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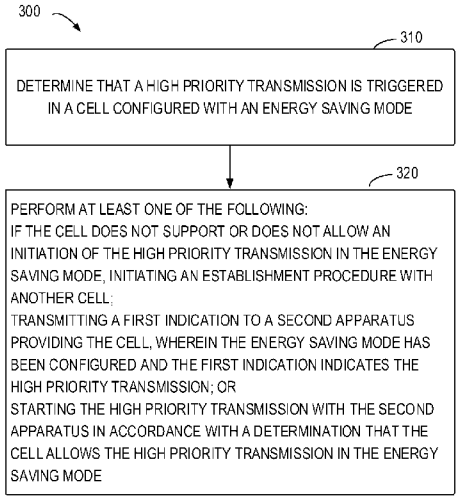

FIG. 3

(57) Abstract: Example embodiments of the present disclosure relate to applying timing advance during random access procedure. The first apparatus determines that a high priority transmission is triggered in a cell configured with an energy saving mode. The first apparatus performs at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

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PROCESSING A HIGH PRIORITY TRANSMISSION TRIGGERED IN NETWORK ENERGY SAVING CELL

FIELDS

[0001] Various example embodiments of the present disclosure generally relate to the field of telecommunication and in particular, to methods, devices, apparatuses and computer readable storage medium of transmission format indicator for processing a high priority transmission triggered in network energy saving (NES) cell.

BACKGROUND

[0002] Network energy saving is of great importance for environmental sustainability, to reduce environmental impact (greenhouse gas emissions), and for operational cost savings. As 5th generation mobile communication technology (5G) is becoming pervasive across industries and geographical areas, handling more advanced services and applications requiring very high data rates (e.g., extended reality (XR)), networks are being denser, use more antennas, larger bandwidths and more frequency bands. The environmental impact of 5G needs to stay under control, and novel solutions to improve network energy savings need to be developed.

SUMMARY

[0003] In a first aspect of the present disclosure, there is provided a first apparatus. The first apparatus comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the first apparatus at least to: determine that a high priority transmission is triggered in a cell configured with an energy saving mode; and perform at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a

determination that the cell allows the high priority transmission in the energy saving mode.

[0004] In a second aspect of the present disclosure, there is provided a second apparatus. The second apparatus comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the second apparatus at least to: configure a cell provided by the second apparatus in an energy saving mode; determine that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following: a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission, an RRC resume request message comprising a cause indicating the high priority transmission, or a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and process the high priority transmission for the first apparatus.

[0005] In a third aspect of the present disclosure, there is provided a method. The method comprises: determining that a high priority transmission is triggered in a cell configured with an energy saving mode; and performing at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

[0006] In a fourth aspect of the present disclosure, there is provided a method. The method comprises: configuring a cell provided by the second apparatus in an energy saving mode; determining that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following: a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission, an RRC resume request message comprising a cause indicating the high priority transmission, or a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and processing the high priority transmission for the first apparatus.

[0007] In a fifth aspect of the present disclosure, there is provided a first apparatus. The

first apparatus comprises means for determining that a high priority transmission is triggered in a cell configured with an energy saving mode; and means for performing at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

[0008] In a sixth aspect of the present disclosure, there is provided a second apparatus. The second apparatus comprises means for configuring a cell provided by the second apparatus in an energy saving mode; means for determining that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following: a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission, an RRC resume request message comprising a cause indicating the high priority transmission, or a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and means for processing the high priority transmission for the first apparatus.

[0009] In a seventh aspect of the present disclosure, there is provided a computer readable medium. The computer readable medium comprises instructions stored thereon for causing an apparatus to perform at least the method according to the third aspect.

[0010] In an eighth aspect of the present disclosure, there is provided a computer readable medium. The computer readable medium comprises instructions stored thereon for causing an apparatus to perform at least the method according to the fourth aspect.

[0011] 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

[0012] Some example embodiments will now be described with reference to the accompanying drawings, where:

[0013] FIG. 1 illustrates an example communication environment in which example embodiments of the present disclosure can be implemented;

[0014] FIG. 2 illustrates a signaling flow of communication in accordance with some embodiments of the present disclosure;

[0015] FIG. 3 illustrates a flowchart of a method implemented at a first apparatus according to some example embodiments of the present disclosure;

[0016] FIG. 4 illustrates a flowchart of a method implemented at a second apparatus according to some example embodiments of the present disclosure;

[0017] FIG. 5 illustrates a simplified block diagram of a device that is suitable for implementing example embodiments of the present disclosure; and

[0018] FIG. 6 illustrates a block diagram of an example computer readable medium in accordance with some example embodiments of the present disclosure.

[0019] Throughout the drawings, the same or similar reference numerals represent the same or similar element.

DETAILED DESCRIPTION

[0020] Principle of the present disclosure will now be described with reference to some example 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. Embodiments described herein can be implemented in various manners other than the ones described below.

[0021] 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.

[0022] References in the present disclosure to "one embodiment," "an embodiment," "an example embodiment," and the like indicate that the embodiment 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 are not necessarily referring to the same embodiment. 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.

[0023] It shall be understood that although the terms "first," "second,"..., etc. in front of noun(s) and 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 and they do not limit the order of the noun(s). For example, a first element could be termed a second element, and similarly, a second element could be termed a first element, without departing from the scope of example embodiments. As used herein, the term "and/or" includes any and all combinations of one or more of the listed terms.

[0024] As used herein, "at least one of the following: <a list of two or more elements>" and "at least one of <a list of two or more elements>" and similar wording, where the list of two or more elements are joined by "and" or "or", mean at least any one of the elements, or at least any two or more of the elements, or at least all the elements.

[0025] As used herein, unless stated explicitly, performing a step "in response to A" does not indicate that the step is performed immediately after "A" occurs and one or more intervening steps may be included.

[0026] 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.

[0027] As used in this application, the term "circuitry" may refer to one or more or all of the following:

(a) hardware-only circuit implementations (such as implementations in only analog and/or digital circuitry) and

(b) combinations of hardware circuits and software, such as (as applicable):

(i) a combination of analog and/or digital hardware circuit(s) with software/firmware and

(ii) any portions of hardware processor(s) with software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus, such as a mobile phone or server, to perform various functions) and

(c) hardware circuit(s) and or processor(s), such as a microprocessor(s) or a portion of a microprocessor(s), that requires software (e.g., firmware) for operation, but the software may not be present when it is not needed for operation.

[0028] This definition of circuitry applies to all uses of this term in this application, including in any claims. As a further example, as used in this application, the term circuitry also covers an implementation of merely a hardware circuit or processor (or multiple processors) or portion of a hardware circuit or processor and its (or their) accompanying software and/or firmware. The term circuitry also covers, for example and if applicable to the particular claim element, a baseband integrated circuit or processor integrated circuit for a mobile device or a similar integrated circuit in server, a cellular network device, or other computing or network device.

[0029] As used herein, the term "communication network" refers to a network following any suitable communication standards, such as New Radio (NR), Long Term Evolution (LTE), LTE-Advanced (LTE-A), Wideband Code Division Multiple Access (WCDMA), High-Speed Packet Access (HSPA), Narrow Band Internet of Things (NB-IoT) and so on. Furthermore, the communications between a terminal device and a network device in the communication network may be performed according to any suitable generation communication protocols, including, but not limited to, the first generation (1G), the second generation (2G), 2.5G, 2.75G, the third generation (3G), the fourth generation (4G), 4.5G, the fifth generation (5G), the sixth generation (6G) communication protocols, and/or any other protocols either currently known or to be developed in the future. Embodiments

of the present disclosure may be applied in various communication systems. Given the rapid development in communications, there will of course also be future type communication technologies and systems with which the present disclosure may be embodied. It should not be seen as limiting the scope of the present disclosure to only the aforementioned system.

[0030] As used herein, the term "network device" refers to a node in a communication network via which a terminal device accesses the network and receives services therefrom. The network device may refer to a base station (BS) or an access point (AP), for example, a node B (NodeB or NB), an evolved NodeB (eNodeB or eNB), an NR NB (also referred to as a gNB), a Remote Radio Unit (RRU), a radio header (RH), a remote radio head (RRH), a relay, an Integrated Access and Backhaul (IAB) node, a low power node such as a femto, a pico, a non-terrestrial network (NTN) or non-ground network device such as a satellite network device, a low earth orbit (LEO) satellite and a geosynchronous earth orbit (GEO) satellite, an aircraft network device, and so forth, depending on the applied terminology and technology. In some example embodiments, radio access network (RAN) split architecture comprises a Centralized Unit (CU) and a Distributed Unit (DU) at an IAB donor node. An IAB node comprises a Mobile Terminal (IAB-MT) part that behaves like a UE toward the parent node, and a DU part of an IAB node behaves like a base station toward the next-hop IAB node.

[0031] The term "terminal device" refers to any end device that may be capable of wireless communication. By way of example rather than limitation, a terminal device may also be referred to as a communication device, user equipment (UE), a Subscriber Station (SS), a Portable Subscriber Station, a Mobile Station (MS), or an Access Terminal (AT). The terminal device may include, but not limited to, a mobile phone, a cellular phone, a smart phone, voice over IP (VoIP) phones, wireless local loop phones, a tablet, a wearable terminal device, a personal digital assistant (PDA), portable computers, desktop computer, image capture terminal devices such as digital cameras, gaming terminal devices, music storage and playback appliances, vehicle-mounted wireless terminal devices, wireless endpoints, mobile stations, laptop-embedded equipment (LEE), laptop-mounted equipment (LME), USB dongles, smart devices, wireless customer-premises equipment (CPE), an Internet of Things (IoT) device, a watch or other wearable, a head-mounted display (HMD), a vehicle, a drone, a medical device and applications (e.g., remote surgery), an industrial device and applications (e.g., a robot and/or other wireless devices

operating in an industrial and/or an automated processing chain contexts), a consumer electronics device, a device operating on commercial and/or industrial wireless networks, and the like. The terminal device may also correspond to a Mobile Termination (MT) part of an IAB node (e.g., a relay node). In the following description, the terms "terminal device", "communication device", "terminal", "user equipment" and "UE" may be used interchangeably.

[0032] As used herein, the term "resource," "transmission resource," "resource block," "physical resource block" (PRB), "uplink resource," or "downlink resource" may refer to any resource for performing a communication, for example, a communication between a terminal device and a network device, such as a resource in time domain, a resource in frequency domain, a resource in space domain, a resource in code domain, or any other combination of the time, frequency, space and/or code domain resource enabling a communication, and the like. In the following, unless explicitly stated, a resource in both frequency domain and time domain will be used as an example of a transmission resource for describing some example embodiments of the present disclosure. It is noted that example embodiments of the present disclosure are equally applicable to other resources in other domains.

[0033] As described above, the study associated with the NES has been discussed in 5G NR for environmental sustainability and for operational cost savings.

[0034] Energy consumption has become a key part of the operators' operating expense (OPEX). The energy cost on mobile networks accounts for ~23% of the total operator cost. Most of the energy consumption comes from the radio access network (RAN) and in particular from the active antenna unit (AAU), with data centres and fibre transport accounting for a smaller share. The power consumption of a radio access can be split into two parts: the dynamic part which is only consumed when data transmission/reception is ongoing, and the static part which is consumed all the time to maintain the necessary operation of the radio access devices, even when the data transmission/reception is not on-going.

[0035] During the study associated with the NES, the network energy consumption model for the BS was defined including the reference configurations for frequency range 1 (FR1) time division duplexing (TDD)/frequency division duplexing (FDD) and frequency range 2 (FR2), the deep/light/micro sleep power states with corresponding

relative power, transition time and energy consumption among different power states based on two types of BS categories, and the scaling rules for the active downlink (DL)/uplink (UL) power states considering base station (BS) power split by a static part of power and a dynamic part of power with the latter part reflecting the dynamic power consumption with respect to transmission/reception resource configurations in time, frequency, spatial and power domains. In addition, evaluation methodology and assumptions were achieved to study and evaluate the network energy saving gains for potential techniques with respect to other key performance indicator (KPI) including user perceived throughput (UPT), access delay, UE power consumption, etc.

[0036] Based on the agreed BS energy consumption model, and the evaluation methodology and assumptions, potential network energy saving techniques in various domains were evaluated with respect to the energy saving gains and the corresponding performance impact considering the above KPIs. The studied techniques are classified into time, frequency, spatial and power domains, and the technical descriptions as well as the legacy UE and specification impacts are summarized in the technical report. The techniques in time and frequency domains mainly aim to reduce the power consumption for dynamic part by trying to shut down more symbols on one or more carriers to achieve BS micro sleep, and even the static power part by enlarging the interval between the contiguous active transmission/reception occasions to achieve BS light/deep sleep. The techniques in spatial and power domains mainly aim to reduce the power consumption of the transceiver chains and power amplifiers (PAs) by trying to shut down more spatial elements and/or reduce transmission power/power spectrum density or increase the PA efficiency.

[0037] In some embodiments, it is expected to specify synchronization signal block (SSB)-less secondary cell (SCell) operation for inter-band carrier aggregation (CA) for FR1 and co-located cells, if found feasible by RAN4 study, where a UE measures SSB transmitted on primary cell (PCell) or another SCell for an SCell's time/frequency synchronization (including downlink automatic gain control (AGC)), and layer 1 (L1)/layer 3 (L3) measurements, including potential enhancement on SCell activation procedures if necessary.

[0038] In some embodiments, it is expected to specify enhancement on cell discontinuous transmission (DTX)/discontinuous reception (DRX) mechanism including the alignment of cell DTX/DRX and UE DRX in RRC_CONNECTED mode, and inter-

node information exchange on cell DTX/DRX. In some embodiments, there is no change for SSB transmission due to cell DTX/DRX. In some embodiments, the impact to IDLE/INACTIVE UEs due to the above enhancement should be avoided.

[0039] In some embodiments, as for techniques in spatial and power domains, it is expected to specify necessary enhancements on channel state information (CSI) and beam management related procedures including measurement and report and signaling to enable efficient adaptation of spatial elements (e.g., antenna ports, active transceiver chains).

[0040] In some embodiments, as for techniques in spatial and power domains, it is expected to specify necessary enhancements on CSI related procedures including measurement and report and signaling to enable efficient adaptation of power offset values between physical downlink shared channel (PDSCH) and CSI reference signal (CSI-RS). The above example embodiments are only for UE specific channels/signals. In some embodiments, legacy UE CSI/CSI-RS capabilities applies when considering total number of CSI reports and requirements.

[0041] In some embodiments, it is expected to specify mechanism(s) to prevent legacy UEs camping on cells adopting the release 18 NES techniques, if necessary.

[0042] In some embodiments, it is expected to specify Conditional Handover (CHO) procedure enhancement(s) in case source/target cell is in NES mode.

[0043] In some embodiments, it is expected to specify inter-node beam activation and enhancements on restricting paging in a limited area.

[0044] In some embodiments, it is expected to specify the corresponding radio resource management (RRM)/radio frequency (RF) core requirements, if necessary, for the above features.

[0045] For the DTX/DRX mechanism, the following operations may be implemented. In some embodiments, a periodic cell DTX/DRX configuration may explicitly signalled to the UEs.

[0046] In some embodiments, a periodic cell DTX/DRX pattern may be configured by UE specific RRC signalling.

[0047] In some embodiments, the Cell DTX/DRX configuration may contains at least: periodicity, start slot/offset, on duration.

[0048] In some embodiments, the Cell DTX/DRX may be activated/deactivated implicitly by RRC signalling, i.e., activated immediately once configured by RRC and deactivated once the RRC configuration is released.

[0049] In some embodiments, L1 signalling for Cell DTX/DRX activation/deactivation may be used.

[0050] In some embodiments, UE doesn't monitor Semi-persistent Scheduling (SPS) occasions during Cell DTX non-active period. As baseline, gNB is assumed to be not transmitting PDSCH to that UE on such SPS occasions during the Cell DTX non-active period.

[0051] In some embodiments, UE does not transmit on configured grant (CG) occasions during Cell DRX non-active periods.

[0052] In some embodiments, UE does not transmit scheduling request (SR) occasions overlapping with Cell DRX non-active periods, e.g., SR transmissions are dropped during the non-active period.

[0053] In some embodiments, (for the SRs that will be dropped) if SR is not to be transmitted on a physical uplink control channel (PUCCH) occasion during Cell DRX non-active time, the UE keep the SR pending, i.e., the UE delays the SR transmission till the Cell DRX active period without triggering random access channel (RACH).

[0054] In some embodiments, the understanding for the gNB scheduling behaviour for new transmissions during Cell DTX non-active period is that the gNB does not schedule UE-specific dynamic grants/assignments, even if the UE is in Connected DRX (C-DRX) Active Time. The UE doesn't monitor physical downlink control channel (PDCCH) for dynamic grants/assignments for new transmissions during Cell DTX non-active period, even if the UE is in C-DRX Active time.

[0055] By far, it is unclear how the high priority transmission (such as, emergency call) can be supported when cell is in NES mode (such as cell DTX/DRX). Further, NES is violated if the network needs to monitor SR and respond SR during Cell DTX/DRX. While not being able to send SR due to Cell DTX/DRX inactive period might cause unacceptable delay for emergency call.

[0056] Even if the UE is allowed to send SR for certain cases (e.g., per SR configuration configured as allowed/not allowed) and the network monitors it, it might take some time

for the network to wake up and response to the UE, which depends on in which sleeping mode the network side transmitter is and therefore the delay might also be caused. Besides, based on the SR reception alone, the network is not able to tell the UE is performing emergency call thus might still wait until its next active time to response to the UE.

[0057] In view of the above discussions, it is desirable to propose a solution of processing a high priority transmission triggered in NES cell.

[0058] According to the present disclosure, the first apparatus (such as, a terminal device) determines that a high priority transmission is triggered in a cell configured with an energy saving mode. The first apparatus performs at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

[0059] In this way, the high priority transmission triggered in the NES cell may be well handled through any one of these embodiments.

Example Environment

[0060] FIG.1 illustrates an example communication environment 100 in which example embodiments of the present disclosure can be implemented. The communication environment 100 includes a first apparatus 110, a second apparatus 120-1, and an optional second apparatus 120-2. For ease of discussion, the second apparatus 120-1 and the second apparatus 120-2 are individually or collectively referred to as a second apparatus 120. A serving area provided by the second apparatus 120 is called a cell. Further, the second apparatus 120 may provide one or more cells.

[0061] In FIG. 1, the first apparatus 110 may be located within one or more cells. As illustrated in FIG.1, in one example scenario, the first apparatus 110 may be located within one cell 102-1 provided by the second apparatus 120-1. In another example scenario, the first apparatus 110 may be located within the cells 102-1 and 102-2 both of which are

provided by the second apparatus 120-1. In a further example scenario, the first apparatus 110 may be located within the cells 102-1 and 102-2 provided by the second apparatus 120-1 and by the second apparatus 120-2, respectively.

[0062] In some example embodiments, the first apparatus 110 may be comprised in a terminal device/apparatus and the second apparatus 120 may be comprised in a network device/apparatus serving the terminal device/apparatus.

[0063] In the following, for the purpose of illustration, some example embodiments are described with the first apparatus 110 operating as a terminal apparatus and the second apparatus 120 operating as a network apparatus. However, in some example embodiments, operations described in connection with a terminal apparatus may be implemented at a network apparatus or other apparatus, and operations described in connection with a network apparatus may be implemented at a terminal apparatus or other apparatus.

[0064] In some example embodiments, if the first apparatus 110 is a terminal apparatus and the second apparatus 120 is a network apparatus, a link from the second apparatus 120 to the first apparatus 110 is referred to as a downlink (DL), while a link from the first apparatus 110 to the second apparatus 120 is referred to as an uplink (UL). In DL, the second apparatus 120 is a transmitting (TX) apparatus (or a transmitter) and the first apparatus 110 is a receiving (RX) apparatus (or a receiver). In UL, the first apparatus 110 is a TX apparatus (or a transmitter) and the second apparatus 120 is a RX apparatus (or a receiver).

[0065] Communications in the communication environment 100 may be implemented according to any proper communication protocol(s), comprising, but not limited to, cellular communication protocols of the first generation (1G), the second generation (2G), the third generation (3G), the fourth generation (4G), the fifth generation (5G), the sixth generation (6G), and the like, wireless local network communication protocols such as Institute for Electrical and Electronics Engineers (IEEE) 802.11 and the like, and/or any other protocols currently known or to be developed in the future. Moreover, the communication may utilize any proper wireless communication technology, comprising but not limited to: Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Frequency Division Duplex (FDD), Time Division Duplex (TDD), Multiple-Input Multiple-Output (MIMO), Orthogonal Frequency Division Multiple (OFDM), Discrete Fourier Transform spread

OFDM (DFT-s-OFDM) and/or any other technologies currently known or to be developed in the future.

Work Principle and Example Signaling for Communication

[0066] According to some example embodiments of the present disclosure, there is provided a solution of processing a high priority transmission triggered in NES cell. Reference is made to FIG. 2, which illustrates a signaling flow 200 of communication in accordance with some embodiments of the present disclosure. For the purposes of discussion, the signaling flow 200 will be discussed with reference to FIG. 1, for example, by using the first apparatus 110 and the second apparatus 120.

[0067] It is to be understood that the operations at the first apparatus 110 and the second apparatus 120 should be coordinated. In other words, the second apparatus 120 and the first apparatus 110 should have common understanding about configurations, parameters and so on. Such common understanding may be implemented by any suitable interactions between the second apparatus 120 and the first apparatus 110 or both the second apparatus 120 and the first apparatus 110 applying the same rule/policy.

[0068] In the following, although some operations are described from a perspective of the first apparatus 110, it is to be understood that the corresponding operations should be performed by the second apparatus 120. Similarly, although some operations are described from a perspective of the second apparatus 120, it is to be understood that the corresponding operations should be performed by the first apparatus 110. Merely for brevity, some of the same or similar contents are omitted here.

[0069] In addition, in the following description, examples of message type (such as system information (SI), a radio resource control (RRC) signalling, a medium access control (MAC) control element (CE)) are only for the purpose of illustration without suggesting any limitations. In other example embodiments, any suitable message types may be used for the interaction between the first apparatus 110 and the second apparatus 120.

[0070] Further, the message from the second apparatus 120 to the first apparatus 110 may be transmitted in either a broadcast manner or in a dedicated manner. The present disclosure is not limited in this regard.

[0071] Merely for a better understanding, in the example of FIG. 2, the first apparatus 110 is a terminal apparatus and the second apparatus 120 is a network apparatus. Further, cell 102-1 is a NES cell, which means that the cell 102 supports or has been configured in an energy saving mode.

[0072] In operation, the first apparatus 110 determines 220 that a high priority transmission is triggered in a cell configured with an energy saving mode.

[0073] One example high priority transmission may be an emergency call. Another example high priority transmission may be data or signaling of mission critical services. The other example high priority transmissions may be, data or signaling belonging to one or more certain access categories, data or signaling belonging to one or more certain access identities, data or signaling with a priority above a threshold priority, or high priority data or signaling. The threshold priority may be preconfigured as a system-default parameter, or it may be received via RRC signalling, for example.

[0074] It is to be understood that the above example high priority transmissions are only for the purpose of illustration without suggesting any limitations. In the other example embodiments, the high priority transmission may be other high priority traffics or services. The present discourse is not limited in this regard.

[0075] In the present discourse, the energy saving mode refers to an operation state of the second apparatus 120 (such as, a network device). When the second apparatus is operated in the energy saving mode, the power consumption may be reduced compared with the power consumption in a non-energy saving mode. One example energy saving mode may be a cell discontinuous transmission (DTX). Another example energy saving mode may be a cell discontinuous reception (DRX). The other example energy saving mode may be a spatial domain energy saving mode or a power domain energy saving mode.

[0076] It is to be understood that the above example energy saving modes are only for the purpose of illustration without suggesting any limitations. In the other example embodiments, the energy saving mode may be any suitable existing energy saving mode or newly-introduced energy saving mode. The present discourse is not limited in this regard.

[0077] In the following, example embodiments about how to handle the conflict between the NES and the need for fast triggering of the high priority transmission will be

detailed discussed. In the present disclosure, the conflict may be well handled by either one or both of the first apparatus 110 and the second apparatus 120. Further, any of the following handling policy may be implemented as a default handling policy or be implemented as a configurable policy.

[0078] In some example embodiments, in response to determining that the high priority transmission is triggered, the first apparatus 110 initiates 270 an establishment procedure with another cell. Refer to FIG. 1 for a better understanding. The first apparatus 110 determines that the high priority transmission is triggered in a cell 102-1, then the first apparatus 110 may initiate an establishment procedure with the cell 102-2.

[0079] Additionally, the initiation of the above establishment procedure may be performed conditionally. Specifically, the first apparatus 110 initiates 270 an establishment procedure with another cell only if the cell 102-1 does not support or does not allow an initiation/starting of the high priority transmission in the energy saving mode.

[0080] The establishment procedure may be implemented as different procedures according to the different states of the first apparatus 110 (such as, idle, inactive or connected state). In some example embodiments, the establishment procedure may be an RRC establishment procedure or an RRC re-establishment procedure (if the first apparatus 110 is in a connected state). Alternatively, in some example embodiments, the establishment procedure may be an RRC setup procedure (if the first apparatus 110 is in an idle state). Alternatively, in some example embodiments, the establishment procedure may be an RRC resume procedure (if the first apparatus 110 is in an inactive state). Alternatively, in some example embodiments, the establishment procedure may be a conditional handover if conditional handover is configured.

[0081] As one specific example embodiment, the first apparatus 110 is in the idle/inactive state and the first apparatus 110 has not received the NES configuration (such as, the DTX/DRX pattern) of the cell 102-1. However, the first apparatus 110 may understand that the cell 102-2 supports the NES mode via SI or dedicated RRC signalling transmitted by the second apparatus. In this specific example embodiment, if the cell 102-1 is set as barred for non-NES apparatuses, the first apparatus 110 which supports the NES feature may select another cell to perform the RRC establishment procedure (i.e., RRC setup procedure or RRC resume procedure).

[0082] As another specific example embodiment, the first apparatus 110 is in the

connnected state and the first apparatus 110 has received the NES configuration (such as, the DTX/DRX pattern) of the cell 102-1. In this specific example embodiment, if the cell 102-1 is set as barred for non-NES apparatuses, the first apparatus 110 which supports the NES feature may select another cell to perform the RRC establishment procedure (i.e., RRC setup procedure or RRC (re-)establishment procedure).

[0083] A cell set as barred for non-NES apparatuses may be understood as that the UEs not supporting the NES are not allowed to enter the cell. Such a cell is thus an example of the above-described cell that does not allow the initiation of the high priority service during the NES.

[0084] Alternatively, the first apparatus 110 may start or try to start the high priority transmission in the NES cell, which also be performed conditionally or as a default policy.

[0085] In some example embodiments, the first apparatus 110 may transmit 230 a first indication to a second apparatus 120 providing the cell 102-1, wherein the first indication indicates the high priority transmission. In some example embodiments, the transmission of the first indication may be performed conditionally. For example, if the energy saving mode has been configured and the first apparatus 110 is allowed not to employ the energy saving mode, the first apparatus 110 may transmit the first indication to the second apparatus 120. The second apparatus 120 utilizing the NES mode in the cell 102-1 may configure at least some of the UEs in the cell to fully adopt the NES mode according to the system specifications. Additionally, the second apparatus may configure an exception to the first apparatus to allow the first apparatus to not fully adopt the NES mode, e.g. to allow the first apparatus to transmit the first indication even during the NES mode. As a consequence, said at least some of the UEs in the cell are not allowed to transmit the first indication during the NES mode while the first apparatus is allowed to transmit the first indication during the NES mode.

[0086] In some example embodiments, the first indication may be comprised in an RRC signalling or a MAC CE.

[0087] In some example embodiments, the first apparatus 110 is in the connected mode and the first apparatus 110 may initiate a random access (RA) procedure with the second apparatus 120 and transmit the first indication to the second apparatus 120. That is because even the cell 102-1 is in the energy saving mode, RA procedure may still be handled normally.

[0088] As for the second apparatus 120, in some example embodiments, in response to receiving the first indication, the second apparatus 120 may deactivate a network energy saving (NES) configuration (such as, DTX/TRX pattern) for the first apparatus 110. Meanwhile, the NES configuration may be activated for at least one other UE in the cell 102-1. Alternatively, or in addition, in some example embodiments, the the second apparatus 120 may further transmits a second indication to the first apparatus 110, where the second indication indicates the first apparatus 110 to deactivate the NES configuration for the first apparatus 110.

[0089] In some example embodiments, the second indication may be dedicated to the first apparatus 110, such as, comprised in the dedicated RRC signalling.

[0090] As for the first apparatus 110, in some example embodiments, the first apparatus 110 may deactivate the NES configuration (such as, DTX/TRX pattern) received from the second apparatus 120 in response to transmitting the first indication to the second apparatus 120.

[0091] Alternatively, in some example embodiments, the first apparatus 110 may deactivate the NES configuration (such as, DTX/TRX pattern) received from the second apparatus 120 in response to receiving 250 the second indication from the second apparatus 120, where the second indication indicates the first apparatus 110 to deactivate the NES configuration.

[0092] As one specific embodiment, the first apparatus 110 is in the connected state, the first apparatus 110 triggers a RACH procedure, and further requests/indicates that the high priority transmission (such as, the emergency call) is triggered in the cell via an RRC message or MAC CE (which may be a newly-introduced message, i.e., the first indication), where the cell has been configured in the energy saving mode.

[0093] In this specific embodiment, upon reception of the first indication, the second apparatus 120 may assume the NES state/configuration (e.g. Cell DTX/DRX) is deactivated at the first apparatus 110 until explicitly activated again by the second apparatus 120.

[0094] Alternatively, the deactivation at the first apparatus 110 may be performed based on an explicit indication from the second apparatus 120 (i.e., the second indication). In some embodiments, the second indication is provided based on the receipt of the first

indication from the first apparatus 110.

[0095] In addition to the first indication, the second apparatus 120 also may determine 240 that the high priority transmission is triggered at a first apparatus 110 by other suitable manners. Specifically, in some example embodiments, the second apparatus 120 may determine that the high priority transmission is triggered in response to receiving one of the following:

- an RRC setup request message comprising a cause indicating the high priority transmission,
- an RRC resume request message comprising a cause indicating the high priority transmission, or
- a first indication indicating the high priority transmission, wherein the energy saving mode has been configured;

[0096] In some example embodiments, if the first apparatus 110 in a non-connected state, in accordance with a determination that the high priority transmission is triggered, the second apparatus 120 may disable configuring the NES configuration to the first apparatus 110.

[0097] As one specific example embodiment, the first apparatus 110 is in the idle/inactive state and the first apparatus 110 has not received the NES configuration (such as, the DTX/DRX pattern) of the cell 102-1. In this event, if the first apparatus 110 initiates the high priority transmission (such as, an emergency call or high priority data), the second apparatus 120 may not configure the NES configuration (such as cell DTX/DRX etc) for the first apparatus 110. In this specific example embodiment, the second apparatus 120 may determine the high priority transmission from the establishment cause (comprised in the RRC Setup Request message) or resume cause (comprised in the RRC Resume Request message) indicated by the first apparatus 110.

[0098] In some example embodiments, after determining that the high priority transmission is triggered at a first apparatus 110 in the cell 102-1, the first apparatus 110 may start 260 the high priority transmission with the second apparatus 120 in accordance with a determination that the cell allows the high priority transmission in the energy saving mode. For example, the first apparatus 110 initiates an RA procedure. Further, if the first apparatus 110 is in an idle state, the first apparatus 110 indicates that the high

priority transmission is triggered at the first apparatus 110 by using the establishment cause comprised in the RRC Setup Request message during the RA procedure. If the first apparatus 110 is in an inactive state, the first apparatus 110 indicates that the high priority transmission is triggered at the first apparatus 110 by using the resume cause comprised in the RRC Setup Resume message during the RA procedure. If the first apparatus 110 is in a connected state, the first apparatus 110 indicates that the high priority transmission is triggered at the first apparatus 110 by using a dedicated message comprising the first indication after the RA procedure.

[0099] In the other example embodiments, the first t apparatus 110 may start the high priority transmission in other suitable manner. The present disclosure is not limited in this regard.

[0100] In some example embodiments, the first apparatus may communicate 210 NES-related information of the second apparatus 120/cell 102-1 (also referred to as configuration information) to the first apparatus 110. Example NES-related information comprises but are not limited to, whether the cell enables the energy saving mode, whether the cell allows the high priority transmission in the energy saving mode, whether the cell is set as barred for non-NES UEs (i.e. whether allow the non-NES UE to camp on the cell) and so on.

[0101] With such NES-related information, the first apparatus 110 may decide how to handle the triggered high priority transmission, for example, decide whether to start the high priority transmission in the NES cell, initiate an establishment procedure with another cell, transmit the first indication to a second apparatus and so on.

[0102] In some example embodiments, the configuration information is comprised in system information (SI) or a radio resource control (RRC) signalling.

[0103] In some example embodiments, the second apparatus 120 may transmit configuration information indicating whether the cell allows the high priority transmission in the energy saving mode. In response to the configuration information, the first apparatus 110 may transmit the first indication or start the high priority transmission accordingly. In particular, if the configuration information indicates that the cell allows the high priority transmission in the energy saving mode, the first apparatus 110 may transmit the first indication or start the high priority transmission. On the other hand, if the configuration information indicates that the cell does not allow the high priority

transmission in the energy saving mode, the first apparatus 110 may choose to initiate the establishment procedure for the high priority transmission in said another cell.

[0104] As one specific example embodiment, the first apparatus 110 is in the idle/inactive state. The second apparatus 120 may indicate (e.g. via broadcast or dedicated signaling) whether the high priority transmission (such as, the emergency call) is supported during the NES cell to the first apparatus 110. Based on this information the first apparatus 110 may start the high priority transmission on the NES cell as discussed above. In particular, if the high priority transmission is supported during the NES for the first apparatus 110, but not necessarily supported for all UEs during the NES, the first apparatus 110 may transmit the first indication or start the high priority transmission. On the other hand, if the high priority transmission is not supported during the NES for the first apparatus 110, the first apparatus 110 may choose to initiate the establishment procedure for the high priority transmission in said another cell.

[0105] As another specific example embodiment, the first apparatus 110 is in the connected state, the second apparatus 120 may indicate (e.g. via broadcast or dedicated signaling) whether the high priority transmission (such as, the emergency call) is supported on the NES cell to the first apparatus. Based on this information the first apparatus 110 may start the high priority transmission on the NES cell if the UE is already in connected state and the emergency call is triggered.

[0106] The three options for initiating the high priority transmission may be collated into the following logical structure. If the second apparatus allows the initiation of the high priority transmission to all UEs in the cell during the energy saving mode, or if the second apparatus allows the initiation of the high priority transmission dedicatedly to the first apparatus in the cell during the energy saving mode (while not allowing it for at least one other apparatus in the cell), the first apparatus may initiate the high priority transmission in the cell. Else if the second apparatus does not allow the initiation of the high priority transmission for the first apparatus in the cell during the energy saving mode, the first apparatus may initiate the establishment procedure for the high priority transmission in said another cell. Such may happen for example when the second apparatus generally does not allow the initiation of the high priority transmissions in the energy saving mode, or when the second apparatus has disabled the initiation of the high priority transmission at least for the first apparatus.

[0107] With the above processes, the high priority transmission triggered in the NES cell may be well handled.

Example Methods

[0108] FIG. 3 shows a flowchart of an example method 300 implemented at a first apparatus in accordance with some example embodiments of the present disclosure. For the purpose of discussion, the method 300 will be described from the perspective of the first apparatus 110 in FIG. 1.

[0109] At block 310, the first apparatus 110 determines that a high priority transmission is triggered in a cell configured with an energy saving mode.

[0110] At block 320, the first apparatus 110 performs at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

[0111] In some example embodiments, the first apparatus 110 may receive, from the second apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode; and in response to the configuration information, transmitting the first indication or starting the high priority transmission.

[0112] In some example embodiments, the configuration information is comprised in system information (SI) or a radio resource control (RRC) signalling.

[0113] In some example embodiments, the first apparatus 110 may initiate a random access (RA) procedure with the second apparatus; and transmit the first indication to the second apparatus.

[0114] In some example embodiments, the first apparatus 110 may deactivate a network energy saving (NES) configuration received from the second apparatus in response to one of the following: transmitting the first indication to the second apparatus; or receiving a

second indication from the second apparatus, the second indication indicating the first apparatus to deactivate the NES configuration.

[0115] In some example embodiments, the second indication may be dedicated to the first apparatus.

[0116] In some example embodiments, the first indication may be comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

[0117] In some example embodiments, the high priority transmission may comprise at least one of: an emergency call, data or signaling of mission critical services, data or signaling belonging to one or more certain access categories, data or signaling belonging to one or more certain access identities, data or signaling with a priority above a threshold priority, or high priority data or signaling.

[0118] In some example embodiments, the energy saving mode may comprise one of the following: a cell discontinuous transmission (DTX), a cell discontinuous reception (DRX), a spatial domain energy saving mode, or a power domain energy saving mode.

[0119] In some example embodiments, the establishment procedure may be one of the following: a radio resource control (RRC) establishment procedure, an RRC re-establishment procedure, an RRC setup procedure, an RRC resume procedure, or a conditional handover if conditional handover is configured.

[0120] In some example embodiments, the first apparatus may be a terminal apparatus and the second apparatus may be a network apparatus.

[0121] FIG. 4 shows a flowchart of an example method 400 implemented at a second apparatus in accordance with some example embodiments of the present disclosure. For the purpose of discussion, the method 400 will be described from the perspective of the second apparatus 120 in FIG. 1.

[0122] At block 410, the second apparatus 120 configures a cell provided by the second apparatus in an energy saving mode.

[0123] At block 420, the second apparatus 120 determines that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following: a radio resource control (RRC) setup request

message comprising a cause indicating the high priority transmission, an RRC resume request message comprising a cause indicating the high priority transmission, or a first indication indicating the high priority transmission, wherein the energy saving mode has been configured.

[0124] At block 430, the second apparatus 120 processes the high priority transmission for the first apparatus.

[0125] In some example embodiments, the second apparatus 120 may transmit, to the first apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode.

[0126] In some example embodiments, the configuration information may be comprised in system information (SI) or a radio resource control (RRC) signalling.

[0127] In some example embodiments, in response to receiving the first indication, the second apparatus 120 may perform at least one of the following: deactivating a network energy saving (NES) configuration for the first apparatus; or transmitting, to the first apparatus, a second indication indicating the first apparatus to deactivate the NES configuration for the first apparatus.

[0128] In some example embodiments, the second indication may be dedicated to the first apparatus.

[0129] In some example embodiments, the first indication may be comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

[0130] In some example embodiments, in accordance with a determination that the high priority transmission is triggered, the second apparatus 120 may disable configuring a network energy saving (NES) configuration to the first apparatus.

[0131] In some example embodiments, the high priority transmission may comprise at least one of: an emergency call, data or signaling of mission critical services, data or signaling belonging to one or more certain access categories, data or signaling belonging to one or more certain access identities, data or signaling with a priority above a threshold priority, or high priority data or signaling.

[0132] In some example embodiments, the energy saving mode may comprise one of

the following: a cell discontinuous transmission (DTX), a cell discontinuous reception (DRX), a spatial domain energy saving mode, or a power domain energy saving mode.

[0133] In some example embodiments, the first apparatus may be a terminal apparatus and the second apparatus may be a network apparatus.

Example Apparatus, Device and Medium

[0134] In some example embodiments, a first apparatus capable of performing any of the method 300 (for example, the first apparatus 110 in FIG. 1 may comprise means for performing the respective operations of the method 300. The means may be implemented in any suitable form. For example, the means may be implemented in a circuitry or software module. The first apparatus may be implemented as or included in the first apparatus 110 in FIG. 1.

[0135] In some example embodiments, the first apparatus comprises means for determining that a high priority transmission is triggered in a cell configured with an energy saving mode; and means for performing at least one of the following: if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell; transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

[0136] In some example embodiments, the first apparatus further comprises: means for receiving, from the second apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode; and in response to the configuration information, transmitting the first indication or starting the high priority transmission.

[0137] In some example embodiments, the configuration information may be comprised in system information (SI) or a radio resource control (RRC) signalling.

[0138] In some example embodiments, the first apparatus may be in the connected mode, the first apparatus may further comprise means for initiating a random access (RA) procedure with the second apparatus; and means for transmitting the first indication to the

second apparatus.

[0139] In some example embodiments, the first apparatus may further comprise: means for deactivating a network energy saving (NES) configuration received from the second apparatus in response to one of the following: transmitting the first indication to the second apparatus; or receiving a second indication from the second apparatus, the second indication indicating the first apparatus to deactivate the NES configuration.

[0140] In some example embodiments, the second indication may be dedicated to the first apparatus.

[0141] In some example embodiments, the first indication may be comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

[0142] In some example embodiments, the high priority transmission may comprise at least one of: an emergency call, data or signaling of mission critical services, data or signaling belonging to one or more certain access categories, data or signaling belonging to one or more certain access identities, data or signaling with a priority above a threshold priority, or high priority data or signaling.

[0143] In some example embodiments, the energy saving mode may comprise one of the following: a cell discontinuous transmission (DTX), a cell discontinuous reception (DRX), a spatial domain energy saving mode, or a power domain energy saving mode.

[0144] In some example embodiments, the establishment procedure may be one of the following: a radio resource control (RRC) establishment procedure, an RRC re-establishment procedure, an RRC setup procedure, an RRC resume procedure, or a conditional handover if conditional handover is configured.

[0145] In some example embodiments, the first apparatus may be a terminal apparatus and the second apparatus may be a network apparatus.

[0146] In some example embodiments, the first apparatus further comprises means for performing other operations in some example embodiments of the method 300 or the first apparatus 110. In some example embodiments, the means comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the performance of the first apparatus.

[0147] In some example embodiments, a second apparatus capable of performing any of the method 400 (for example, the second apparatus 120 in FIG. 1 may comprise means for performing the respective operations of the method 400. The means may be implemented in any suitable form. For example, the means may be implemented in a circuitry or software module. The second apparatus may be implemented as or included in the second apparatus 120 in FIG. 1.

[0148] In some example embodiments, the second apparatus comprises means for configuring a cell provided by the second apparatus in an energy saving mode; means for determining that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following: a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission, an RRC resume request message comprising a cause indicating the high priority transmission, or a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and means for processing the high priority transmission for the first apparatus.

[0149] In some example embodiments, the second apparatus may further comprise means for transmitting, to the first apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode.

[0150] In some example embodiments, the configuration information may be comprised in system information (SI) or a radio resource control (RRC) signalling.

[0151] In some example embodiments, the first apparatus may be in a connected state, the second apparatus may further comprise means for in response to receiving the first indication, performing at least one of the following: deactivating a network energy saving (NES) configuration for the first apparatus; or transmitting, to the first apparatus, a second indication indicating the first apparatus to deactivate the NES configuration for the first apparatus.

[0152] In some example embodiments, the second indication may be dedicated to the first apparatus.

[0153] In some example embodiments, the first indication may be comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

[0154] In some example embodiments, the second apparatus may further comprise means for in accordance with a determination that the high priority transmission is triggered, disabling configuring a network energy saving (NES) configuration to the first apparatus.

[0155] In some example embodiments, the high priority transmission may comprise at least one of: an emergency call, data or signaling of mission critical services, data or signaling belonging to one or more certain access categories, data or signaling belonging to one or more certain access identities, data or signaling with a priority above a threshold priority, or high priority data or signaling.

[0156] In some example embodiments, the energy saving mode may comprise one of the following: a cell discontinuous transmission (DTX), a cell discontinuous reception (DRX), a spatial domain energy saving mode, or a power domain energy saving mode.

[0157] In some example embodiments, the first apparatus may be a terminal apparatus and the second apparatus may be a network apparatus.

[0158] In some example embodiments, the second apparatus may further comprise means for performing other operations in some example embodiments of the method 400 or the second device 120. In some example embodiments, the means comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the performance of the second apparatus.

[0159] FIG. 5 is a simplified block diagram of a device 500 that is suitable for implementing example embodiments of the present disclosure. The device 500 may be provided to implement a communication device, for example, the first device 110 or the second apparatus 120 as shown in FIG. 1. As shown, the device 500 includes one or more processors 510, one or more memories 520 coupled to the processor 510, and one or more communication modules 540 coupled to the processor 510.

[0160] The communication module 540 is for bidirectional communications. The communication module 540 has one or more communication interfaces to facilitate communication with one or more other modules or devices. The communication interfaces may represent any interface that is necessary for communication with other network elements. In some example embodiments, the communication module 540 may include at least one antenna.

[0161] The processor 510 may be of any type suitable to the local technical network and may include one or more of the following: general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multicore processor architecture, as non-limiting examples. The device 500 may have multiple processors, such as an application specific integrated circuit chip that is slaved in time to a clock which synchronizes the main processor.

[0162] The memory 520 may include one or more non-volatile memories and one or more volatile memories. Examples of the non-volatile memories include, but are not limited to, a Read Only Memory (ROM) 524, an electrically programmable read only memory (EPROM), a flash memory, a hard disk, a compact disc (CD), a digital video disk (DVD), an optical disk, a laser disk, and other magnetic storage and/or optical storage. Examples of the volatile memories include, but are not limited to, a random access memory (RAM) 522 and other volatile memories that will not last in the power-down duration.

[0163] A computer program 530 includes computer executable instructions that are executed by the associated processor 510. The instructions of the program 530 may include instructions for performing operations/acts of some example embodiments of the present disclosure. The program 530 may be stored in the memory, e.g., the ROM 524. The processor 510 may perform any suitable actions and processing by loading the program 530 into the RAM 522.

[0164] The example embodiments of the present disclosure may be implemented by means of the program 530 so that the device 500 may perform any process of the disclosure as discussed with reference to FIG. 2 to FIG. 6. The example embodiments of the present disclosure may also be implemented by hardware or by a combination of software and hardware.

[0165] In some example embodiments, the program 530 may be tangibly contained in a computer readable medium which may be included in the device 500 (such as in the memory 520) or other storage devices that are accessible by the device 500. The device 500 may load the program 530 from the computer readable medium to the RAM 522 for execution. In some example embodiments, the computer readable medium may include any types of non-transitory storage medium, such as ROM, EPROM, a flash memory, a hard disk, CD, DVD, and the like. The term "non-transitory," as used herein, is a limitation

of the medium itself (i.e., tangible, not a signal) as opposed to a limitation on data storage persistency (e.g., RAM vs. ROM).

[0166] FIG. 6 shows an example of the computer readable medium 600 which may be in form of CD, DVD or other optical storage disk. The computer readable medium 600 has the program 530 stored thereon.

[0167] Generally, various embodiments of the present disclosure may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. Some aspects may be implemented in hardware, and other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device. Although various aspects of embodiments of the present disclosure are illustrated and described as block diagrams, flowcharts, or using some other pictorial representations, it is to be understood that the block, apparatus, system, technique or method described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[0168] Some example embodiments of the present disclosure also provide at least one computer program product tangibly stored on a computer readable medium, such as a non-transitory computer readable medium. The computer program product includes computer-executable instructions, such as those included in program modules, being executed in a device on a target physical or virtual processor, to carry out any of the methods as described above. Generally, program modules include routines, programs, libraries, objects, classes, components, data structures, or the like that perform particular tasks or implement particular abstract data types. The functionality of the program modules may be combined or split between program modules as desired in various embodiments. Machine-executable instructions for program modules may be executed within a local or distributed device. In a distributed device, program modules may be located in both local and remote storage media.

[0169] Program code for carrying out methods of the present disclosure may be written in any combination of one or more programming languages. The program code may be provided to a processor or controller of a general purpose computer, special purpose computer, or other programmable data processing apparatus, such that the program code, when executed by the processor or controller, cause the functions/operations specified in

the flowcharts and/or block diagrams to be implemented. The program code may execute entirely on a machine, partly on the machine, as a stand-alone software package, partly on the machine and partly on a remote machine or entirely on the remote machine or server.

[0170] In the context of the present disclosure, the computer program code or related data may be carried by any suitable carrier to enable the device, apparatus or processor to perform various processes and operations as described above. Examples of the carrier include a signal, computer readable medium, and the like.

[0171] The computer readable medium may be a computer readable signal medium or a computer readable storage medium. A computer readable medium may include but not limited to an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples of the computer readable storage medium would include an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[0172] Further, although operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, although several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the present disclosure, but rather as descriptions of features that may be specific to particular embodiments. Unless explicitly stated, certain features that are described in the context of separate embodiments may also be implemented in combination in a single embodiment. Conversely, unless explicitly stated, various features that are described in the context of a single embodiment may also be implemented in a plurality of embodiments separately or in any suitable sub-combination.

[0173] Although the present disclosure has been described in languages specific to structural features and/or methodological acts, it is to be understood that the present disclosure defined in the appended claims is not necessarily limited to the specific features

or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

WHAT IS CLAIMED IS:

1. A first apparatus comprising:

at least one processor; and

at least one memory storing instructions that, when executed by the at least one processor, cause the first apparatus at least to:

determine that a high priority transmission is triggered in a cell configured with an energy saving mode; and

perform at least one of the following:

if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell;

transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the high priority transmission; or

starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

2. The first apparatus of claim 1, wherein the first apparatus is further caused to:

receive, from the second apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode; and

in response to the configuration information, transmit the first indication or starting the high priority transmission.

3. The first apparatus of claim 1, wherein the configuration information is comprised in system information (SI) or a radio resource control (RRC) signalling.

4. The first apparatus of claim 1, wherein the first apparatus is in the connected mode,

and the first apparatus is further caused to:

initiate a random access (RA) procedure with the second apparatus; and

transmit the first indication to the second apparatus.

5. The first apparatus of claim 4, wherein the first apparatus is further caused to:

deactivate a network energy saving (NES) configuration received from the second apparatus in response to one of the following:

transmitting the first indication to the second apparatus; or

receiving a second indication from the second apparatus, the second indication indicating the first apparatus to deactivate the NES configuration.

6. The first apparatus of claim 5, wherein the second indication is dedicated to the first apparatus.

7. The first apparatus of claim 1, wherein the first indication is comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

8. The first apparatus of claim 1, wherein the high priority transmission comprises at least one of:

an emergency call,

data or signaling of mission critical services,

data or signaling belonging to one or more certain access categories,

data or signaling belonging to one or more certain access identities,

data or signaling with a priority above a threshold priority, or

high priority data or signaling.

9. The first apparatus of claim 1, wherein the energy saving mode comprises one of the following:

a cell discontinuous transmission (DTX),

a cell discontinuous reception (DRX),

a spatial domain energy saving mode, or

a power domain energy saving mode.

10. The first apparatus of claim 1, wherein the establishment procedure is one of the following:

a radio resource control (RRC) establishment procedure,

an RRC re-establishment procedure,

an RRC setup procedure,

an RRC resume procedure, or

a conditional handover if conditional handover is configured.

11. The first apparatus of any of claims 1-10, wherein the first apparatus is a terminal apparatus and the second apparatus is a network apparatus.

12. A second apparatus comprising:

at least one processor; and

at least one memory storing instructions that, when executed by the at least one processor, cause the second apparatus at least to:

configure a cell provided by the second apparatus in an energy saving mode;

determine that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following:

a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission,

an RRC resume request message comprising a cause indicating the high priority transmission, or

a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and

process the high priority transmission for the first apparatus.

13. The second apparatus of claim 12, wherein the second apparatus is further caused to:

transmit, to the first apparatus, configuration information indicating whether the cell allows the high priority transmission in the energy saving mode.

14. The second apparatus of claim 13, wherein the configuration information is comprised in system information (SI) or a radio resource control (RRC) signalling.

15. The second apparatus of claim 12, wherein the first apparatus is in a connected state, and the second apparatus is further caused to:

in response to receiving the first indication, perform at least one of the following:

deactivating a network energy saving (NES) configuration for the first apparatus; or

transmitting, to the first apparatus, a second indication indicating the first apparatus to deactivate the NES configuration for the first apparatus.

16. The second apparatus of claim 15, wherein the second indication is dedicated to the first apparatus.

17. The second apparatus of claim 12, wherein the first indication is comprised in a radio resource control (RRC) signalling or a medium access control (MAC) control element (CE).

18. The second apparatus of claim 12, wherein the first apparatus in a non-connected state and the second apparatus is further caused to:

in accordance with a determination that the high priority transmission is triggered, disable configuring a network energy saving (NES) configuration to the first apparatus.

19. The second apparatus of claim 12, wherein the high priority transmission comprises at least one of:

an emergency call,

data or signaling of mission critical services,

data or signaling belonging to one or more certain access categories,

data or signaling belonging to one or more certain access identities,

data or signaling with a priority above a threshold priority, or

high priority data or signaling.

20. The second apparatus of claim 12, wherein the energy saving mode comprises one of the following:

a cell discontinuous transmission (DTX),

a cell discontinuous reception (DRX),

a spatial domain energy saving mode, or

a power domain energy saving mode.

21. The second apparatus of any of claims 12-20 wherein the first apparatus is a terminal apparatus and the second apparatus is a network apparatus.

22. A method comprising:

determining, at a first apparatus, that a high priority transmission is triggered in a cell configured with an energy saving mode; and

performing at least one of the following:

if the cell does not support or does not allow an initiation of the high priority transmission in the energy saving mode, initiating an establishment procedure with another cell;

transmitting a first indication to a second apparatus providing the cell, wherein the energy saving mode has been configured and the first indication indicates the

high priority transmission; or

starting the high priority transmission with the second apparatus in accordance with a determination that the cell allows the high priority transmission in the energy saving mode.

23. A method comprising:

configuring, at a second apparatus, a cell provided by the second apparatus in an energy saving mode;

determining that a high priority transmission is triggered at a first apparatus in the cell in the energy saving mode in response to receiving one of the following:

a radio resource control (RRC) setup request message comprising a cause indicating the high priority transmission,

an RRC resume request message comprising a cause indicating the high priority transmission, or

a first indication indicating the high priority transmission, wherein the energy saving mode has been configured; and

processing the high priority transmission for the first apparatus.

24. A computer readable medium comprising instructions stored thereon for causing an apparatus at least to perform the method of any of claim 22 or 23.

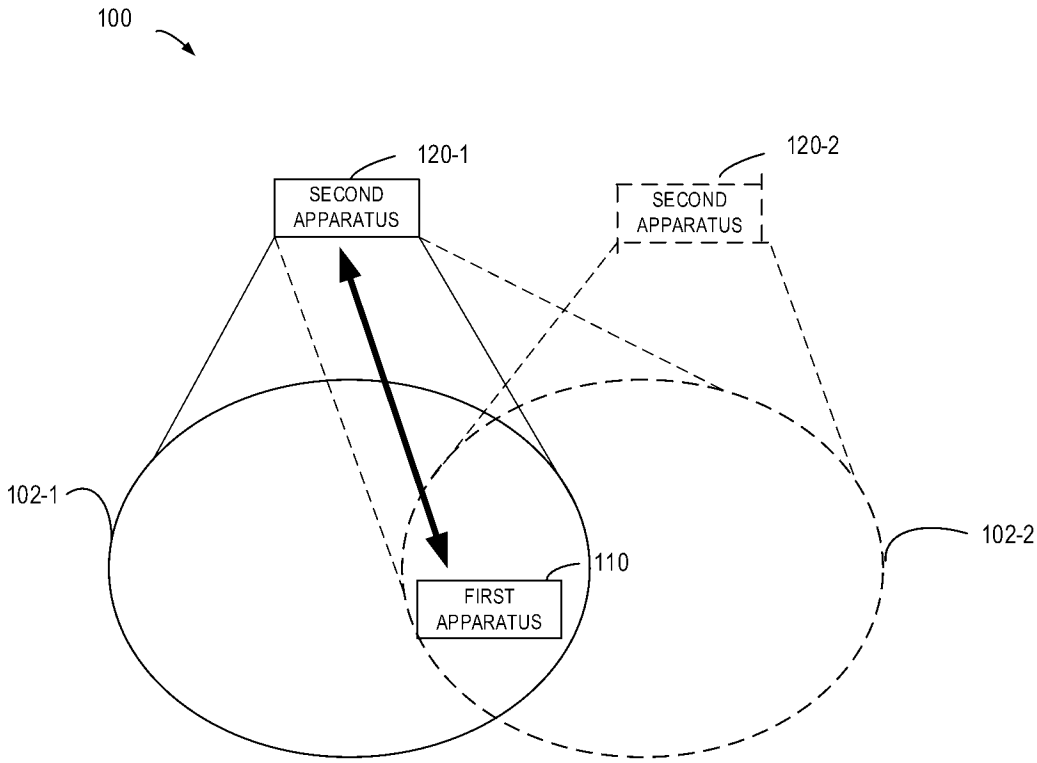
100
120-1
SECOND APPARATUS
120-2
SECOND APPARATUS
102-1
102-2
110
FIRST APPARATUS

FIG. 1

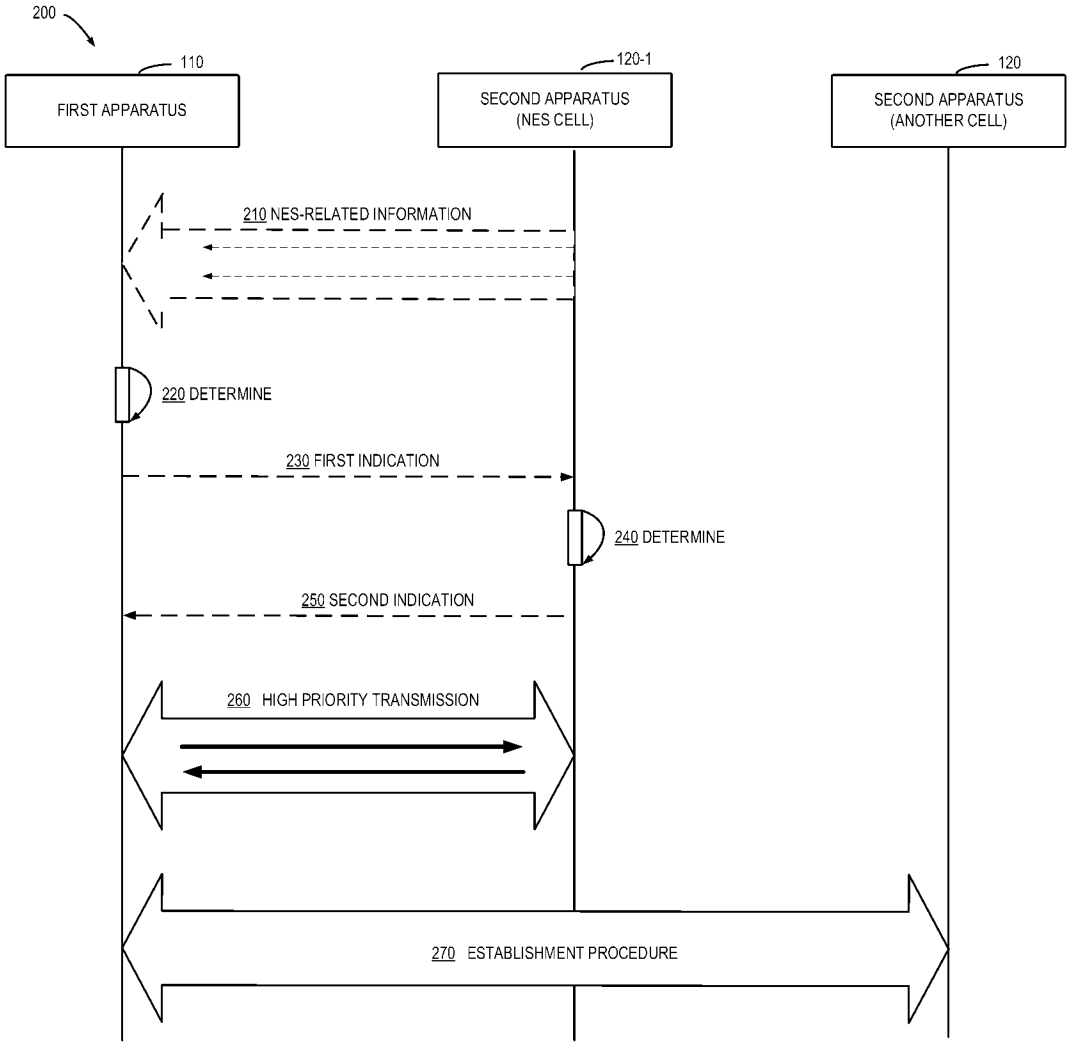
200
110
FIRST APPARATUS
120-1
SECOND APPARATUS
(NES CELL)
120
SECOND APPARATUS
(ANOTHER CELL)
210 NES-RELATED INFORMATION
220 DETERMINE
230 FIRST INDICATION
240 DETERMINE
250 SECOND INDICATION
260 HIGH PRIORITY TRANSMISSION
270 ESTABLISHMENT PROCEDURE

FIG. 2

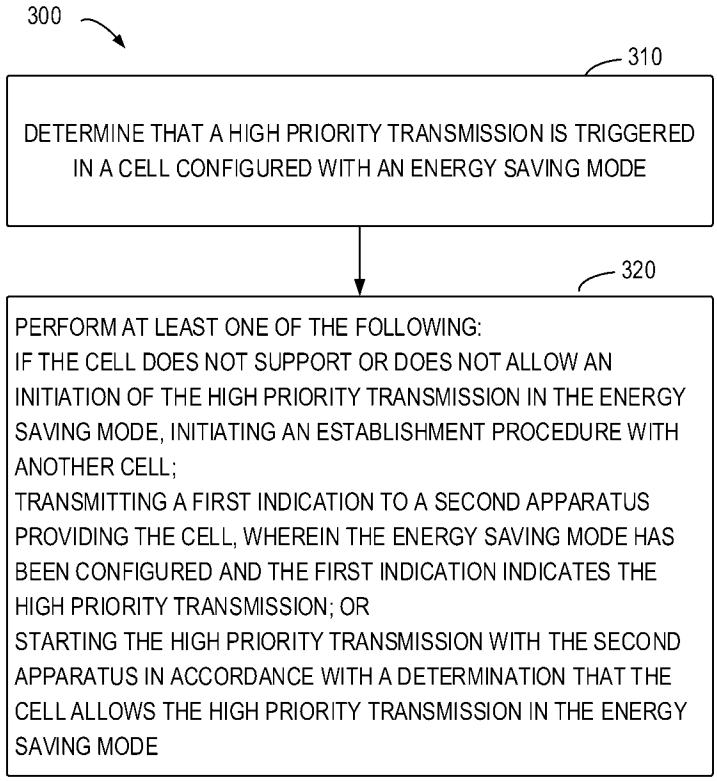
300
310
DETERMINE THAT A HIGH PRIORITY TRANSMISSION IS TRIGGERED IN A CELL CONFIGURED WITH AN ENERGY SAVING MODE
320
PERFORM AT LEAST ONE OF THE FOLLOWING:
IF THE CELL DOES NOT SUPPORT OR DOES NOT ALLOW AN INITIATION OF THE HIGH PRIORITY TRANSMISSION IN THE ENERGY SAVING MODE, INITIATING AN ESTABLISHMENT PROCEDURE WITH ANOTHER CELL;
TRANSMITTING A FIRST INDICATION TO A SECOND APPARATUS PROVIDING THE CELL, WHEREIN THE ENERGY SAVING MODE HAS BEEN CONFIGURED AND THE FIRST INDICATION INDICATES THE HIGH PRIORITY TRANSMISSION; OR
STARTING THE HIGH PRIORITY TRANSMISSION WITH THE SECOND APPARATUS IN ACCORDANCE WITH A DETERMINATION THAT THE CELL ALLOWS THE HIGH PRIORITY TRANSMISSION IN THE ENERGY SAVING MODE

FIG. 3

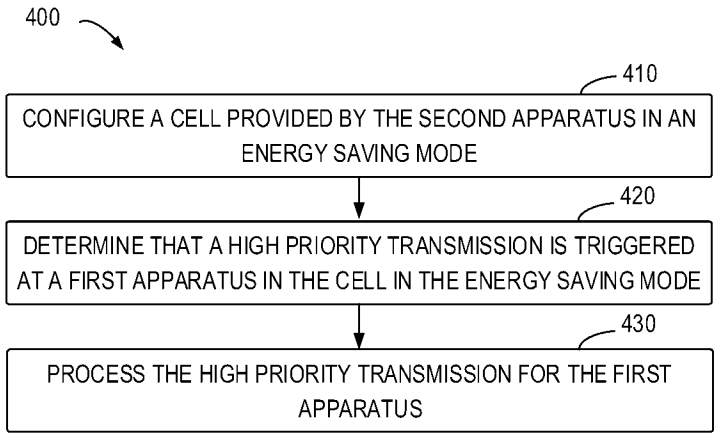
400
410
CONFIGURE A CELL PROVIDED BY THE SECOND APPARATUS IN AN ENERGY SAVING MODE
420
DETERMINE THAT A HIGH PRIORITY TRANSMISSION IS TRIGGERED AT A FIRST APPARATUS IN THE CELL IN THE ENERGY SAVING MODE
430
PROCESS THE HIGH PRIORITY TRANSMISSION FOR THE FIRST APPARATUS

FIG. 4

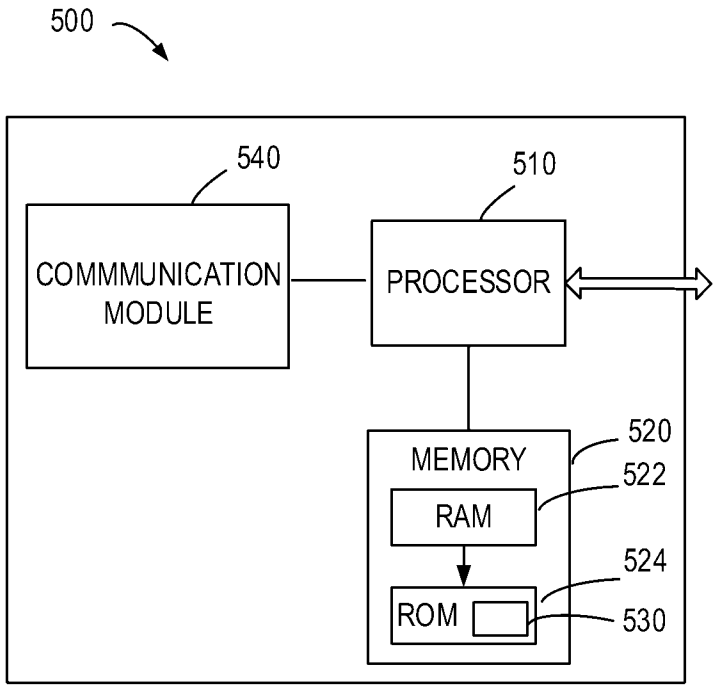
500
540
510
COMMMUNICATION MODULE
PROCESSOR
MEMORY
520
522
RAM
524
ROM
530

FIG. 5

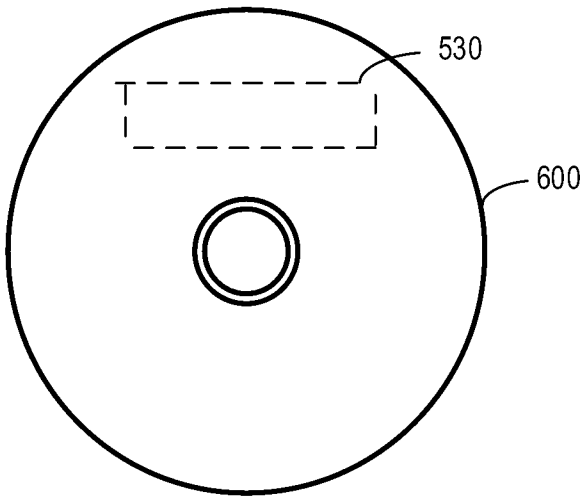
530
600

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/098729

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/56(2023.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H04W

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT,DWPI,ENTXTC,VEN,3GPP:power saving, energy saving, mode, cell, indication,high priority,RRC,trigger

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 112512068 A (CHINA UNITED NETWORK COMMUNICATIONS CORPORATION) 16 March 2021 (2021-03-16) description, paragraphs 0023-0079	1-24
A	CN 103888986 A (HUAWEI TECHNOLOGIES CO., LTD.) 25 June 2014 (2014-06-25) the whole document	1-24
A	CN 110769484 A (ZTE CORPORATION) 07 February 2020 (2020-02-07) the whole document	1-24
A	WO 2013023320 A1 (NOKIA SIEMENS NETWORKS OY) 21 February 2013 (2013-02-21) the whole document	1-24
A	HUAWEI. "LTE energy saving solution proposal to cell switch off/on" *3GPP TSG-RAN WG3 #66bis R3-100163,* 22 January 2010 (2010-01-22), the whole document	1-24

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 December 2023	**21 December 2023**

Name and mailing address of the ISA/CN	Authorized officer
CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China**	**LIU,Juan** Telephone No. **(+86) 010-53961619**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/098729

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 112512068 A	16 March 2021	None	
CN 103888986 A	25 June 2014	None	
CN 110769484 A	07 February 2020	WO 2020019752 A1	30 January 2020
WO 2013023320 A1	21 February 2013	US 2014194110 A1	10 July 2014
		PL 2742740 T3	24 August 2020
		ES 2804028 T3	02 February 2021
		EP 2742740 A1	18 June 2014
		CN 103843412 A	04 June 2014
		TR 202009400 T4	21 July 2020