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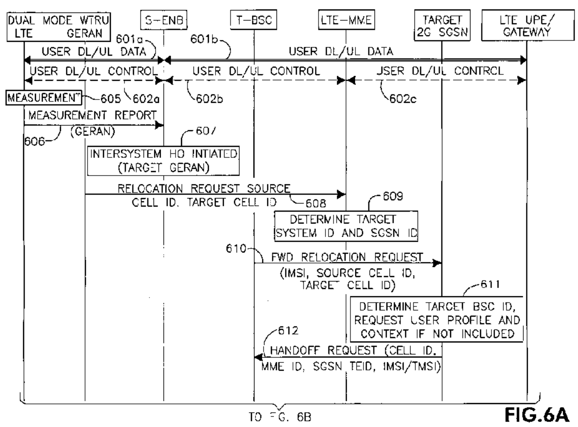

FIG.6A

(57) **Abstract:** A method and apparatus for handover of a dual mode wireless transmit/receive unit (WTRU) from an LTE system to a GERAN system uses measurements of the LTE and GERAN frequencies and a decision by a source evolved Node B to perform the handover. A GERAN access procedure includes PS attach messages exchanged between the WTRU and the target base station controller and a target SGSN. Alternatively, the GERAN access procedure uses RAN mobility information messages exchanged by the WTRU and the target base station controller and a relocation detect message by the source evolved Node B.

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[0001] METHOD AND APPARATUS FOR SUPPORTING HANDOVER FROM LTE/EUTRAN TO GPRS/GERAN

[0002] FIELD OF INVENTION

[0003] This application is related to wireless communications.

[0004] BACKGROUND

[0005] There are different types of wireless communication systems. For example, some wireless communication systems include general packet radio service (GPRS), global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN), and the newly introduced long term evolution (LTE) evolved universal terrestrial radio access network (EUTRAN). LTE/EUTRAN system has a different physical layer and a different architecture from those systems preceding it, i.e., GPRS, GERAN, or UTRAN.

[0006] When a Multi-mode mobile unit is traveling across the geographic coverage of these different systems, it may need to be handed off from one network to another. Since not all networks are identical, a method for supporting the handover between systems would be beneficial.

[0007] Figure 1 shows an exemplary diagram of a system 100 including an LTE system architecture. The system 100 shows an LTE /EUTRAN 101 and its evolved packet core 105 interworking with an existing GERAN 102, UTRAN 103, and their GPRS Core 104. The LTE /EUTRAN 101 comprises an E-Node B (not shown) that is connected (S1) to an evolved packet core 105 containing a mobility management entity/user plane entity (MME/UPE) 106 and an inter AS anchor Gateway 107. The Evolved Packet Core 105 connects (S6) to a home subscriber service (HSS) 111, and connects (S7) to a Policy and Charging Rules (PCRF) 112. The inter AS Anchor gateway 107 connects (Gi) to Operator IP Servers (such as IMS, PSS) 110, connects (S2) to a Non-3GPP IP Access network 108, and connects (S2) to a WLAN 3GPP IP Access network 109. The GPRS Core 104 comprises a Serving GPRS Support Node (SGSN) (not shown) which is responsible for Mobility Management, Access Procedures, and User Plane

Control. The GPRS Core 104 also comprises a Gateway GPRS Support Node (GGSN), where the network is connected to external networks and other operator servers. The Operator IP Servers 110 may include an IP Multimedia Service Subsystem (IMS) where VoIP and other multimedia services are controlled. The N on-3GPP IP access network 108 includes connections to other technologies that are developed in other standard Forums such as 3GPP2 (CDMA2000) and WiMAX (IEEE 802.16 system). The WLAN 3GPP IP access network 109 has WLAN s incorporated into 3GPP systems via interworking architecture defined in 3GPP.

SUMMARY

A method and apparatus for supporting handover from an LTE/EUTRAN cell to a general packet radio service (GPRS)/global system for mobile communications *(GSM)/* enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell. In one embodiment, a GERAN access procedure during the handover includes sending a packet switched (PS) attach signal. In another embodiment, the GERAN access procedure includes RAN mobility information messages being exchanged between the WTRU and a target base station controller (T-BSC).

In one aspect the present invention provides a dual mode wireless transmit/receive unit (WTRU) including:

a receiver configured to receive global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell information while receiving wireless communications in a long term evolution (LTE)/evolved universal terrestrial radio access network (EUTRAN) cell;

a processor configured to receive list of available cells and their technologies in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information; and

a transmitter configured to send a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

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In another aspect the present invention provide a method for handover of a dual mode wireless transmit/receive unit (WTRU) from a long term evolution (LTE) system cell to a global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell, the method including:

receiving GERAN cell information while receiving wireless communications in a LTE cell;

receiving a list of available cells and their technologies from the LTE system in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information; and

sending a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

BRIEF DESCRIPTION OF THE DRAWINGS

A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings wherein:

Figure 1 shows an example of an L TE general network architecture;

Figure 2 shows an initial state for handoff from an LTE system to a *GPRS/GERAN* system;

Figure 3 shows a second state for handoff from an LTE system to a *GPRS/GERAN* system;

Figure 4 shows a third state for handoff from an LTE system to a *GPRS/GERAN* system;

[0016] Figure 5 shows a functional block diagram of a wireless transmit/receive unit and a Node B;

[0017] Figures 6A, 6B, 6C show a signal flow diagram of a handover procedure including a packet switched (PS) handover signal; and

[0018] Figures 7A, 7B, 7C show a signal flow diagram of a handover procedure including a relocation detect from a source evolved Node-B (S-ENB) to a target base station controller (T-BSC).

[0019] DETAILED DESCRIPTION

[0020] When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0021] Figures 2-4 show examples of three states of traffic paths and tunnels established between network entities during a handover of a WTRU from an LTE network to a GERAN network. In Figure 2, an initial state 200 is shown for a mobile WTRU 201 moving from an LTE network cell designated as local area LA2/Routing Area RA2, to a GERAN system LA1/RA1. The cells belonging to GERAN systems may constitute different Location Area/Routing Area (LA1/RA1) from those belonging to LTE based cells (LA2/RA2). In certain deployments, although GERAN cells may be co-located with GERAN cells, these cells will remain under different LA/RA configuration due to the difference between the two system architectures. Other WTRUs 254, 255 are shown camped on the cell LA2/RA2, and WTRUs 251, 252 are camped on the cell LA1/RA1. The WTRU is currently connected to an access gateway 211 via a source Evolved Node B (ENB) 222, where tunnels 215 and 216 are established for the user data plane. Source mobility management entity (MME) 221 controls mobility and handles user control plane traffic on tunnels 217 and 218. User control plane traffic is connected on tunnel 219 between the source ENB 222 and the WTRU 201. The target GERAN system comprises a target SGSN 231, a target base station controller (BSC) 232, and a target mobile services switching center/visitor location register (MSC/VLR) entity 233.

[0022] Figure 3 shows an optional second state 300 for tunneling of network entities during the handover of the WTRU 201 from the LTE network cell LA2/RA2 to the GERAN cell LA1/RA1. The WTRU 201 is now migrated to the GERAN cell LA1/RA1.

[0023] An optional tunnel 225 may be created between the target BSC 232 of the GERAN system and the source ENB 222. The tunnel 225 may be used to temporarily forward the current pending data transfer between GERAN system and the WTRU via E-Node B while a new connection between the Evolved Core Network 105 and the GPRS Core 104 (i.e., while the backbone procedures to switch traffic is completed). This will ensure that no data is lost during transition. A system operator may choose not to implement this step and go to a complete transition case where no connection is established between the GERAN BSC 232 and ENB 222. In such a case, forwarding of data occurs at higher layers, between the two core networks on S3 and S4 connections. The user data plane and control plane traffic is carried to the WTRU 201 across the tunnels 235 and 236, respectively.

[0024] Figure 4 state 400 for tunneling of network entities during the handover of the WTRU 201 from the LTE network cell LA2/RA2 to the GERAN cell LA1/RA1. As shown in Figure 4, the traffic switching has occurred in the upper layers such that the GERAN system is now is the network source for user traffic, as shown by GGSN 411. The WTRU 201 is now connected to the GERAN system GGSN 411 via the Target SGSN 231, and the target BSC 232, on user data plane and control plane tunnels 415, 416 and 417, respectively.

[0025] Figure 5 is a functional block diagram of a WTRU 510 and a Node B 520. As shown in Figure 5, the WTRU 510 is in communication with the Node B

520 and both are configured to support handover from GPRS/GERAN to LTE/EUTRAN.

[0026] In addition to the components that may be found in a typical WTRU, the WTRU 510 includes a processor 515, a receiver 516, a transmitter 517, and an antenna 518. The processor 515 is configured to support handover from GPRS/GERAN to LTE/ EUTRAN. The receiver 516 and the transmitter 517 are in communication with the processor 515. The antenna 518 is in communication with both the receiver 516 and the transmitter 517 to facilitate the transmission and reception of wireless data. The processor 515, receiver 516, transmitter 517, and antenna 518 may be configured as a GPRS/GERAN radio transceiver, or configured as an LTE/EUTRAN radio transceiver. Also, although only one processor, receiver, transmitter, and antenna is shown, it should be noted that multiple processors, receivers, transmitters, and antennas may be included in the WTRU 510, whereby different groupings of processors, receivers, transmitters, and antennas operate in different modes, (e.g., GPRS/GERAN transceiver or LTE/EUTRAN transceiver).

[0027] In addition to the components that may be found in a typical Node B, the Node B 520 includes a processor 525, a receiver 526, a transmitter 527, and an antenna 528. The processor 525 is configured to support handover from LTE/EUTRAN to GERAN. The receiver 526 and the transmitter 527 are in communication with the processor 525. The antenna 528 is in communication with both the receiver 526 and the transmitter 527 to facilitate the transmission and reception of wireless data.

[0028] In a first embodiment, GERAN access procedures include packet switched (PS) attach signals between the LTE transceiver of the WTRU 510. Figure 6 shows exemplary signal diagram of a handover procedure 600 for this embodiment. While the following signals are shown in Figure 6 and described in a particular sequence, the signals may occur in variations to the sequence in accordance with this embodiment.

[0029] In the signal diagram of Figure 6, signals are exchanged among: a dual mode LTE/GERAN WTRU having an LTE transceiver and a GERAN transceiver, each transceiver comprising a receiver and a transmitter; a source e-Node B (S-ENB); a target BSC (T-BSC); a source LTE-MME; a target SGSN; and an LTE UPE/Gateway. The dual mode WTRU in this example includes an LTE and GERAN transceiver.

[0030] As shown in Figure 6, user downlink (DL) and uplink (UL) traffic 601a, 601b is exchanged between the WTRU LTE transceiver, the S-ENB and the LTE UPE/Gateway. The WTRU LTE transceiver performs measurements 605 on LTE frequencies and GERAN frequencies, and transmits a GERAN measurement report signal 606 to the S-ENB. The WTRU may receive a list of different radio access technologies, including GERAN, from the S-ENB to identify the types of frequency measurements to undertake. Intersystem Handover 607 is initiated by the S-ENB, which makes the handover decision based on the measurement report 606, with GERAN being the target. A relocation request signal 608, containing the source cell ID and the target cell ID, is transmitted from the S-ENB to the source MME. The source MME makes a determination 609 of the target system cell ID and the SGSN ID by mapping the target cell ID (GERAN) to an SGSN IP address. The source MME forwards the relocation request 610 to the target SGSN, including an international mobile subscriber identity (IMSI), source cell ID and target cell ID.

[0031] The target SGSN performs a determination 611 of the target BSC ID, and requests the user profile and context if it was not included in signaling message 610. The target SGSN sends a handover request signal 612 to the T-BSC, including the cell ID, SGSN ID, and the international mobile subscriber identity /temporary mobile subscriber identity (IMSI/TMSI). The T-BSC performs a determination 613 of channel availability and initiates radio access bearer (RAB) establishment. The T-BSC transmits a handoff request ACK 614, including the IMSI/TMSI, to the Target SGSN. A user plane and control plane tunnel 615 is established between the T-BSC and the Target SGSN. The target SGSN creates an MM state and SM state 616 to prepare for activating packet data protocol (PDP) context information.

[0032] The target SGSN sends a relocation response 617 including an IMSI and SGSN ID, to the Source MME, which sends a relocation command signal 618, that includes the TMSI and target BSC ID to the S-ENB. A temporary tunnel 619 to the T-BSC is established by the S-ENB to forward user data to the T-BSC. A handover command 620 is transmitted from the source MME to the S-ENB, and is forwarded to the WTRU LTE transceiver, which recognizes the target GERAN technology amongst others that may be supported, and an initiate/synch radio signal 621, including a target channel ID, is communicated to the WTRU GERAN transceiver. The GERAN transceiver sends an ACK signal 623. User data 622 is exchanged on the temporary tunnel 619 between the S-ENB and the T-BSC. A handover complete signal 624 is sent from the WTRU LTE transceiver to the S-ENB. The T-BSC sends a relocation detect signal 625 to the target SGSN.

[0033] The GERAN access procedure includes a PS attach signal 626 transmitted from the WTRU GERAN transceiver to the T-BSC, which forwards the PS attach signal 627 to the target SGSN. A PS attach accepted signal 628 is returned by the target SGSN to the T-BSC. The WTRU GERAN transceiver is configured to receive a PS attach Accept 629 from the T-BSC, and to respond with a PS attach accept ACK 630. The T-BSC forwards a PS attach accept ACK signal 631 to the target SGSN.

[0034] The target SGSN performs an update 633 of the PDP context with the new SGSN TEID, and establishes a tunnel 634 with the LTE UPE/gateway for a GPRS tunneling protocol user plane and control plane (GTP-U and GTP-C). At this stage the user plane path is established for all PDP contexts between the WTRU GERAN transceiver, Target BSC, Target SGSN, and serving gateway. The switch of traffic 638 is complete from the source ENB to the target SGSN. Between the WTRU GERAN transceiver and T-BSC, a tunnel 632 is established for exchange of RAN information and RAB establishment, and user DL/UL traffic 635 is exchanged.

[0035] A handover complete signal 636 is sent from the target SGSN to the source MME, which sends a release signal 639 to the S-ENB and an HO complete ACK 637 to the target SGSN. The S-ENB performs a release 640 of its resources related to the WTRU, and stops forwarding data. A release ACK 641 is transmitted from the S-ENB to the source MME, and user DL/UL GERAN traffic now flows on tunnel 642 between the WTRU GERAN transceiver and the target BSC, on tunnel 643 between the T-BSC and the target SGSN, and on tunnel 644 between the target SGSN and the GGSN gateway.

[0036] Figure 7 shows a signaling diagram according to a second embodiment in which the GERAN access procedure includes a relocation detect signal from the source ENB and the target BSC, and RAN mobility information signals. In this embodiment, the signals are similar to the first embodiment as shown in Figure 6A, 6B and 6C, except for the following signals which are used in lieu of the PS attach signals 626-631 excluded in this embodiment.

[0037] As shown in Figure 7, a GERAN access procedure begins the handover complete signal 624. A relocation detect signal 725 is sent by the S-ENB to the T-BSC, and a relocation detect signal 726 is forwarded from the T-BSC to the target SGSN. RAN mobility information 727 is transmitted by the T-BSC to the WTRU GERAN transceiver, which returns a RAN mobility information ACK 728. The T-BSC sends a Relocation complete signal 729 to the target SGSN.

[0038] As described in Figures 1-7 above, radio resources are prepared in the target 3GPP access system before the WTRU 510 is commanded by the source 3GPP access system to change to the target 3GPP access system. A tunnel is established between the two radio access networks (RANs) (basic service set (BSS)/basic service controller (BSC) and E-Node B) in order to forward the data while the core network resources are assigned.

[0039] A control interface may exist in the core level between the 2G/3G SGSN and corresponding MME to exchange the mobility context and the session context of the Mobile. Additionally, the target system may provide directions to the WTRU as to the radio access requirements, such as the radio resource configuration, target cell system information, and the like.

[0040] There is an intermediate state during handoff where the DL User plane data is sent from source system to the target system before the User plane is switched directly to the target system in order to avoid the loss of user data, (e.g., by forwarding). Bi-casting may also be used until the 3GPP Anchor determines that it can send DL U-plane data directly to the target system.

[0041] Embodiments

1. A dual mode wireless transmit/receive unit (WTRU) comprising:

a processor configured to receive list of available cells and their technologies from LTE system in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information.

2. The WTRU as in embodiment 1, further comprising:

a transmitter configured to send a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

3. The WTRU as in embodiment 1 or 2, further comprising:

a receiver configured to receive global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell information while receiving wireless communications in a long term evolution (LTE)/evolved universal terrestrial radio access network (EUTRAN) cell.

4. The WTRU as in any of embodiments 1-3, further comprising a second receiver configured to receive GERAN communications, where the receiver recognizes the target technology from among a plurality of supported radio access technologies, whereby the processor communicates the target channel ID to the second receiver.

5. The WTRU as in any of embodiments 1-4, further comprising a second transmitter configured to start GERAN access procedures by sending a packet switched (PS) attach request to a target base station controller (T-BSC),

wherein the second receiver is configured to receive a PS attach accept signal from the T-BSC.

6. The WTRU as in embodiment 5, wherein the second transmitter is configured to send a PS attach accept ACK signal to the T-BSC.

7. The WTRU as in any of embodiments 1-3, further comprising:

a second receiver configured to receive GERAN communications and to receive a RAN mobility information signal from a target base station controller; and

a second transmitter configured to send GERAN communications and to send a RAN mobility information ACK signal to the target base station controller.

8. A source evolved Node B (eNB) comprising:

a transmitter configured to send a measurement list including different radio access technologies, including GERAN, to a wireless transmit/receive unit (WTRU).

9. The eNB as in embodiment 8, further comprising:

a receiver configured to receive a measurement report from the WTRU having measurements of a target GERAN cell for a handover of the WTRU.

10. The eNB as in any of embodiments 8-9, further comprising:

a processor configured to make a decision for handover of the WTRU from a source LTE cell to the target GERAN cell based on the measurement report.

11. The eNB as in any of embodiments 8-10, wherein the transmitter is configured to send a relocation request to a source mobility management entity (MME) supporting the source eNB, the request having a target system ID and the source eNB ID.

12. The eNB as in any of embodiments 8-11, wherein the receiver is configured to receive a relocation command that includes a temporary mobile subscriber identity (TMSI) and a target base station controller (T-BSC) ID, whereby the processor is configured to establish a temporary tunnel to the T-BSC to forward data.

13. A source LTE mobility management entity (MME) comprising a processor configured to determine a handover target GERAN system for a handover of a wireless transmit/receive unit (WTRU) from a received relocation request from a serving eNB, the relocation request having a source cell ID and a target cell ID, the processor configured to identify a Serving GPRS Support Node (SGSN) that controls a target GERAN cell by mapping the target GERAN Cell ID to an SGSN IP address.

14. The MME as in embodiment 13, wherein the processor is configured to forward a request for resource allocation in the target system via a message that includes the target cell ID and the WTRU ID as an international mobile subscriber identity (IMSI).

15. The MME as in any of embodiments 13-14, wherein the processor is configured to release the resources allocated to the WTRU in LTE system after receiving handover complete message from a target SGSN.

16. A method for handover of a dual mode wireless transmit/receive unit (WTRU) from a long term evolution system cell to a global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell, the method comprising:

receiving GERAN cell information while receiving wireless communications in a LTE cell;

receiving a list of available cells and their technologies from the LTE system in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information.

17. The method as in embodiment 16, further comprising:

sending a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

18. The method as in embodiments 16 or 17, further comprising a first receiver of the dual mode WTRU recognizing a target radio access technology from among a plurality of supported radio access technologies; and communicating a target channel ID to a second receiver of the dual mode WTRU.

19. The method as in any of embodiments 16-18, further comprising starting GERAN access procedures by sending a packet switched (PS) attach request to a target base station controller (T-BSC), wherein the second receiver is configured to receive a PS attach accept signal from the T-BSC.

20. The method as in embodiment 19, further comprising sending a PS attach accept ACK signal to the T-BSC.

21. The method as in embodiment 12, further comprising:

receiving a RAN mobility information signal from a target base station controller; and

sending a RAN mobility information ACK signal to the target base station controller.

22. A method for an evolved Node B (eNB) performing handover of a wireless transmit/receive unit, comprising:

performing a decision for handover of the WTRU from a source LTE cell to the target GERAN cell based on the measurement report received from a wireless transmit/receive unit (WTRU) of measured GERAN frequencies.

23. The method as in embodiment 22, further comprising sending a measurement list including different radio access technologies, including GERAN, to the wireless transmit/receive unit (WTRU); and

receiving a measurement report from the WTRU having measurements of a target GERAN cell for the handover; and

24. The method as in any of embodiments 22-23, wherein the transmitter is configured to send a relocation request to a source mobility management entity (MME) supporting the source eNB, the request having a target system ID and the source eNB ID.

25. The method as in embodiment 24, further comprising receiving a relocation command that includes a temporary mobile subscriber identity (TMSI) and a target base station controller (T-BSC) ID; and establishing a temporary tunnel to the T-BSC to forward data in response to the relocation command.

[0042] Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0043] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[0044] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A dual mode wireless transmit/receive unit (WTRU) including:

a receiver configured to receive global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell information while receiving wireless communications in a long term evolution (LTE)/evolved universal terrestrial radio access network (EUTRAN) cell;

a processor configured to receive list of available cells and their technologies in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information; and

a transmitter configured to send a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

2. The dual mode WTRU as in claim 1, further including a second receiver configured to receive GERAN communications, where the receiver recognizes the target technology from among a plurality of supported radio access technologies, whereby the processor communicates the target channel ID to the second receiver.

3. The dual mode WTRU as in claim 1, further including a second transmitter configured to start GERAN access procedures by sending a packet switched (PS) attach request to a target base station controller (T-BSC), wherein the second receiver is configured to receive a PS attach accept signal from the T-BSC.

4. The dual mode WTRU as in claim 3 wherein the second transmitter is configured to send a PS attach accept ACK signal to the T-BSC.

5. The dual mode WTRU as in claim 1, further including:

a second receiver configured to receive GERAN communications and to receive a radio access network (RAN) mobility information signal from a target base station controller; and a second transmitter configured to send GERAN communications and to send a RAN mobility information ACK signal to the target base station controller.

6. A method for handover of a dual mode wireless transmit/receive unit (WTRU) from a long term evolution (LTE) system cell to a global system for mobile (GSM)/enhanced data rates for GSM evolution (EDGE) radio access network (GERAN) cell, the method including:

receiving GERAN cell information while receiving wireless communications in a LTE cell;

receiving a list of available cells and their technologies from the LTE system in order to perform measurements on LTE frequencies and GERAN frequencies to be used for a handover from a source LTE cell to other wireless coverage areas, including a target GERAN cell using the GERAN cell information; and

sending a measurement report of the measurements on the GERAN frequencies to a source evolved Node B (eNB).

7. The method as in claim 6, further including a first receiver of the dual mode WTRU recognizing a target radio access technology from among a plurality of supported radio access technologies; and communicating a target channel ID to a second receiver of the dual mode WTRU.

8. The method as in claim 7, further including starting GERAN access procedures by sending a packet switched (PS) attach request to a target base station controller (T-BSC), wherein the second receiver is configured to receive a PS attach accept signal from the T-BSC.

9. The method as in claim 8, further including sending a PS attach accept ACK signal to the T-BSC.

10. The method as in claim 6, further including:

receiving a radio access network (RAN) mobility information signal from a target base station controller; and sending a RAN mobility information ACK signal to the target base station controller.

11. The dual lode WTRU as in claim 1 and substantially as hereinbefore described with reference to figures 2 to 7 of the accompanying drawings.

12. The method as in claim 6 and substantially as hereinbefore described with reference to figures 2 to 7 of the accompanying drawings.

INTERDIGITAL TECHNOLOGY CORPORATION

WATERMARK PATENT & TRADE MARK ATTORNEYS

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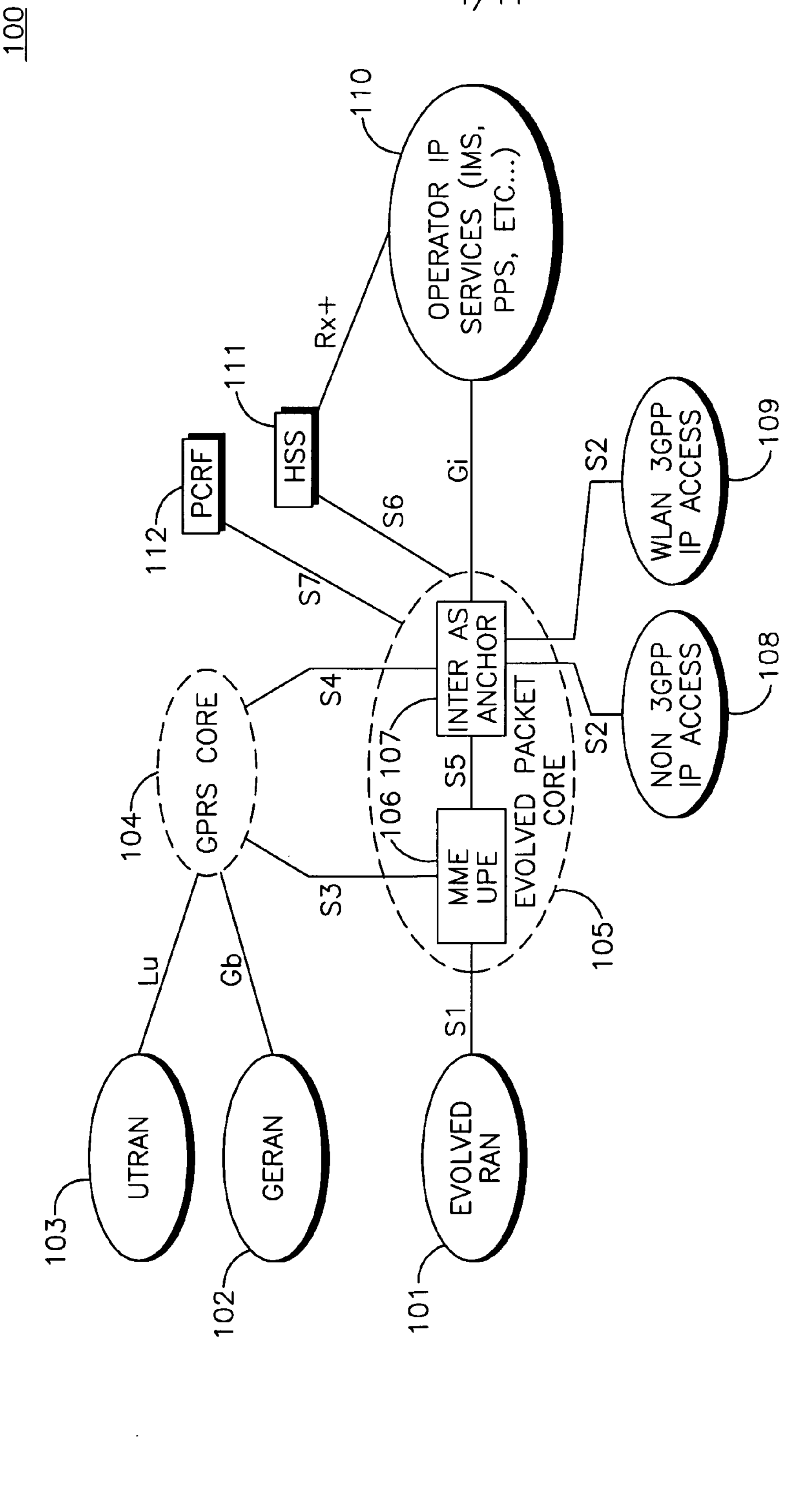
100
UTRAN
103
GERAN
102
EVOLVED RAN
101
Lu
Gb
S1
GPRS CORE
104
S3
S4
MME UPE
106
107
S5
INTER AS ANCHOR
EVOLVED PACKET CORE
105
S7
S6
Gi
S2
S2
PCRF
112
HSS
111
Rx+
OPERATOR IP SERVICES (IMS, PPS, ETC...)
110
NON 3GPP IP ACCESS
108
WLAN 3GPP IP ACCESS
109

FIG.1

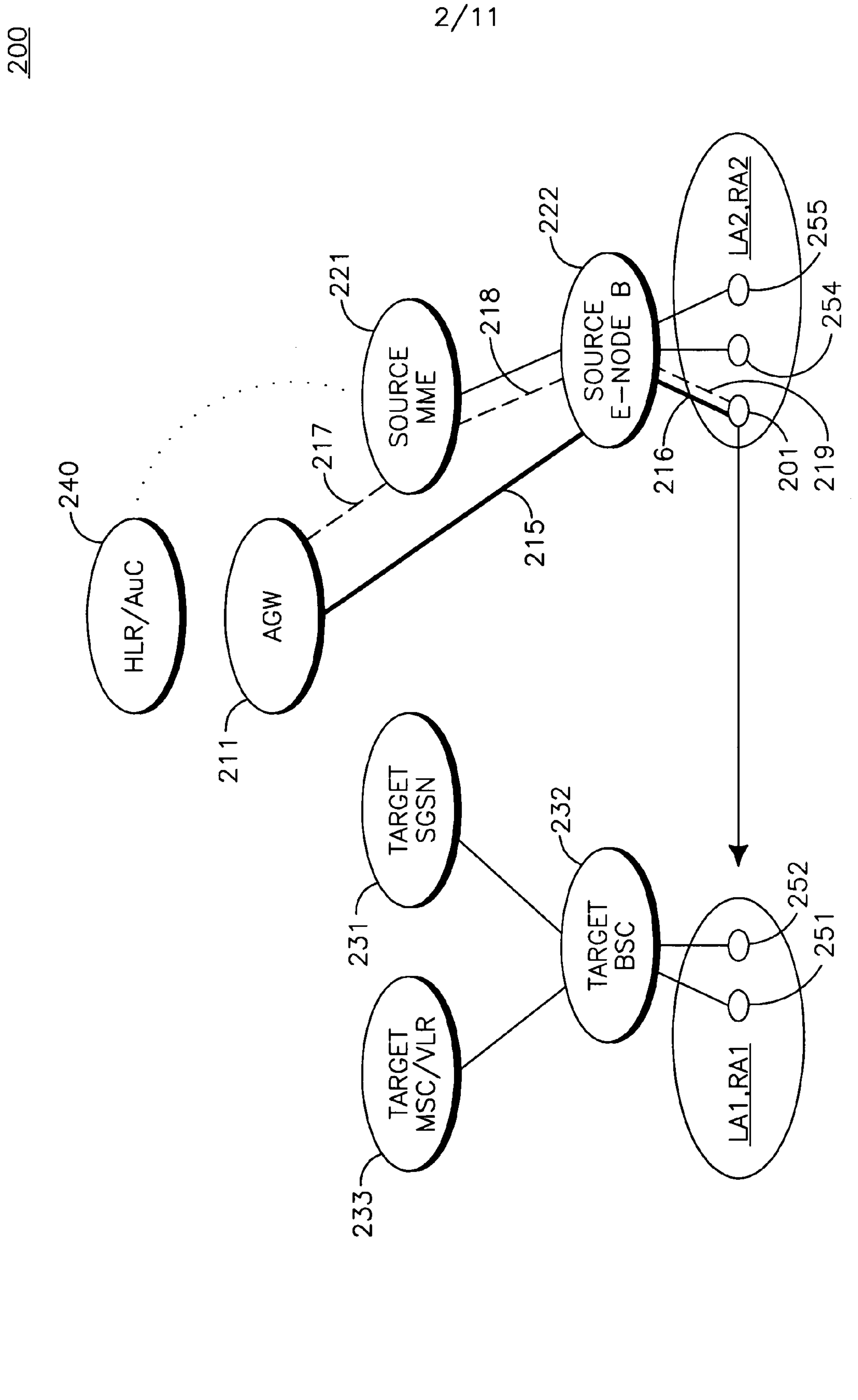
200
HLR/AuC
240
AGW
211
SOURCE MME
221
SOURCE E-NODE B
222
217
218
215
216
201
219
254
255
LA2,RA2
TARGET SGSN
231
TARGET BSC
232
TARGET MSC/VLR
233
252
251
LA1,RA1

FIG.2

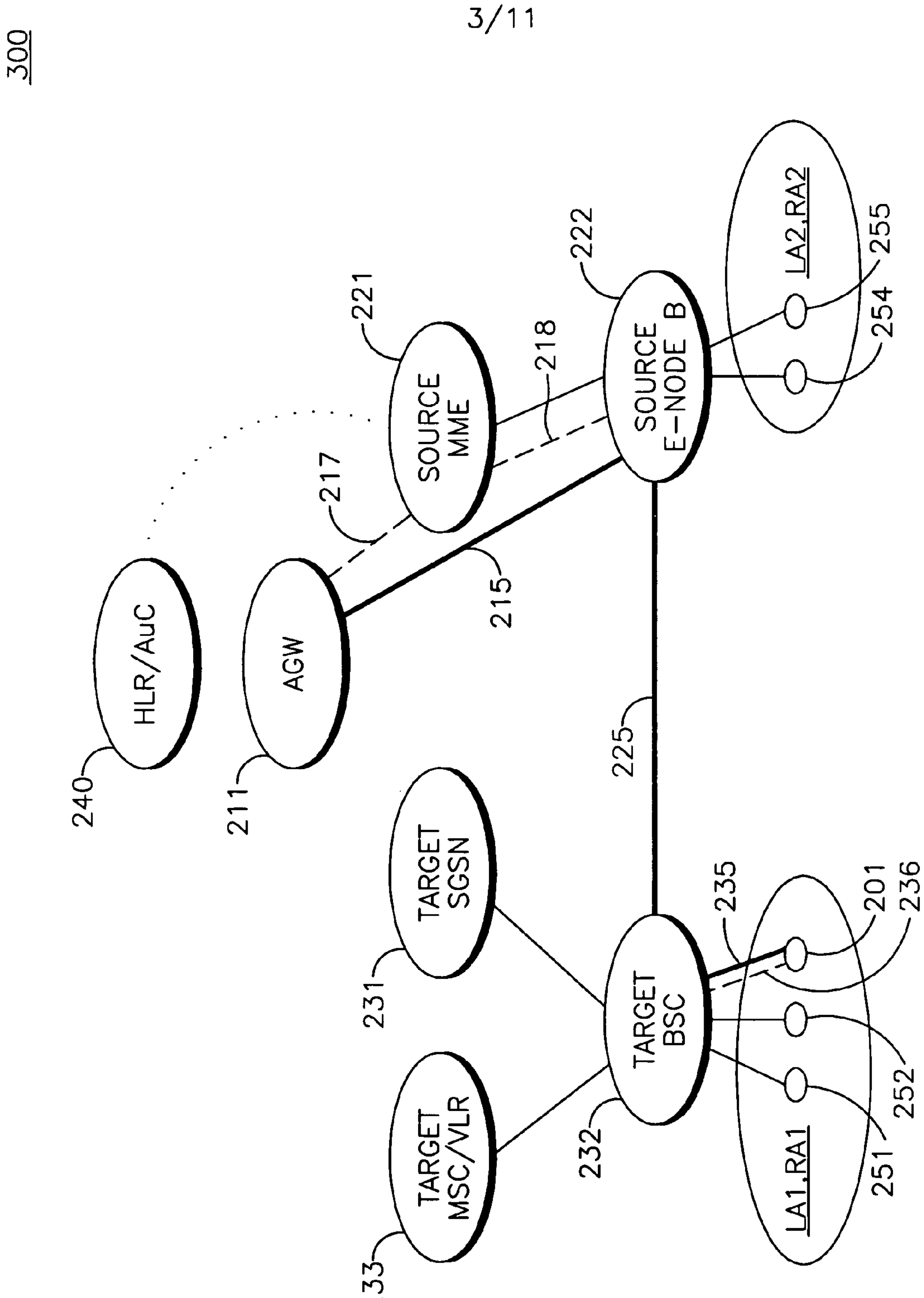
300
HLR/AuC
240
AGW
211
SOURCE MME
221
217
215
218
SOURCE E-NODE B
222
LA2,RA2
254
255
225
TARGET SGSN
231
TARGET MSC/VLR
233
TARGET BSC
232
235
201
236
LA1,RA1
251
252

FIG.3

400

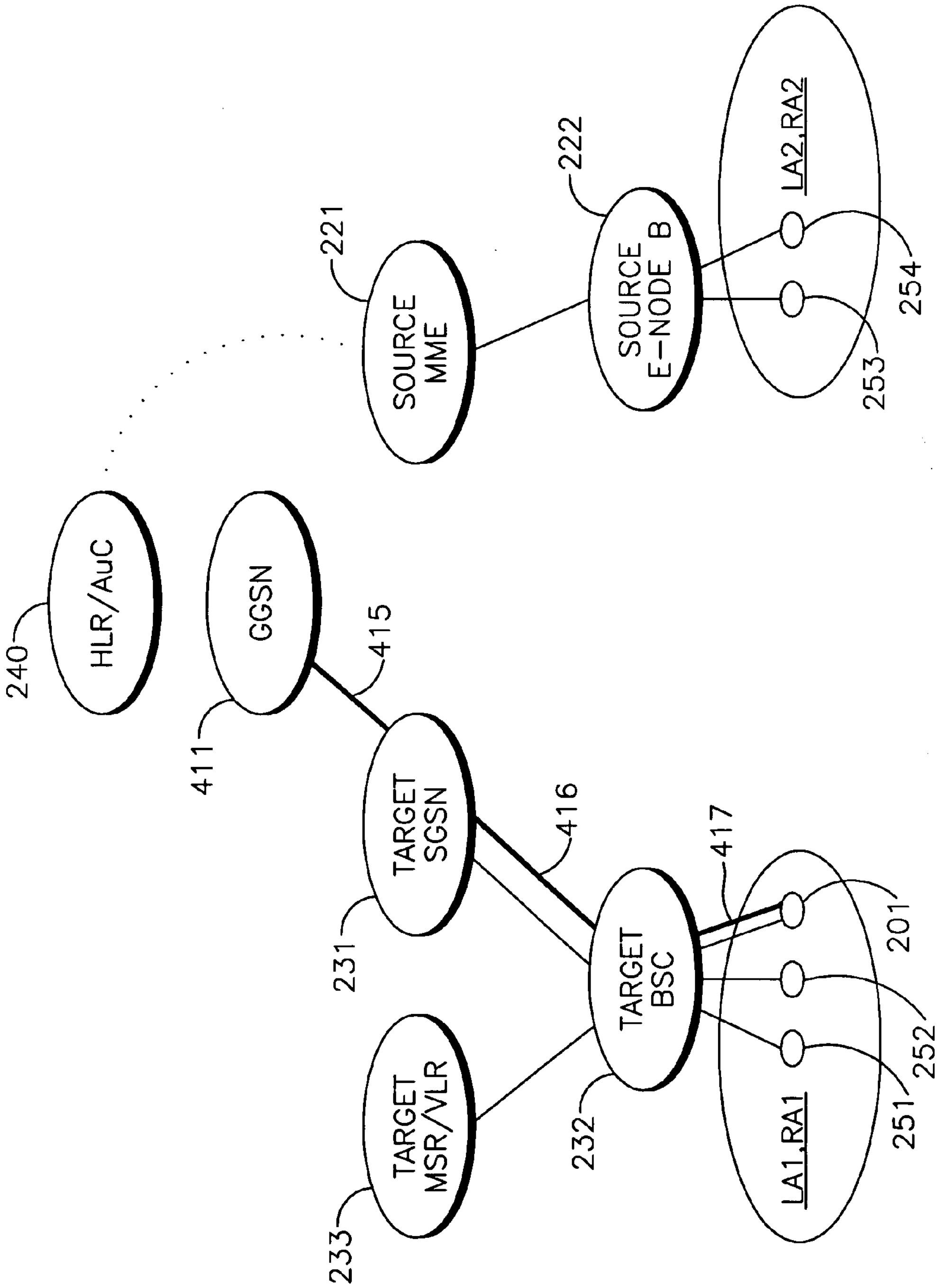
HLR/AuC
240
GGSN
411
415
SOURCE MME
221
SOURCE E–NODE B
222
LA2,RA2
253
254
TARGET SGSN
231
416
TARGET BSC
232
417
TARGET MSR/VLR
233
LA1,RA1
251
252
201

FIG.4

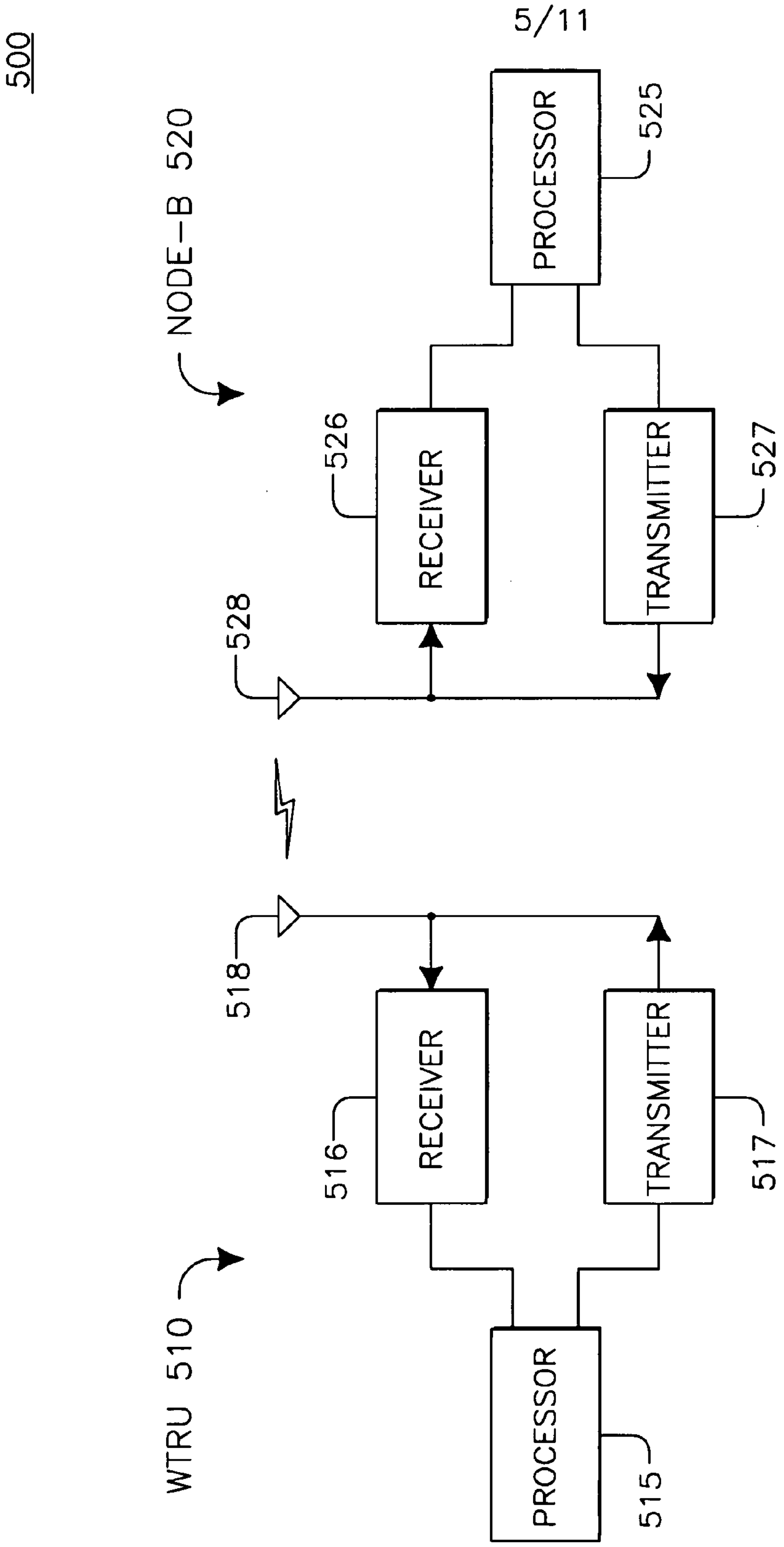
500
WTRU 510
NODE-B 520
PROCESSOR
515
RECEIVER
516
TRANSMITTER
517
518
528
RECEIVER
526
TRANSMITTER
527
PROCESSOR
525

FIG.5

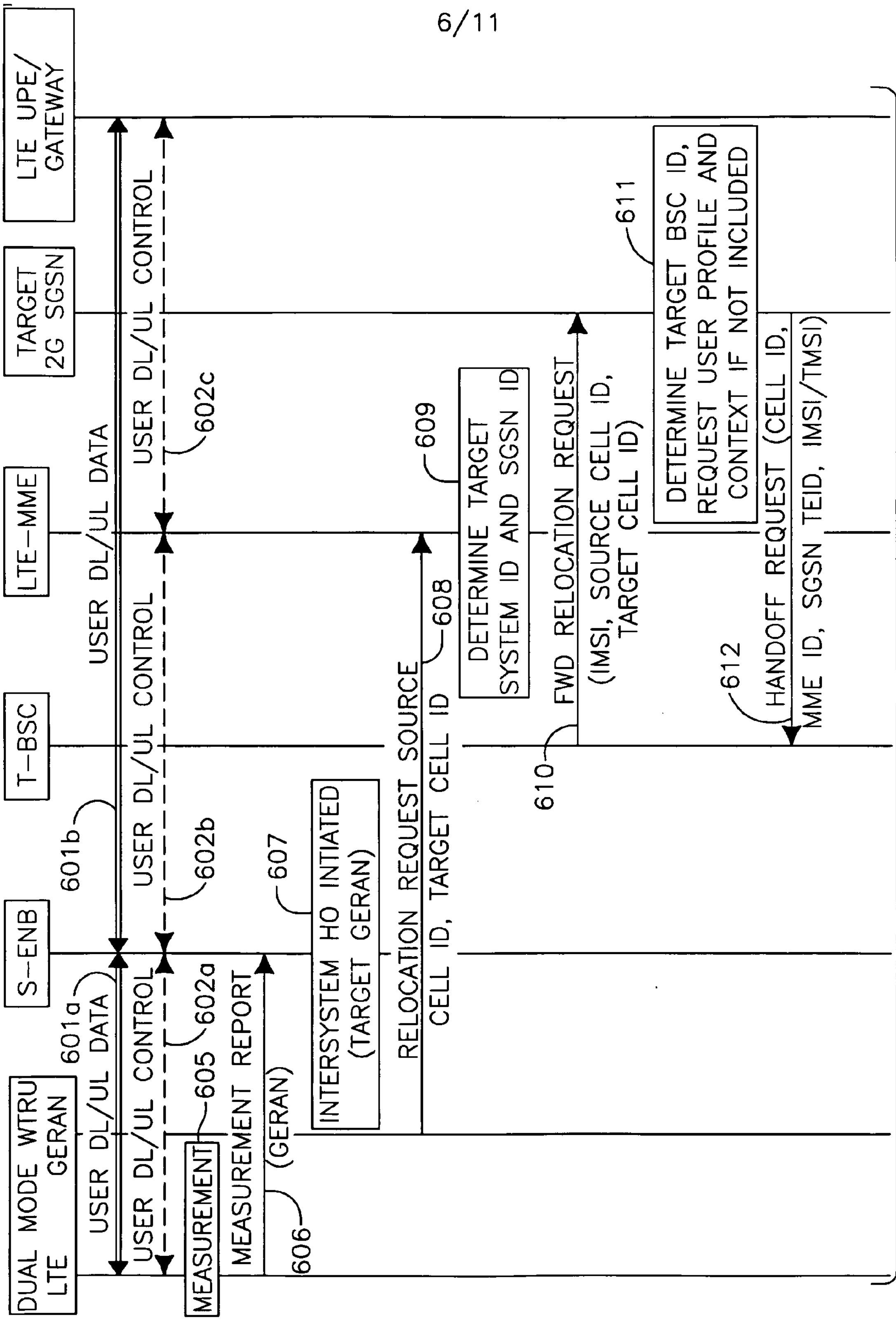
DUAL MODE WTRU LTE GERAN
S-ENB
T-BSC
LTE-MME
TARGET 2G SGSN
LTE UPE/ GATEWAY
USER DL/UL DATA
601a
601b
USER DL/UL CONTROL
602a
602b
602c
MEASUREMENT
605
MEASUREMENT REPORT (GERAN)
606
INTERSYSTEM HO INTIATED (TARGET GERAN)
607
RELOCATION REQUEST SOURCE CELL ID, TARGET CELL ID
608
DETERMINE TARGET SYSTEM ID AND SGSN ID
609
FWD RELOCATION REQUEST (IMSI, SOURCE CELL ID, TARGET CELL ID)
610
DETERMINE TARGET BSC ID, REQUEST USER PROFILE AND CONTEXT IF NOT INCLUDED
611
HANDOFF REQUEST (CELL ID, MME ID, SGSN TEID, IMSI/TMSI)
612
TO FIG. 6B

FIG.6A

FROM FIG. 6A

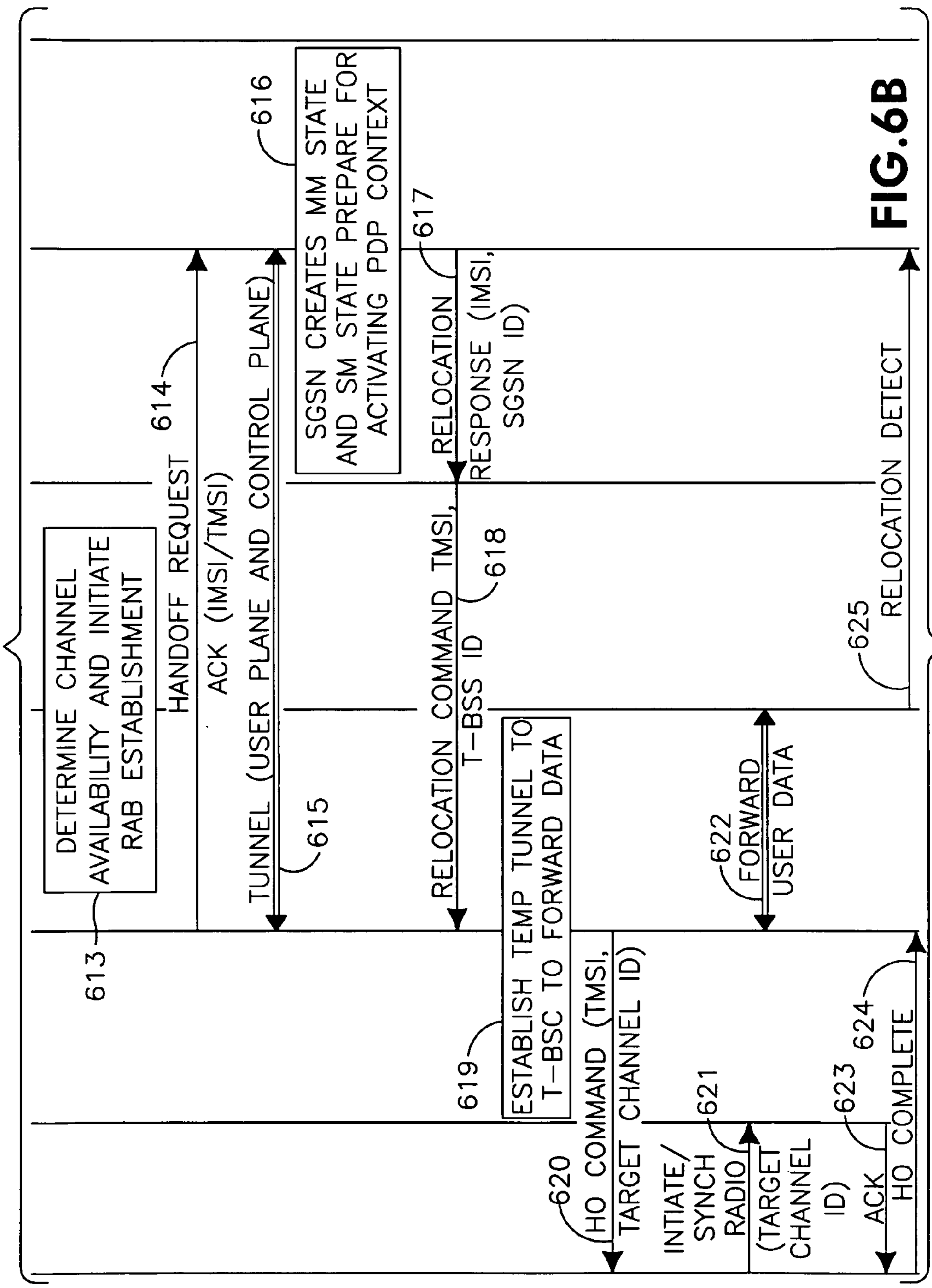

FIG.6B

TO FIG. 6C

FROM FIG. 6B

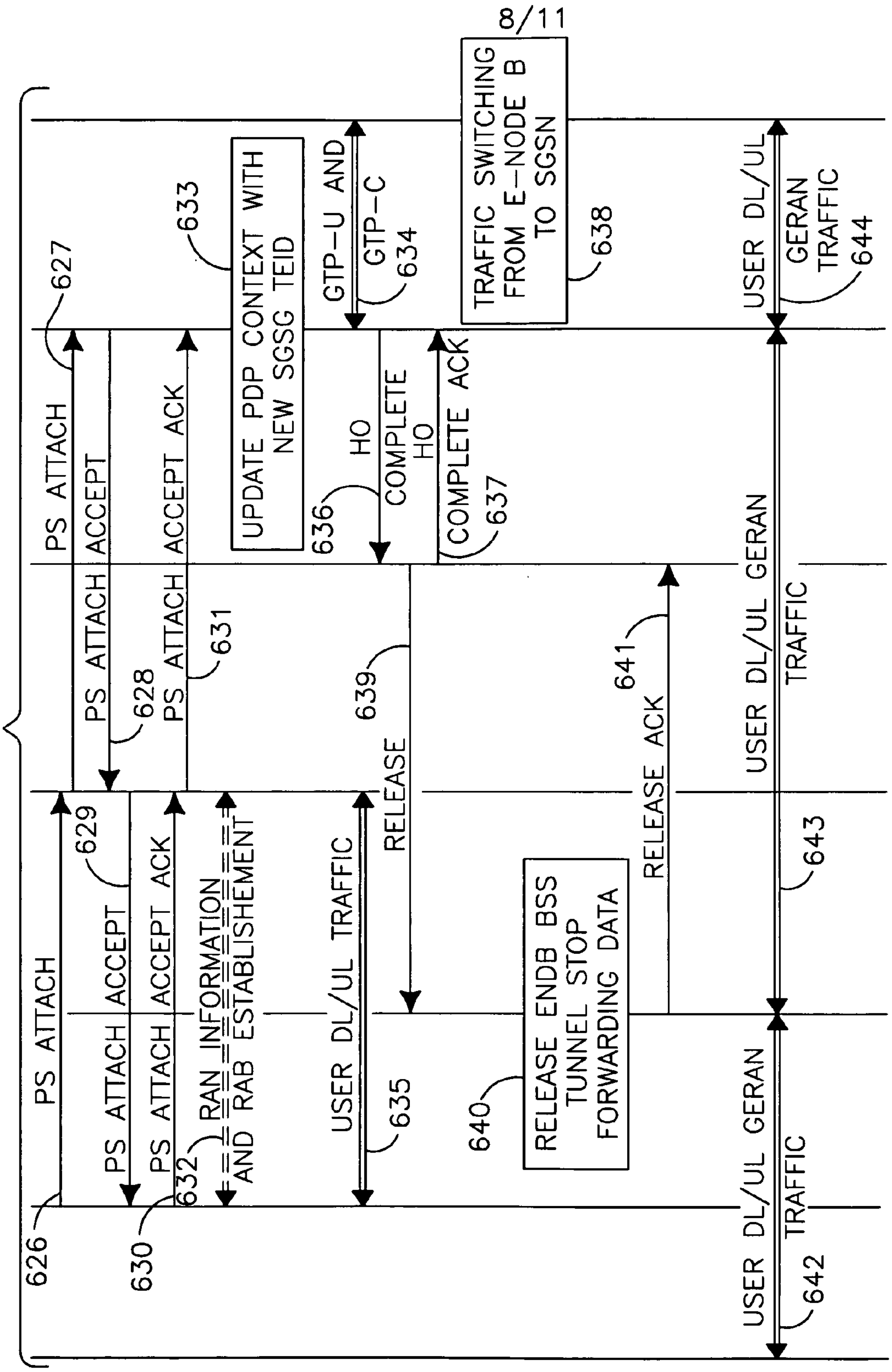

FIG.6C

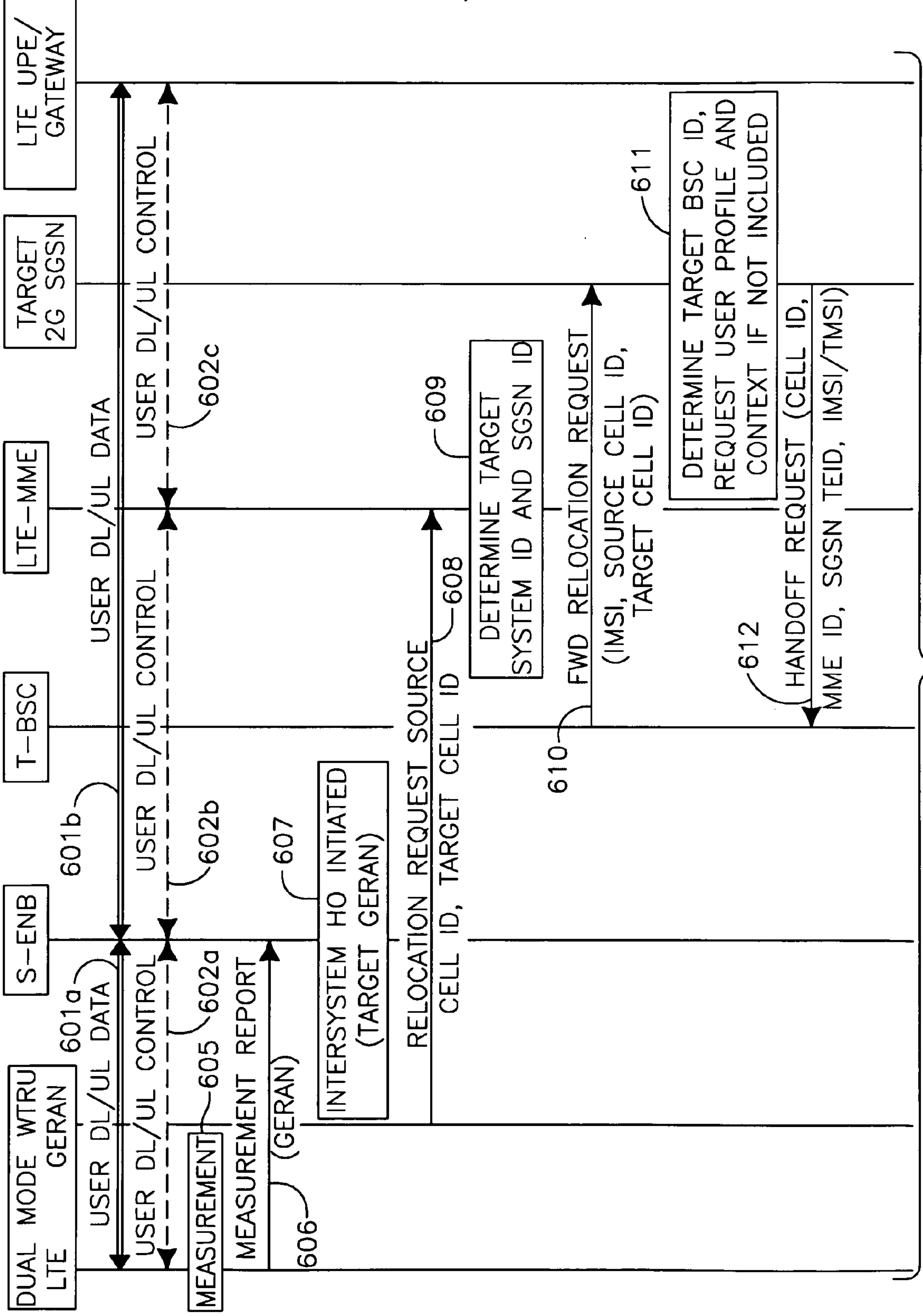
DUAL MODE WTRU LTE GERAN
S-ENB
T-BSC
LTE-MME
TARGET 2G SGSN
LTE UPE/ GATEWAY
601a
USER DL/UL DATA
601b
USER DL/UL DATA
USER DL/UL DATA
602a
USER DL/UL CONTROL
602b
USER DL/UL CONTROL
USER DL/UL CONTROL
602c
USER DL/UL CONTROL
USER DL/UL CONTROL
605
MEASUREMENT
606
MEASUREMENT REPORT (GERAN)
607
INTERSYSTEM HO INTIATED (TARGET GERAN)
608
RELOCATION REQUEST SOURCE CELL ID, TARGET CELL ID
609
DETERMINE TARGET SYSTEM ID AND SGSN ID
610
FWD RELOCATION REQUEST (IMSI, SOURCE CELL ID, TARGET CELL ID)
611
DETERMINE TARGET BSC ID, REQUEST USER PROFILE AND CONTEXT IF NOT INCLUDED
612
HANDOFF REQUEST (CELL ID, MME ID, SGSN TEID, IMSI/TMSI)
TO FIG. 7B

FIG.7A

FROM FIG. 7A

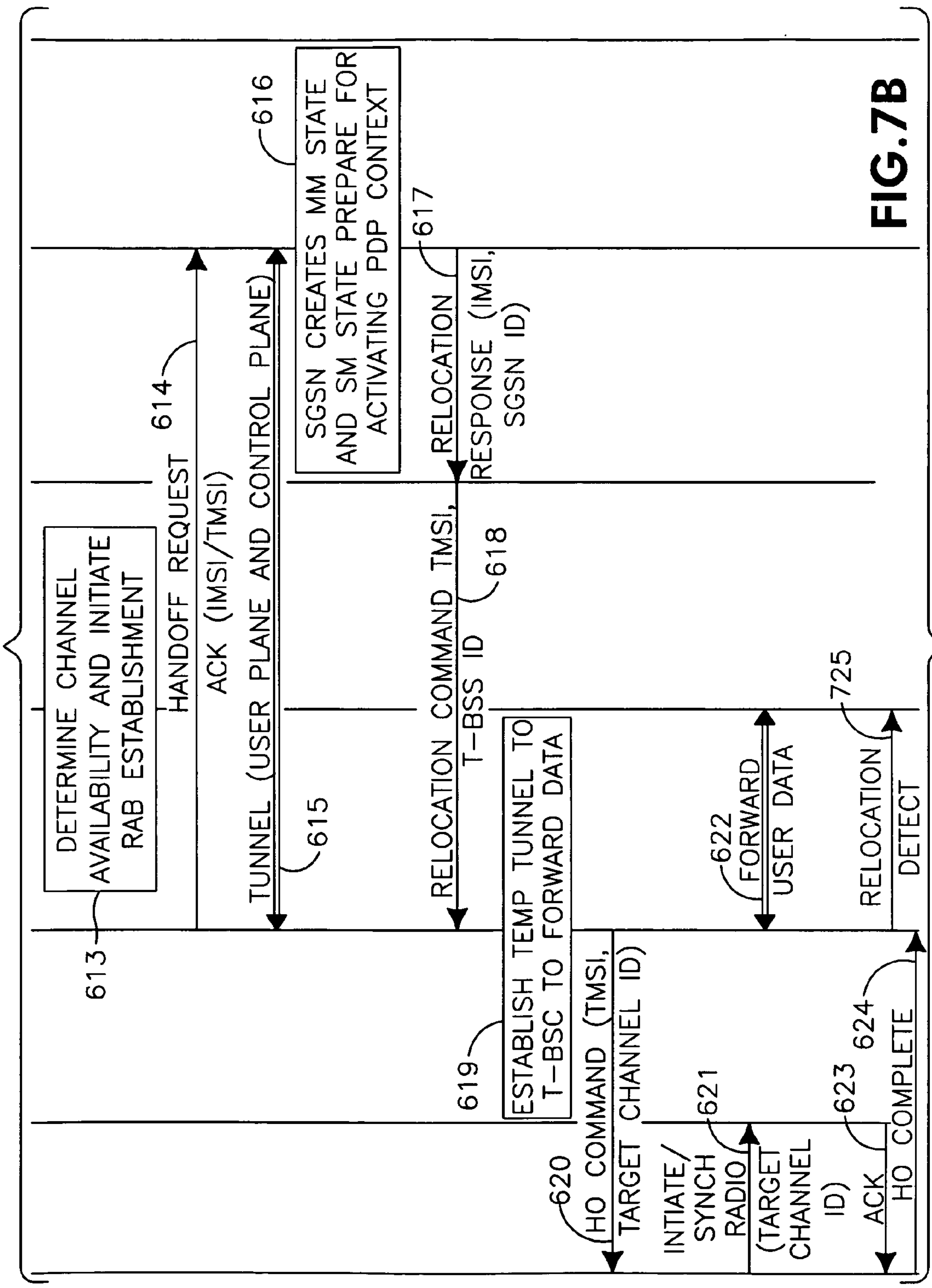

FIG.7B

TO FIG. 7C

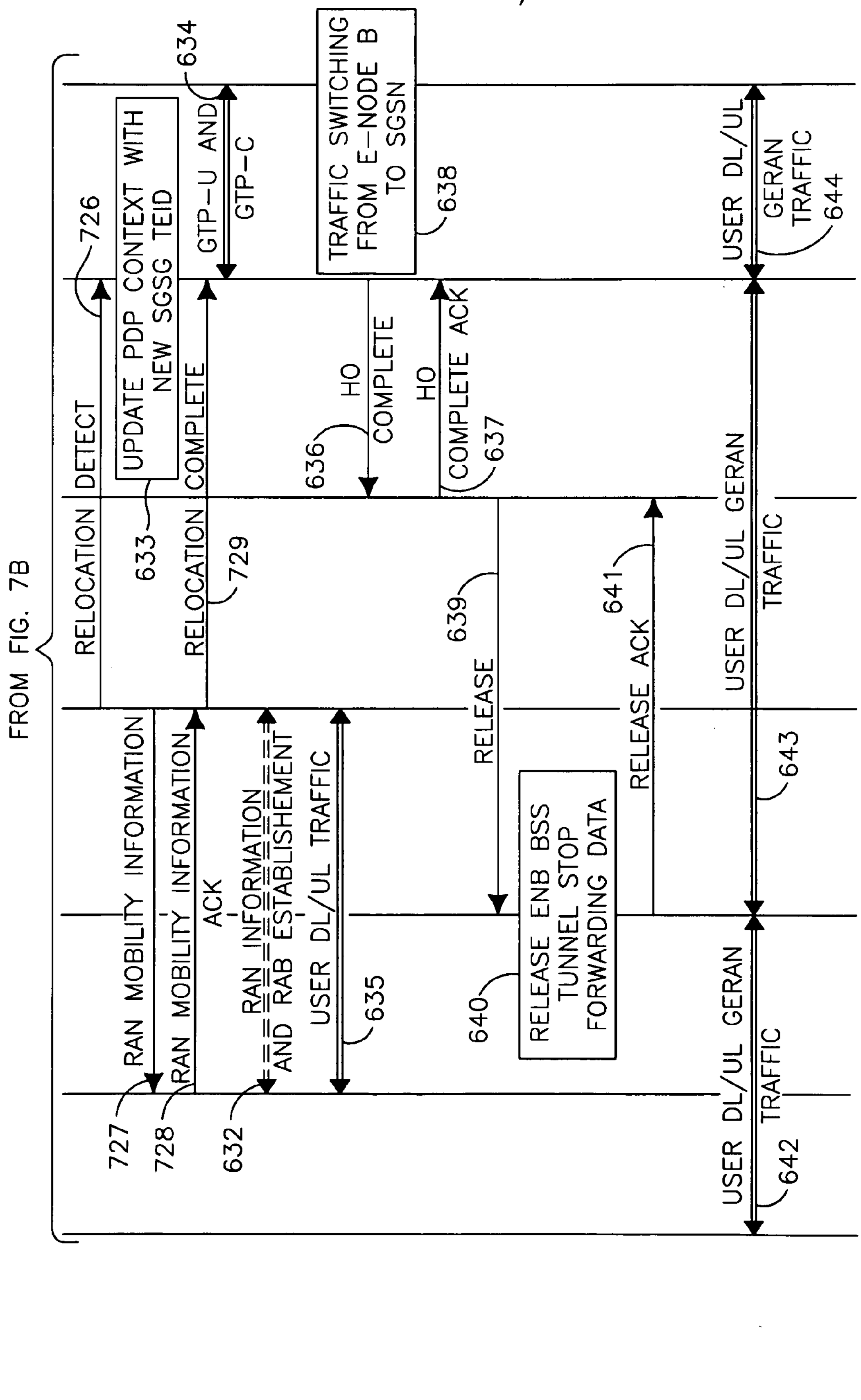
FROM FIG. 7B
RAN MOBILITY INFORMATION
727
RAN MOBILITY INFORMATION ACK
728
RAN INFORMATION AND RAB ESTABLISHEMENT
632
USER DL/UL TRAFFIC
635
RELOCATION DETECT
726
UPDATE PDP CONTEXT WITH NEW SGSG TEID
633
RELOCATION COMPLETE
729
GTP-U AND GTP-C
634
HO COMPLETE
636
HO COMPLETE ACK
637
TRAFFIC SWITCHING FROM E-NODE B TO SGSN
638
RELEASE
639
RELEASE ENB BSS TUNNEL STOP FORWARDING DATA
640
RELEASE ACK
641
USER DL/UL GERAN TRAFFIC
642
643
USER DL/UL GERAN TRAFFIC
USER DL/UL GERAN TRAFFIC
644

FIG.7C