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(54) Title: METHOD AND APPARATUS FOR OPTIMIZING COMMUNICATIONS OF A MULTI-STANDBY WIRELESS DEVICE

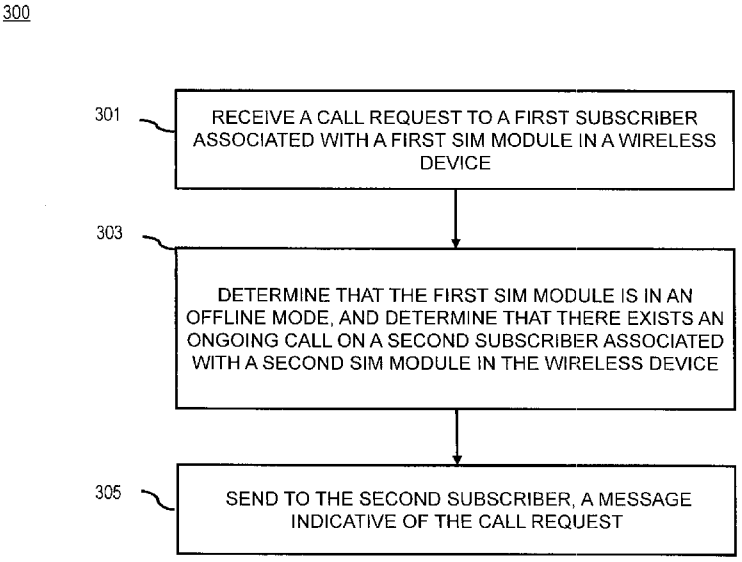

FIG. 3

(57) Abstract: An approach is provided for improving communications of multi-standby wireless device. A network device is configured to receive a call request to a first subscriber associated with a first subscriber identity module in a wireless device; to determine that the first subscriber identity module is in an offline mode, and determine that there exists an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and to send to the second subscriber, a message indicative of the call request.

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METHOD AND APPARATUS FOR OPTIMIZING COMMUNICATIONS OF A MULTI-STANDBY WIRELESS DEVICE

FIELD OF THE INVENTION

[0001] The present invention generally relates to wireless communication system. More specifically, the invention relates to optimizing communications of a multi-standby wireless device, such as a dual-Subscriber Identity Module (SIM) dual-standby (DSDS) mobile phone.

BACKGROUND

[0002] Nowadays, some wireless devices may include a multi-standby capability. For example, one wireless telephone may include multiple SIM cards, and each SIM card is associated with a different subscriber which may be identified with a different wireless telephone number. The multi-standby wireless devices may be configured to register to multiple wireless communication networks corresponding to the different subscribers, and standby (listen) for data and calls from the multiple networks. For example, a DSDS device may include two SIM cards - one card for a first subscriber and a second card for a second subscriber. In a DSDS device, a user may engage in a packet service (PS) call on the first subscriber, while the second subscriber may remain in an idle mode. When in an idle mode, there is no communication connection for the second subscriber, and the second subscriber (i.e. the second SIM card) may discretely receive information (such as paging messages) to camp to the network serving the second subscriber.

[0003] However, these multi-standby wireless devices also bring some bad experiences to users. Normally, a standby time of a DSDS wireless device will be shorter than a single-SIM device, because the dual SIM cards would be registered and active more frequently. Furthermore, when a PS service is ongoing through a first SIM card, the PS service may be always suspended to tune a transceiver of the device away from the first SIM card to the second SIM card, for example, for frequent paging. This may decrease the efficiency of the PS service, and increase the power consumption.

[0004] Thus, it would be advancement in the art to provide methods and apparatus for improving communications of a multi-standby wireless device.

SOME EXAMPLE EMBODIMENTS

[0005] To overcome the problem described above, and to overcome the limitations that will be apparent upon reading and understanding the prior arts, the disclosure provides an approach for improving communications of a multi-standby wireless device.

[0006] According to one embodiment, a method comprises receiving at a network device, a call request to a first subscriber associated with a first subscriber identity module in a wireless device; determining that the first subscriber identity module is in an offline mode, and determining that there exists an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and sending to the second subscriber, a message indicative of the call request.

[0007] In an exemplary embodiment, the method may further comprise in response to the message, receiving from the wireless device an indication indicating that the call request is to be accepted; and triggering an establishment of communication connection for the requested call. The method may further comprise in response to the sent message, receiving from the wireless device an indication indicating that the call request is to be rejected; and casing to reject the requested call.

[0008] In an exemplary embodiment, the method may further comprise receiving from the wireless device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module. The information may indicate that the first subscriber identity module of the wireless device is in the offline mode, in which paging activities for the first subscriber identity module is stopped. The information may be received through a free unstructured supplementary service data channel. In response to receiving the information indicating that the first subscriber identity module is in the offline mode, the network device may start to monitor and receive call requests to the first subscriber.

[0009] According to another embodiment, a method comprises configuring a first subscriber identity module of a wireless device to be in an offline mode; engaging in an ongoing call on a second subscriber associated with a second subscriber identity module in

the wireless device; and receiving a message destinated to the second subscriber from a network device, indicating a call request to a first subscriber associated the first subscriber identity module.

[0010] In an exemplary embodiment, the method may further comprise determining whether or not to accept the call request; and sending a result of the determination to the network device in response to the message. If it is determined to accept the call request, an establishment of communication connection for the requested call may be triggered. If it is determined to reject the call request, the ongoing call on the second subscriber may be kept.

[0011] In an exemplary embodiment, the method may further comprise configuring the a wireless device to stop paging activities of the first subscriber identity module.

[0012] In an exemplary embodiment, the method may further comprise sending to the network device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module. The information may indicate that the first subscriber identity module of the wireless device is in the offline mode, in which paging activities for the first subscriber identity module is stopped, and may be sent through a free unstructured supplementary service data channel.

[0013] According to another embodiment, an apparatus comprising at least one processor, and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause, at least in part, the apparatus to receive a call request to a first subscriber associated with a first subscriber identity module in a wireless device; determine that the first subscriber identity module is in an offline mode, and determine that there exists an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and send to the second subscriber, a message indicative of the call request.

[0014] According to another embodiment, an apparatus comprising at least one processor, and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause, at least in part, the apparatus to configure a first subscriber identity module of a wireless device to be in an

offline mode; engage in an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and receive a message destinated to the second subscriber from a network device, indicating a call request to a first subscriber associated the first subscriber identity module.

[0015] According to another embodiment, a computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, cause, at least in part, an apparatus to perform one of the methods discussed above.

[0016] According to another embodiment, an apparatus comprises means for performing one of the methods discussed above.

[0017] A computer program product including one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to at least perform one of the methods discussed above.

[0018] Still other aspects, features, and advantages of the invention are readily apparent from the following detailed description, simply by illustrating a number of particular embodiments and implementations, including the best mode contemplated for carrying out the invention. The invention is also capable of other and different embodiments, and its several details may be modified in various obvious respects, all without departing from the spirit and scope of the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings:

[0020] FIGs. 1A, 1B and 1C illustrate exemplary architectures of suitable systems in which one or more illustrative embodiments of the invention may be implemented;

[0021] FIG. 2 illustrates timing diagrams of normal paging and PS call procedures, and a timing diagram of paging and PS call procedures for DSDS communication according to some embodiments of the present invention;

[0022] FIG. 3 is a flowchart for improving DSDS communications according to some embodiments of the present invention;

[0023] FIG. 4 is a flowchart for improving DSDS communication according to some embodiments of the present invention; and

[0024] FIG. 5 illustrates a simplified block diagram of various electronic devices that are suitable for use in practicing the exemplary embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Examples of a method, apparatus, system and computer program for improving communications of a multi-standby wireless device are disclosed. In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the embodiments of the invention. It is apparent, however, to one skilled in the art that the embodiments of the invention may be practiced without these specific details or with an equivalent arrangement. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the embodiments of the invention. Like reference numerals refer to like elements throughout.

[0026] According to various exemplary embodiments, at least one SIM module of a multi-standby wireless device may be configured to stay in an offline mode, in which the SIM module would not need to camp to its network. It means that an offline SIM module would not even need to discretely receive any paging messages in an offline mode. In comparison with an idle mode, the offline mode allows a least power consumption for a SIM module. Furthermore, an ongoing call of another active SIM module in the multi-standby wireless device could not be interrupted by discrete paging activities of a traditional idle mode SIM module. An additional function may be added in a network side for managing

communications of a multi-standby wireless device (such as a DSDS mobile phone), especially for handle a coming call on an offline SIM module. In this regard, a DSDS unit may be added in a core network. The DSDS unit is responsible for giving call notices and managements to multi-standby wireless devices. Multi-standby wireless devices may send their multi-standby status to the DSDS unit. For example, a DSDS mobile phone may send its two telephone numbers associated with its dual SIM cards to the DSDS unit, and indicate to the DSDS unit the status of the two SIM cards, for example a first SIM card is in an offline mode while a second SIM card is in an active mode for engaging in a call. The call may be a PS call, such as interviewing a social network service (e.g. micro blog) or downloading contents from an internet site, or the like, or may be a circuit service call, such as a telephone call. Information of the multi-standby status may be transmitted to the DSDS unit through a free USSD (Unstructured Supplementary Service Data) channel. According to the multi-standby status, the DSDS unit can manage communication of the DSDS mobile phone, and especially handle actions of the offline SIM card.

[0027] FIGs. 1A, 1B and 1C illustrate exemplary architectures of suitable systems 100A, 100B, 100C, respectively, in which one or more illustrative embodiments of the invention may be implemented. Below, embodiments of the invention will be described using the 2G, 3G, and 4G wireless communication systems as examples of the wireless communications system. The invention may, however, be applied to any wireless communications system that supports communications of a multi-standby wireless device. The structures and functions of such a wireless communications systems and those of the associated network elements are only described when relevant to the invention.

[0028] As shown, the system 100A may be a GSM system utilizing the 2G wireless communication techniques. The system 100B may be a UMTS system utilizing the 3G wireless communication techniques. The system 100C may be a LTE system utilizing the 4G wireless communication techniques. These systems may be divided into a core network, a radio access network (such as BSS, UTRAN, E-UTRAN), and user terminal (UE), such as mobile phone 104. The core network and the radio access network compose a network

infrastructure of the wireless communications system, and are generally called as a network side of a wireless communications system.

[0029] As discussed above, a management function for communications of a multi-standby wireless device may be placed in the network side. For example, a DSDS unit 102 may be added in a MSC (Mobile Switch Center), a SGSN (Serving GPRS Support Node), or a MME (Mobile Management Entity). A mobile phone 104 supports a multi-standby communication with multiple SIM modules 112, 114. Each SIM module is associated with a different subscriber registered in the system, and comprises subscriber-related information and information related to information security in particular, for instance, an encryption algorithm. In some embodiments, the mobile phone 104 may register on two different networks corresponding to each SIM. Once registered, the mobile phone 104 may listen to pages of all of the two networks while in an idle mode.

[0030] Although only two SIM modules are shown in mobile phone 104, the mobile phone 104 may have more than two SIM modules. In the following, for the sake of clarity, a mobile phone configured with two SIM modules will be used as an example of multi-standby wireless device, but other type of wireless devices having other number (more than two) of SIM modules is also possible.

[0031] Normally, for supporting a DSDS configuration, a mobile phone may register its both subscribers on networks corresponding to each SIM module. Once registered, the mobile phone may listen to pages of both subscribers while in an idle mode. When a first SIM module associated with a first subscriber of the DSDS mobile phone is in an active mode for engaging in a PS call, a second SIM module associated with a second subscriber of the DSDS mobile phone will keep or go into an idle mode. During the period of the PS call of the first SIM module, the mobile phone may occasionally or periodically suspend the PS call, for listening to pages for the second subscriber.

[0032] FIG. 2 illustrates timing diagrams of normal paging and PS call procedures for a single-SIM mobile phone, and paging and PS call procedures for a normal DSDS mobile phone. As shown in the FIG 2, for a single-SIM mobile phone, a DRX paging occurs periodically (at T1, T2, T3, T4, ...), and a PS call procedure can occupy resources for a while

(from T0 to T5) until the call ends. For a normal dual-SIM mobile phone, the PS call procedure of one SIM module would be interrupted by DRX paging activities for the other SIM module.

[0033] According to embodiments, the PS call and paging procedure of dual-SIM modules are optimized by further configuring an idle SIM module into an offline mode and handle its action by a management function unit in a nework side. When in an offline mode, the DSDS mobile phone would stop to listen to pages for an offline SIM module. As such, the PS call can be kept all the time without being interrupted by traditional paging activities of an idle SIM module any more. The offline mode may be set by the DSDS mobile phone for a SIM module accordingly its requirement, and then be notified to the network side, such as a DSDS unit.

[0034] Then, the DSDS unit may start to monitor coming call requests to the offline SIM module. When one SIM module of a DSDS mobile phone is active for engaging in a call, such as a PS call, and a subscriber associated with the other SIM module in offline mode is requested by a coming call (such as a voice call), the DSDS unit may send a message indicative of this coming call to the subscriber associated with the active SIM module. Then, a user of the DSDS mobile phone is able to decide whether to accept this coming call or not. If this coming call is denied, the PS call is continued. If this coming call is accepted, it triggers the DSDS mobile phone to suspend or terminate the PS call and start to establish a communication connection for the coming call. In this regard, the offline SIM module may be activated from its offline mode, to register on its corresponding network, and then a call procedure is followed as a normal case. Although the activation from the offline mode would cause a delay for establishing the communication connection, the DSDS unit may be configured to manage a comfortable delay on this register. For example, the delay can be limited within 2 seconds, as a SIM modem normally needs 1 second to register to a network.

[0035] The bottom time line of FIG. 2 shows an exemplary paging and PS call procedures for a DSDS mobile phone according to an example embodiment. As shown, a PS call for an active SIM module can be kept all the time without being interrupted by paging activities for an offline SIM module. During the PS call, the DSDS mobile phone may also

monitor network information of the active SIM module, and then may receive a message indicative of a coming call (e.g. a voice call) with respective to the offline SIM module. For example, the message may be a SMS message destinated to a subscriber number associated with the active SIM module. In some embodiments, the message may be transmitted to the mobile phone via a free USSD channel. Dependent on a selection of the user of the DSDS phone, the PS call may be suspended and a call of the offline SIM module may generated at T4. As such, call requests for the idle SIM module is allowed to be monitored and handled in time. Meanwhile, duration of the PS call of the active SIM module is allowed to be shorten in comparison with the normal dual-SIM communciation, for example as shown by T8. Accordingly, the power consumption of the DSDS mobile phone may be also decreased.

[0036] Referring to FIG. 3, a flowchart for improving DSDS communications according to some embodiments will now be described. In such an embodiment, the process 300 is performed by a DSDS unit (such as the DSDS unit 102), and is implemented in, for instance, a chip set including a processor and a memory as shown in FIG. 5. As such, the DSDS unit may provide means for accomplishing various parts of the process 300 as well as means for accomplishing other processes in conjunction with other components.

[0037] At 301, a DSDS unit receives a call request to a first subscriber associated with a first SIM module in a wireless device. Then, at 303, the DSDS unit determines that the first SIM module is in an offline mode, in which paging activities for the first SIM module is stopped, and further determines that there exists an ongoing call on a second subscriber associated with a second SIM module in the wireless device. The ongoing call may be a PS call, such as interviewing a social network service (e.g. micro blog) or downloading contents from an internet site, or the like, or may be a circuit service call, such as a telephone call. In some embodiments, the DSDS unit may be notified of multi-standby status of the wireless device previously, for example when the first and second SIM modules are registered to corresponding networks. In some embodiments, the wireless device may send information of its multi-standby status to the DSDS unit based on its requirement. For example, when the networks corresponding to an offline SIM module is stable, the wireless device may send updated multi-standby status to the DSDS unit, notifying that paging activities of the idle

SIM module is stopped. After got the notification, the DSDS unit may start to monitor call requests to the first subscriber associated with the offline SIM module.

[0038] Next at 305, the DSDS unit sends to the second subscriber, a message indicative of the call request with respect to the first subscriber. According to the message, the wireless device may determine whether or not to accept the call request. If it is determined to accept the call request, the DSDS unit may trigger an establishment of communication connection for the requested call. If it is determined to reject the call request, the DSDS unit may reject the requested call on behalf of the first subscriber. Then, efficiency of communications of the multi-standby wireless device can be optimized without missing or decreasing any function.

[0039] Referring to FIG. 4, a flowchart for improving DSDS communications according to some embodiments will now be described. In such an embodiment, the process 400 is performed by a multi-standby wireless device (such as the DSDS mobile phone 104), and is implemented in, for instance, a chip set including a processor and a memory as shown in FIG. 5. As such, the multi-standby wireless device may provide means for accomplishing various parts of the process 400 as well as means for accomplishing other processes in conjunction with other components.

[0040] At 401, a first SIM module of a multi-standby wireless device is configured to be in an offline mode, in which paging activities for the first SIM module is stopped. At 403, the wireless device engages in an ongoing call on a second subscriber associated with a second SIM module in the wireless device. The ongoing call may be a package service call such as interviewing a social network service (e.g. micro blog) or downloading contents from an internet site, or be a circuit service call such as a telephone call. At 405, the wireless device receives a message destinated to the second subscriber from a network device (such as a DSDS unit), indicating a call request to a first subscriber associated the first SIM module. This allowed the user of the wireless device to monitor incoming calls of the offline SIM module in time, without interrupting the ongoing call of the active SIM module.

[0041] In some embodiments, in response to the message, it may be determined whether or not to accept the call request, as shown at 407. Then, the result of the determination may be sent to the network device. If it is determined to accept the call request, an establishment

of communication connection for the requested call is triggered. Accordingly, the ongoing call of the second subscriber will be suspended or terminated. If it is determined to reject the call request, the ongoing call on the second subscriber is kept to be continued.

[0042] Now reference is made to FIG. 5 illustrating a simplified block diagram of various electronic devices that are suitable for use in practicing the exemplary embodiments of the present invention. In FIG. 5, a wireless communication network 500 may be adapted for communication with a multi-standby wireless device 520 (such as the DSDS mobile phone 104) via base stations (such as an eNB, not shown). The network 500 may further include a network device 540 for managing communications of the multi-standby device 520, such as the DSDS unit 102. The network device 540 may include one or more of any type of network component, such as a core network node, including a MSC, a SGSN, a MME, etc., that can enable wireless device 520 to communicate and/or that can establish and maintain a communication link 560. The wireless device may perform communications under the control of the network device 540, according to the exemplary embodiments as discussed above.

[0043] The wireless device 520 may include a data processor (DP) 520A, a memory (MEM) 520B that stores a program (PROG) 520C, and a suitable radio frequency (RF) transceiver 520D for wireless communications with the network device 540 via one or more antennas. In addition, the wireless device 520 may include multiple SIM modules associated with different subscriber identifies of the wireless communication network 500. The transceiver 520D in the wireless device 520 may be used for communications of each of the SIM modules.

[0044] The network device 540 includes a DP 540A, a MEM 540B that stores a PROG 540C, and a suitable communication interface 540D. The communication interface 540D may be able to communicate with the wireless devices. The communication interface 540D may be further able to communicate with any other network devices, such as eNBs, MSC, AAA server, HSS (Home Subscriber Server), and the like.

[0045] At least one of the PROGs 520C, 540C is assumed to include program instructions that, when executed by the associated DP, enable the electronic device to operate in accordance with the exemplary embodiments of this invention, as discussed above. That is,

the exemplary embodiments of this invention may be implemented at least in part by computer software executable by the DP 520A of the wireless device 520, and by the DP 540A of the network device 540, or by hardware, or by a combination of software and hardware. The basic structure and operation of the wireless device 520 (e.g. a DSDS mobile phone), and the network device 540 (e.g. a MSC) are known to one skilled in the art.

[0046] In general, the various embodiments of the multi-standby wireless device 520 may include, but are not limited to, a cellular telephone, a smart phone, a session initiation protocol (SIP) phone, a laptop, a notebook, a netbook, a smartbook, a personal digital assistant (PDA) having wireless communication capabilities, portable computers having cellular wireless communication capabilities, an image capture device such as a digital camera having wireless communication capabilities, a gaming device having wireless communication capabilities, a music storage and playback appliance having wireless communication capabilities, an Internet appliance permitting wireless Internet access and browsing, as well as portable units or terminals that incorporate combinations of such functions.

[0047] The MEMs 520B, 540B may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, flash memory, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The DPs 520A, 540A may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multi-core processor architectures, as non-limiting examples.

[0048] In general, the various exemplary embodiments may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example, some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the exemplary embodiments of this invention may be illustrated and described as block diagrams,

flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods 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.

[0049] It should be appreciated that at least some aspects of the exemplary embodiments of the inventions may be embodied in computer-executable instructions, such as in one or more program modules, executed by one or more computers or other devices. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types when executed by a processor in a computer or other device. The computer executable instructions may be stored on a computer readable medium such as a hard disk, optical disk, removable storage media, solid state memory, RAM, etc. As will be appreciated by one of skill in the art, the function of the program modules may be combined or distributed as desired in various embodiments. In addition, the function may be embodied in whole or in part in firmware or hardware equivalents such as integrated circuits, field programmable gate arrays (FPGA), and the like.

[0050] The present invention includes any novel feature or combination of features disclosed herein either explicitly or any generalization thereof. Various modifications and adaptations to the foregoing exemplary embodiments of this invention may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings. However, any and all modifications will still fall within the scope of the non-limiting and exemplary embodiments of this invention.

CLAIMS

WHAT IS CLAIMED IS:

1. A method, comprising:

receiving at a network device, a call request to a first subscriber associated with a first subscriber identity module in a wireless device;

determining that the first subscriber identity module is in an offline mode, and determining that there exists an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and

sending to the second subscriber, a message indicative of the call request.

2. A method of claim 1, further comprising:

in response to the message, receiving from the wireless device an indication indicating that the call request is to be accepted; and

triggering an establishment of communication connection for the requested call.

3. A method of claim 1, further comprising:

in response to the sent message, receiving from the wireless device an indication indicating that the call request is to be rejected; and

casing to reject the requested call.

4. A method of claim 1, further comprising:

receiving from the wireless device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module.

5. A method of claim 4, wherein the information about a multi-standby status indicates that

the first subscriber identity module of the wireless device is in the offline mode, in which paging activities for the first subscriber identity module is stopped.

6. A method of claim 5, further comprising:

starting to monitor and receive call requests to the first subscriber, in response to receiving the information indicating that the first subscriber identity module is in the offline mode.

7. A method of any one of claims 4-6, wherein the information about a multi-standby status is received through a free unstructured supplementary service data channel.

8. A method, comprising:

configuring a first subscriber identity module of a wireless device to be in an offline mode;

engaging in an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and

receiving a message destinated to the second subscriber from a network device, indicating a call request to a first subscriber associated the first subscriber identity module.

9. A method of claim 8, further comprises:

determining whether or not to accept the call request; and

sending a result of the determination to the network device in response to the message.

10. A method of claim 9, further comprises:

if it is determined to accept the call request, triggering an establishment of communication connection for the requested call; or

if it is determined to reject the call request, keeping the ongoing call on the second subscriber.

11. A method of claim 8, further comprises configuring the a wireless device to stop paging activities of the first subscriber identity module.

12. A method of claim 8, further comprises:

sending to the network device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module.

13. A method of claim 12, wherein the information about a multi-standby status indicates that the first subscriber identity module of the wireless device is in the offline mode, in which paging activities of the first subscriber identity module is stopped.

14. A method of any one of claims 12-13, wherein the information about a multi-standby status is sent through a free unstructured supplementary service data channel.

15. An apparatus comprising:

at least one processor; and

at least one memory including computer program code,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:

receive a call request to a first subscriber associated with a first subscriber identity module in a wireless device;

determine that the first subscriber identity module is in an offline mode, and determine that there exists an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and

send to the second subscriber, a message indicative of the call request.

16. An apparatus of claim 15, wherein the apparatus is further caused to:

in response to the message, receive from the wireless device an indication indicating that the call request is to be accepted; and

trigger an establishment of communication connection for the requested call.

17. An apparatus of claim 15, wherein the apparatus is further caused to:

in response to the sent message, receive from the wireless device an indication indicating that the call request is to be rejected; and

case to reject the requested call.

18. An apparatus of claim 15, wherein the apparatus is further caused to:

receive from the wireless device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module.

19. An apparatus of claim 18, wherein the information about a multi-standby status indicates that the first subscriber identity module of the wireless device is in the offline mode, in which paging actitities for the first subscriber identity module is stopped.

20. An apparatus of claim 19, wherein the apparatus is further caused to:

start to monitor and receive call requests to the first subscriber, in response to receiving the information indicating that the first subscriber identity module is in the offline mode.

21. An apparatus of any one of claims 18-20, wherein the information about a multi-standby status is received through a free unstructured supplementary service data channel.

22. An apparatus comprising:

at least one processor; and

at least one memory including computer program code,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following:

configure a first subscriber identity module of a wireless device to be in an offline mode;

engage in an ongoing call on a second subscriber associated with a second subscriber identity module in the wireless device; and

receive a message destinated to the second subscriber from a network device, indicating a call request to a first subscriber associated the first subscriber identity module.

23. An apparatus of claim 22, wherein the apparatus is further configured to:

determine whether or not to accept the call request; and

send a result of the determination to the network device in response to the message.

24. An apparatus of claim 23, wherein the apparatus is further configured to:

if it is determined to accept the call request, trigger an establishment of communication connection for the requested call; or

if it is determined to reject the call request, keep the ongoing call on the second subscriber.

25. An apparatus of claim 22, wherein the apparatus is further configured to:

stop paging activities of the first subscriber identity module.

26. An apparatus of claim 22, wherein the apparatus is further configured to:

send to the network device, information about a multi-standby status of the first subscriber identity module and the second subscriber identity module.

27. An apparatus of claim 26, wherein the information about a multi-standby status indicates that the first subscriber identity module of the wireless device is in the offline mode, in which paging actitivities for the first subscriber identity module is stopped.

28. An apparatus of any one of claims 26-27, wherein the information about a multi-standby status is sent through a free unstructured supplementary service data channel.

29. A computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, causing an apparatus to at least perform a method of any one of claims 1-7.

30. A computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, causing an apparatus to at least perform a method of any one of claims 8-14.

31. An apparatus comprising means for performing a method according to any of claims 1-7.

32. An apparatus comprising means for performing a method according to any of claims 8-14.

33. A computer program product including one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to at least perform the steps of a method of any one of claims 1-7.

34. A computer program product including one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to at least perform the steps of a method of any one of claims 8-14.

100A

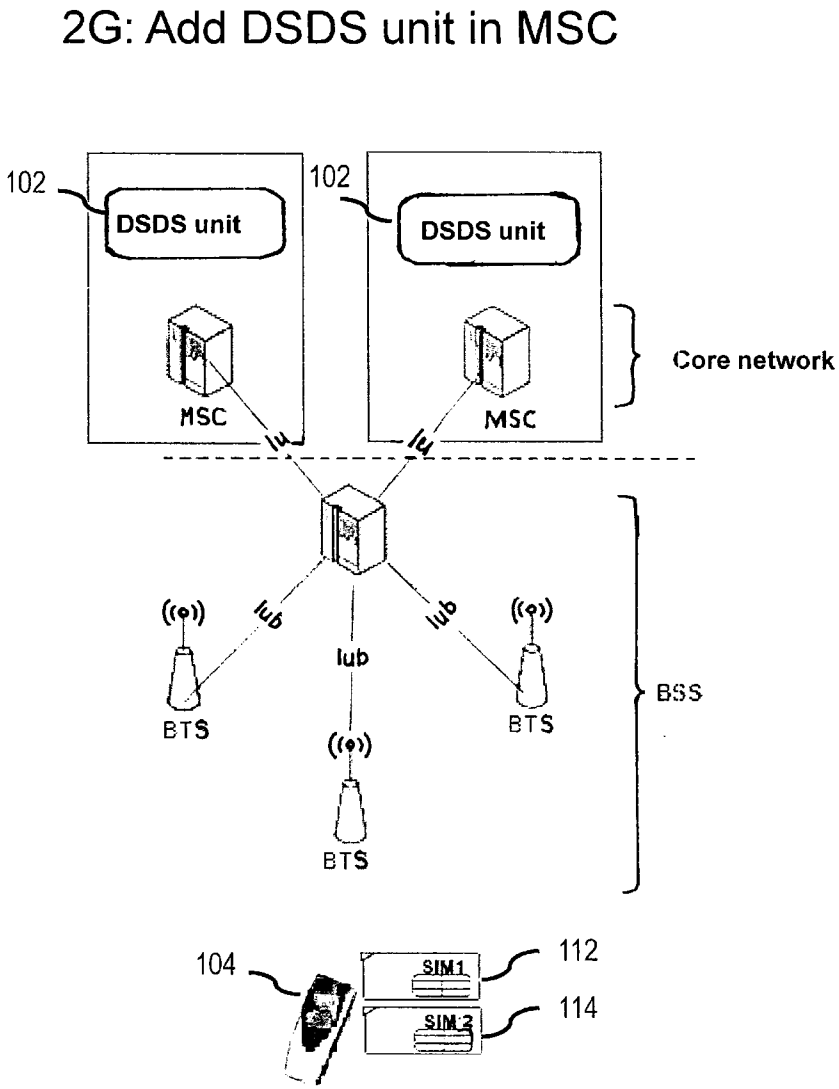
2G: Add DSDS unit in MSC
102
DSDS unit
102
DSDS unit
Core network
MSC
MSC
lub
lub
lub
BTS
BTS
BTS
BSS
104
SIM1
SIM2
112
114

FIG. 1A

100B

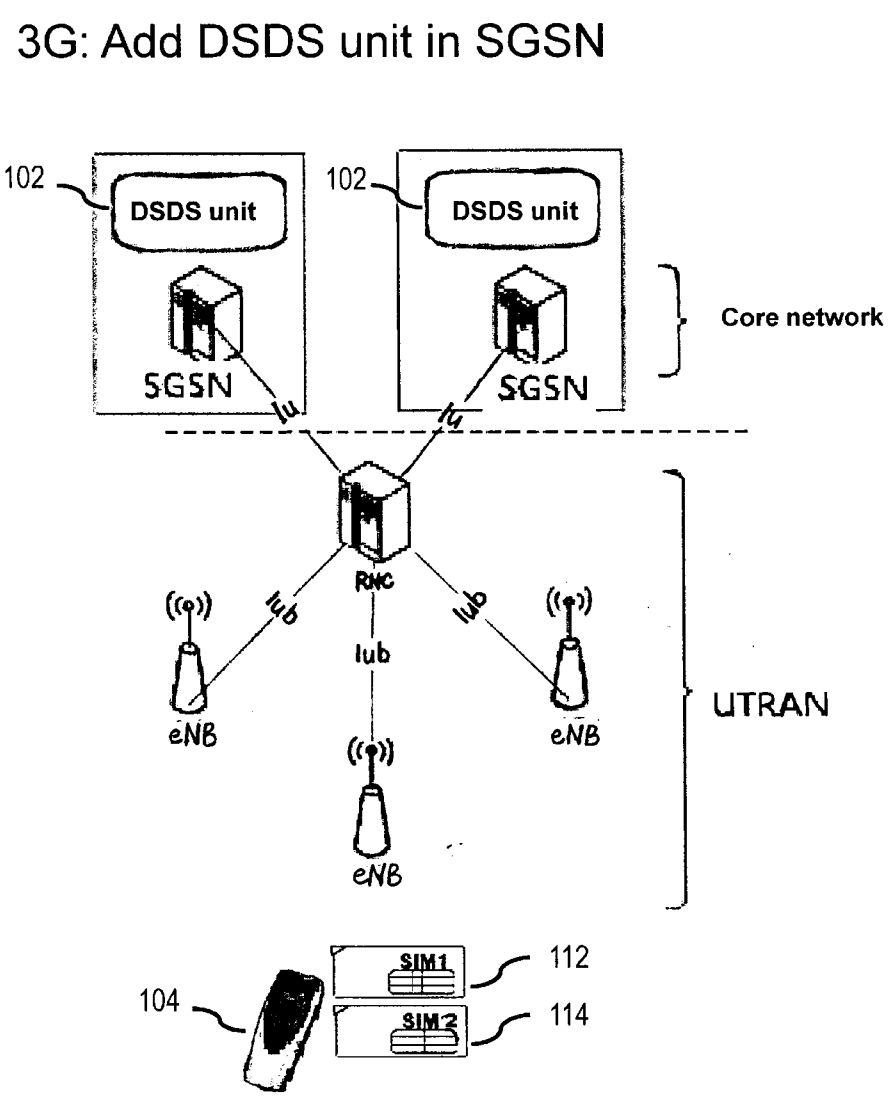
3G: Add DSDS unit in SGSN
102
DSDS unit
SGSN
Iu
102
DSDS unit
SGSN
Iu
Core network
RNC
Iub
Iub
Iub
eNB
eNB
eNB
UTRAN
104
SIM1
SIM2
112
114

FIG. 1B

100C

4G: Add DSDS unit in MME

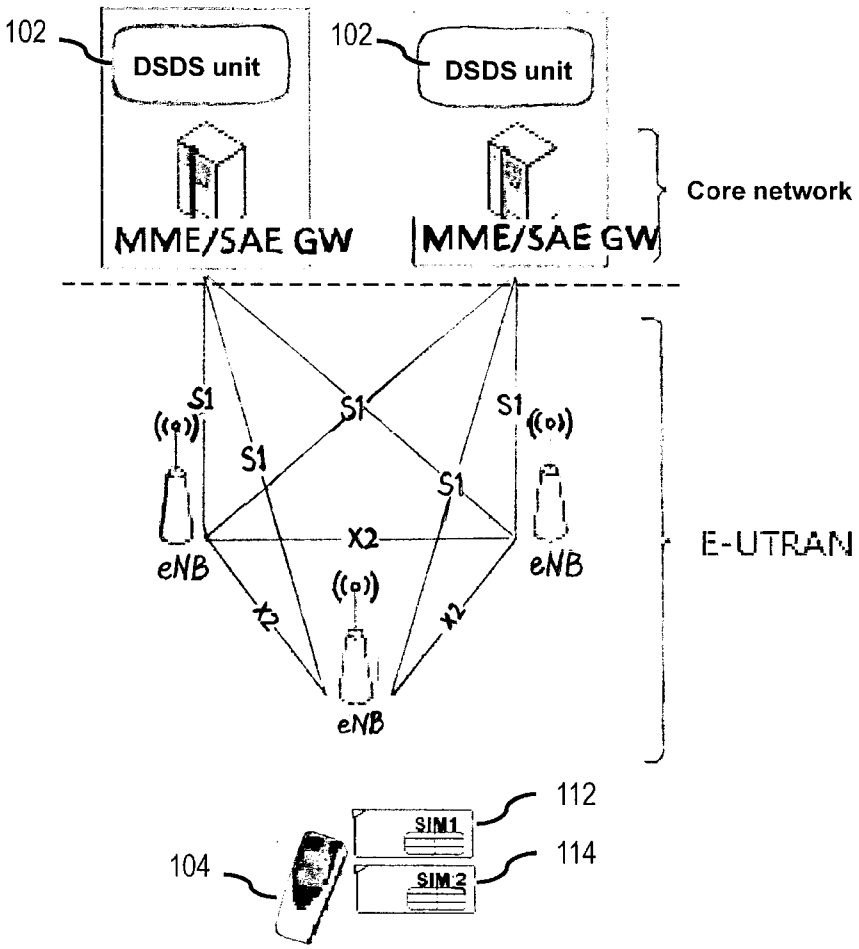

FIG. 1C

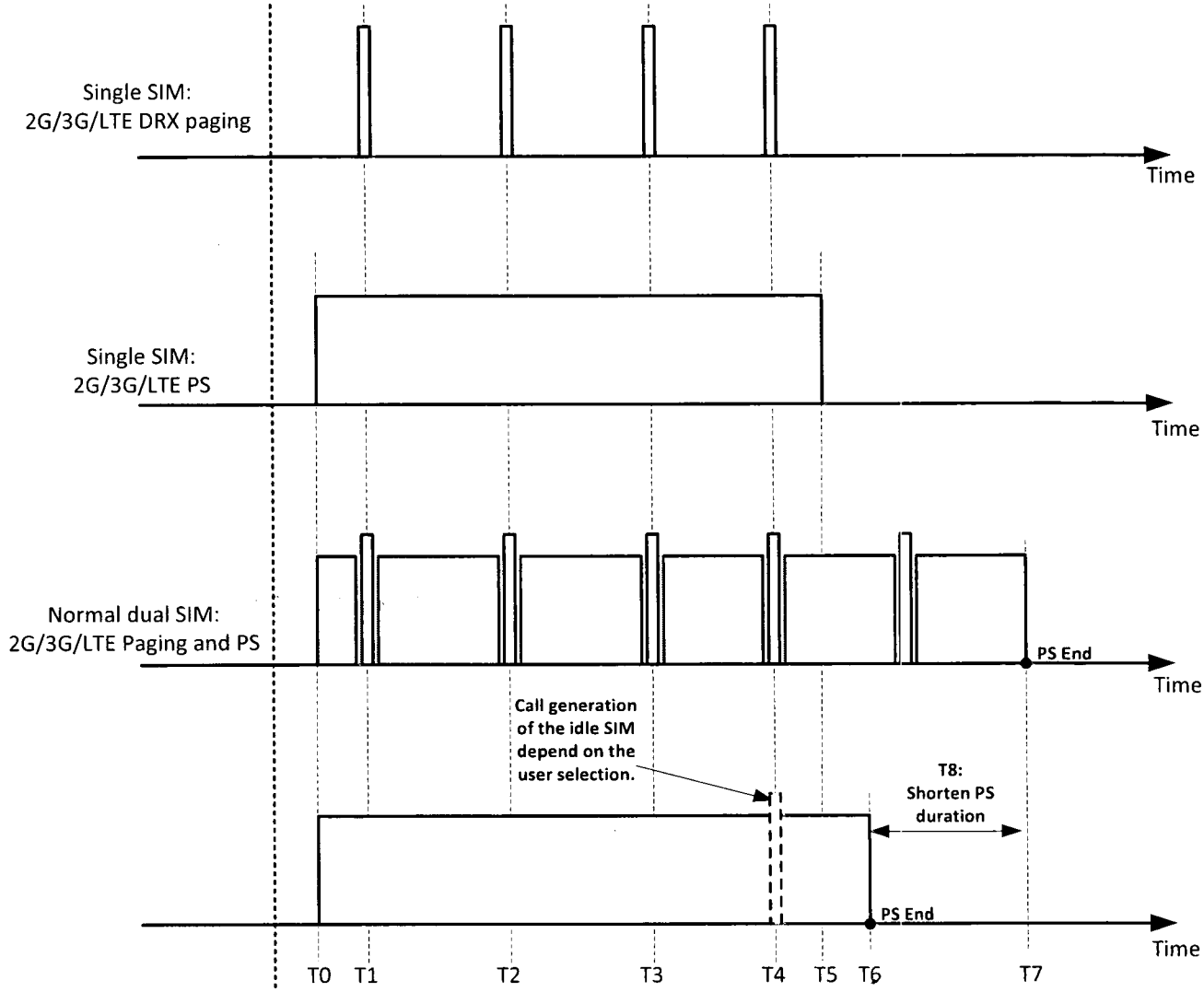
Single SIM:
2G/3G/LTE DRX paging
Time
Single SIM:
2G/3G/LTE PS
Time
Normal dual SIM:
2G/3G/LTE Paging and PS
PS End
Time
Call generation of the idle SIM depend on the user selection.
T8: Shorten PS duration
PS End
Time
T0
T1
T2
T3
T4
T5
T6
T7

FIG. 2

300

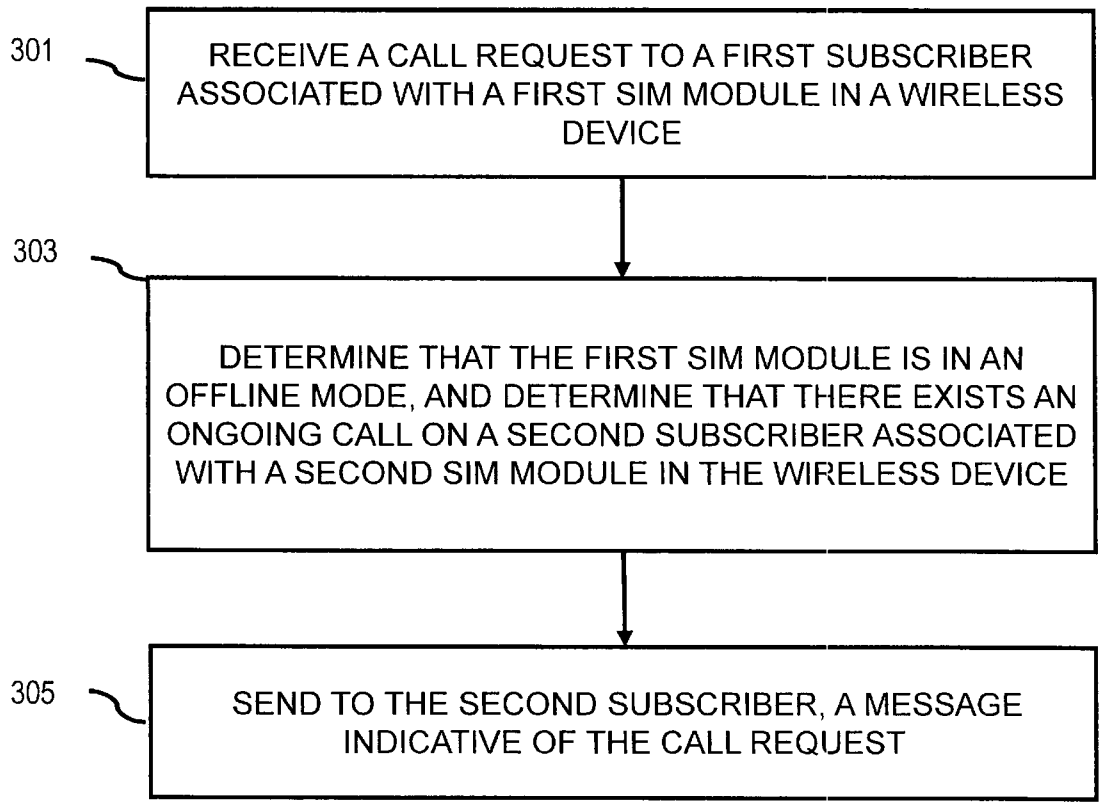
301
RECEIVE A CALL REQUEST TO A FIRST SUBSCRIBER ASSOCIATED WITH A FIRST SIM MODULE IN A WIRELESS DEVICE
303
DETERMINE THAT THE FIRST SIM MODULE IS IN AN OFFLINE MODE, AND DETERMINE THAT THERE EXISTS AN ONGOING CALL ON A SECOND SUBSCRIBER ASSOCIATED WITH A SECOND SIM MODULE IN THE WIRELESS DEVICE
305
SEND TO THE SECOND SUBSCRIBER, A MESSAGE INDICATIVE OF THE CALL REQUEST

FIG. 3

400

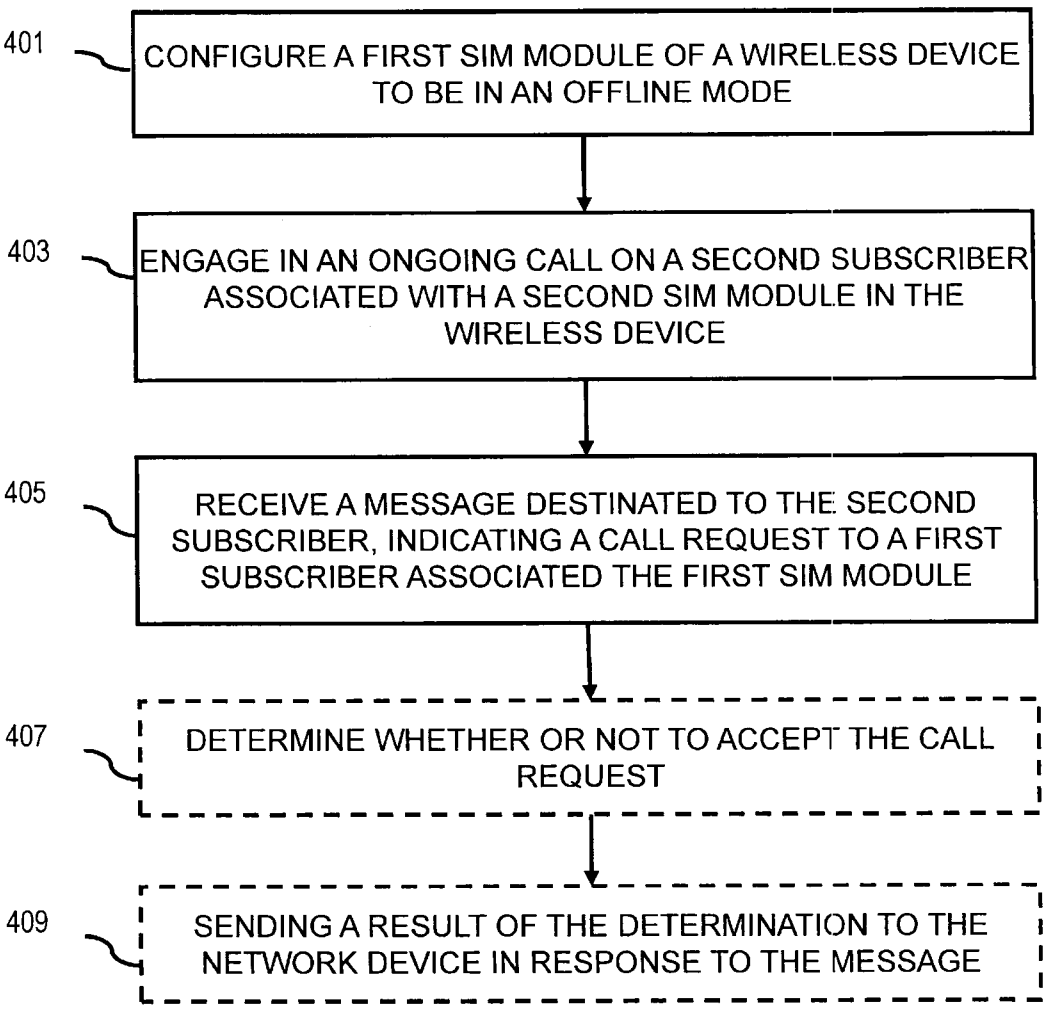
401
CONFIGURE A FIRST SIM MODULE OF A WIRELESS DEVICE TO BE IN AN OFFLINE MODE
403
ENGAGE IN AN ONGOING CALL ON A SECOND SUBSCRIBER ASSOCIATED WITH A SECOND SIM MODULE IN THE WIRELESS DEVICE
405
RECEIVE A MESSAGE DESTINATED TO THE SECOND SUBSCRIBER, INDICATING A CALL REQUEST TO A FIRST SUBSCRIBER ASSOCIATED THE FIRST SIM MODULE
407
DETERMINE WHETHER OR NOT TO ACCEPT THE CALL REQUEST
409
SENDING A RESULT OF THE DETERMINATION TO THE NETWORK DEVICE IN RESPONSE TO THE MESSAGE

FIG. 4

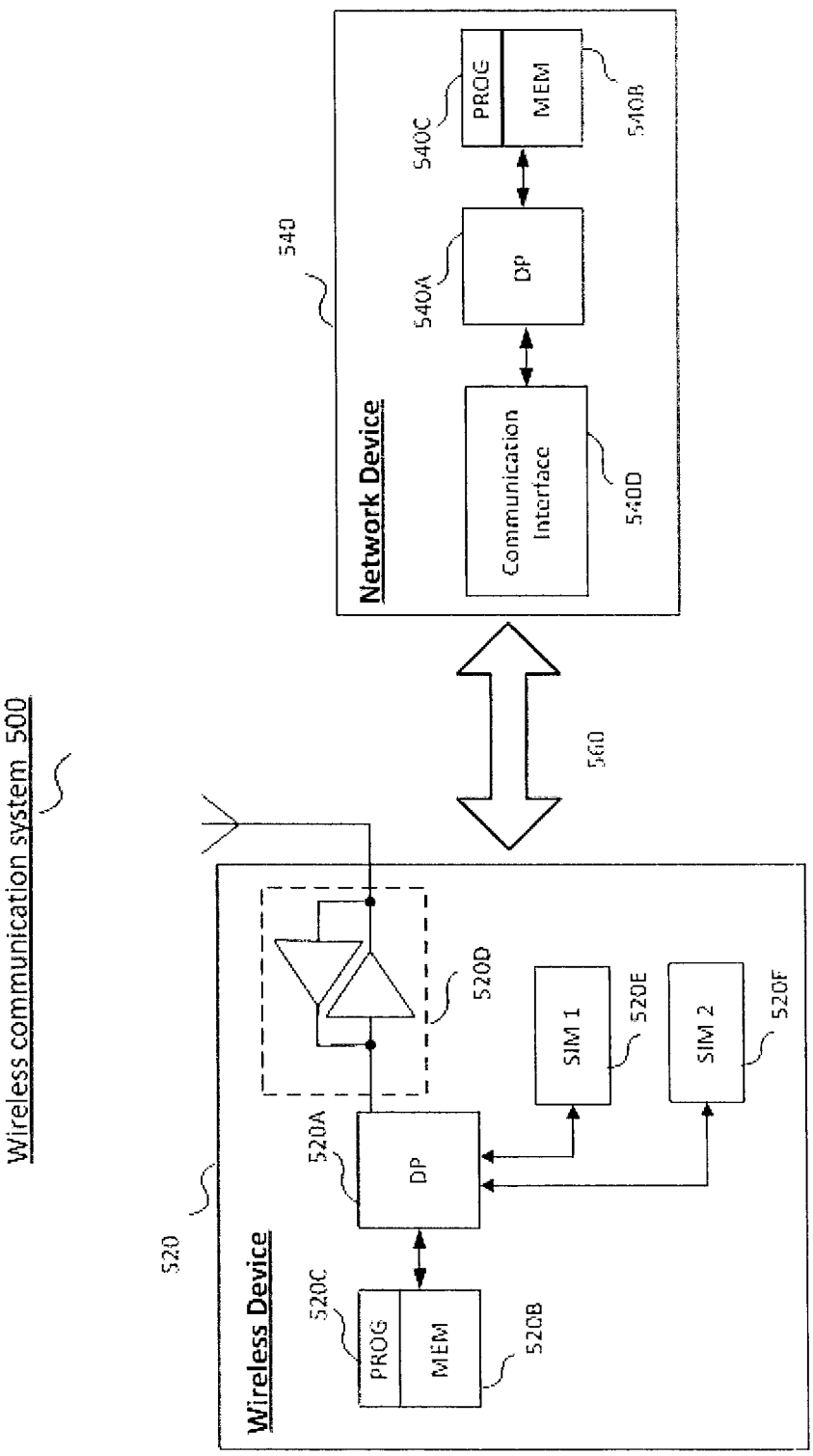
Wireless communication system 500
Network Device
540
540A
DP
540B
MEM
540C
PROG
Communication Interface
540D
560
Wireless Device
520
520A
DP
520B
MEM
520C
PROG
520D
SIM 1
520E
SIM 2
520F

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/072508

A. CLASSIFICATION OF SUBJECT MATTER

H04W 4/12(2009.01)i; H04W 88/06(2009.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W; H04B; H04L; H04Q

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)

CNPAT,CNKI,WPI,EPODOC: wireless, double, dual, multi, mode, SIM, subscriber identity module, DSDS, call request, offline, idle, free, message, information, indication

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102348179 A (SUZHOU ACTION PROWAVE TECHNOLOGY CO., LTD.) 08 February 2012 (2012-02-08) abstract, claims 1-2, description, paragraph [0048]	1-34
X	CN 1604661 A (HUAWEI TECHNOLOGIES CO., LTD.) 06 April 2005 (2005-04-06) abstract, claim 1, description, page 4 lines 11-20	1-34
X	CN 101123807 A (YULONG COMPUTER TELECOMMUNICATION TECHNOLOGY SHENZHEN CO., LTD.) 13 February 2008 (2008-02-13) claim 4, description, page 6 paragraph 7- page 7 paragraph 1	1-34
X	CN 101119542 A (SHANGHAI CHENXING ELECTRONICS SCIENCE & TECHNOLOGY CO., LTD.) 06 February 2008 (2008-02-06) abstract, claim 3, description, page 2 paragraph 3	1-34
X	US 2013065570 A1 (SAMSUNG ELECTRONICS CO., LTD.) 14 March 2013 (2013-03-14) claim 8, description, paragraph [0009]	1-34

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

* Special categories of cited documents:

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

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

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"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
27 October 2014	**24 November 2014**
Name and mailing address of the ISA/CN **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA(ISA/CN)** **6,Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China** Facsimile No. **(86-10)62019451**	Authorized officer **WANG,Yanhua** Telephone No. **(86-10)82245275**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/072508

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007077932 A1 (HON HAI PRECISION INDUSTRY CO., LTD.) 05 April 2007 (2007-04-05) the whole document	1-34

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/072508

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 102348179 A	08 February 2012	None	
CN 1604661 A	06 April 2005	None	
CN 101123807 A	13 February 2008	None	
CN 101119542 A	06 February 2008	None	
US 2013065570 A1	14 March 2013	EP 2568731 A1	13 March 2013
		KR 20130027649 A	18 March 2013
US 2007077932 A1	05 April 2007	TW I301369 B	21 September 2008