI may comprise the seventh bitmap. The UCI may be transmitted on PUSCH, e.g., on a specific configured grant configured by the base station 102. Alternatively, the UCI may be transmitted on PUCCH. For example, the sixth indication may comprise an ID of an MG configuration. The ID may be the first ID or second ID of the MG configuration.

[0310] Alternatively, in some implementations, the UE 104 may transmit the sixth indication by transmitting a layer 2 control element comprising the sixth indication. For example, the layer 2 control element may comprise the seventh bitmap. Alternatively, the layer 2 control element may comprise one bit. The one bit indicates to request that all of the one or more MGs are allowed to be autonomously activated or deactivated by the UE 104.

[0311] In some implementations, the UE 104 may transmit the sixth indication based on determining that a DSR is triggered or reported. For example, the UE 104 may transmit

the sixth indication based on determining that a DSR for any or one specific LCG configured by the base station 102 is triggered or reported.

[0312] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that a BSR triggered or reported. For example, the UE 104 may transmit the sixth indication based on determining that a BSR for any or one specific LCG configured by the base station 102 is triggered or reported.

[0313] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that a scheduling request is triggered or reported. For example, the UE 104 may transmit the sixth indication based on determining that a scheduling request for any or one specific LCH configured by the base station 102 is triggered or reported.

[0314] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that arrival of not low importance data in buffer of the UE 104.

[0315] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that data (e.g., not low importance) to be available in buffer of the UE 104 during an activated MG.

[0316] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that arrival of the not low importance data is triggered or reported.

[0317] Alternatively, in some implementations, the UE 104 may transmit the sixth indication based on determining that there will be potential data for transmission or reception during the at least one MG.

[0318] In some implementations, if the base station 102 determines to activate an MG which is autonomously deactivated by the UE 104, the base station 102 may transmit, to the UE 104, a command indicating the MG is to be activated. If the UE 104 receives the command, the UE 104 considers the MG is activated.

[0319] In some implementations, the UE 104 may transmit the sixth indication to the base station 102. The sixth indication indicates that the at least one MG is autonomously deactivated by the UE 104. Upon receiving the sixth indication, the base station 102 considers the at least one MG is deactivated.

[0320] In some implementations, the UE 104 may transmit the sixth indication indicating that the at least one MG is autonomously deactivated by the UE 104, and a next MG occasion is deactivated.

[0321] In some implementations, the UE 104 may transmit the sixth indication indicating that the at least one MG is autonomously deactivated by the UE 104, and the at least one MG is deactivated for a period of time. Upon expiration of the period of time, the UE 104 considers the at least one MG is activated. In such implementations, the base station 102 does not need to transmit, to the UE 104, a command indicating the at least one MG is to be activated.

[0322] In some implementations, the period of time may be configured by the base station 102.

[0323] In some implementations, the UE 104 may transmit a seventh indication to the base station 102. For example, if the UE 104 determines to prioritize measurement based on an MG over uplink transmission or downlink reception, the UE 104 may transmit the seventh indication to the base station 102. The seventh indication indicates that the at least one MG is autonomously activated by the UE 104 or indicates that measurement based on the at least one MG is autonomously prioritized by the UE 104. Upon receiving the seventh indication, the base station 102 considers the at least one MG is activated or that measurement based on the at least one MG is autonomously prioritized.

[0324] The above implementations of the sixth indication are also applicable to the seventh indication. Details of these implementations are omitted for brevity.

[0325] In some implementations, the UE 104 may transmit an eighth indication. The eighth indication indicating how long the at least one MG is to be autonomously deactivated by the UE 104. For example, the eighth indication indicating the MG deactivation duration by number of the MG period. The start of the duration is the start of the next MG occasion or all subsequent MG occasions.

[0326] In some implementations, the UE 104 may transmit seventh indication, the seventh indication indicating start timing of the at least one MG is to be autonomously deactivated by the UE 104.

[0327] In some implementations, the UE 104 may transmit seventh indication, the seventh indication indicating end timing of the at least one MG is to be autonomously

deactivated by the UE 104.

[0328] In some implementations, the UE 104 may transmit or report, to the base station 102, information related to at least one MG based on which the UE 104 did not perform measurement. For example, the information indicates the number of MGs in the second period based on which the UE 104 does not perform measurement. For example, the information indicates a duration of at least one MG in the third period based on which the UE 104 does not perform measurement. For example, the information indicates a ratio of a deactivation duration of MGs in the fourth period to a total duration of the MGs in the fourth period.

[0329] In some implementations, the UE 104 may receive, from the base station 102, a configuration for transmission or report of the information. For example, the configuration for transmission or report of the information may be configured per MG configuration.

[0330] In some implementations, the configuration for transmission of the information may indicate at least one of the following: a first period for transmission of the information, one shot request for transmission of the information or at least one trigger event for transmission of the information.

[0331] In some implementations, the at least one trigger event may be associated with a first threshold for the number of MGs in a second period based on which the UE 104 does not perform measurement. In such implementations, if the number of MGs in the second period based on which the UE 104 does not perform measurement is greater than or equal to the first threshold, the UE 104 may transmit, to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement.

[0332] Alternatively or additionally, in some implementations, the at least one trigger event may be associated with a second threshold for a duration of at least one MG in a third period based on which the UE 104 does not perform measurement. In such implementations, if a duration of at least one MG in the third period based on which the UE 104 does not perform measurement is greater than or equal to the second threshold, the UE 104 may transmit, to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement.

[0333] Alternatively or additionally, in some implementations, the at least one trigger event may be associated with a third threshold for a percentage of at least one deactivated MG in a fourth period. In such implementations, if a ratio of a deactivation duration of MGs in the fourth period to a total duration of the MGs in the fourth period is greater than or equal to the third threshold, the UE 104 may transmit, to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement. Alternatively, if a ratio of a deactivation duration of MGs in the fourth period to an activation duration of the MGs in the fourth period is greater than or equal to the third threshold, the UE 104 may transmit, to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement.

[0334] In some implementations, the UE 104 may transmit periodically, to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement based on the first period for transmission of the information.

[0335] In some implementations, based on one request from the base station, the UE 104 may transmit to the base station 102, the information related to the MGs based on which the UE 104 does not perform measurement based on the first period for transmission of the information.

[0336] In some implementations, the UE 104 may transmit, per MG configuration, the information related to the MGs based on which the UE 104 does not perform measurement.

[0337] In some implementations, the UE 104 may transmit, in a radio link failure (RLF) report, the information related to the MGs based on which the UE 104 did not perform measurement.

[0338] Fig. 9 illustrates an example of a device 900 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The device 900 may be an example of a network entity 102 or a UE 104 as described herein. The device 900 may support wireless communication with one or more network entities 102, UEs 104, or any combination thereof. The device 900 may include components for bi-directional communications including components for transmitting and receiving communications, such as a processor 902, a memory 904, a transceiver 906, and, optionally, an I/O controller 908. These components may be in electronic

communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0339] The processor 902, the memory 904, the transceiver 906, or various combinations thereof or various components thereof may be examples of means for performing various aspects of the present disclosure as described herein. For example, the processor 902, the memory 904, the transceiver 906, or various combinations or components thereof may support a method for performing one or more of the operations described herein.

[0340] In some implementations, the processor 902, the memory 904, the transceiver 906, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA) or other programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure. In some implementations, the processor 902 and the memory 904 coupled with the processor 902 may be configured to perform one or more of the functions described herein (e.g., executing, by the processor 902, instructions stored in the memory 904).

[0341] For example, the processor 902 may support wireless communication at the device 900 in accordance with examples as disclosed herein. The processor 902 may be configured to operable to support a means for performing the following: receiving at least one MG configuration for one or more MGs from a base station; and performing uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0342] Alternatively, in some implementations, the processor 902 may be configured to operable to support a means for performing the following: transmitting a command for one or more MGs to a UE; and performing, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0343] Alternatively, in some implementations, the processor 902 may be configured to operable to support a means for performing the following: receiving first DCI scheduling first new transmission or first retransmission of data from a base station; and

performing, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one MG.

[0344] The processor 902 may include an intelligent hardware device (e.g., a general-purpose processor, a DSP, a CPU, a microcontroller, an ASIC, an FPGA, a programmable logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some implementations, the processor 902 may be configured to operate a memory array using a memory controller. In some other implementations, a memory controller may be integrated into the processor 902. The processor 902 may be configured to execute computer-readable instructions stored in a memory (e.g., the memory 904) to cause the device 900 to perform various functions of the present disclosure.

[0345] The memory 904 may include random access memory (RAM) and read-only memory (ROM). The memory 904 may store computer-readable, computer-executable code including instructions that, when executed by the processor 902 cause the device 900 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some implementations, the code may not be directly executable by the processor 902 but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some implementations, the memory 904 may include, among other things, a basic I/O system (BIOS) which may control basic hardware or software operation such as the interaction with peripheral components or devices.

[0346] The I/O controller 908 may manage input and output signals for the device 900. The I/O controller 908 may also manage peripherals not integrated into the device 900. In some implementations, the I/O controller 908 may represent a physical connection or port to an external peripheral. In some implementations, the I/O controller 908 may utilize an operating system such as iOS®, ANDROID®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. In some implementations, the I/O controller 908 may be implemented as part of a processor, such as the processor 906. In some implementations, a user may interact with the device 900 via the I/O controller 908 or via hardware components controlled by the I/O controller 908.

[0347] In some implementations, the device 900 may include a single antenna 910. However, in some other implementations, the device 900 may have more than one antenna 910 (i.e., multiple antennas), including multiple antenna panels or antenna arrays, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver 906 may communicate bi-directionally, via the one or more antennas 910, wired, or wireless links as described herein. For example, the transceiver 906 may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver 906 may also include a modem to modulate the packets, to provide the modulated packets to one or more antennas 910 for transmission, and to demodulate packets received from the one or more antennas 910. The transceiver 906 may include one or more transmit chains, one or more receive chains, or a combination thereof.

[0348] A transmit chain may be configured to generate and transmit signals (e.g., control information, data, packets). The transmit chain may include at least one modulator for modulating data onto a carrier signal, preparing the signal for transmission over a wireless medium. The at least one modulator may be configured to support one or more techniques such as amplitude modulation (AM), frequency modulation (FM), or digital modulation schemes like phase-shift keying (PSK) or quadrature amplitude modulation (QAM). The transmit chain may also include at least one power amplifier configured to amplify the modulated signal to an appropriate power level suitable for transmission over the wireless medium. The transmit chain may also include one or more antennas 910 for transmitting the amplified signal into the air or wireless medium.

[0349] A receive chain may be configured to receive signals (e.g., control information, data, packets) over a wireless medium. For example, the receive chain may include one or more antennas 910 for receive the signal over the air or wireless medium. The receive chain may include at least one amplifier (e.g., a low-noise amplifier (LNA)) configured to amplify the received signal. The receive chain may include at least one demodulator configured to demodulate the receive signal and obtain the transmitted data by reversing the modulation technique applied during transmission of the signal. The receive chain may include at least one decoder for decoding the processing the demodulated signal to receive the transmitted data.

[0350] Fig. 10 illustrates an example of a processor 1000 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The processor 1000 may be an example of a processor configured to perform various operations in accordance with examples as described herein. The processor 1000 may include a controller 1002 configured to perform various operations in accordance with examples as described herein. The processor 1000 may optionally include at least one memory 1004, such as L1/L2/L3 cache. Additionally, or alternatively, the processor 1000 may optionally include one or more arithmetic-logic units (ALUs) 1006. One or more of these components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0351] The processor 1000 may be a processor chipset and include a protocol stack (e.g., a software stack) executed by the processor chipset to perform various operations (e.g., receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) in accordance with examples as described herein. The processor chipset may include one or more cores, one or more caches (e.g., memory local to or included in the processor chipset (e.g., the processor 1000) or other memory (e.g., random access memory (RAM), read-only memory (ROM), dynamic RAM (DRAM), synchronous dynamic RAM (SDRAM), static RAM (SRAM), ferroelectric RAM (FeRAM), magnetic RAM (MRAM), resistive RAM (RRAM), flash memory, phase change memory (PCM), and others).

[0352] The controller 1002 may be configured to manage and coordinate various operations (e.g., signaling, receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) of the processor 1000 to cause the processor 1000 to support various operations in accordance with examples as described herein. For example, the controller 1002 may operate as a control unit of the processor 1000, generating control signals that manage the operation of various components of the processor 1000. These control signals include enabling or disabling functional units, selecting data paths, initiating memory access, and coordinating timing of operations.

[0353] The controller 1002 may be configured to fetch (e.g., obtain, retrieve, receive) instructions from the memory 1004 and determine subsequent instruction(s) to be

executed to cause the processor 1000 to support various operations in accordance with examples as described herein. The controller 1002 may be configured to track memory address of instructions associated with the memory 1004. The controller 1002 may be configured to decode instructions to determine the operation to be performed and the operands involved. For example, the controller 1002 may be configured to interpret the instruction and determine control signals to be output to other components of the processor 1000 to cause the processor 1000 to support various operations in accordance with examples as described herein. Additionally, or alternatively, the controller 1002 may be configured to manage flow of data within the processor 1000. The controller 1002 may be configured to control transfer of data between registers, arithmetic logic units (ALUs), and other functional units of the processor 1000.

[0354] The memory 1004 may include one or more caches (e.g., memory local to or included in the processor 1000 or other memory, such RAM, ROM, DRAM, SDRAM, SRAM, MRAM, flash memory, etc. In some implementation, the memory 1004 may reside within or on a processor chipset (e.g., local to the processor 1000). In some other implementations, the memory 1004 may reside external to the processor chipset (e.g., remote to the processor 1000).

[0355] The memory 1004 may store computer-readable, computer-executable code including instructions that, when executed by the processor 1000, cause the processor 1000 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. The controller 1002 and/or the processor 1000 may be configured to execute computer-readable instructions stored in the memory 1004 to cause the processor 1000 to perform various functions. For example, the processor 1000 and/or the controller 1002 may be coupled with or to the memory 1004, the processor 1000, the controller 1002, and the memory 1004 may be configured to perform various functions described herein. In some examples, the processor 1000 may include multiple processors and the memory 1004 may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories, which may, individually or collectively, be configured to perform various functions herein.

[0356] The one or more ALUs 1006 may be configured to support various operations in accordance with examples as described herein. In some implementation, the one or

more ALUs 1006 may reside within or on a processor chipset (e.g., the processor 1000). In some other implementations, the one or more ALUs 1006 may reside external to the processor chipset (e.g., the processor 1000). One or more ALUs 1006 may perform one or more computations such as addition, subtraction, multiplication, and division on data. For example, one or more ALUs 1006 may receive input operands and an operation code, which determines an operation to be executed. One or more ALUs 1006 be configured with a variety of logical and arithmetic circuits, including adders, subtractors, shifters, and logic gates, to process and manipulate the data according to the operation. Additionally, or alternatively, the one or more ALUs 1006 may support logical operations such as AND, OR, exclusive-OR (XOR), not-OR (NOR), and not-AND (NAND), enabling the one or more ALUs 1006 to handle conditional operations, comparisons, and bitwise operations.

[0357] The processor 1000 may support wireless communication in accordance with examples as disclosed herein. The processor 1000 may be configured to operable to support a means for performing the following: receiving at least one MG configuration for one or more MGs from a base station; and performing uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0358] Alternatively, in some implementations, the processor 1000 may be configured to operable to support a means for performing the following: transmitting a command for one or more MGs to a UE; and performing, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs.

[0359] Alternatively, in some implementations, the processor 1000 may be configured to operable to support a means for performing the following: receiving first DCI scheduling first new transmission or first retransmission of data from a base station; and performing, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one MG.

[0360] Fig. 11 illustrates a flowchart of a method 1100 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The operations of the method 1100 may be implemented by a device or its components as described herein. For example, the operations of the method 1100 may be

performed by a UE 104 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0361] At 1110, the method may include receiving at least one MG configuration for one or more MGs from a base station. The operations of 1110 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1110 may be performed by a device as described with reference to Fig. 1.

[0362] At 1120, the method may include performing uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs. The operations of 1120 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1120 may be performed by a device as described with reference to Fig. 1.

[0363] Fig. 12 illustrates a flowchart of a method 1200 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The operations of the method 1200 may be implemented by a device or its components as described herein. For example, the operations of the method 1200 may be performed by a base station 102 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0364] At 1210, the method may include transmitting a command for one or more MGs to a UE. The operations of 1210 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1210 may be performed by a device as described with reference to Fig. 1.

[0365] At 1220, the method may include performing, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs. The operations of 1220 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1220 may be performed by a device as described with reference to Fig. 1.

[0366] Fig. 13 illustrates a flowchart of a method 1300 that supports handling of transmission or reception during an MG in accordance with aspects of the present disclosure. The operations of the method 1300 may be implemented by a device or its components as described herein. For example, the operations of the method 1300 may be performed by a UE 104 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0367] At 1310, the method may include receiving first DCI scheduling first new transmission or first retransmission of data from a base station. The operations of 1310 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1310 may be performed by a device as described with reference to Fig. 1.

[0368] At 1320, the method may include performing, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one MG. The operations of 1320 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1320 may be performed by a device as described with reference to Fig. 1.

[0369] It shall be noted that implementations of the present disclosure which have been described with reference to Figs. 1 to 8 are also applicable to the device 900, the processor 1000 as well as the methods 1100, 1200 and 1300.

[0370] It should be noted that the methods described herein describes possible implementations, and that the operations and the steps may be rearranged or otherwise modified and that other implementations are possible. Further, aspects from two or more of the methods may be combined.

[0371] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a DSP, an ASIC, a CPU, an FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any processor, controller, microcontroller, or state machine. A 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.

[0372] The functions described herein may be implemented in hardware, software executed by a processor, firmware, 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 computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described herein may be implemented using software executed by a processor, hardware, firmware, 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.

[0373] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer. By way of example, non-transitory computer-readable media may include RAM, ROM, electrically erasable programmable ROM (EEPROM), flash memory, compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that may be used to carry or store desired program code means in the form of instructions or data structures and that may be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor.

[0374] As used herein, including in the claims, an article “a” before an element is unrestricted and understood to refer to “at least one” of those elements or “one or more” of those elements. The terms “a,” “at least one,” “one or more,” and “at least one of one or more” may be interchangeable. As used herein, including in the claims, “or” as used in a list of items (e.g., a list of items prefaced by a phrase such as “at least one of” or “one or more of” or “one or both of”) indicates an inclusive 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 (i.e., A and B and C). Also, as used herein, the phrase “based on” shall not be construed as a reference

to a closed set of conditions. For example, an example step that is described as “based on condition A” may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase “based on” shall be construed in the same manner as the phrase “based at least in part on. Further, as used herein, including in the claims, a “set” may include one or more elements.

[0375] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

1. A user equipment (UE), comprising:
a processor; and
a transceiver coupled to the processor,
wherein the processor is configured to:
receive at least one measurement gap (MG) configuration for one or more MGs via the transceiver from a base station; and
perform uplink transmission or downlink reception on at least one resource which is overlapped with at least one MG among the one or more MGs.
2. The UE of claim 1, wherein the processor is further configured to:
receive a command for the one or more MGs via the transceiver from the base station; and
wherein the processor is configured to perform, based on the command, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG.
3. The UE of claim 2, wherein the command indicates whether the one or more MGs are to be activated or deactivated.
4. The UE of claim 3, wherein the command comprises a first bitmap, each of at least one bit in the first bitmap is associated with one of at least one MG configuration, and each of the at least one bit indicates that at least one MG associated with a respective one of the at least one MG configuration is to be activated or deactivated.
5. The UE of claim 3, wherein the command comprises a second bitmap, each of at least one bit in the second bitmap is associated with one of MG types, and each of the at least one bit indicates that at least one MG with a respective one of the MG types is to be activated or deactivated.
6. The UE of claim 3, wherein the processor is further configured to:
transmit, via the transceiver to the base station, a request for activating or deactivating the one or more MGs.

7. The UE of claim 6, wherein the processor is configured to transmit the request for activating or deactivating the at least one gap by transmitting one of the following via the transceiver to the base station:

- uplink control information (UCI) comprising the request;
- a scheduling request;
- a random access request; or
- a layer 2 control element.

8. The UE of claim 6, wherein the processor is configured to transmit the request for activating or deactivating the at least one MG based on determining at least one of the following:

- a delay status report is triggered or reported;
- a regular buffer status report triggered or reported;
- a scheduling request is triggered or reported;
- arrival of not low importance data in buffer of the UE;
- arrival of the not low importance data is reported; or
- there will be potential data for transmission or reception during the at least one MG.

9. The UE of claim 2, wherein:

- the command indicates that the at least one MG is to be deactivated;
- the processor is configured to perform the transmission or reception of data by deactivating the at least one MG based on the command; and
- the processor is further configured to:
 - start a timer based on reception of the command.

10. The UE of claim 2, wherein the processor is further configured to:
monitor the command based on a time window.

11. The UE of claim 2 or 10, wherein the processor is further configured to:
monitor a dedicated search space for a physical downlink control channel (PDCCH) carrying the command.

12. The UE of claim 2 or 11, wherein the processor is further configured to:

monitor a physical downlink control channel (PDCCH) scrambled with a dedicated radio network temporary identity (RNTI), the PDCCH carrying the command.

13. The UE of any of claims 2, 11 and 12, wherein the command is included in a dedicated downlink control information (DCI) format or multiplexed in an existing DCI format.

14. The UE of claim 2, wherein the command is included in a layer 2 control element.

15. The UE of claim 1, wherein the command indicates to adjust at least one location of the at least one MG in time domain.

16. The UE of claim 1, wherein the processor is configured to perform, based on a rule, the uplink transmission or downlink reception on the at least one resource which is overlapped with the at least one MG.

17. The UE of claim 16, wherein the processor is further configured to:
transmit a sixth indication via the transceiver to the base station, the sixth indication indicating that the at least one MG is autonomously deactivated by the UE.

18. The UE of claim 16, wherein the processor is further configured to:
transmit, via the transceiver to the base station, information related to at least one second MG based on which the UE does not perform measurement.

19. A base station, comprising:
a processor; and
a transceiver coupled to the processor,
wherein the processor is configured to:
transmit a command for one or more measurement gaps (MGs) via the transceiver to a user equipment (UE); and
perform, based on the command, transmission or reception of data on at least one resource which is overlapped with at least one MG among the one or more MGs.

20. A user equipment (UE), comprising:

a processor; and

a transceiver coupled to the processor,

wherein the processor is configured to:

receive first downlink control information (DCI) scheduling first new transmission or first retransmission of data via the transceiver from a base station; and

perform, based on the first DCI, the first new transmission or the first retransmission of data on at least one resource which is overlapped with at least one measurement gap (MG).