Nokia Siemens Networks

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RNC Call Setup and Release

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Summary of changes

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made to previous issues.

Changes between issues 6-2 and 6-3

Radio access bearer setup section has been updated with information about non-real time DCH bit rate.

Chapter *Congestion and preemption over Iur* has been added.

Feature *RAN1759: Support for I-HSPA Sharing and Iur Mobility Enhancements* has been added to *Features per release* chapter.

RAN1759: Support for I-HSPA Sharing and Iur Mobility Enhancements parameter has been added to *Management data for Call Setup and Release* chapter.

URA_PCH state has been added to Table *UE cell states*.

Editorial change to section *Radio link reconfiguration* has been made.

Changes between issues 6-1 and 6-2

References to the following features have been removed from *Features per release* and *Management data for Call Setup and Release*:

- RAN1.011 UE Location management with handover procedures
- RAN1.013 Layer 2 for the real-time radio access bearers
- RAN1.014 Macro diversity combining and splitting
- RAN1.016 Layer 2 for the non-real-time radio access bearers
- RAN1.017 Transport channels and physical channels
- RAN1.018 Transport channel coding and multiplexing

- RAN1.019 Spreading and modulation
- RAN1.021 BTS Logical resource management
- RAN1.022 Packet data handling on Iu
- RAN2.0041 LCS - Cell coverage based (RTT) with geographical coordinates
- RAN2.0023 Service area broadcast
- RAN2.0022 Support for volume based charging
- RAN2.0091 Early UE handling
- RAN839: HSDPA 16 Users per Cell
- RAN1164: HSDPA Service Indicator
- RAN814: Intelligent Directed Emergency Call Inter-system Handover for US

Changes between issues 6-0 and 6-1

Information on management data has been added.

1 Call setup and release

Call setup and release refers to setting up or releasing a speech or data connection between the end-user user equipment (UE) and the core network (CN). When the UE is in the idle state, it has no radio resource control connection (RRC connection) to the radio access network. RRC is used to optimise the capability of the UE in sending and receiving signals over the air interface. Only one RRC connection is used between the UE and the network, regardless of the number of radio access bearers (RABs) and services used.

The RRC connection is always initiated by the UE, and its establishment and release is handled by the RRC protocol. Once the RRC connection is established, it is possible to take into use various radio bearers (RB) and signalling radio bearers (SRB). The role of this radio bearer service is to cover all the aspects of the radio interface transport. These radio bearers can make use of both dedicated RRC channels and common channels. On common channels, RACH is used in uplink and FACH in downlink. The radio access bearer service handles circuit-switched speech calls, circuit-switched data calls as well as packet-switched data calls.

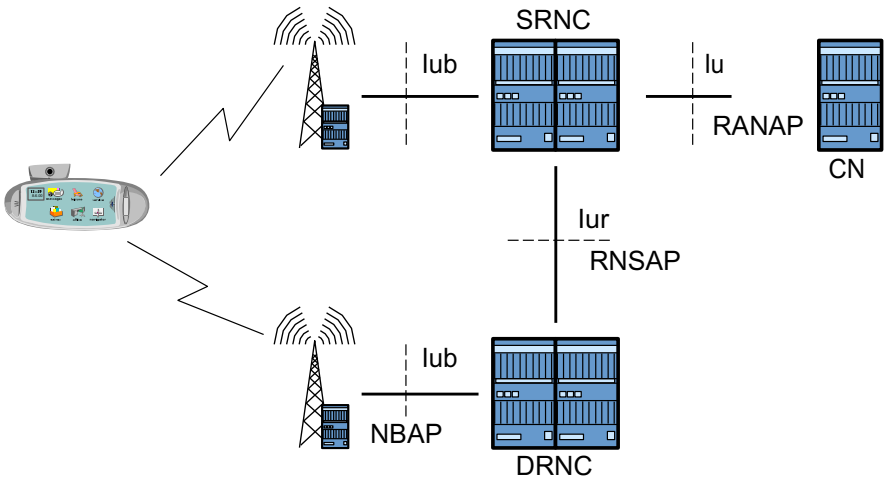

Figure 1. Signalling protocols

RANAP layer

The RANAP layer includes all the RANAP signalling entities of the Radio Network Controller (RNC) and the related application for RANAP signalling entity management.

A RANAP signalling entity is a serving RNC functionality responsible for the RANAP connection-specific signalling and information management between the RNC and core network for the UE.

RNSAP layer

The RNSAP layer includes all the RNSAP signalling entities of the RNC and the related application for RNSAP signalling entity management.

A RNSAP signalling entity is an RNC functionality responsible for RNSAP-connection-specific signalling and information management between two RNCs for the UE.

NBAP layer

The NBAP layer includes all common and dedicated NBAP signalling entities of the RNC or the Base Transceiver Station (BTS) and the related application for the NBAP signalling entity management.

A common NBAP signalling entity is a BTS or a controlling RNC functionality responsible for the logical resource management, BCH management, and communication context creation for one BTS.

A dedicated NBAP signalling entity is a BTS or a controlling RNC functionality responsible for the radio link management for a group of UEs.

RRC layer

The RRC layer includes all the RRC signalling entities of the RNC and the related application for RRC signalling entity management.

The RRC signalling entity is a serving RNC functionality responsible for the RRC connection-specific signalling and information management for the UE.

Overview of setting up a call

The procedure of setting up a call depends on whether the call is mobile-originated or mobile-terminated.

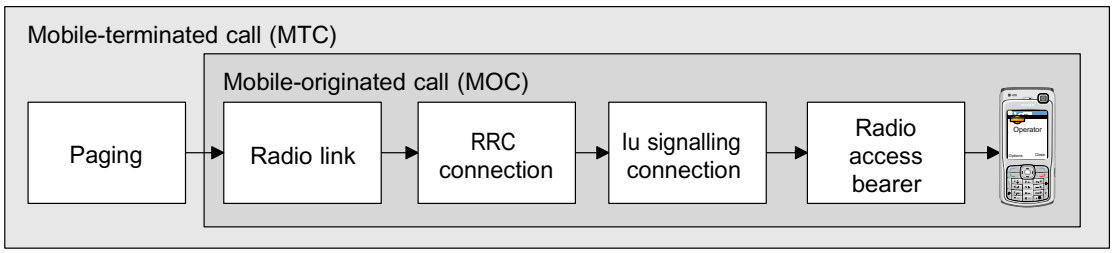

Figure 2. Overview of setting up a call

In case of a mobile-terminated call (MTC), the process starts with paging. Paging is the procedure by which a mobile network attempts to locate the UE within its location area before any other network-initiated procedure can take place.

If the UE originates the call, paging is not needed and the UE directly requests RRC connection setup.

After having established an RRC connection, the UE starts setting up a signalling connection to the CN. For that, a new radio link is needed.

Finally, the radio access bearer setup procedure builds a radio access bearer service between the UE and the core network (CN), and the call is established.

2 Real-time and non-real time services

Real-time (RT) services involve mobile-originated and mobile-terminated speech and data calls, as well as real time packet-switched (PS) data transmissions.

Non-real time (NRT) handles only packet-switched transmissions. Individual procedures presented in the figures are described in *Call setup and release*.

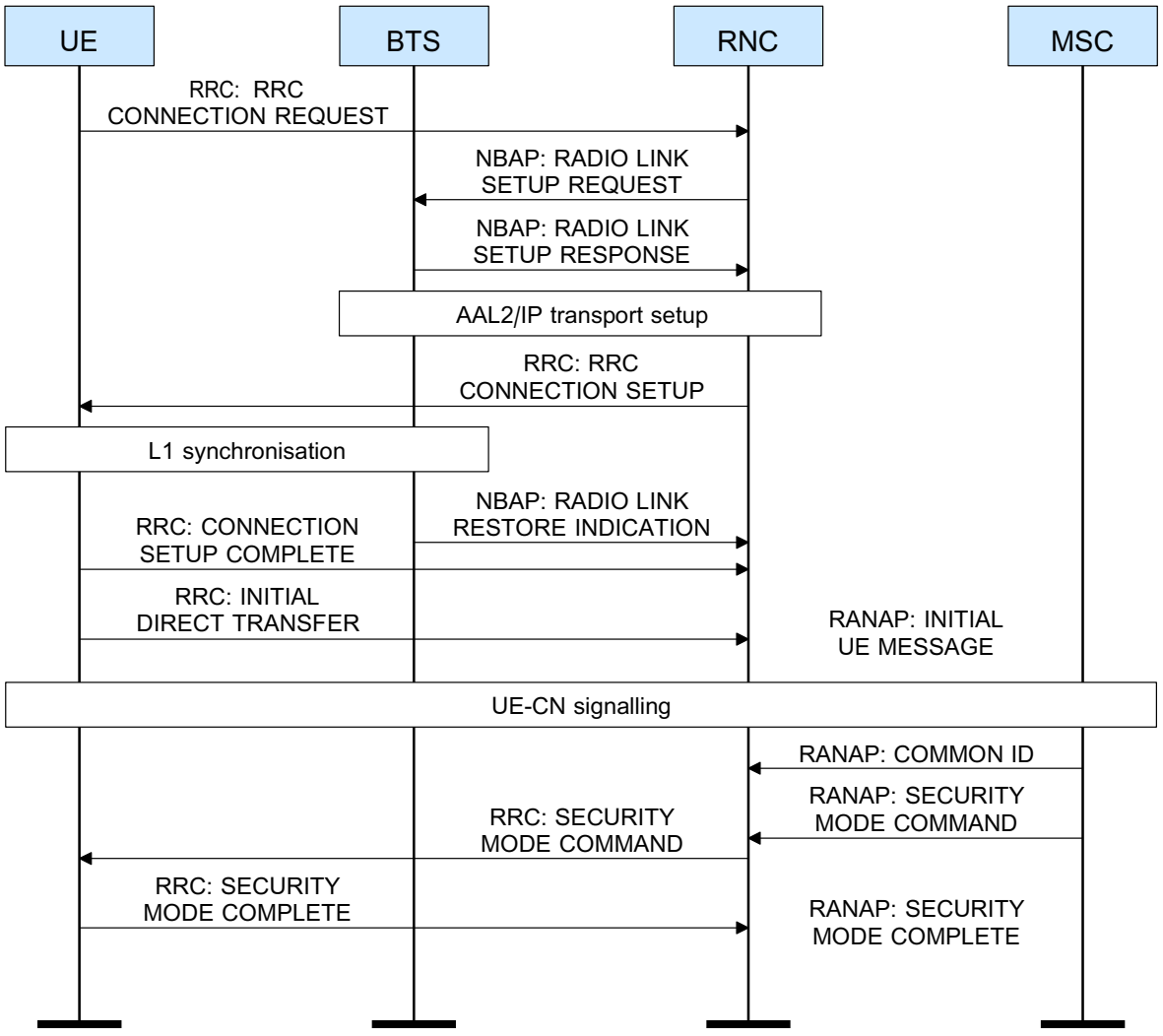

Figure 3. Mobile-originated call (CS), 1/2

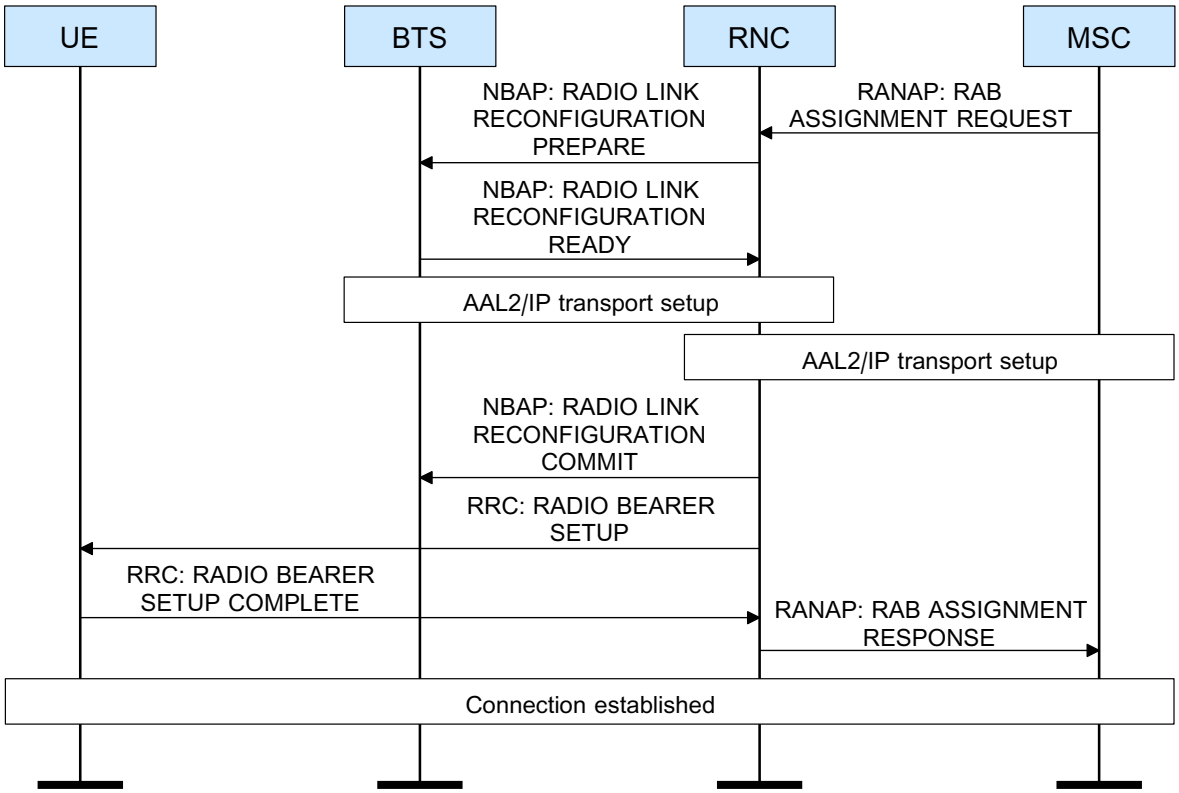

Figure 4. Mobile-originated call (CS), 2/2

The following figure illustrates the mobile-terminated circuit-switched (CS) call. The only difference between a mobile-originated and mobile-terminated call is that only mobile-terminated calls include paging the UE.

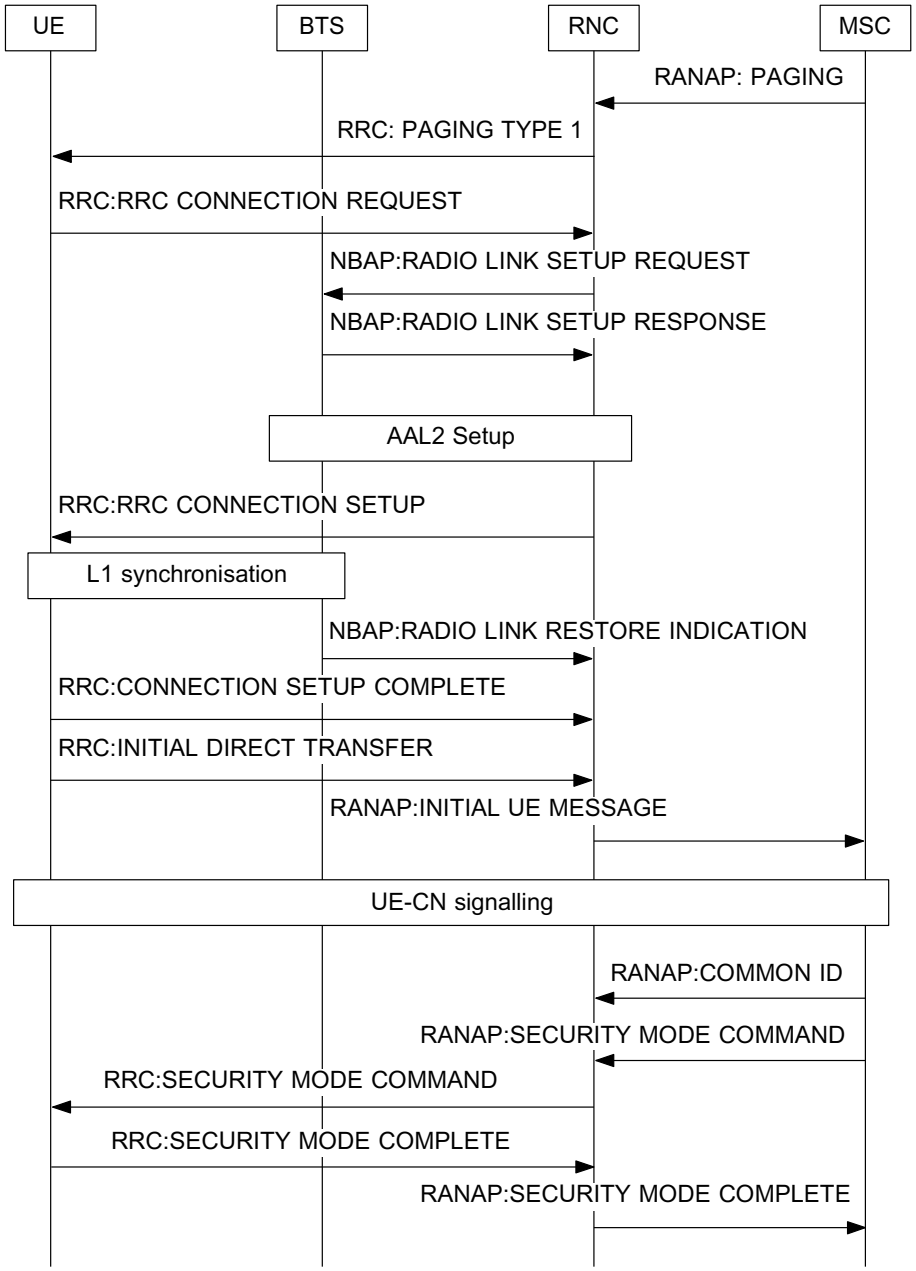

Figure 5. Mobile-terminated call (CS), 1/2

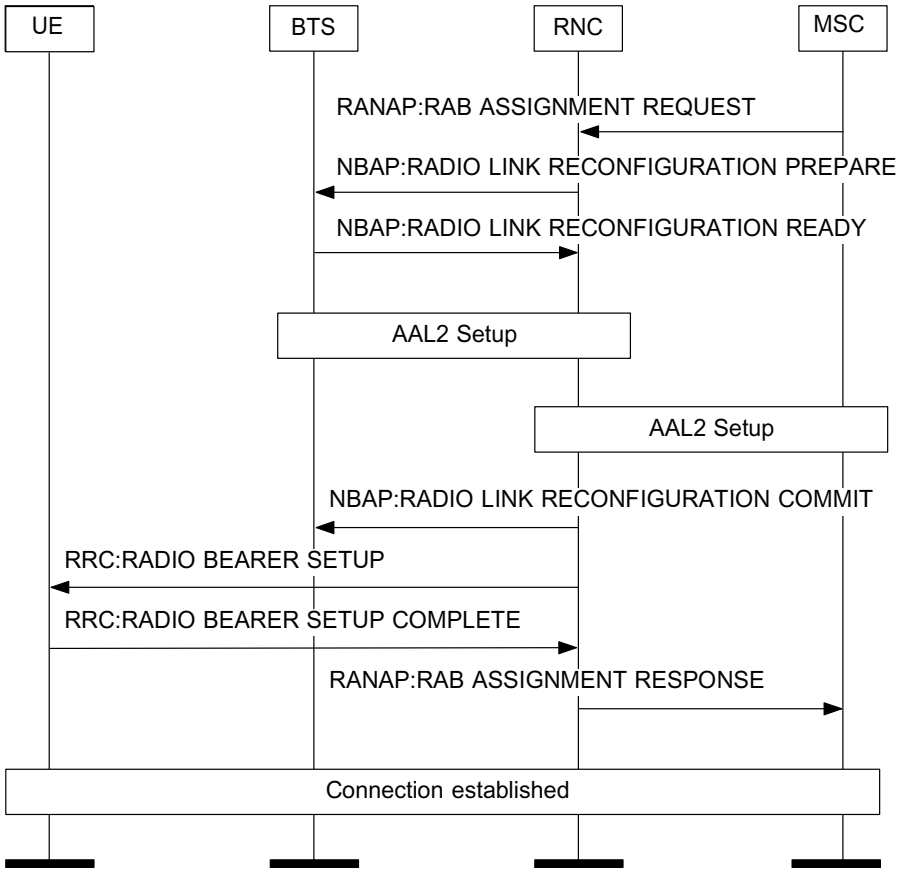

Figure 6. Mobile-terminated call (CS), 2/2

Non-real time services only involve packet-switched data calls. For non-real time services, the radio access bearer is created without immediately reserving radio resources. The resources are allocated on demand by using the signalling link between the UE and the RNC. The following figures illustrate the process of establishing a packet-switched call.

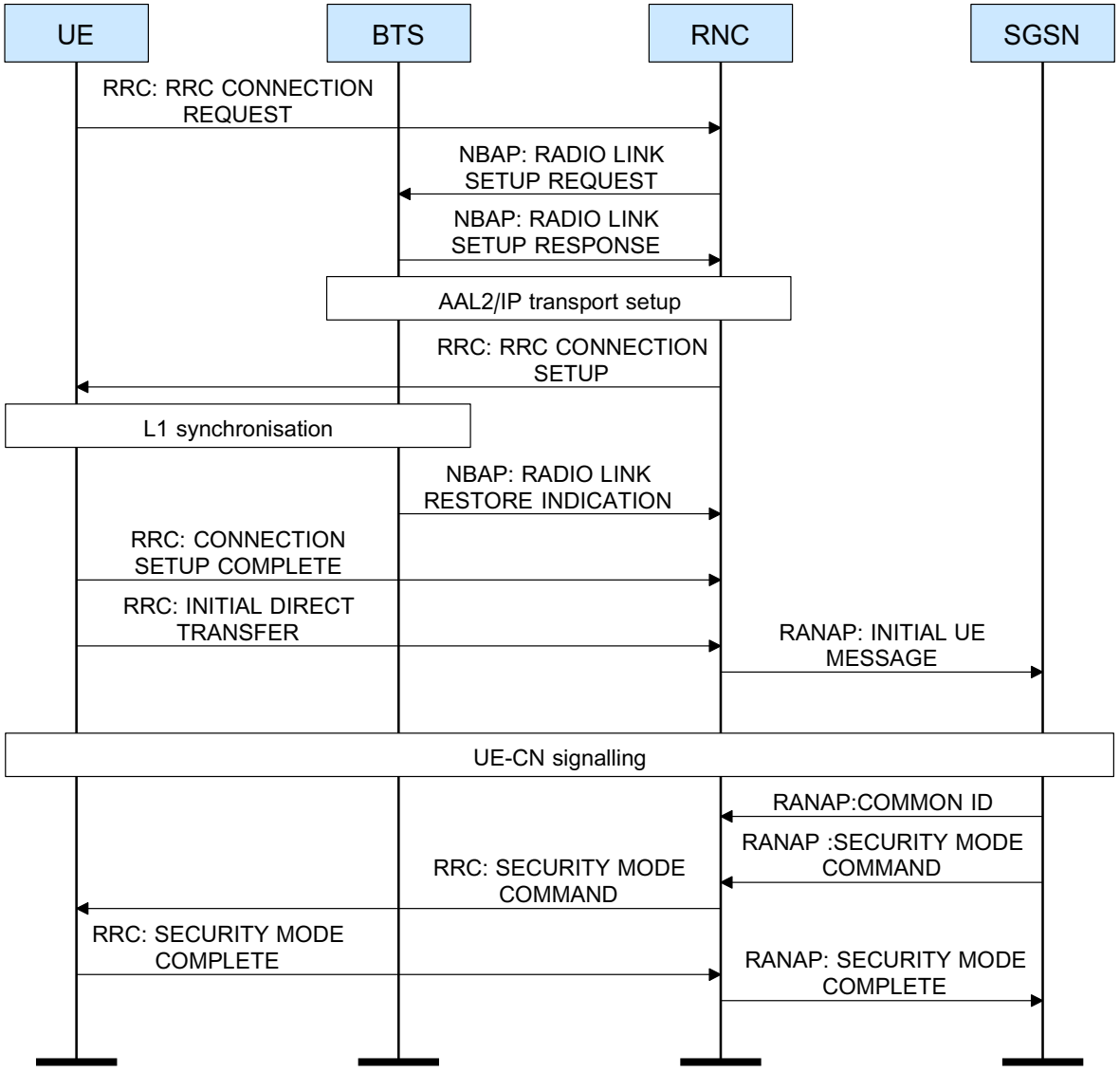

Figure 7. Mobile-originated call (PS), 1/2

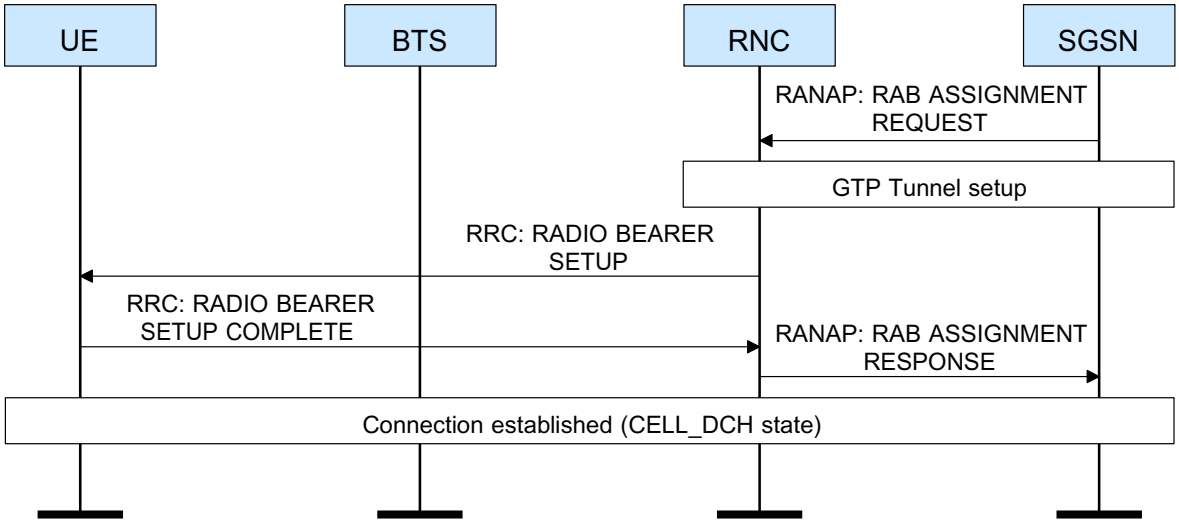

Figure 8. Mobile-originated call (PS), 2/2

The following figure illustrates the mobile-terminated packet-switched call. The only difference between mobile-originated and mobile-terminated calls is that only mobile-terminated calls include paging the UE.

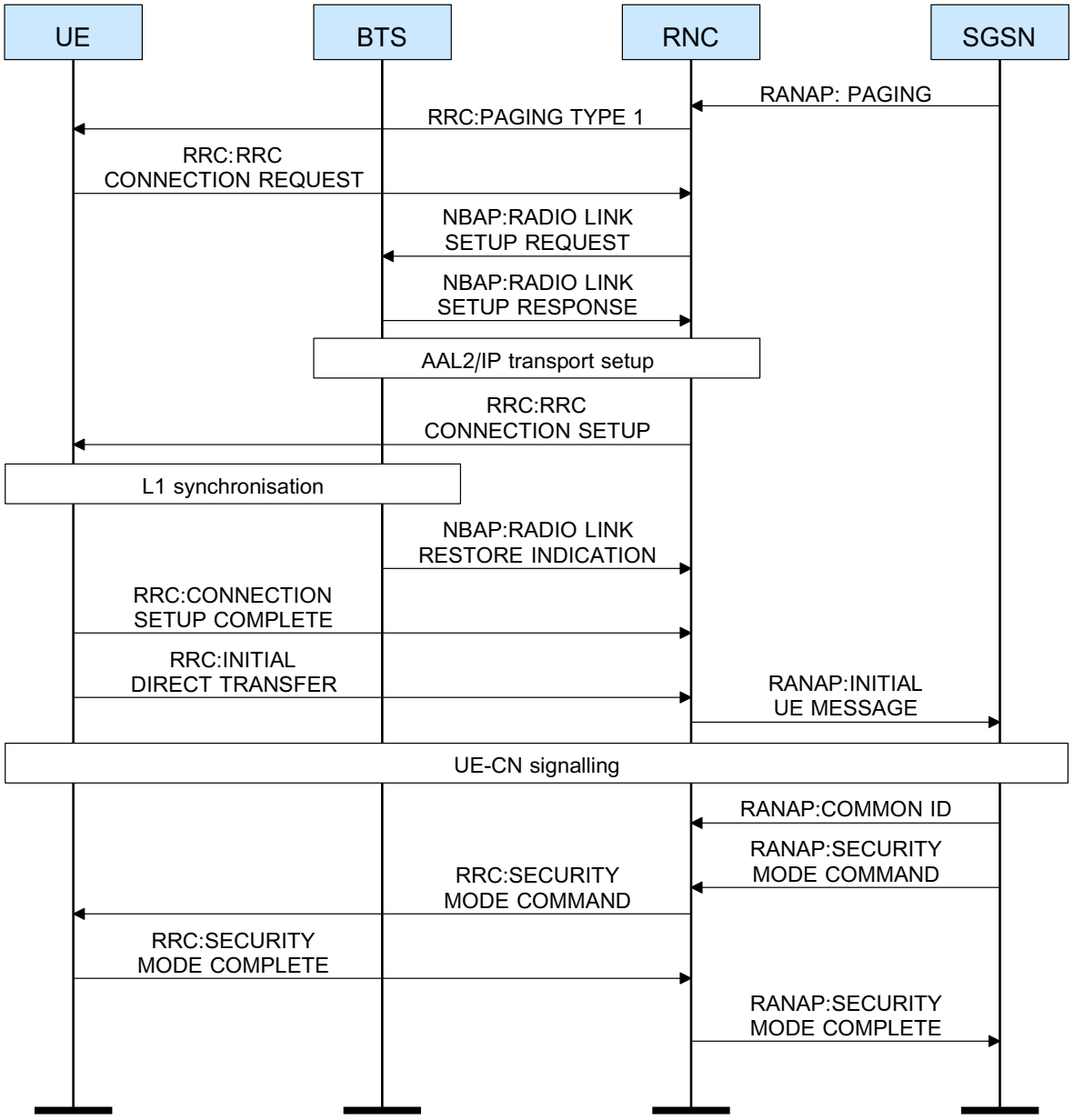

Figure 9. Mobile-terminated call (PS), 1/2

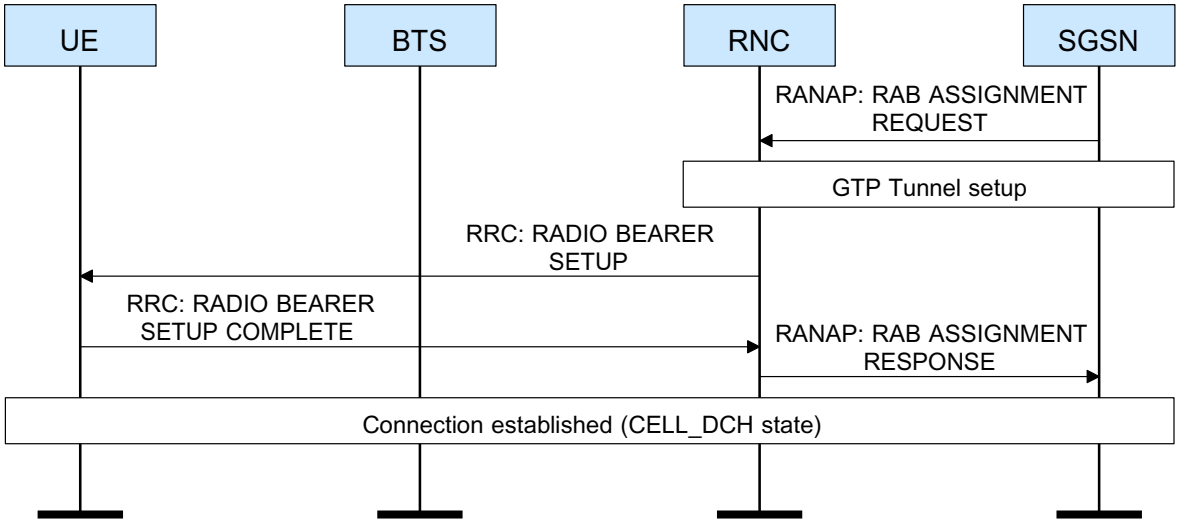

Figure 10. Mobile-terminated call (PS), 2/2

3 Paging

Paging is necessary for the CN to reach the UE from the specific location or routing area. In idle mode, paging is always initiated by the CN. In CS paging, the CN and further the RNC broadcast paging messages through base stations of the routing area in which the UE is situated.

To save on power consumption, the UE can use discontinuous reception (DRX). This means that the network pages the UE according to a preset sequence of frames during specific intervals. This preset frame sequence interval is called a DRX cycle. DRX cycles can vary in length, and in case the UE is connected to two different CN domains with different DRX cycle lengths, the UE uses the shortest DRX cycle. The UE can store each domain-specific DRX cycle of each CN it is currently attached to.

If the CN sends a specific DRX cycle length coefficient, the RAN uses it in the paging message. If there is no CN-specific coefficient, the RAN uses the default value for CN-specific DRX cycle length coefficient in the radio network database.

The RNC sends paging requests to all WCDMA BTSs which belong to the paging area where the UE is currently registered. The cells in a single BTS can belong to different paging areas.

Each paging message on the Iu interface involves only the UE and therefore, the RNC has to pack the pages into the relevant radio interface paging message.

3.1 Paging the UE in idle mode

The RNC checks whether the paged UE is engaged in an ongoing radio resource control (RRC) connection. If there is no connection, the RNC starts the idle mode paging procedure. As a result, the UE starts the RRC connection setup procedure.

The procedure using the PAGING TYPE 1 message is referred to as *paging procedure* in the *3GPP RRC specification*.

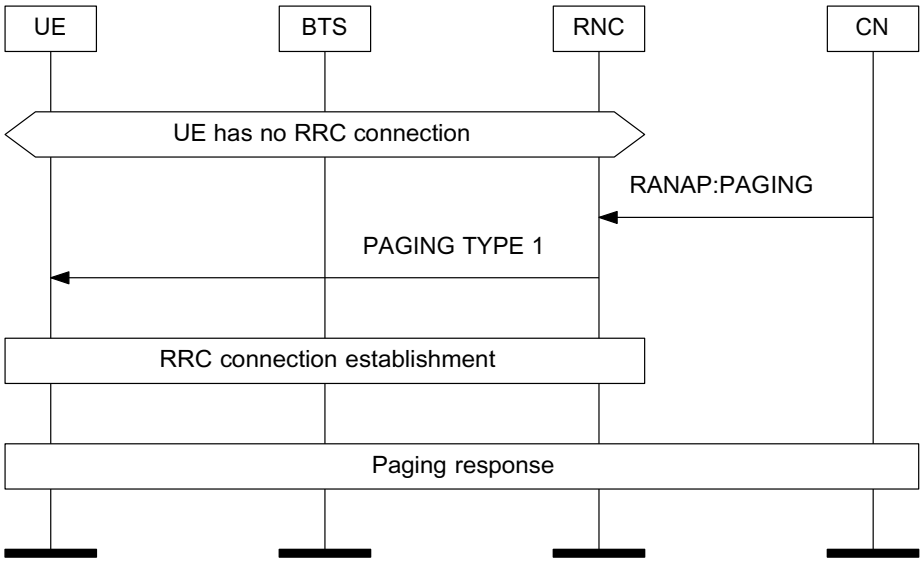

Figure 11. Paging the UE in idle mode

3.2 Paging the UE in connected mode

The RNC checks whether the paged UE already has an RRC connection.

If it does not, the idle mode paging procedure using RRC:PAGING TYPE 1 message is applied. The CN is responsible for making repetitions for this paging procedure.

If the UE is in UTRA RRC connected mode, also the RRC state of the UE is checked. Depending on the current RRC state, the RNC initiates a *UE-dedicated paging type 2 procedure* or a *connected mode paging type 1 procedure*.

3.2.1 UE-dedicated channel paging procedure

If the UE is in CELL_DCH or CELL_FACH state, there is a dedicated signalling link allocated for the UE in the Uu interface. The RNC sends a paging message (RRC:PAGING TYPE 2) to an RRC-connected UE through the existing RRC connection.

The procedure using the PAGING TYPE 2 message is referred to as *UE-dedicated paging procedure* in the *3GPP RRC specification*.

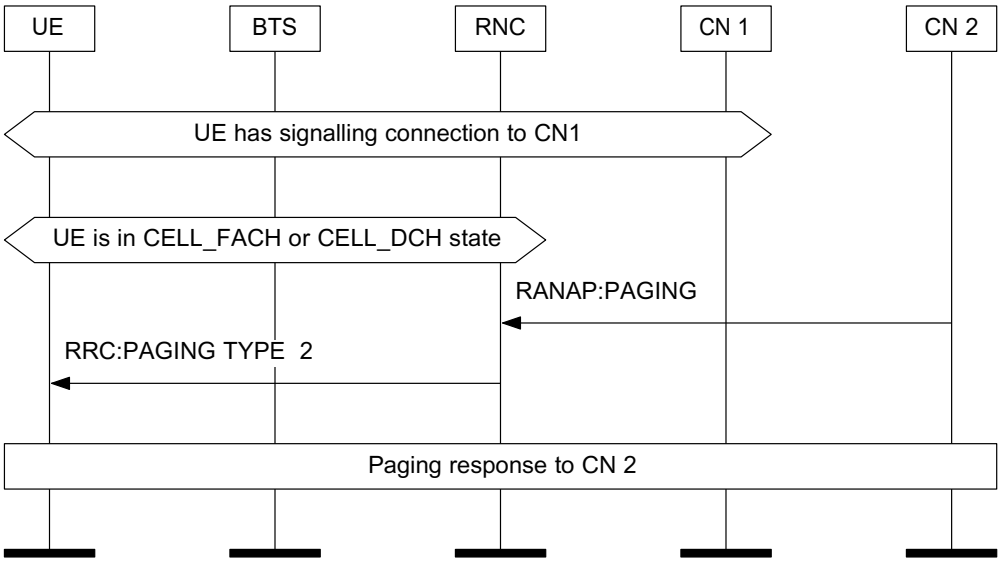

Figure 12. Paging the UE in connected mode (CELL_FACH or CELL_DCH state)

3.2.2 Connected mode paging type 1 procedure

If the UE is in CELL_PCH or URA_PCH state, the RNC originates the paging procedure (RRC:PAGING TYPE1). The paging procedure can be triggered due to an idle mode paging received from the CS CN or due to downlink data (or signalling) received from the PS CN. If there is no response received from the UE, the RNC repeats the paging procedure in a predefined interval.

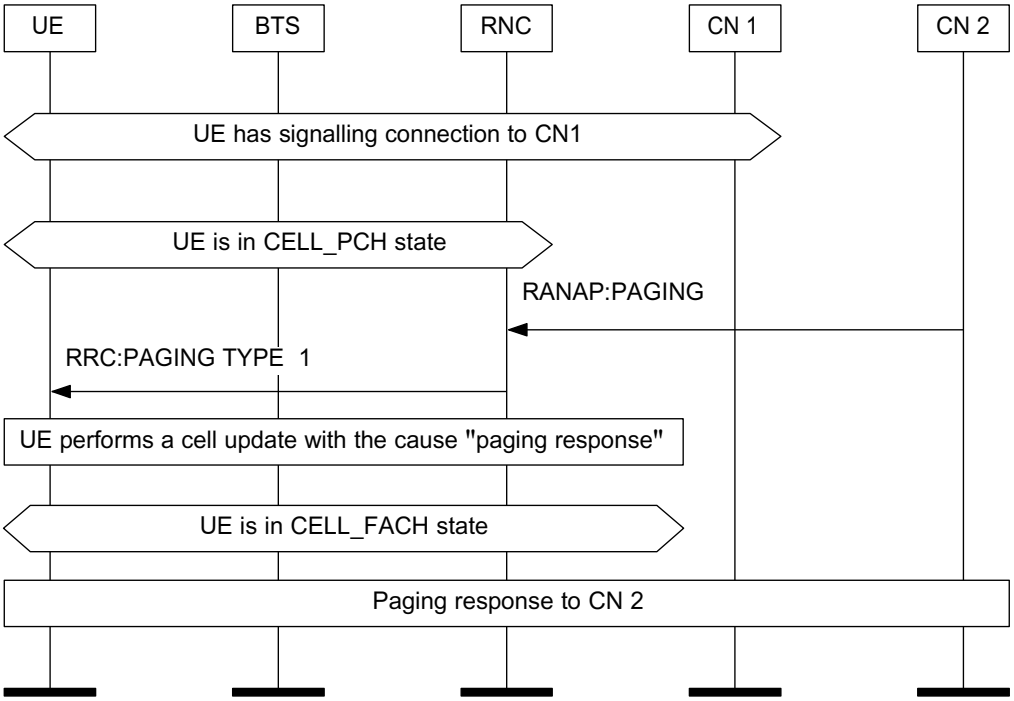

Figure 13. Paging the UE in connected mode (CELL_PCH state)

3.3 RNC-originated paging

To save its battery, the UE can reside on common channels (the paging channel) while still maintaining the RRC connection to the RNC. In such a case, the RNC needs to page the UE when there is downlink user data or a downlink signalling message addressed to the UE. This is because in CELL_PCH and URA_PCH states, the DCCH logical channel cannot be used. Therefore, the RNC transmits a paging request on the PCCH logical channel in the known cell (CELL_PCH) or group of cells (URA_PCH) where the UE is located. The RNC's RRC signalling entity starts the paging procedure. As a response, the UE moves to the CELL_FACH state and starts the cell update procedure with the cause *paging response*.

If the UE in CELL_PCH or URA_PCH state needs to transmit anything to the RAN, it moves to the CELL_FACH state and executes a cell update procedure with the cause *UL data transmission*.

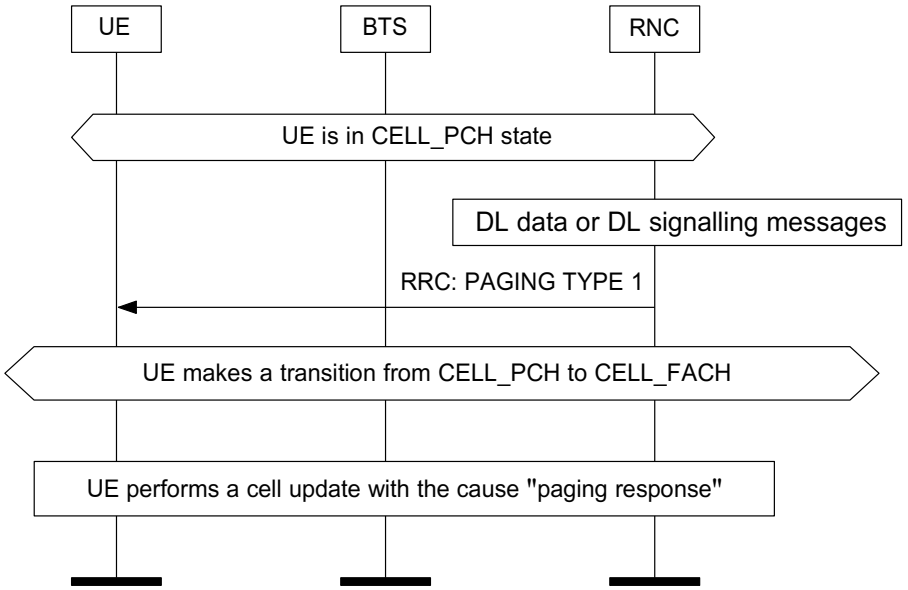

Figure 14. RNC-originated paging

4 RRC connection setup and release

4.1 RRC connection setup

The radio resource control (RRC) connection is always started by the UE. The UE sends a message to the RNC requesting RRC connection setup. The RNC sets up a radio link and sends the UE the physical channel information. After the UE has synchronised itself to the WCDMA BTS, it transmits an acknowledgement to the RNC.

Once the UE has set up the RRC connection, it can send higher-layer messages, for instance, a call setup message.

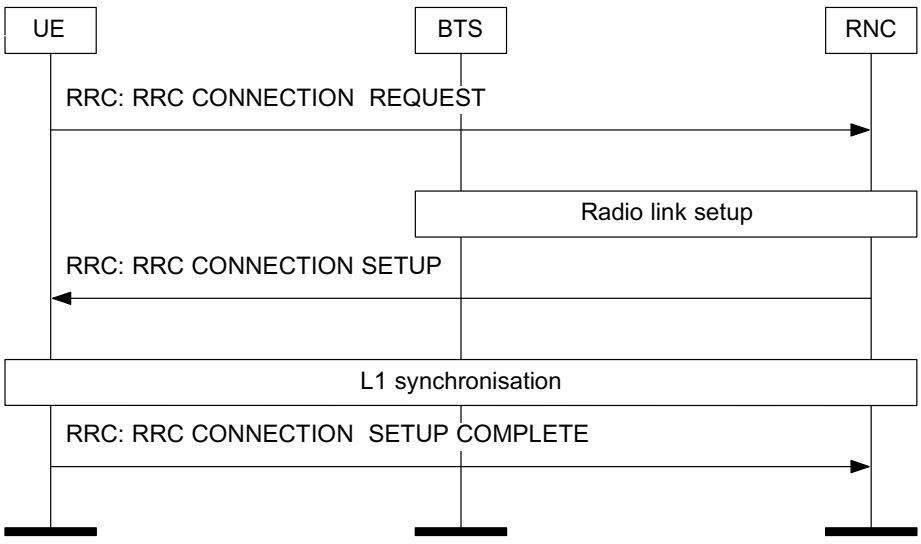

Figure 15. Setting up an RRC connection

The following figure illustrates an example of an RRC connection failure. The RNC can fail in its attempt to set up a radio link due to hardware blocking, for instance. Also, admission control can reject the setup attempt. In an error situation, the RNC transmits an RRC connection setup reject message, and the UE initiates an RRC connection setup retry timer. When the timer expires, the UE can attempt to set up the RRC connection again.

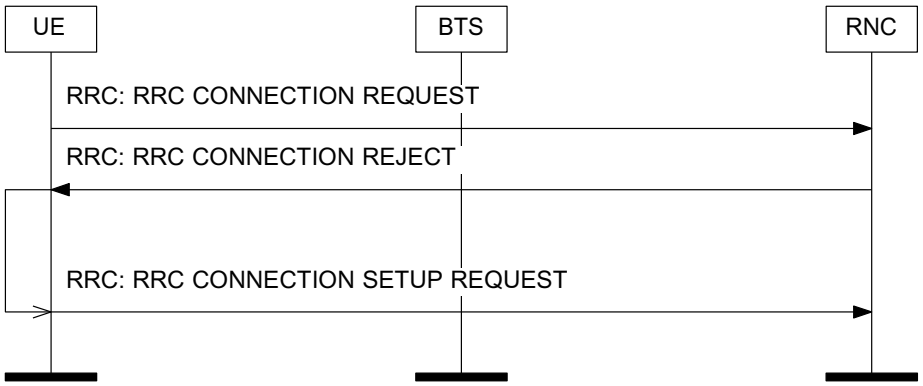

Figure 16. RRC connection setup failure and retry

Directed RRC connection setup

Directed RRC connection setup provides an efficient way to balance the load between two (or more) carrier frequencies (cells having equal coverage areas) within one BTS. The RNC balances the load by establishing an RNC connection on the carrier frequency (cell) which has less load. The admission control of the RNC makes a decision on whether to perform the directed RRC connection setup procedure. Directed RRC connection setup is controlled with RNP parameters.

RNC commands the UE to the different frequency by using the *RRC Connection Setup* message.

4.2 RRC connection release

The RRC connection is released when the UE no longer has an active signalling connection to any core network (CN) node. The UE and the CN negotiate about the release, and after that, the CN sends a release command. The UE in CELL_DCH state sends a layer 3 acknowledgement message in unacknowledged mode of RLC to the radio access network. If the UE receives the release message while in CELL_FACH state, it responds to the RAN using an acknowledged mode of RLC.

After the UE response, the RNC starts the radio link release procedure towards the BTS, releases transport bearers on the Iub interface and sends an acknowledgement to the core network. The RNC can delete the RRC entity of the UE at the same time with the radio link release procedures.

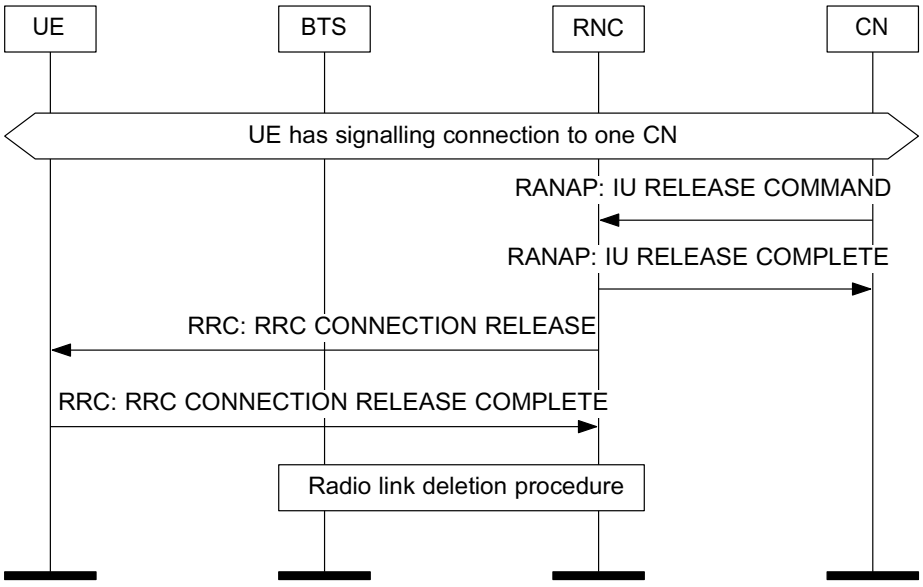

Figure 17. RRC connection release in CELL_DCH state

5 Signalling connection setup and release

5.1 Direct transfer

After having established an RRC connection, the UE starts setting up a signalling connection to the core network (CN). The UE sends a message to the RNC which generates a different message to the CN, depending on whether or not there is an active signalling connection to the CN domain.

The UE initiates signalling connection establishment to the CN after having established an RRC connection with an RRC:INITIAL DIRECT TRANSFER message. This message triggers the upper layers to initiate a signalling connection to the core network and to transfer a non-access stratum (NAS) message. The RNC establishes a signalling connection and forwards the (NAS) message of the RRC:INITIAL DIRECT TRANSFER message to the CN using a RANAP:INITIAL UE MESSAGE message.

If the RNC fails in transferring the message to the UE, the CN does not get an indication of the failure. Higher layers are used to repeat the message.

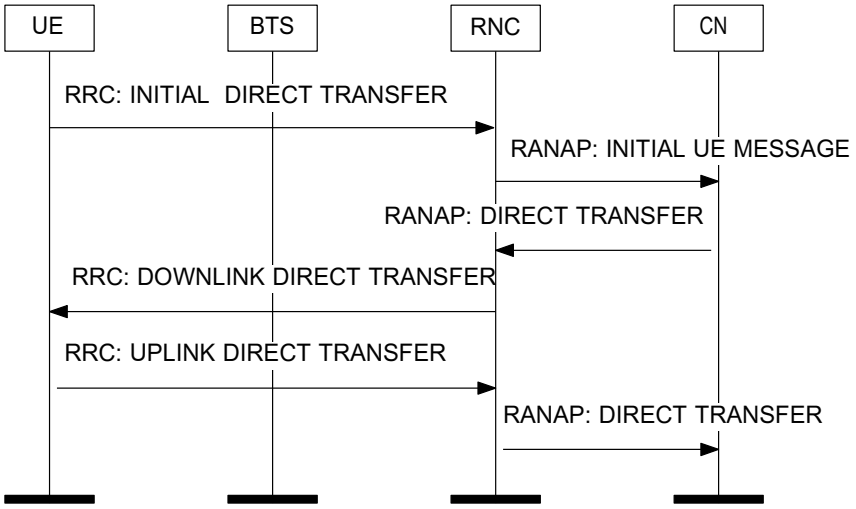

Figure 18. Signalling connection setup

5.2 Signalling connection release

Signalling connection release can be requested by the CN or by the UE. The UE can have an ongoing signalling connection to one circuit-switched and one packet-switched core network simultaneously. If one network then requests the release of the signalling connection by running the Iu release procedure, the RNC detects that there is still another signalling connection using the current RRC connection. The RRC connection is not released but the UE is informed that one of the signalling connections is released.

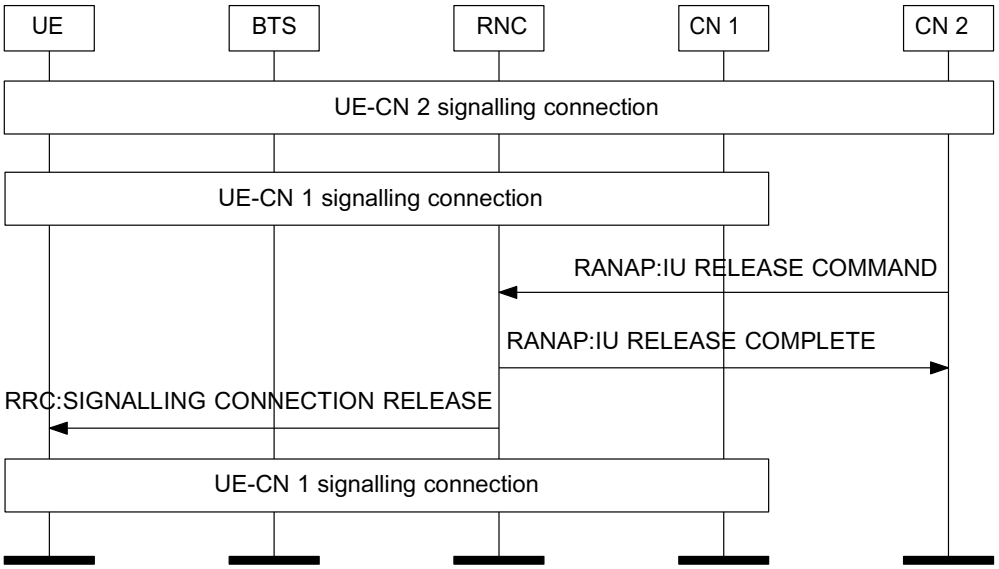

Figure 19. Signalling connection release requested by the CN

When the UE requests the release of a signalling connection, either the signalling connection release or the RRC connection release procedure is run. The number of current signalling connections determines which of these release procedures is run. If the UE has two signalling connections, the signalling connection release procedure is run (as in the figure) and the UE continues to have a signalling connection to one core network. If the UE has only one signalling connection from before, the RRC connection release procedure is run after which the UE is no longer connected to any core network.

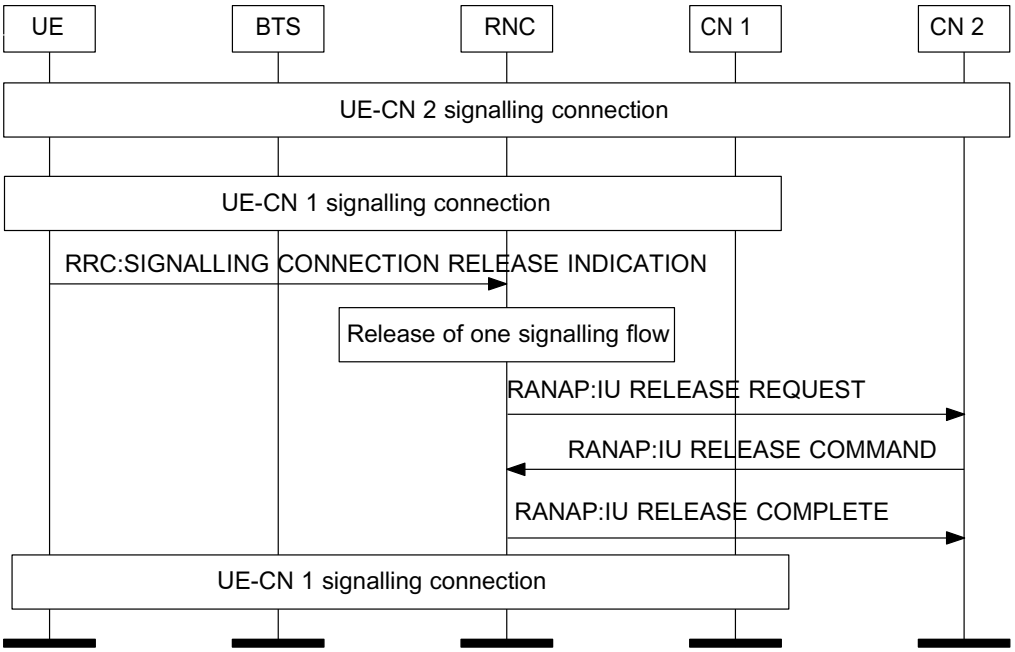

Figure 20. Signalling connection release requested by the UE (all flows are not released)

6 Radio link setup, reconfiguration and deletion

6.1 Radio link setup

Radio link setup procedure is started when a new radio link is needed, for instance, when a new signalling link is set up or when a handover is performed. The RNC determines the radio link parameters and requests radio link activation at the BTS. In the first radio link setup, the BTS selects the traffic termination point for the communication context and sends the identification of the associated NBAP signalling link to the RNC. The radio link allocation is valid at the BTS until the RNC orders radio link deletion.

The procedure also starts the creation or modification of a communication context. Communication context contains information about all activity in one traffic termination point concerning the UE. It is used to associate a set of radio links together at the BTS.

Transport channel can be DCH, E-DCH or HS-DSCH, or combination of those so that all PS services use the same uplink and downlink transport channel configuration (DCH/DCH, HS-DSCH/DCH, HS-DSCH/E-DCH) and CS services use only DCH/DCH.

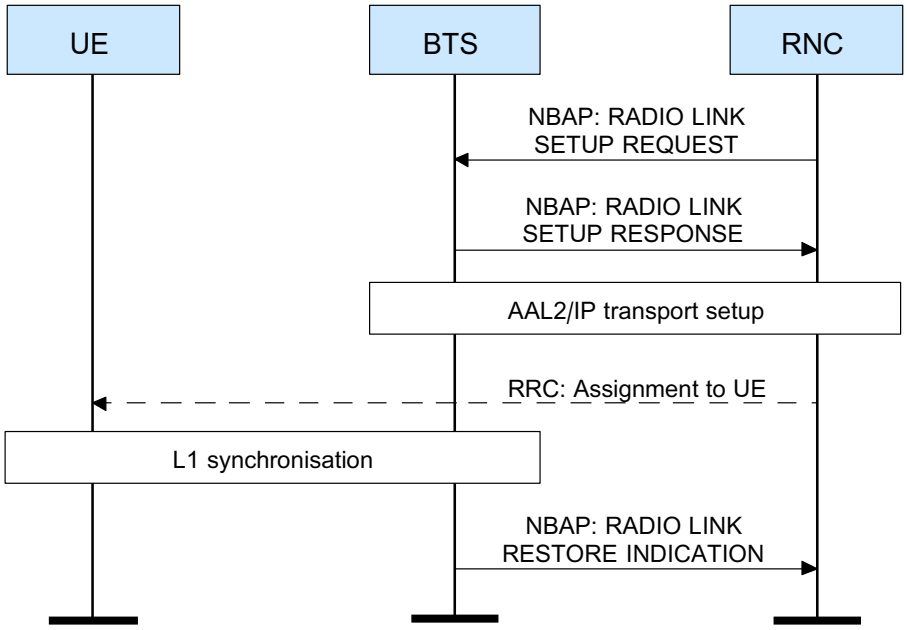

Figure 21. Radio link setup

Error situations that can occur during radio link setup are illustrated in the following figure. Radio link setup can fail, for example, because resources are not available or the controlling RNC communication context is already in use. If radio link setup fails, the BTS sends a failure message to the RNC indicating the cause value. The BTS's L3 Common NBAP signalling entity sends the message to the RNC's L3 Common NBAP signalling entity.

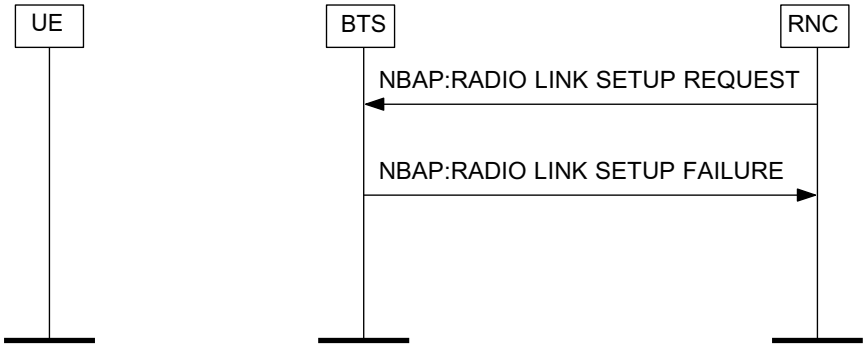

Figure 22. Radio link setup failure

6.2 Radio link reconfiguration

Synchronised radio link reconfiguration is used to add, delete or modify a transport channel (DCH, HS-DSCH or E-DCH) or to modify the radio links belonging to the same communication context. The resource manager of the RNC initiates the reconfiguration procedure.

The situations that can trigger the radio link reconfiguration procedure are:

- radio access bearer setup (AAL2/IP transport setup)
- radio access bearer negotiation (possible AAL2/IP setup, switching, and release)
- radio access bearer release (AAL2/IP transport release)
- NRT rradio access bearer scheduling (AAL2/IP transport setup, possible AAL2/IP transport switching, AAL2 release).

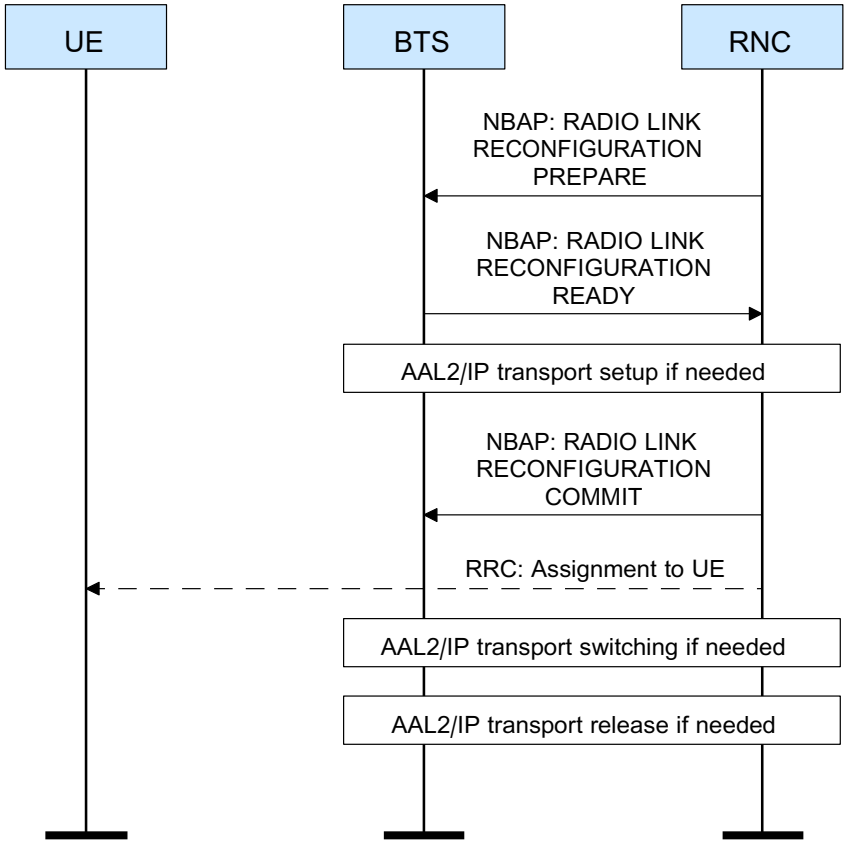

Figure 23. Synchronised radio link reconfiguration

Radio link reconfiguration can fail because of a BTS capability failure or because there are not enough resources, for example. The BTS responds with a failure message to the RNC's prepare message. The failure message indicates the failed radio links and the cause value for the failure.

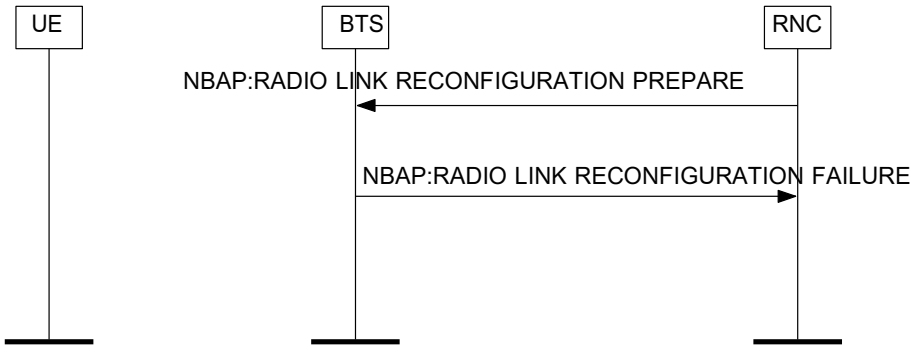

Figure 24. Radio link reconfiguration failure

6.3 Radio link deletion

The RNC starts the radio link deletion procedure to release one or more radio links in a communication context. Active set updates, RRC connection releases and also resets and other error situations such as the BTS and UE being unsynchronised can trigger this procedure.

If the RNC does not receive a response from the BTS before a timer expires, it sends the deletion message again three times. After that, if there is still no answer, the resource manager in the RNC starts recovery actions.

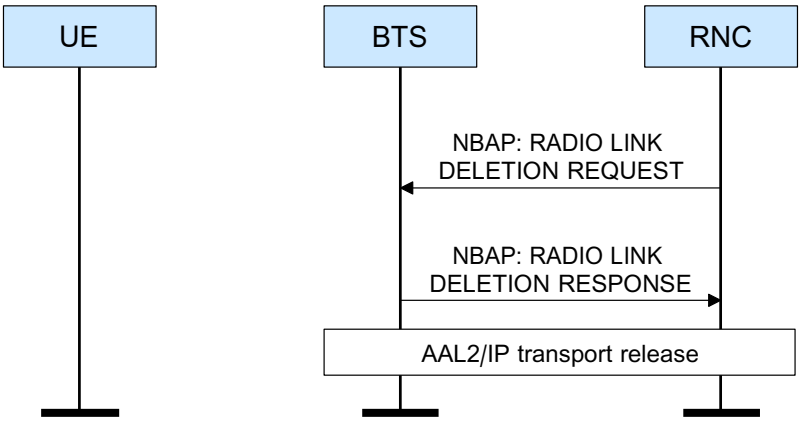

Figure 25. Radio link deletion

7 Radio access bearer setup, reconfiguration and release

7.1 Radio access bearer setup

The radio access bearer setup procedure builds a radio access bearer service between the UE and the core network (CN). The service is negotiated between the UE and CN through the signalling link between the UE and radio access network (RAN) and through the signalling connection between RAN and CN.

Once the CN has all the necessary information, it forwards it to the RNC. The RNC analyses the parameters for radio access bearer service and checks whether the resources needed exist. After that, the RNC activates or modifies the physical uplink and downlink radio channels from the WCDMA BTS and creates the transmission channels at the Iub and Iur interfaces according to the reserved radio resources.

The RNC then sends the new radio link parameters to the UE on the existing signalling link. Once the UE informs the RNC that it uses the new radio link parameters, the RNC acknowledges the information to the CN and radio access bearer establishment is then complete.

The same procedure is also used for adding radio access bearers.

For non-real time (NRT) services, the radio access bearers are created without immediate reservation of radio resources. Instead, radio resources are allocated on demand by using the signalling link between the UE and the RNC. NRT DCH bit rate allocation, downgrade and upgrade are supported also in anchoring situation (all radio links under other than serving RNC (SRNC)).

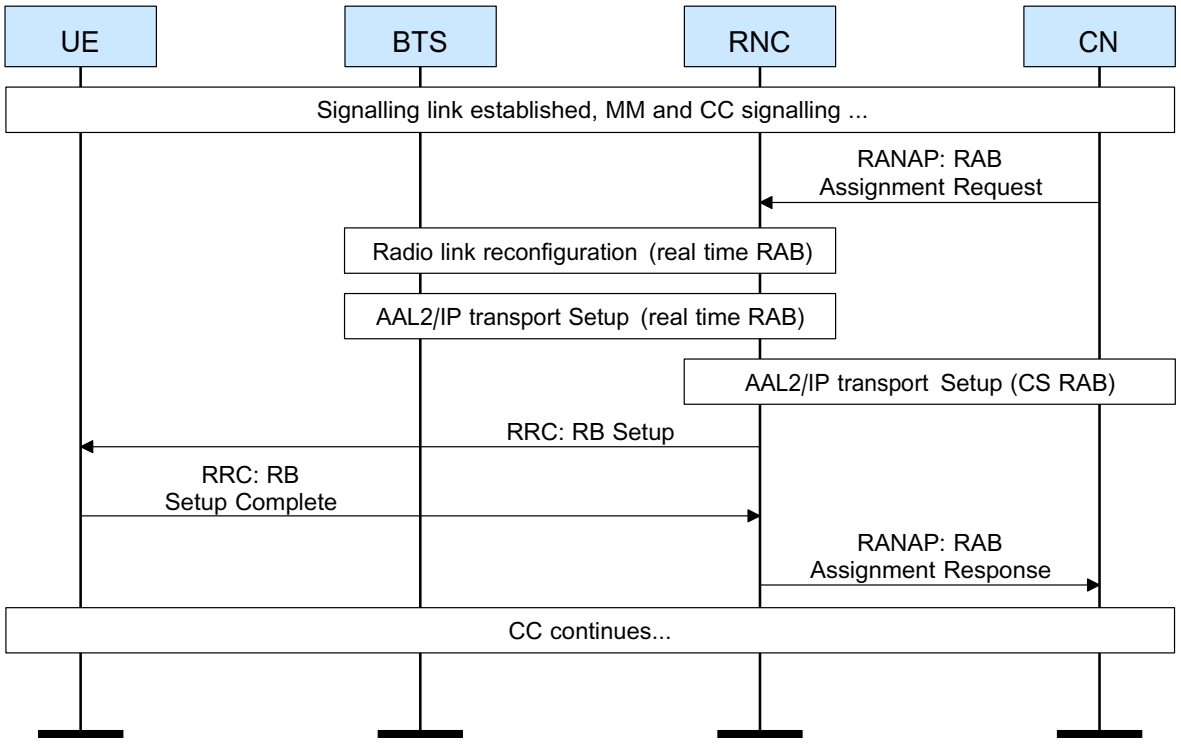

Figure 26. Radio access bearer establishment procedure (DCH to DCH)

Setting up a radio access bearer can fail, for instance, because the RNC cannot provide the resources requested. If the requested channel type or resource (for example channel rate) indicated in the RANAP:RAB ASSIGNMENT REQUEST message is not available in the RAN, a RANAP:RAB ASSIGNMENT RESPONSE message is sent to the CN. The message contains the appropriate failure cause.

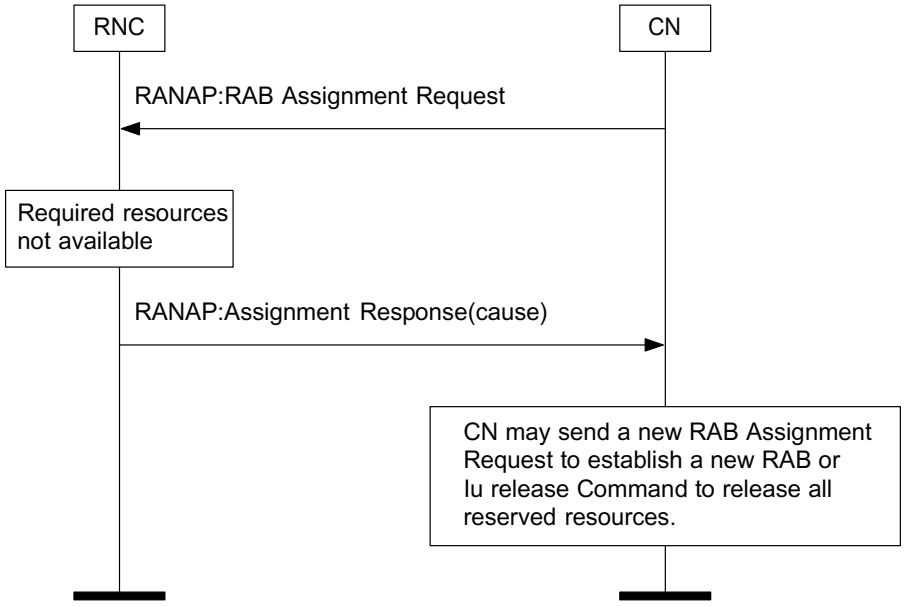

Figure 27. Failure in radio access bearer establishment

7.2 Radio access bearer release

The UE and CN negotiate about releasing the radio access bearer services. The CN then commands the RAN to release a radio access bearer service. The RNC sends an indication of the release to the UE and either releases the radio link or modifies the radio link parameters if all radio access bearers are not released.

The radio links are also released or modified at the WCDMA BTS, and transmission channels are released both on the Iu and Iub interfaces. Also Iur branches are released or modified if the UE had branches through another (drifting RNC).

The CN can also request releasing the signalling link if all radio access bearers related to the CN are released. Then the signalling connection between the RNC and CN is released. The signalling link between the RNC and UE is also released if the UE has no active connection to another CN.

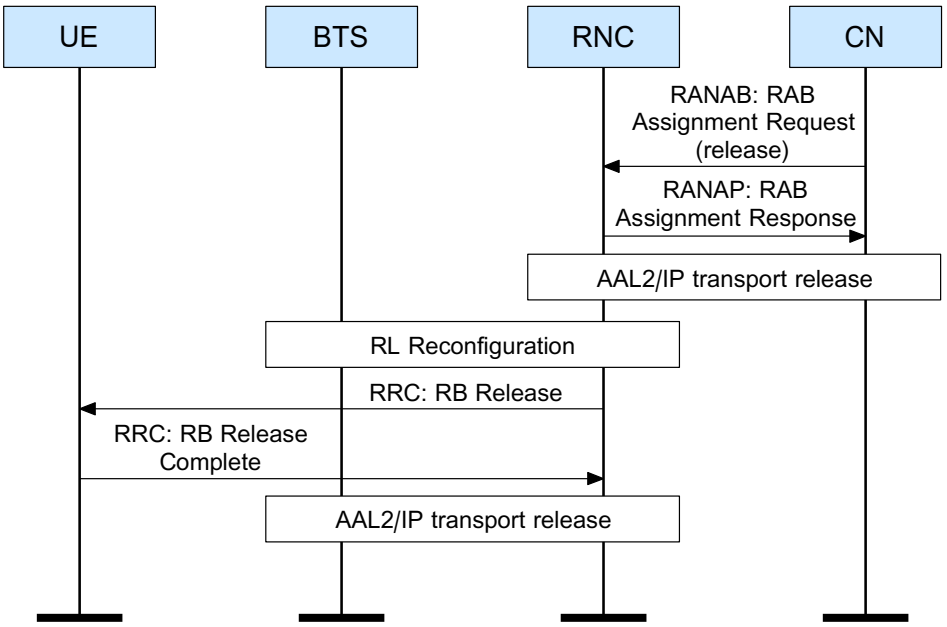

Figure 28. Radio access bearer release

From the Iu interface's point of view, radio access bearer release is always successful. The UE can return a release failure message to the RNC. In this case, the UE uses the old configuration.

7.3 Radio access bearer reconfiguration

7.3.1 CS service reconfiguration

The only supported CS RAB modification is modification between Wideband-AMR and Narrowband-AMR. Modification can be done to both directions. All supported AMR codec sets can be used in modification phase (NB-AMR: 12.2, (12.2, 7.95, 5.90, 4.75) and (5.90, 4.75), WB-AMR: (12.65, 8.85, 6.6)). Modification is initiated by the CN.

7.3.2 PS service reconfiguration

The SGSN or the UE (via SGSN) can request the RAB modification procedure if there is a need to modify the characteristics of a RAB service. To the RAN the reconfiguration is triggered by the CN with a RANAP:RAB ASSIGNMENT REQUEST message requesting reconfiguration of the existing RAB.

The following RAB parameters can be changed for the interactive and background traffic class RABs:

- Traffic class interactive <−> background
- Maximum bit rate (MBR) for UL and DL
- Traffic Handling Priority (THP) of an interactive RAB
- Allocation and Retention Priority (ARP)

Modification on PS real time (PS RT) services are not supported.

The RNC shall adapt different handling of RAB modification request depending on the state of the UE (UE in URA/Cell_PCH, Cell_FACH or Cell_DCH), type of request (downgrade/upgrade QoS parameter) and whether UE is using DCH or HSPA service.

1. The RANAP:RAB ASSIGNMENT REQUEST does not initiate paging procedure in URA/Cell_PCH state when it requests to modify NRT RAB parameters. The RNC only stores the RAB parameters, and the new RAB parameters are taken into use when the state transition is made to Cell_DCH.
2. When UE is in Cell_FACH state the new RAB parameters are taken into use when the state transition is made from Cell_FACH to Cell_DCH.
3. When UE has a DCH service and the RAB modification requests to change the QoS priority parameters (THP, ARP, TC), the new parameters are taken into use immediately inside RNC, but new parameters are updated to the UE during next reconfiguration message due to some other reason (e.g. UE state transition). In case of upgrading the MBR the new parameter is taken into use when the new admission decision for RRM resources is done.
4. When UE has a HSPA (HS-DSCH/E-DCH or HS-DSCH/DCH) service or DCH service and the RAB modification requests downgrading the maximum bit rate, the new RAB parameters are taken into use immediately.

The RAB Id identifies the RAB to be modified. There can be multiple RAB Ids in RANAP:RAB ASSIGNMENT REQUEST message.

If the SGSN requests any other parameter modification the RNC sends the response back to the SGSN using RANAP:RAB Assignment Response with cause code ”Invalid RAB Parameters Combination”.

New QoS parameters are sent to the BTS (and DRNC) by using NBAP (RNSAP): RADIO LINK RECONFIGURATION PREPARE message, and to the UE by using RRC:RADIO BEARER RECONFIGURATION message.

If the PS RAB reconfiguration feature is not activated, or BTS doesn’t support HSPA service modification, the RAB modification procedure is rejected and the RNC sends the response back to the SGSN using RANAP:RAB Assignment Response with cause code ”Unspecified Failure”.

8 RRC state

Radio resource control (RRC) state is also called packet data transfer state.

The description of the packet data transfer states given here is based on the 3GPP RRC protocol specification. The Figure *RRC states and state transitions* shows the supported RRC states and state transitions.

The RRC handles the control plane signalling of layer 3 between the UEs and RAN. RRC allows a dialogue between the RAN and the UE and also between the core network and the UE. An RRC connection is a logical connection between the UE and the RAN used by two peer entities to support the upper layer exchange of information flows. There can only be one RRC connection per UE. Several upper layer entities use the same RRC connection.

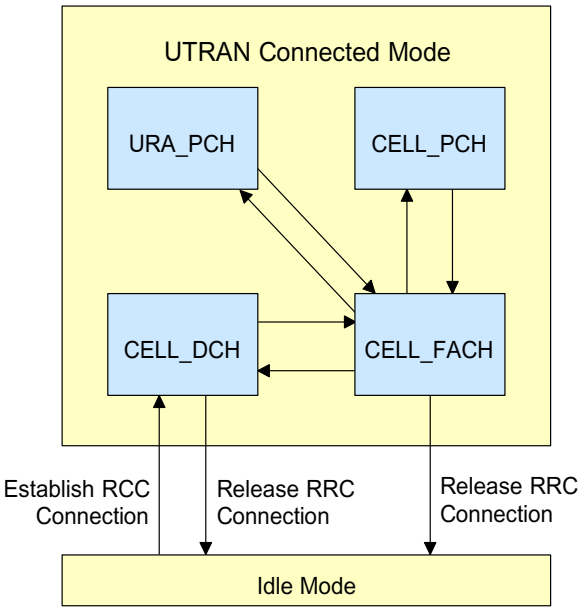

Figure 29. RRC states and state transitions

When a signalling connection exists, there is an RRC connection and the UE is in UTRAN connected mode. In UTRAN connected mode, the position of the UE is known on cell level. The UE leaves the UTRAN connected mode and returns to idle mode when the RRC connection is released or at RRC connection failure. When the UE position is known on cell level, it is either in CELL_FACH, CELL_DCH or CELL_PCH state. The RRC connection mobility is then handled by handover procedures and cell updates.

Table 1. UE cell states

UE cell state	Description
CELL_DCH	UE receives and transmits on the dedicated traffic channel (DCH). The location of the UE is known on the cell level.
CELL_FACH	UE receives on the forward access channel (FACH) and transmits on the random access channel (RACH). The location of the UE is known on the cell level.

Table 1. UE cell states (cont.)

UE cell state	Description
CELL_PCH	UE receives on the paging channel (PCH). The location of the UE is known on the cell level. If the UE has something to transmit, it transfers to CELL_FACH state.
URA_PCH	UE receives on the paging channel (PCH). The location of the UE is known on the URA level. If the UE has something to transmit, it transfers to CELL_FACH state.

CELL_DCH

The CELL_DCH state is characterised by the allocation of a dedicated transport channel to the UE. The UE is transferred from idle mode to the CELL_DCH substate through the setup of an RRC connection, or by establishing a dedicated channel (DCH) from the CELL_FACH state. Transition from CELL_DCH state to idle mode is realised through the release of the RRC connection. Transition from CELL_DCH substate to CELL_FACH substate is performed when the last active NRT DCH is released and the RT RABs do not exist. Transition from CELL_DCH substate to CELL_PCH (or URA_PCH) substate can be performed e.g. when during inactive NRT connection RT service is released.

CELL_FACH

In the CELL_FACH substate the UE monitors a forward access channel (FACH). In this state, the UE is able to transmit uplink control signals and may be able to transmit small data packets on the random access channel (RACH). A transition from CELL_FACH to CELL_DCH state occurs, when a dedicated transport channel is established through explicit signalling. While in the CELL_FACH substate, the UE monitors the FACH continuously and therefore it should be moved to the CELL_PCH substate when the data service has been inactive for a while, as defined by the elapse of an inactivity timer. When the timer expires, the UE is transferred to the CELL_PCH state in order to decrease UE power consumption. Also, when the UE is moved from the CELL_PCH state to the CELL_FACH state to perform a cell update procedure, the UE state is changed back to CELL_PCH state if neither the UE nor the network has any data to transmit after the procedure has been performed. When the RRC connection is released, the UE is moved to idle mode.

CELL_PCH / URA_PCH

In the CELL_PCH and URA_PCH substates the UE listens to the PCH transport channel. The dedicated control channel (DCCH) logical channel cannot be used in this substate. If the network wants to initiate any activity, it needs to make a paging request on the PCCH logical channel in the known cell(s) to initiate any downlink activity. The UE initiates a cell update procedure when it selects a new cell in CELL_PCH state and a ura update procedure when it selects a new URA in URA_PCH state.. The only overhead in keeping a UE in the PCH substate is the potential possibility of cell updating, when the UE moves to other cells. To reduce this overhead, the UE is moved to the URA_PCH state when low activity is observed. This can be controlled with an inactivity timer, and optionally, with a counter that counts the number of cell updates. When the number of cell updates has exceeded certain limits, then the UE changes to the URA_PCH state. The UE is transferred from CELL_PCH to CELL_FACH state either by a packet paging command from RAN or through any uplink access.

To conserve resources, the packet data transfer allocates the resources when they are needed. When the RNC detects inactivity in either uplink or downlink, it starts an inactivity timer in that direction. If the timer in both directions expires and the inactivity continues, the RNC releases the dedicated resources and starts the transition of the UE from CELL_DCH to CELL_FACH state. The transition is usually done with the radio bearer reconfiguration procedure.

The *radio bearer reconfiguration procedure* is used if the radio link control (RLC) parameters of the NRT RB need to be reconfigured when the DCH of the NRT RB is released.

The *physical channel reconfiguration procedure* is used when the UE is moved from CELL_FACH to CELL_PCH or URA_PCH states.

The *radio bearer release procedure* is used when an NRT RAB and an RT RAB are simultaneously used for the same UE, and the NRT RAB has been inactive (the inactivity timer has expired) when the CN releases the RT RAB.

The following figure illustrates the state transition using radio bearer reconfiguration.

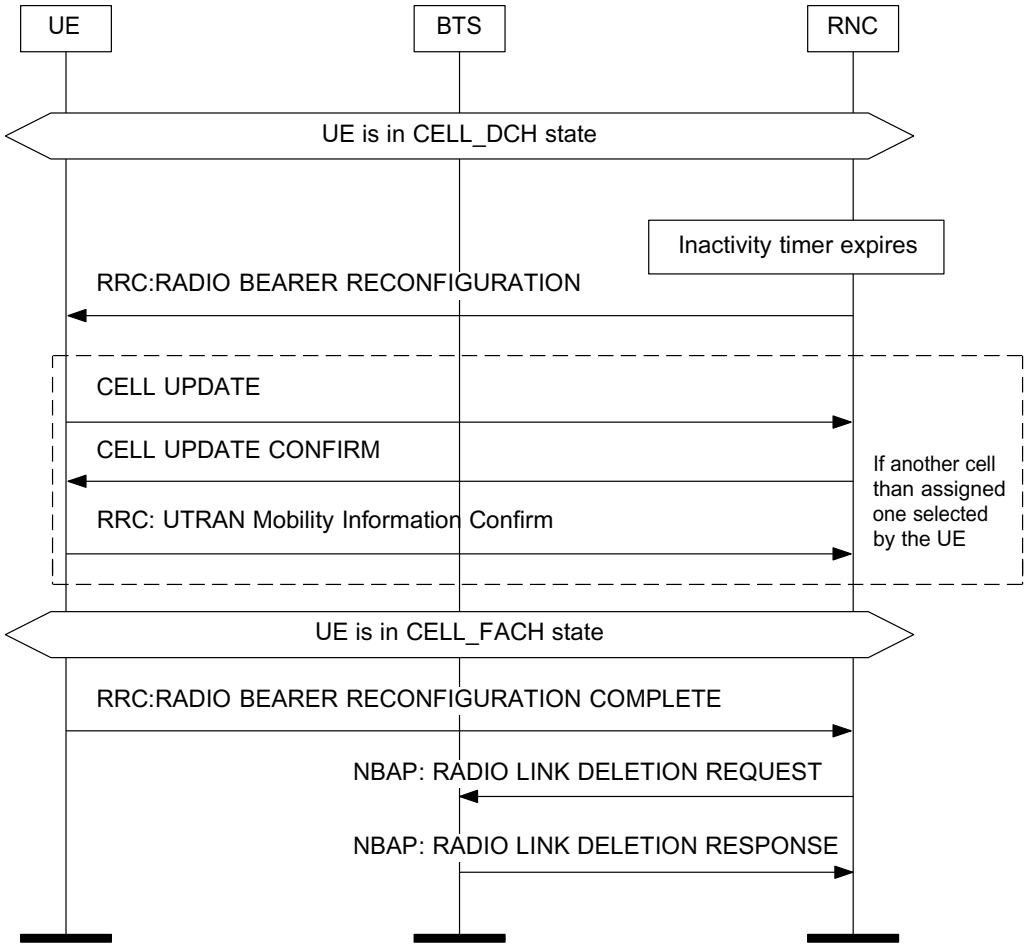

Figure 30. CELL_DCH to CELL_FACH state transition using radio bearer reconfiguration

The transition from CELL_FACH state to CELL_DCH state is started when the RNC has user or control data waiting for transmission in downlink direction or when the UE requests capacity for user data in uplink direction. The RNC's resource manager (RM) checks that there are logical resources available and allocates the requested resources. Specifically the RM also performs code allocation to achieve the requested bit rate for the signal by giving it an appropriate spreading code. The RM also requests a radio link setup procedure (for more information, see *Radio link setup*).

Once a radio link is set up, the transition is done with the radio bearer reconfiguration procedure.

The *radio bearer reconfiguration procedure* is used, if the radio link control (RLC) parameters of the NRT RB need to be reconfigured.

The *radio bearer setup procedure* is used, if an NRT RAB already exists and a new RT RAB must be established.

The following figure illustrates the state transition from CELL_FACH to CELL_DCH.

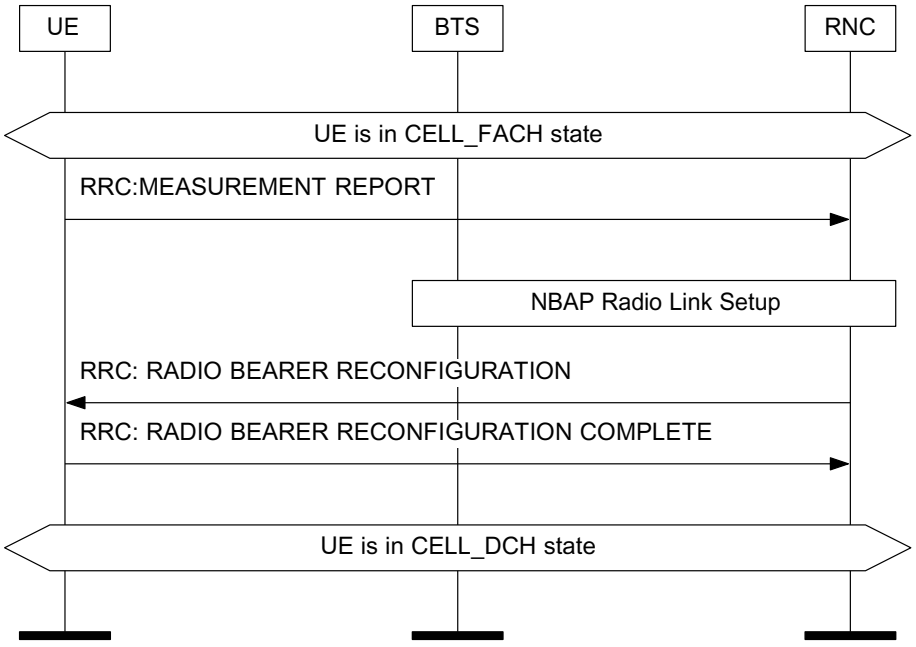

Figure 31. CELL_FACH to CELL_DCH state transition due to UL data transmission

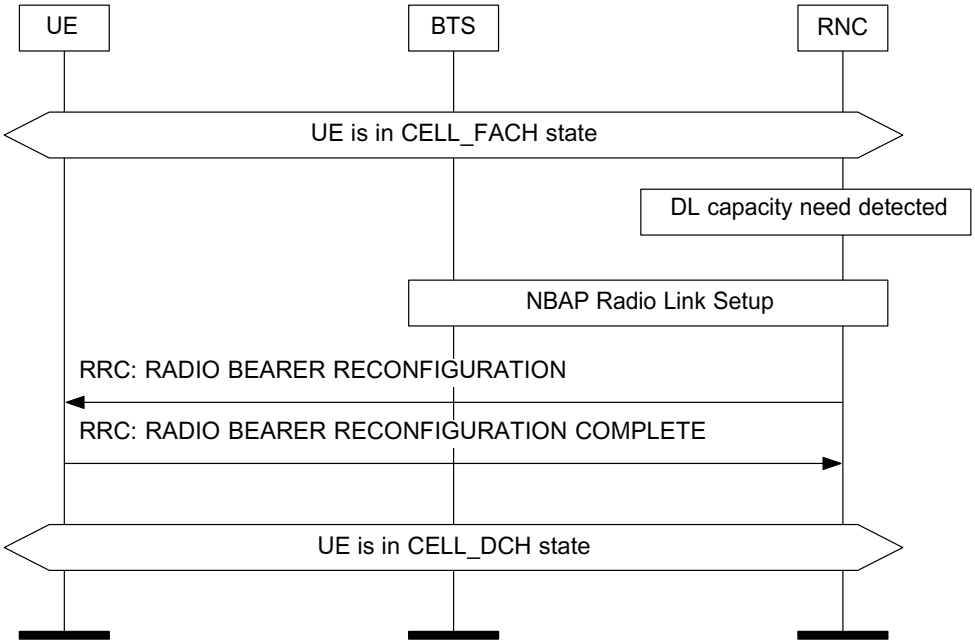

Figure 32. CELL_FACH to CELL_DCH state transition due to DL data transmission

Uplink data transmission can cause a cell update as illustrated in the figure below.

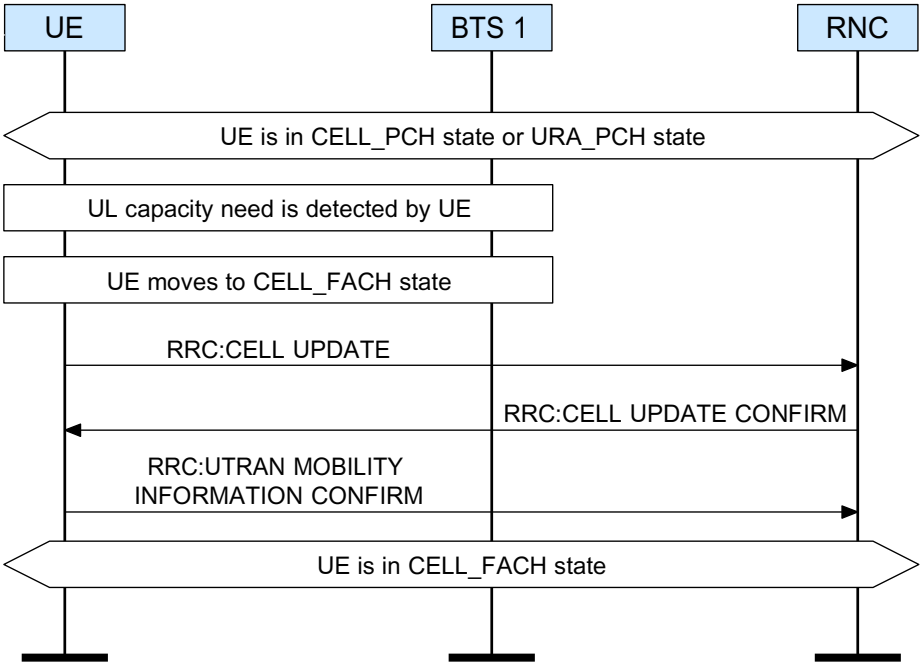

Figure 33. Cell update due to UL data transmission

9 Ciphering and integrity protection setup

Authentication and ciphering in circuit switched (CS) and packet switched (PS) is used to verify that the users are who they claim to be. There are two security modes: ciphering and integrity protection.

Ciphering is used to encrypt signals between the user equipment (UE) and the Radio Network Controller (RNC). This is done to prevent third parties from listening to transmissions.

Integrity protection is used to prevent third parties from sending unauthorised signalling messages between the UE and RNC.

Distribution of the ciphering key (CK) and integrity key (IK) is handled by the authentication and key agreement (AKA).

Authentication procedure

The authentication procedure verifies that the SIM card of the UE is valid. The SIM card contains IMSI/IMUI security keys as well as other subscriber specific information. The UE sends its MS classmark to the CN. The ciphering capability of the UE is set by the MS classmark which also indicates which integrity protection algorithm (UIA) and encyption algorithm (UEA) it supports. Through the authentication procedure the network is able to verify that the security keys of the UE are valid and correspond to the subscriber information on the network side. If necessary, the network also requests security parameters from the authentication centre (AC) of the CN. The CN sends back subscriber specific authentication vectors (AV) which consist of information based on the SIM card of the UE. The AV is only valid for one authentication procedure between the UE and the CN. The AV consists of the following:

RAND (random number)
: random number sent to the UE for generating XRES, CK and IK

XRES (expected response)
: expected response which needs to be compared with the RES in order to allow the AKA procedure to be successful

CK (ciphering key)
: key consisting of a number of symbols which controls the encipherment and decipherment between the UE and RNC

IK (integrity key)
: data protection key which is used for protecting the integrity of data items as well as verifying the origin of signalling data

  The IK is generated together with CK in the security mode setup procedure.

AUTN (authentication token)
: information used to authenticate the sender and containing the claimant identity and ticket, as well as signed and encrypted secret key exchange messages transmitting a secret key to be used in ciphering operations

In the authentication key agreement, the CN sends the RAND and AUTN to the UE. This random number is sent unprotected. On the basis of the RAND, the UE generates RES, CK, and IK. This RES is sent to the CN, unprotected. RES and XRES are compared by the CN. The authentication key agreement is successful if the RES and XRES match. The CK and IK are then established and subsequent messages are encrypted. The only signalling which is sent unprotected is the RAND and the RES. To an eavesdropper, the values appear to be random.

Ciphering functionality

The following figure illustrates the use of the ciphering algorithm to encrypt plaintext by applying a keystream using a bit per bit binary addition of the plaintext and the keystream. The plaintext may be recovered by generating the same keystream using the same input parameters and applying a bit per bit binary addition with the ciphertext

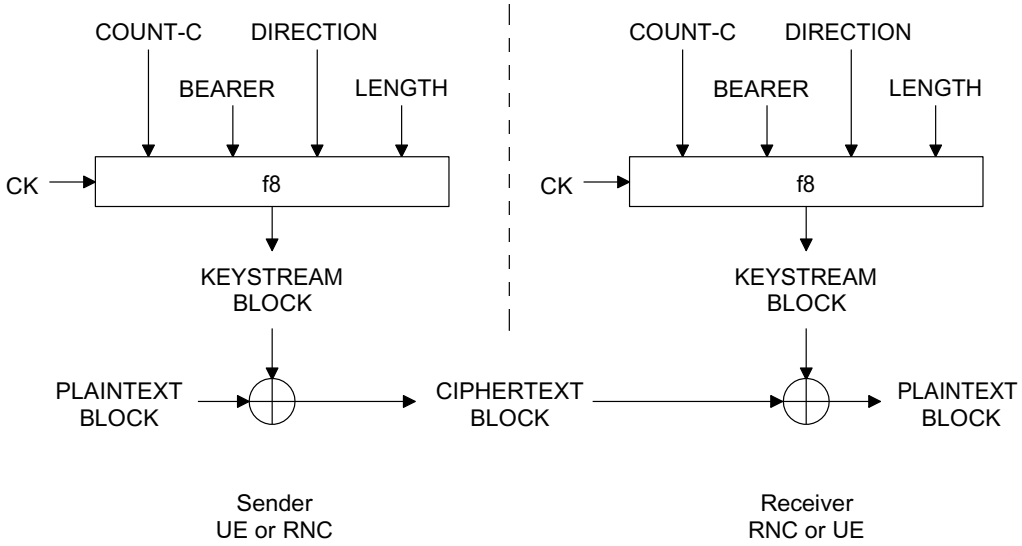

Figure 34. Ciphering of user and signalling data transmitted over the radio access link

The input parameters to the algorithm are the cipher key CK, a time dependent input COUNT-C, the bearer identity BEARER, the direction of transmission DIRECTION and the length of the keystream required LENGTH. Based on these input parameters the algorithm generates the output keystream block KEYSTREAM, which is used to encrypt the input plaintext block PLAINTEXT to produce the output ciphertext block CIPHERTEXT.

The mechanism for ciphering of the user data and signalling data requires the f8 cryptographic function. The function f8 is fully standardized in 3GPP.

Integrity protection functionality

The integrity key is used in order for the CN to identify the UE and the user behind it. The input parameters of the integrity key algorithm consist of a time-dependent input (COUNT-I) and a random number generated by the CN (FRESH), a direction bit (DIRECTION) and the signalling data (MESSAGE). The SRNC generates a MAC-I and sends it to the UE which in turn generates an XMAC-I based on the integrity key algorithm parameters. This XMAC-I code is subscriber and RAB specific. The UE compares the received MAC-I and the XMAC-I of the UE and verifies their validity, and if they match the UE returns an RRC: SECURITY MODE COMPLETE acknowledged message to the CN. The COUNT-I is simply a

counter which is incremented by one for each sent signalling message; due to this the result (MAC-I/XMAC-I) of the algorithm changes for every new signalling message. If the sent signalling messages are received with the wrong message authentication, they are discarded.

Security procedure

The integrity protection and ciphering procedures are started from RNC point of view when RNC selects which integrity algorithm UIA and encryption algorithm UEA it can use from the CN's algorithm list. If the RNC does not succeed in starting the integrity protection or ciphering procedure with UE, it sends a rejection message to the CN.

To prevent the same ciphering keys from being used indefinitely and thus making it possible for third parties to monitor the traffic, the UE stores the preset key time value in the USIM. This key time value is a counter that defines the preset number of times the ciphering keys can be used. The operator sets the maximum time value for the ciphering keys. New ciphering keys must be generated for subsequent signalling connections. It is also possible to change the ciphering keys in an ongoing RRC connection if the ciphering keys expire.

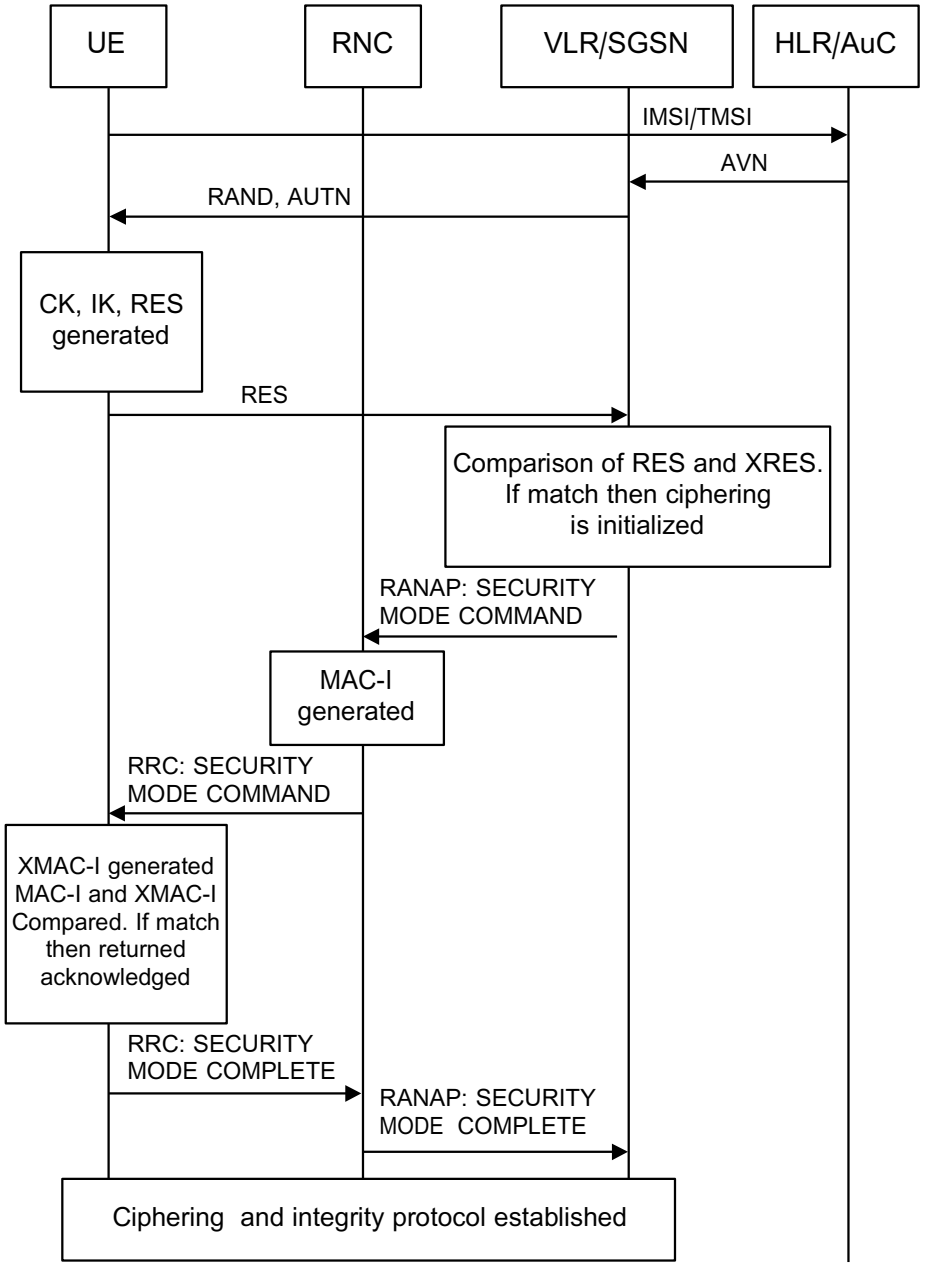

Figure 35. Ciphering and integrity procedure overview

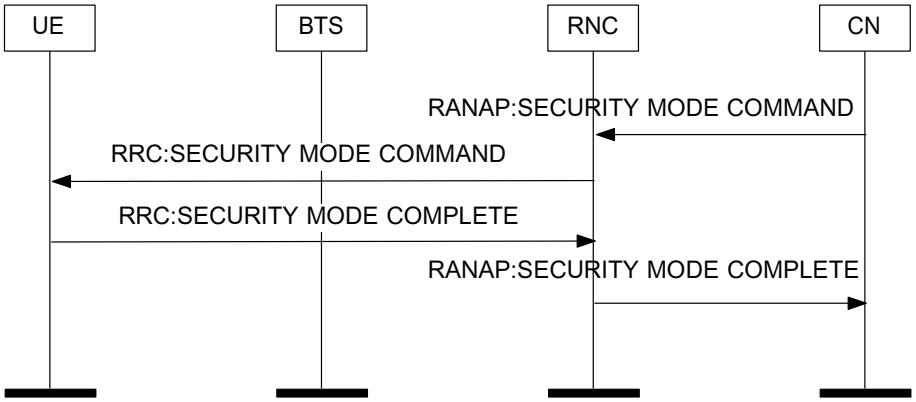

Figure 36. Setting up ciphering and integrity protection

10 Cell and URA updates

10.1 Cell update

Cell update procedure is mainly used to update the RNC information on the UE location after a cell reselection. When the UE selects a new cell, it informs the RNC in a cell update. In other words, cell update is used instead of handover. The UE also performs periodic cell updates according to system information.

After the UE has switched to a new cell, it sends a cell update message to the RNC's radio resource control (RRC). The UE message contains the cell update cause, which can be:

- cell reselection
- periodic cell update
- uplink data transmission
- paging response
- re-entering service area
- radio link failure
- RLC unrecoverable error

If the cell update was caused by *cell reselection*, the RNC updates the UE location information and resets the CELL_FACH or CELL_PCH state supervision timer. The RNC's confirmation message to the UE includes a radio network temporary identifier for the cell (C-RNTI) if the UE remains in CELL_FACH state. If the cell update was performed to a cell not residing under the serving RNC (SRNC), the message also contains the radio network temporary identifier for the RAN (U-RNTI) after relocation, in other words; if the SRNC changes.

If the cause was a *periodic cell update*, the RNC updates the UE location information and resets the CELL_FACH or CELL_PCH state supervision timer.

If the cause was *uplink data transmission*, the RNC sends a confirmation and a radio network temporary identifier (C-RNTI). The RNTI for RAN (U-RNTI) is sent if the cell update was performed to a cell not residing under the serving RNC (SRNC) after the relocation. The UE remains in CELL_FACH state.

If the cell update cause was *paging response*, the RNC updates the UE location information. The RNC sends a confirmation and a new radio network temporary identifier for cell (C-RNTI). The UE remains in CELL_FACH state.

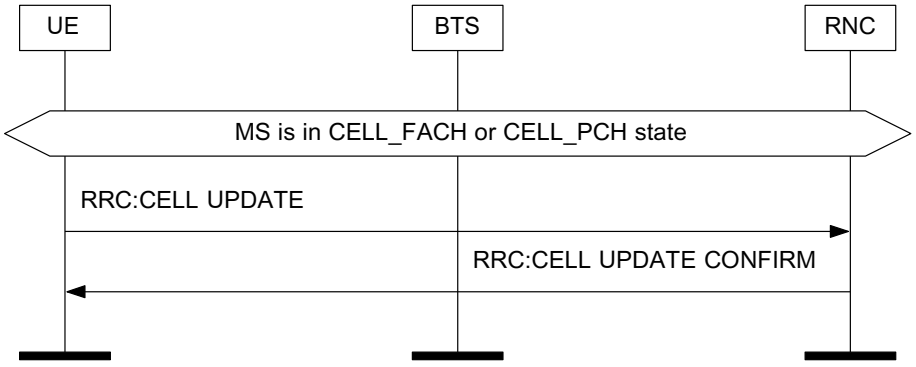

Figure 37. Cell update due to periodic update

10.2 URA Update

The UE mainly uses the UTRAN registration area (URA) update procedure to inform the RNC that it has switched to a new UTRAN registration area. The procedure is triggered after a change of cell when the UE has decoded the URA identifiers of the cell. URA updates are also performed periodically after a predefined timer expires.

UTRAN registration areas can be hierarchical to avoid excessive signalling. This means that several URA identifiers can be broadcast in one cell and that different UEs in one cell can reside in different URAs.

When the UE is in URA_PCH state and has switched to a new URA, it sends an update message with the U-RNTI (radio network temporary identifier) and URA update cause to the RNC. The cause is either URA reselection or periodic URA update.

If the update was due to URA reselection, the RNC registers the change of URA and sends a confirmation message to the UE. The message includes a radio network temporary identifier for cell (C-RNTI), if the UE remains in CELL_FACH state after the URA update. The message includes a radio network temporary identifier for RAN (UTRAN, U-RNTI), if the URA update was performed to a cell not residing under the serving RNC (SRNC) after relocation.

If multiple URAs are valid in the cell, the RNC assigns the URA to the UE.

If the update was a periodical one, the RNC resets the periodic URA update timer and sends a confirmation message to the UE

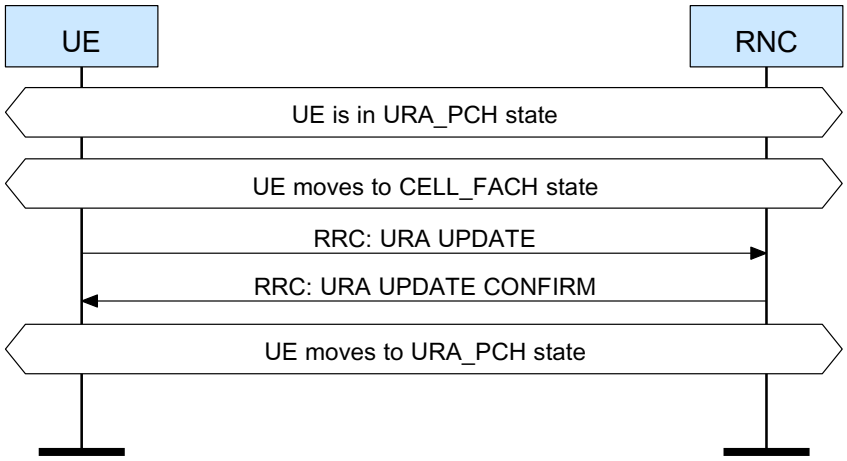

Figure 38. URA update due to periodic update

11 Transcoder Free Operation (TrFO) and Tandem Free Operation (TFO)

The Transcoder Free Operation (TrFO) and Tandem Free Operation (TFO) are included in 3GPP specifications from 3GPP Release 4 onwards. The TrFO /TFO affects the RNC, MSC, and MGW network elements.

In TrFO, the transcoding which is done in 3GPP Release 99 networks in the MSC, can be avoided when the CN negotiates Out-of-Band (OoB). OoB is the common set of adaptive multi-rate (AMR) codec modes that are supported by both end UEs. When the UEs support the same codecs, there is no need for transcoding in the core network (CN), and therefore, the speech quality is increased.

Although the main reason for avoiding transcoding in mobile-to-mobile calls is improving speech quality, another reason is saving bandwidth by the transmission of compressed information in the CN, and CN to CN interface of the cellular network.

The difference between the TrFO/TFO is, that in TrFO, the transcoder is not used in the CN while it is used TFO. Also, the bandwidth savings are only achieved with TrFO.

The basic architecture for the UMTS to UMTS TrFO connection is shown in the following figure.

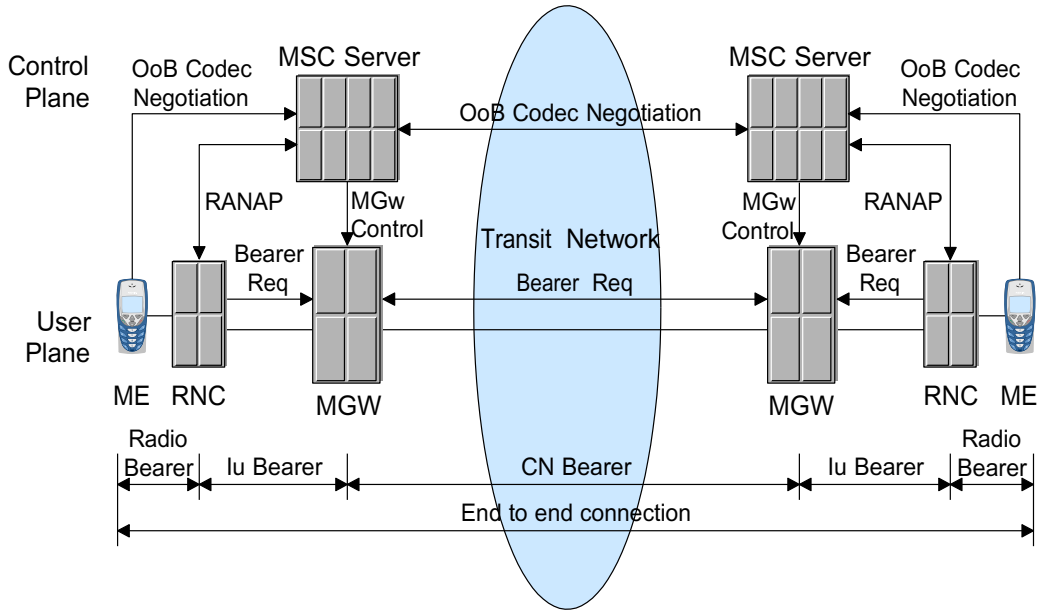

Figure 39. Basic architecture for UMTS to UMTS TrFO connection

From the RAN point of view, TFO /TrFO are similar functions. The selection between TFO and TrFO is done in the core network, and depends on the core network capabilities and if transcoding is needed in the CN.

TFO and TrFO can be used for mobile-to-mobile calls within the WCDMA network or between WCDMA and GSM networks, or between the WCDMA network and an external network, for example, fixed landline network.

In the RNC, the TFO/TrFO features can be switched on and off by the *PeriodULRCAMR* management parameter. If it is on, that is, its value is between 0 and 254, TFO and TrFO is used together with the supported AMR modes in WCDMA RAN. Therefore, in the Iu user plane protocol (Iu UP) support mode for predefined SDU sizes, version 2 is supported in the RNC. If the *PeriodULRCAMR* is set to value off, that is, it is 255, only the Iu UP support mode for predefined SDU sizes version 1 is supported in the RNC.

11.1 TrFO /TFO with Multimode AMR

TFO/TrFO can be used with all the supported AMR codec modes. If the codec mode set includes more than one codec mode, the rate control between the codec modes is supported, thus enabling link adaptation in the other end. If the codec mode set includes only one codec, the TrFO is used to achieve bandwidth savings in the CN and improved voice quality in the UE.

In uplink (UL), rate control is based on the maximum rate control information received from the Iu interface. The uplink rate control information is conveyed to the UE with the RRC: TRANSPORT FORMAT COMBINATION CONTROL (TFCC) message on dedicated control channel (DCCH) using AM RLC. After that, the UE selects the codec mode based on that information.

In downlink (DL), the RNC controls the allowed maximum rate, and if a change is needed, the RNC sends the Rate Control procedure to the Iu interface.

Then, when the RNC receives the Iu UP data frames from the Iu interface, the RNC forwards the data to the UE if the codec mode is equal to or below the current maximum downlink rate.

11.2 RNC TrFO/TFO functionalities

When the *PeriodULRCAMR* RNC management parameter is set to a value between 0 and 254, the RNC supports the following TrFO/TFO functionalities.

RAB Assignment procedure

The RAB ASSIGNMENT REQUEST message contains Iu user plane mode version 2 as an alternative to enable the TrFO functionality in the RNC. The RAB ASSIGNMENT REQUEST message also contains the AMR codec modes that are negotiated Out-of-Band by the CN and supported by the UEs. Therefore, they are to be initialised in the User Plane.

The following figure illustrates the RAB assignment procedure.

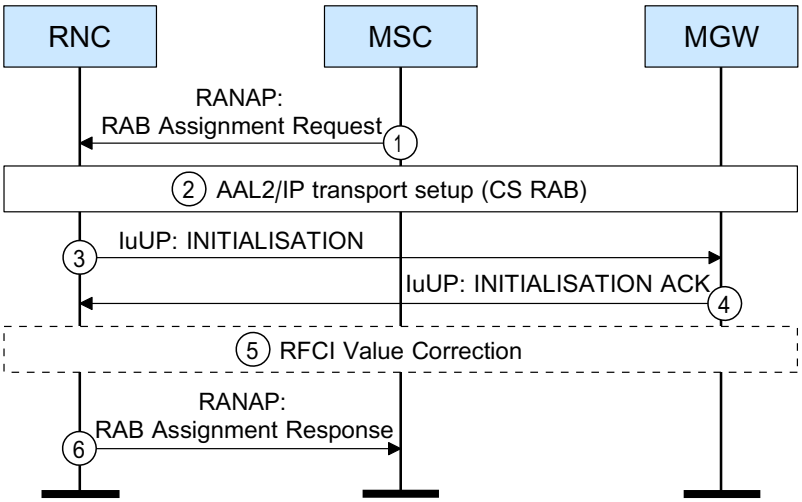

Figure 40. RAB Assignment procedure

1. The RNC receives the RAB ASSIGNMENT REQUEST message from the MSC.

   The message contains:

   - All the AMR codec modes that are negotiated Out-of-Band in the CN. For more information, see Figure *Basic architecture for UMTS to UMTS TrFO connection*.
   - The Iu UP mode versions that are allowed for the Iu user plane. For TrFO, version 2 must be included.

2. The RNC establishes the transport bearer for the CS RAB.

3. The RNC sends the IuUP: INITIALISATION control frame to the MGW.

   The message contains:

   - The RFCI values for all the AMR codec modes that have been received in RAB ASSIGNMENT REQUEST message.
   - All the Iu UP mode versions supported by the RNC and that have been among the mode versions included in RAB ASSIGNMENT REQUEST message.

4. MGW sends the IuUP: INITIALISATION ACK control frame to the RNC. The message contains:

   - the selected Iu UP mode version. For TrFO, the Iu UP mode version is 2.

5. Depending on the MGW implementation, the MGW can initiate the RFCI Value Correction procedure to change the RFCI values, which have been initially allocated by the RNC. The RNC can also receive RFCI Value Correction after the following step.

6. After a successful Iu UP initialisation, the RNC sends the RAB ASSIGNMENT RESPONSE message to the MSC.

For more information about Iub and Uu procedures, see Figure *Radio access bearer establishment procedure (DCH to DCH)*.

SRNS Relocation procedures

The parameters received in the RAB Assignment procedure are transferred from the source RNC to the target RNC in Relocation Preparation and Relocation Resource Allocation procedures. During the relocation, the Iu UP protocol entity is created in the target RNC in a similar manner as during the RAB Assignment procedure in the source RNC.

Iu UP Initialisation procedure

When TrFO is supported, the RNC initiates the Iu UP with all the codecs that have been included in the RANAP: RAB ASSIGNMENT REQUEST message. When the CN includes version 1 and 2 of the UP mode versions in the RAB Assignment procedure, the RNC allocates the codec modes and if version 2 is enabled by the *PeriodULRCAMR* parameter, the RNC includes both versions as preferred versions in the IuUP: INITIALISATION control frame. Therefore, the RNC delegates the final decision of the used Iu UP version for the MGW. If the RAB ASSIGNMENT REQUEST message contains only version 2, the RNC includes only Iu UP version 2 as the preferred version if the TrFO feature is supported.

The IuUP INITIALISATION control frame also contains information about the maximum allowed DL rate. The RNC uses IuUP INITIALISATION frame version 1 (Iu UP Mode Version = 1) if this version has been included in the RAB Assignment procedure. Therefore, the first RFCI contains information about the maximum allowed DL rate in the first frame only, then all the rates are allowed again. On the other hand, if the RAB Assignment procedure contains only Iu UP mode version 2, the RNC uses the IuUP INITIALISATION control frame version 2. In this case, the first RFCI contains information about the maximum allowed DL rate, which is valid until RNC sends a Rate Control procedure.

RFCI value correction

The RNC allocates and stores the RFCI values for each codec. The same values are included in the Iu UP INITIALISATION control frame, which is sent to the MGW. When the RNC at the other end allocates RFCI values independently of the first RNC, the allocated RFCI values can be different in each end. Therefore, the MGW, which is in the middle, can distinguish the different values and start the RFCI Value Correction procedure towards the other end, which replaces the earlier allocated RFCI values with new ones.

The RFCI Value Correction procedure is an Iu UP Initialisation procedure, which is initiated by the MGW, and therefore the RNC supports the incoming Iu UP Initialisation procedure. It is also possible that the MGW does not start the RFCI Value Correction when the MGW determines that the RFCI values are different. In that case the RNC does not receive the incoming Iu UP Initialisation procedure, and the MGW changes continuously the RFCI values in the user data frames so that they are valid for each RNC.

Maximum Rate Control procedure

The RNC controls the UL and DL maximum rate in its cells. The Iu UP Rate Control procedure is used by the RNC when the RNC detects that the maximum allowed DL rate needs to be changed. This can occur, for example, if the AMR modes set is reduced due to the UE capability in a multiservice configuration.

When the RNC sends the IuUP: RATE CONTROL control frame to the MGW, the TrFO operation has priority, and therefore, the MGW does not start the transcoding. The MGW then forwards the message, which finally reaches the other end.

Therefore, in order to support the TrFO, the RNC must also support the incoming IuUP: RATE CONTROL control frames.

When the RNC receives IuUP: RATE CONTROL control frame, the RNC immediately forwards this information to the UE if the RNC does not detect an overload and no other RRC procedures are running.

Filtering of Frequent IuUP Rate Control frames

In some cases, for example, in GSM link adaptation, the IuUP: RATE CONTROL control frames are received frequently. This is called Frequent Rate Control, and it needs a special functionality if the overload control of the RNC detects a high signalling load. The functionality in the RNC is called ‘Filtering’ and it is activated by the *PeriodULRCAMR* management parameter.

When the RNC receives the IuUP: RATE CONTROL control frame requests to upgrade the maximum UL AMR mode, the RNC starts waiting as long as it is defined by the *PeriodULRCAMR* management parameter. During that time, if there are Rate Control requests to even further upgrade the UL AMR mode, or to downgrade it compared to the recently received Rate Control request, but the Rate Control is still above the current maximum UL AMR mode the UE knows, the RNC ‘filters’ the Rate Control requests, and does not send the upgrades to the UE.

When the time defined by *PeriodULRCAMR* expires, the RNC sends the RRC: TRANSPORT FORMAT CONTROL COMMAND to the UE if the most recent Rate Control request was to increase the maximum UL AMR mode that the UE knows.

Every maximum UL AMR mode downgrade request is transferred to the UE without filtering, unless there is another RRC procedure running that prohibits it.

The RRC: TRANSPORT FORMAT CONTROL COMMAND is sent to the UE in DCCH, which uses the Acknowledge Mode (AM) RLC.

Figure *Filtering Frequent Iu UP Rate Control procedures* shows an example scenario for Filtering Frequent Iu UP Rate Control procedures.

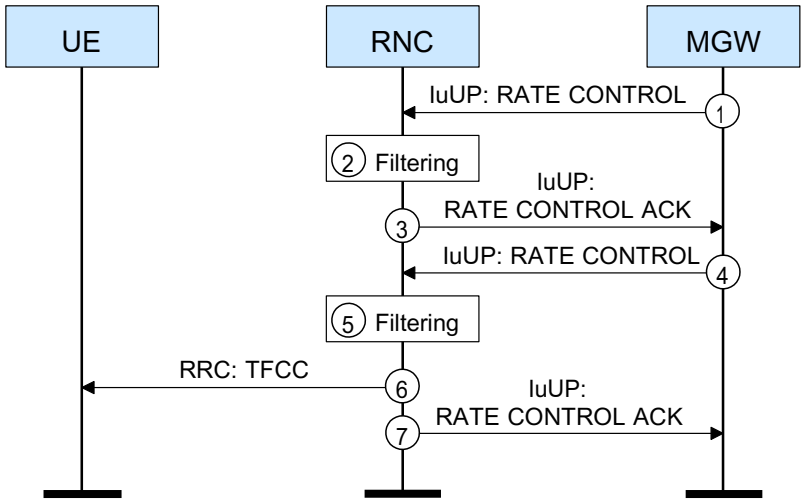

Figure 41. Filtering Frequent Iu UP Rate Control procedures

1. The RNC receives the IuUP: RATE CONTROL control frame from the MGW.
2. The RNC detects a signalling overload and the Rate Control request is to increase the Maximum UL rate.
3. The RNC does not send the increased Maximum UL rate information to the UE but sends the IuUP: RATE CONTROL ACK control frame to the MGW.
4. The RNC receives a new frequent IuUP: RATE CONTROL control frame before the time defined by *PeriodULRCAMR* parameter has elapsed.
5. The RNC filters the Rate Control and this time, the Rate Control requests to reduce the Maximum rate, or the time defined by the *PeriodULRCAMR* parameter just elapses.
6. The RNC sends the RRC: TRANSPORT FORMAT CONTROL COMMAND to the UE to reduce the Maximum rate.
7. The RNC sends the IuUP: RATE CONTROL ACK control frame to the MGW.

Immediate Rate Control

The maximum UL rate information is not delivered in the SRNS Relocation procedures (in RANAP), therefore, it is gathered by Immediate Rate Control procedure. This also allows the Target RNC to send its maximum DL rate to the other end.

The Immediate Rate Control is done after the SRNS Relocation and Iu UP Initialisation procedures. It is triggered when the Target RNC receives a relocation execution trigger from the UE or from the Iur interface.

If the type of the SRNS relocation is 'UE not involved in relocation of SRNS', the relocation execution trigger is the RNSAP: RELOCATION COMMIT message from the Source RNC. Otherwise, the relocation execution trigger is the RRC message received from the UE, or the established L1 synchronisation between Node B and the UE.

11.3 Definitions

Transcoder Free Operation (TrFO)

The purpose of TrFO is to remove unnecessary speech encoding completely from the speech path. This is achieved by Out-of-Band signalling that performs the coded negotiation and selection throughout the network.

Configuration of a speech or multimedia call for which no transcoder device is physically present in the communication path and thus, no control or conversion or other functions can be associated with it.

Tandem Free Operation (TFO)

In 2G (GSM), TFO is a base station system (BSS) feature. In 3G (WCDMA), TFO is performed by transcoders located in the core network. The objective of avoiding multiple transcoding is to improve the speech quality in mobile-to-mobile calls.

Configuration of a voice or multimedia call for which transcoders are physically present in the communication path but transcoding functions are disabled or partially disabled in order to avoid multiple transcoding.

12 Flexible Iu

Feature RAN834: Flexible Iu is also known as ‘Multipoint Iu’or ‘Intra Domain Connection of RAN Nodes to Multiple CN nodes’.

The Intra Domain Connection of RAN Nodes to Multiple CN Nodes overcomes the strict hierarchy, which restricts the connection of a RAN node to just one CN node (see also Feature Nokia MORAN). The Intra Domain Connection of RAN Nodes to Multiple CN Nodes introduces a routing mechanism (and other related functionality), which enables the RAN nodes to route information to the different CN nodes within the CS or PS domain.

The Intra Domain Connection of RAN Nodes to Multiple CN Nodes introduces the concept of ‘Pool Areas’. Within a Pool Area, a UE can roam freely (in either connected or idle mode) without the need to change the CN serving node.

The usage of this 'Pool Area' concept aims to reduce inter CN node updates, inter CN handovers/relocations and HLR updating signalling.

Simultaneous usage of Flexible Iu and the Nokia-specific Multiple Core Networks Support or Nokia Multi-Operator RAN (MORAN) is not possible.

Flexible Iu is an optional feature.

12.1 Pool-Area

Iu Flexible capable RNCs are able to select any CN node within a pool area. Iu Flexible capable RNCs and CN nodes are able to coexist with pre-release 5 RNCs and pre-release 5 CN nodes. However, Iu Flexible capable RNC cannot have both Iu Flexible capable and pre-release 5 CN nodes connected to it.

Pool configurations are done in CN nodes. Pool areas itself are not visible to the RNC. The configuration of the RNC configuration database is done according to the CN pool configurations. CS and PS pool areas are configured independently from each other.

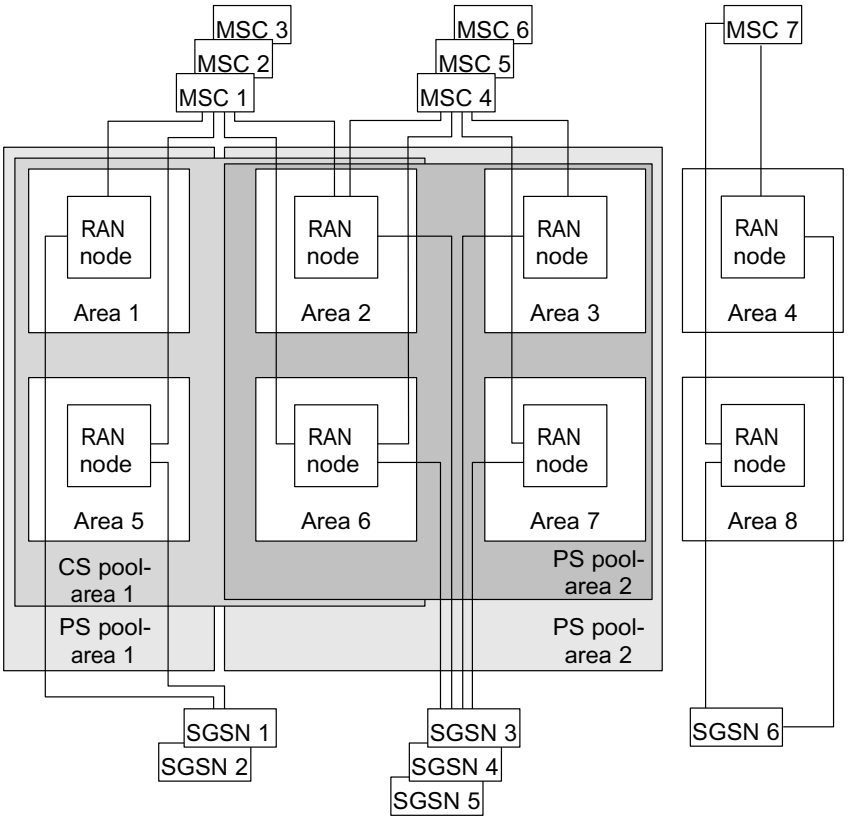

Figure 42. Pool area example

12.2 Network Resource Identification

The Network Resource Identifier (NRI) identifies the specific CN node of the pool. The UE derives the NRI from the TMSI, P-TMSI, IMSI or IMEI.

The UE provides an IDNNS IE in the RRC: INITIAL DIRECT TRANSFER message to the RNC. The IDNNS IE contains a routing parameter, which transports the NRI value. In addition, the IDNNS IE contains the indication from which identity (TMSI, P-TMSI, IMSI & IMEI) the routing parameter is derived. NAS node selection function in RNC does not use this identity information in routing at all. The NRI values are always used in routing regardless of what the identity where the NRI was taken was.

The NAS node selection function is used in the RNC to select the specific CN node (that is, MSS or SGSN) to which initial signalling messages are routed. The NRI identifies the specific CN node.

The values of the routing parameters (NRI) are configured into the RNC database according to the pool area configurations. There are independent parameter sets defined for PS and CS pools.

Max 16 NRI values or value ranges can be configured to every CN node connected to the RNC. CS and PS Core pools have the same maximum 16 NRI values per CN node. The maximum number of CN nodes per domain to be connected in one RNC is 16. This limit consists of a CN nodes connected to the RNC in case of overlapping pool areas. When overlapping pool areas are used in the network, in the overlapping area, RNC is connected to all CN nodes operating there, see Figure *Pool area example*.

The NRI length is configured in the RNC for both CN domains. The length of the NRI is the same in all the nodes of the domain in one pool-area. In case of overlapping pool areas, the NRI length must be the same for all overlapping pools. If the value of the NRI length is 0, it means that the Iu Flexible feature is not used (inactive) in network.

12.3 Load Balancing

The NAS node selection function in the RNC balances the load between the available CN nodes. This is performed by an appropriate selection of the CN node for a UE, which has no CN node configured for the NRI indicated by the UE. The load balancing is used to choose the appropriate CN node. The default assumption is that the NRI value is always used for routing in the RNC. If the CN node indicated by the NRI is not available, the CN node is not found with the given NRI, or NRI is the ‘Null NRI’, a load balancing is used for routing. Load sharing between the CN nodes can be affected by parameters.

The method for load balancing is the round robin. Round robin means that the resources are evenly spread in the Iu interface. The Iu signalling entity chooses one of the available CN nodes from the list of the Iu items with the concerned CN domain.

The availability of the CN node is defined with the IuState parameter for each CN node. Normal Iu state is WO-EX, working. CN nodes in states BAL-US and BAR-US are not available for load balancing.

BAL-US value is used for barring only from load balancing function which means that old UEs with correct NRI value are allowed to establish connection to CN node, but new UEs, UEs with unknown NRI, or UEs with Null-NRI are not allowed.

BAR-US value means that the CN Node is totally blocked from all connection establishments.

12.4 Definitions

Pool Area

It is a collection of one or more MSC or SGSN serving areas, and within them a UE can roam without the need to change the serving CN node (that is, the MSC-server or the SGSN).

A Pool Area is served by one or more CN nodes in parallel. All the cells are controlled by a RAN node, that is, (the RNC belongs to the same (or more) pool area(s).

NAS Node Selection Function

A function used to assign specific network resources (that is, the MSC-server or the SGSN) to serve a UE, and subsequently, route the traffic to the assigned network resource.

Network Resource Identifier, NRI

A specific parameter which is used to identify the CN node assigned to serve a mobile station.

Null-NRI

A 'null-NRI' indicates to an RNC that the NAS Node Selection Function must be used for selecting a CN node to receive a message.

13 Load Based AMR Codec Mode Selection

With load based AMR codec mode selection feature, the AMR codec mode is selected for incoming and ongoing AMR calls based on the radio interface load and Iub/Iur load. AMR codec mode set (5.9, 4.75) is utilized to admit more voice users or reserve more capacity for data services in a loaded network.

For incoming AMR calls, when load exceeds a predefined overload threshold, AMR codec mode set (5.9, 4.75) is used, and when load goes below the underload threshold, the higher AMR codec modes are used.

For ongoing AMR calls, to avoid changing back and forth between codec modes, a hysteresis is applied. There are two thresholds: higher and lower. The difference between the higher and the lower thresholds is the hysteresis. When load exceeds the higher threshold, the lower AMR codec mode is used and when load goes below the lower threshold, the higher AMR codec mode can be applied again. For the ongoing calls, the AMR codec mode change is applied gradually to avoid sudden signalling peaks caused by the Radio Link Reconfiguration procedures.

Load based AMR codec mode selection feature is used only for narrow band AMR calls.

Feature is used only for single AMR calls i.e. load based AMR codec mode selection feature is not used for multi-RAB connections.

DRNC supports load based AMR codec mode selection feature regardless of the feature activation state of the DRNC.

For more information about this feature, please see Admission Control document.

The following figures illustrate load based AMR codec mode upgrading and downgrading procedures.

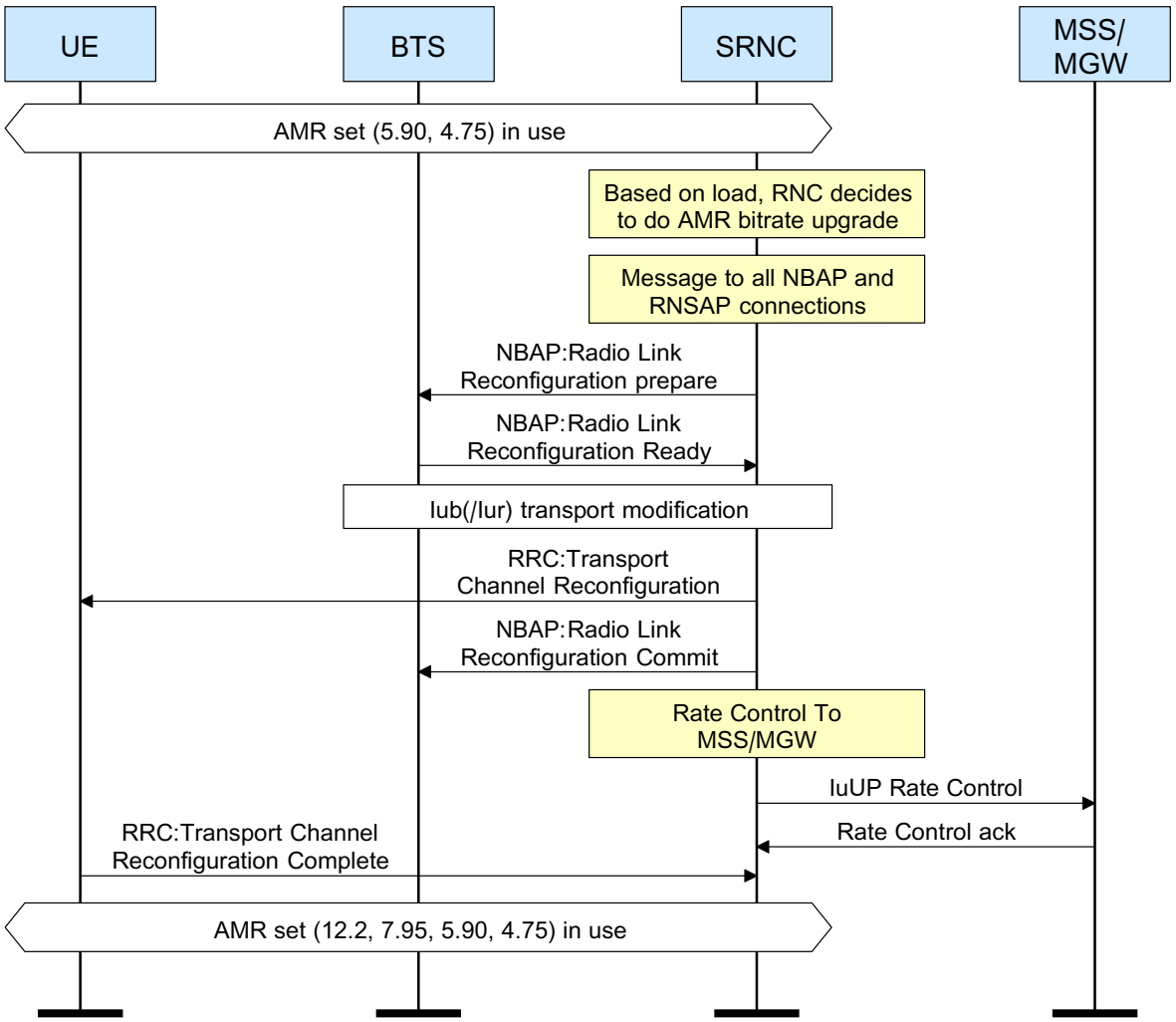

Figure 43. AMR codec mode upgrading

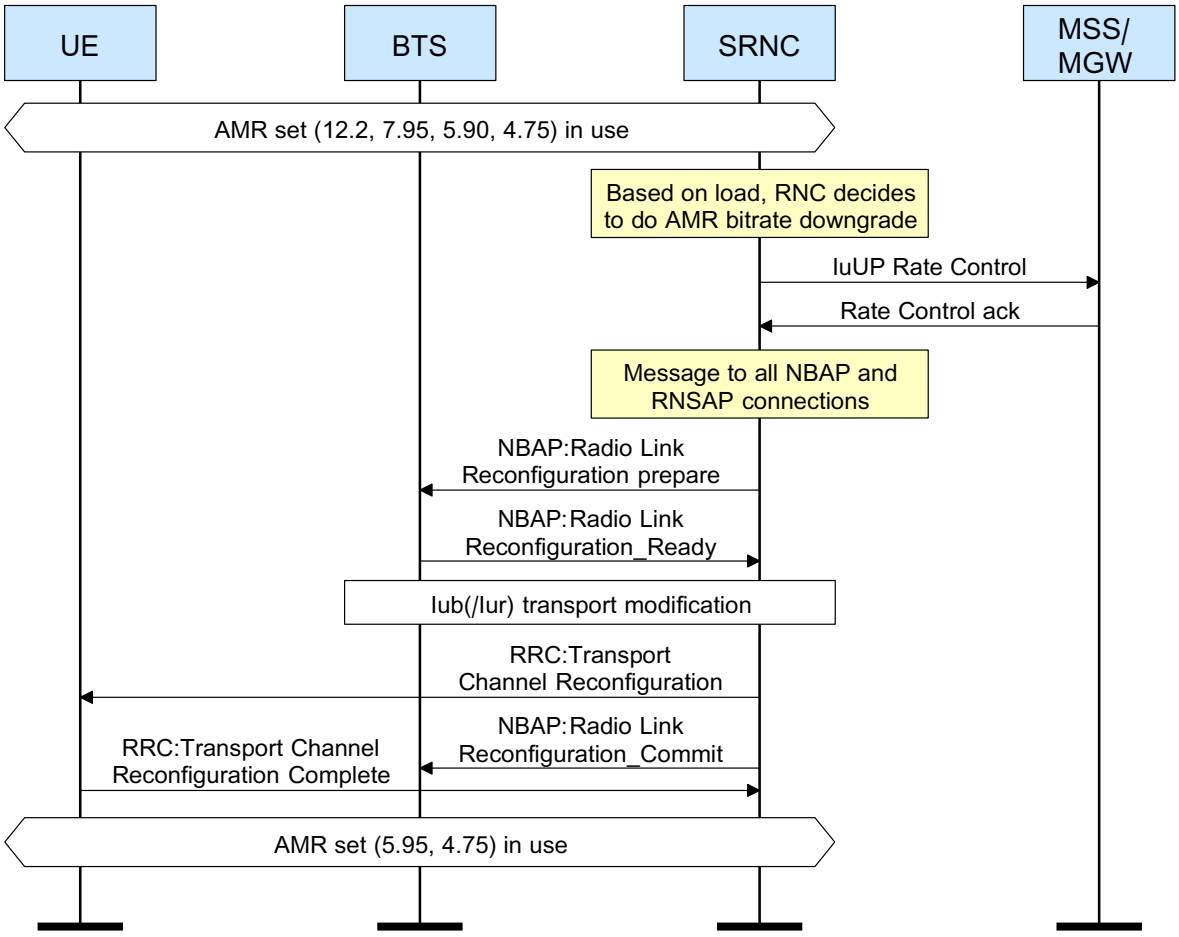

Figure 44. AMR codec mode downgrading

14 Congestion and preemption over Iur

14.1 Congestion over Iur

The DRNC can indicate resource congestion to the SRNC with the radio link congestion control procedure. The procedure indicates that the rate of one or more DCHs, corresponding to one or more radio links, is preferred to be limited in the UL and/or DL.

A radio link congestion control procedure is started in the DRNC when congestion in one or more of the following resources occur:

- downlink power
- uplink interference
- downlink spreading code
- BTS HW (WSP)
- Iub transmission

The procedure is triggered by preemption, RT-over- RT, RT-over-NRT or priority-based scheduling when resource congestion occurs, and by overload control in case of high interference load.

Both the SRNC and the DRNC must participate in the congestion control procedures during anchoring when congestion is detected in the DRNC cells.

The radio link congestion control procedure is also used in the DRNC during inter-RNC SHO scenarios (when there are active set cells in the SRNC).

When the SRNC receives a radio link congestion indication message from the DRNC, the SRNC performs the normal radio link reconfiguration procedure. If the new maximum bit rate is zero, the whole DCH is deleted.

14.2 Preemption over Iur

The DRNC can ask the SRNC to release a radio link because of congestion with the preemption procedure. The basic principle is that all preemption requests from the DRNC are accepted and processing is started immediately.

If there are more than one radio links in the current active set, the required radio link is removed from the current active set by using the RRC Active Set Update message.

If the whole call must be released (all radio links in the current active set must be released), the handling of the call release depends on the situation:

- UE with CS-only service => Iu Release Request is sent to the CS-CN
- UE with PS-only service => UE is moved to Cell_FACH state
- UE with CS/PS multi-service => Iu Release Request is sent to the CS-CN and the UE is moved to Cell_FACH state

15 Features per release

The following table lists the features related to this functional area. The features are arranged according to the release in which they were introduced. Note that a feature may belong to more than one functional area.

Table 2. Features related to call setup and release

RAN1.5 and RAN04
RAN1.007 RAN Procedures for the idle UEs
RAN1.008 RAN - UE connection establishment
RAN1.009 Management of the connected mode UE
RAN1.010 Radio Access Bearer Establishment and Release
RAN1.012 Radio link allocation for real-time radio access bearer services
RAN1.015 Packet data transfer states
RAN2.0051 Streaming packet switched quality of service
RAS05
RAN763 Basic HSDPA with QPSK and 5 codes
RAN764 HSDPA 16QAM Support
RAN869 HSDPA BTS Packet Scheduler
RAN871 HSDPA Flow Control
RAN766 HSDPA Shared Control Channel Power Control
RAS05.1
RAN849: HSDPA Proportional Fair Resource Packet Scheduler
RAN134: Support for Tandem/Transcoder Free Operation
RAS06
RAN834: Flexible Iu
RU10
RAN930: PS RAB Reconfiguration

Table 2. Features related to call setup and release (cont.)

RAN580: Load Based AMR Codec Mode Selection
RAN1759: Support for I-HSPA Sharing and Iur Mobility Enhancements

16 Management data for Call Setup and Release

16.1 Alarms

There are no alarms in connection with Call Setup and Release.

16.2 Counters

This section lists the counters per feature.

For more information, see the Reference Information Service in NOLS

See also RNC Counters – RNW Part and RNC Counters – Transport and HW Part in WCDMA RAN System Library.

Table 3. RAN134: Support for Tandem/Transcoder Free Operation

PI ID	Counter name
M1006C81	TRANSPORT FORMAT COMBINATION CONTROL FOR TFO

Table 4. RAN763 Basic HSDPA with QPSK and 5 codes

PI ID	Counter name
M1001C548	UE SUPPORT FOR HSDSCH CLASS 1 TO 6
M1001C549	UE SUPPORT FOR HSDSCH CLASS 7 OR 8
M1001C550	UE SUPPORT FOR HSDSCH CLASS 9 OR 10

Table 4. RAN763 Basic HSDPA with QPSK and 5 codes (cont.)

M1001C551	UE SUPPORT FOR HSDSCH CLASS 11 OR 12
M5000C0	MAC-HS PDU RETRANSMISSION DISTRIBUTION - CLASS 0
M5000C1	MAC-HS PDU RETRANSMISSION DISTRIBUTION - CLASS 1
M5000C3	MAC-HS PDU RETRANSMISSION DISTRIBUTION - CLASS 3
M5000C4	MAC-HS PDU RETRANSMISSION DISTRIBUTION - CLASS 4
M5000C5	MAC-HS PDU RETRANSMISSION DISTRIBUTION - CLASS 5

Table 5. RAN764 HSDPA 16QAM Support

PI ID	Counter name
M5000C54	ORIGINAL MAC-HS PDU TRANSMISSION WITH 1 CODE BY 16QAM
M5000C55	ORIGINAL MAC-HS PDU TRANSMISSION WITH 2 CODE BY 16QAM
M5000C56	ORIGINAL MAC-HS PDU TRANSMISSION WITH 3 CODE BY 16QAM
M5000C57	ORIGINAL MAC-HS PDU TRANSMISSION WITH 4 CODE BY 16QAM
M5000C58	ORIGINAL MAC-HS PDU TRANSMISSION WITH 5 CODE BY 16QAM
M5000C64	MAC-HS PDU RETRANSMISSION WITH 1 CODE BY 16QAM
M5000C65	MAC-HS PDU RETRANSMISSION WITH 2 CODE BY 16QAM
M5000C66	MAC-HS PDU RETRANSMISSION WITH 3 CODE BY 16QAM
M5000C67	MAC-HS PDU RETRANSMISSION WITH 4 CODE BY 16QAM
M5000C68	MAC-HS PDU RETRANSMISSION WITH 5 CODE BY 16QAM

Table 6. RAN766 HSDPA Shared Control Channel Power Control

PI ID	Counter name
M5000C8	REPORTED CQI DISTRIBUTION - CLASS 0
M5000C9	REPORTED CQI DISTRIBUTION - CLASS 1
M5000C10	REPORTED CQI DISTRIBUTION - CLASS 2
M5000C11	REPORTED CQI DISTRIBUTION - CLASS 3
M5000C12	REPORTED CQI DISTRIBUTION - CLASS 4
M5000C13	REPORTED CQI DISTRIBUTION - CLASS 5
M5000C14	REPORTED CQI DISTRIBUTION - CLASS 6
M5000C15	REPORTED CQI DISTRIBUTION - CLASS 7
M5000C16	REPORTED CQI DISTRIBUTION - CLASS 8
M5000C17	REPORTED CQI DISTRIBUTION - CLASS 9
M5000C18	REPORTED CQI DISTRIBUTION - CLASS 10
M5000C19	REPORTED CQI DISTRIBUTION - CLASS 11
M5000C20	REPORTED CQI DISTRIBUTION - CLASS 12
M5000C21	REPORTED CQI DISTRIBUTION - CLASS 13
M5000C22	REPORTED CQI DISTRIBUTION - CLASS 14
M5000C23	REPORTED CQI DISTRIBUTION - CLASS 15
M5000C24	REPORTED CQI DISTRIBUTION - CLASS 16
M5000C25	REPORTED CQI DISTRIBUTION - CLASS 17
M5000C26	REPORTED CQI DISTRIBUTION - CLASS 18
M5000C27	REPORTED CQI DISTRIBUTION - CLASS 19
M5000C28	REPORTED CQI DISTRIBUTION - CLASS 20
M5000C29	REPORTED CQI DISTRIBUTION - CLASS 21
M5000C30	REPORTED CQI DISTRIBUTION - CLASS 22
M5000C31	REPORTED CQI DISTRIBUTION - CLASS 23
M5000C32	REPORTED CQI DISTRIBUTION - CLASS 24
M5000C33	REPORTED CQI DISTRIBUTION - CLASS 25
M5000C34	REPORTED CQI DISTRIBUTION - CLASS 26
M5000C35	REPORTED CQI DISTRIBUTION - CLASS 27
M5000C36	REPORTED CQI DISTRIBUTION - CLASS 28
M5000C37	REPORTED CQI DISTRIBUTION - CLASS 29
M5000C38	REPORTED CQI DISTRIBUTION - CLASS 30
M5000C39	FAILED CQI DECODING

Table 6. RAN766 HSDPA Shared Control Channel Power Control (cont.)

M5000C69	HS-SCCH POWER DISTRIBUTION - CLASS 0
M5000C70	HS-SCCH POWER DISTRIBUTION - CLASS 1
M5000C71	HS-SCCH POWER DISTRIBUTION - CLASS 2
M5000C72	HS-SCCH POWER DISTRIBUTION - CLASS 3
M5000C73	HS-SCCH POWER DISTRIBUTION - CLASS 4
M5000C74	HS-SCCH POWER DISTRIBUTION - CLASS 5
M5000C75	SUM OF HS-SCCH POWER

Table 7. RAN849: HSDPA Proportional Fair Resource Packet Scheduler

PI ID	Counter name
M5000C41	AVERAGE MAC-D PDU BUFFER DELAY
M5000C42	MINIMUM MAC-D PDU BUFFER DELAY
M5000C43	MAXIMUM MAC-D PDU BUFFER DELAY

Table 8. RAN869 HSDPA BTS Packet Scheduler

PI ID	Counter name
M5000C49	ORIGINAL MAC-HS PDU TRANSMISSION WITH 1 CODE BY QPSK
M5000C50	ORIGINAL MAC-HS PDU TRANSMISSION WITH 2 CODE BY QPSK
M5000C51	ORIGINAL MAC-HS PDU TRANSMISSION WITH 3 CODE BY QPSK
M5000C52	ORIGINAL MAC-HS PDU TRANSMISSION WITH 4 CODE BY QPSK
M5000C53	ORIGINAL MAC-HS PDU TRANSMISSION WITH 5 CODE BY QPSK
M5000C59	MAC-HS PDU RETRANSMISSION WITH 1 CODE BY QPSK
M5000C60	MAC-HS PDU RETRANSMISSION WITH 2 CODE BY QPSK
M5000C61	MAC-HS PDU RETRANSMISSION WITH 3 CODE BY QPSK

Table 8. RAN869 HSDPA BTS Packet Scheduler (cont.)

M5000C62	MAC-HS PDU RETRANSMISSION WITH 4 CODE BY QPSK
M5000C63	MAC-HS PDU RETRANSMISSION WITH 5 CODE BY QPSK

Table 9. RAN871 HSDPA Flow Control

PI ID	Counter name
M5000C6	DROPPED MAC-D PDUS DUE TO BTS OVERFLOW
M5000C7	TOTAL NUMBER OF MAC-D PDUS
M5000C46	DISCARDED MAC-HS PDUS DUE TO T1 TIMER
M5000C47	DISCARDED MAC-HS PDUS DUE TO MAX NUMBER OF RETRANSMISSIONS

Table 10. RAN930: PS RAB Reconfiguration

PI ID	**Counter name**
M1003C9	RAB RECONF REQ BY CN
M1003C12	RAB RECONF SUCC
M1003C20	RAB RECONF NONSUCC DUE TO RN LAYER CAUSE
M1003C24	RAB RECONF NONSUCC DUE TO MISC CAUSE
M1001C197	RAB RECONFIGURATION ATTEMPTS

Table 11. RAN1.008 RAN - UE connection establishment

PI ID	Counter name
M1006C0	RRC CONN REQ FOR MOC ESTAB OF CONV CALL
M1006C1	RRC CONN REQ FOR MTC ESTAB OF CONV CALL
M1006C2	RRC CONN REQ FOR MOC ESTAB OF STREAM CALL
M1006C3	RRC CONN REQ FOR MTC ESTAB OF STREAM CALL
M1006C4	RRC CONN REQ FOR MOC ESTAB OF INTERACT CALL

Table 11. RAN1.008 RAN - UE connection establishment (cont.)

M1006C4	RRC CONN REQ FOR MTC ESTAB OF INTERACT CALL
M1006C6	RRC CONN REQ FOR MOC ESTAB OF BACKGR CALL
M1006C7	RRC CONN REQ FOR MTC ESTAB OF BACKGR CALL
M1006C8	RRC CONN REQ FOR EMERG CALL
M1006C9	RRC CONN REQ FOR INTR_RAT_CELL_R_E_SELECT
M1006C10	RRC CONN REQ FOR INTR_RAT_CELL_C HNG_ORD
M1006C11	RRC CONN REQ FOR REGISTRATION
M1006C12	RRC CONN REQ FOR DETACH
M1006C13	RRC CONN REQ FOR ORIGINATING HIGH PRIORITY SIGNALLING
M1006C14	RRC CONN REQ FOR ORIGINATING LOW PRIORITY SIGNALLING
M1006C15	RRC CONN REQ FOR TERMINATING HIGH PRIORITY SIGNALLING
M1006C16	RRC CONN REQ FOR TERMINATING LOW PRIORITY SIGNALLING
M1006C17	RRC CONN REQ FOR TERMINATING CAUSE UNKNOWN
M1006C18	RRC CONN REQ FOR ORIGINATING SUBSCRIBED TRAFFIC CALL
M1006C19	RRC CONN REQ FOR CALL RE ESTAB
M1006C20	RRC CONN REQ FAIL
M1006C21	RRC CONN REJECT
M1006C22	RRC CONN SETUP
M1006C24	RRC CONN REL
M1006C25	PAGING TYPE 1 ATT CN ORIG
M1006C26	PAGING TYPE 1 ATT RNC ORIG
M1006C27	PAGING TYPE 2 ATT
M1006C51	RRC CONN FOR CELL PCH DUE TO MS IS LOST
M1006C52	RRC CONN REL FOR DUE TO CELL OR URA UPDATE CONF FAIL
M1006C53	RRC CONN REL FOR DUE TO DIR SIG CONN RE EST
M1006C54	INI DIR TRAN
M1006C55	SEC MOD CONTRL
M1006C56	SEC MOD CONTRL COMP

Table 11. RAN1.008 RAN - UE connection establishment (cont.)

M1006C57	SIG CONN REL
M1006C58	SIG CONN REL REQ

Table 12. RAN1.009 Management of the connected mode UE

PI ID	Counter name
M1003C0	SIGN CONN SETUP
M1003C1	SIGN CONN REL BY CN
M1003C2	SIGN CONN REL REQ DUE TO RN LAYER CAUSE
M1003C3	SIGN CONN REL REQ DUE TO TR LAYER CAUSE
M1003C4	SIGN CONN REL REQ DUE TO NAS CAUSE
M1003C5	SIGN CONN REL REQ DUE TO PROT CAUSE
M1003C6	SIGN CONN REL REQ DUE TO MISC CAUSE
M1003C7	SIGN CONN REL REQ DUE TO NON STAN CAUSE
M1003C8	RAB ASS REQ BY CN
M1003C10	RAB REL REQ BY CN
M1003C11	RAB ASS SUCC
M1003C13	RAB ASS NONSUCC DUE TO RN LAYER CAUSE
M1003C14	RAB ASS NONSUCC DUE TO TR LAYER CAUSE
M1003C15	RAB ASS NONSUCC DUE TO NAS CAUSE
M1003C16	RAB ASS NONSUCC DUE TO PROT CAUSE
M1003C17	RAB ASS NONSUCC DUE TO MISC CAUSE
M1003C18	RAB ASS NONSUCC DUE TO NON STAN CAUSE
M1003C19	NBR OF NRT RAB ASS NONSUCC DUE TO ANCH
M1003C26	RAB REL SUCC
M1003C27	RAB REL NONSUCC
M1003C28	RAB REL REQ BY RNC
M1003C29	RAB REL REQ BY RNC DUE TO RN LAYER CAUSE
M1003C30	RAB REL REQ DUE TO TR LAYER CAUSE
M1003C31	RAB REL REQ DUE TO NAS CAUSE
M1003C32	RAB REL REQ DUE TO PROT CAUSE
M1003C33	RAB REL REQ DUE TO MISC CAUSE
M1003C34	RAB REL REQ DUE TO NON STAN CAUSE

Table 12. RAN1.009 Management of the connected mode UE (cont.)

M1003C35	RAB REL REQ BY RNC DUE TO ANCH
M1003C36	REC PAG MSG
M1003C37	NBR OF REC LOC REP CONTR
M1003C38	NBR OF SENT LOC REP
M1003C39	NBR OF SENT OVER CONT
M1003C40	NBR OF REC OVER CONT
M1003C41	NBR OF SENT RESET
M1003C42	NBR OF REC RESET
M1003C43	NBR OF SENT RESET ACK
M1003C44	NBR OF REC RESET ACK
M1006C28	RADIO BEARER SETUP
M1006C29	RADIO BEARER SETUP COMPLETE
M1006C30	RADIO BEARER RECONF
M1006C31	RADIO BEARER RECONF COMPLETE
M1006C32	TRAN CH RECONF
M1006C33	TRAN CH RECONF COMP
M1006C59	PHY CH RECONF
M1006C60	PHY CH RECONF COMP

Table 13. RAN1.010 Radio Access Bearer Establishment and Release

PI ID	Counter name
M1001C0	RRC SETUP ATT
M1001C1	RRC SETUP COMPL
M1001C2	RRC SETUP FAIL DUE TO HC
M1001C3	RRC SETUP FAIL DUE TO AC
M1001C4	RRC SETUP FAIL DUE TO BTS REASONS
M1001C5	RRC SETUP FAIL DUE TO TRANS
M1001C6	RRC SETUP FAIL DUE TO RNC INTER REASONS
M1001C7	RRC SETUP FAIL DUE TO FROZEN BTS
M1001C8	RRC ACC COMP
M1001C9	RRC ACC FAIL DUE TO RADIO INT SYNCH
M1001C10	RRC ACC FAIL DUE TO UU INT

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C11	RRC ACC FAIL DUE TO RNC INTER REASONS
M1001C12	RRC ACTIVE COMP
M1001C13	RRC ACTIVE REL DUE TO SRNC RELOC
M1001C14	RRC ACTIVE REL DUE TO PRE EMP
M1001C15	RRC ACTIVE FAIL DUE TO IU INT
M1001C16	RRC ACTIVE FAIL DUE TO RADIO INTERFACE
M1001C17	RRC ACTIVE FAIL DUE TO BTS REASONS
M1001C18	RRC ACTIVE FAIL DUE TO THE IUR INT
M1001C19	RRC ACTIVE FAIL DUE TO CIPH FAIL
M1001C21	RRC ACTIVE FAIL DUE TO RNC INTER REASONS
M1001C22	MOBILE ORIGINATING CONVERSATIONAL CALL ATTEMPTS
M1001C23	MOBILE ORIGINATING CONVERSATIONAL CALL FAILURES
M1001C24	MOBILE ORIGINATING STREAMING CALL ATTEMPTS
M1001C25	MOBILE ORIGINATING STREAMING CALL FAILURES
M1001C26	MOBILE ORIGINATING INTERACTIVE CALL ATTEMPTS
M1001C27	MOBILE ORIGINATING INTERACTIVE CALL FAILURES
M1001C28	MOBILE ORIGINATING BACKGROUND CALL ATTEMPTS
M1001C29	MOBILE ORIGINATING BACKGROUND CALL FAILURES
M1001C30	MOBILE ORIGINATING SUBSCRIBED TRAFFIC CALL ATTEMPTS
M1001C31	MOBILE ORIGINATING SUBSCRIBED TRAFFIC CALL FAILURES
M1001C32	MOBILE TERMINATING CONVERSATIONAL CALL ATTEMPTS
M1001C33	MOBILE TERMINATING CONVERSATIONAL CALL FAILURES
M1001C34	MOBILE TERMINATING STREAMING CALL ATTEMPTS
M1001C35	MOBILE TERMINATING STREAMING CALL FAILURES
M1001C36	MOBILE TERMINATING INTERACTIVE CALL ATTEMPTS
M1001C37	MOBILE TERMINATING INTERACTIVE CALL FAILURES
M1001C38	MOBILE TERMINATING BACKGROUND CALL ATTEMPTS

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C39	MOBILE TERMINATING BACKGROUND CALL FAILURES
M1001C40	EMERGENCY CALL ATTEMPTS
M1001C41	EMERGENCY CALL FAILURES
M1001C42	INTR_RAT_CELL_R E_SELECT ATTEMPTS
M1001C43	INTR_RAT_CELL_R E_SELECT FAILURES
M1001C44	INTR_RAT_CELL_C HNG_ORD ATTEMPTS
M1001C45	INTR_RAT_CELL_C HNG_ORD FAILURES
M1001C46	REGISTRATION ATTEMPTS
M1001C47	REGISTRATION FAILURES
M1001C48	DETACH ATTEMPTS
M1001C49	DETACH FAILURES
M1001C50	MOBILE ORIGINATING HIGH PRIORITY SIGNALLING FAILURES
M1001C51	MOBILE TERMINATING HIGH PRIORITY SIGNALLING ATTEMPTS
M1001C53	MOBILE TERMINATING HIGH PRIORITY SIGNALLING FAILURES
M1001C54	MOBILE ORIGINATING LOW PRIORITY SIGNALLING ATTEMPTS
M1001C55	MOBILE ORIGINATING LOW PRIORITY SIGNALLING FAILURES
M1001C56	MOBILE TERMINATING LOW PRIORITY SIGNALLING ATTEMPTS
M1001C57	MOBILE TERMINATING LOW PRIORITY SIGNALLING FAILURES
M1001C58	CALL RE ESTAB ATTEMPTS
M1001C59	CALL RE ESTAB FAILURES
M1001C60	TERMINATING CAUSE UNKNOWN ATTEMPTS
M1001C61	TERMINATING CAUSE UNKNOWN FAILURES
M1001C62	NUMBER OF SRNC RELOCATION ATTEMPTS
M1001C217	NUMBER OF UNSUCCESSFUL SRNC RELOCATION ATTEMPTS
M1001C64	NUMBER OF INTERRNC INTRA FREQ HHO ATTEMPTS
M1001C65	NUMBER OF UNSUCCESSFUL INTER RNC INTRA FREQ HHO ATTEMPTS
M1001C66	RAB SETUP ATTEMPTS FOR CS VOICE

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C67	RAB SETUP ATTEMPTS FOR CS DATA CONV
M1001C68	RAB SETUP ATTEMPTS FOR CS DATA STREAM
M1001C71	RAB SETUP ATTEMPTS FOR PS DATA INTERA
M1001C72	RAB SETUP ATTEMPTS FOR PS DATA BACKG
M1001C73	RAB SETUP COMPLETIONS FOR CS VOICE
M1001C74	RAB SETUP COMPLETIONS FOR CS DATA CONV
M1001C75	RAB SETUP COMPLETIONS FOR CS DATA STREAM
M1001C78	RAB SETUP COMPLETIONS FOR PS DATA INTERA
M1001C79	RAB SETUP COMPLETIONS FOR PS DATA BACKG
M1001C80	RAB SETUP FAILURES DUE TO AC FOR CS VOICE
M1001C81	RAB SETUP FAILURES DUE TO BTS FOR CS VOICE
M1001C82	RAB SETUP FAILURES DUE TO TRANSPORT FOR CS VOICE
M1001C83	RAB SETUP FAILURES DUE TO RNC FOR CS VOICE
M1001C84	RAB SETUP FAILURES DUE TO FROZEN BTS FOR CS VOICE
M1001C85	RAB SETUP FAILURES DUE TO AC FOR CS DATA CONV
M1001C86	RAB SETUP FAILURES DUE TO BTS FOR CS DATA CONV
M1001C87	RAB SETUP FAILURES DUE TO TRANSPORT FOR CS DATA CONV
M1001C83	RAB SETUP FAILURES DUE TO RNC FOR CS DATA CONV
M1001C84	RAB SETUP FAILURES DUE TO FROZEN BTS FOR CS DATA CONV
M1001C85	RAB SETUP FAILURES DUE TO AC FOR CS DATA STREAM
M1001C91	RAB SETUP FAILURES DUE TO BTS FOR CS DATA STREAM
M1001C92	RAB SETUP FAILURES DUE TO TRANSPORT FOR CS DATA STREAM
M1001C93	RAB SETUP FAILURES DUE TO RNC FOR CS DATA STREAM
M1001C94	RAB SETUP FAILURES DUE TO FROZEN BTS FOR CS DATA STREAM
M1001C105	RAB SETUP FAILURES DUE TO AC FOR PS DATA INTERA

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C107	RAB SETUP FAILURES DUE TO RNC FOR PS DATA INTERA
M1001C108	RAB SETUP FAILURES DUE TO ANCHORING FOR PS DATA INTERA
M1001C109	RAB SETUP FAILURES DUE TO FROZEN BTS FOR PS DATA INTERA
M1001C110	RAB SETUP FAILURES DUE TO AC FOR PS DATA BACKG
M1001C112	RAB SETUP FAILURES DUE TO RNC FOR PS DATA BACKG
M1001C113	RAB SETUP FAILURES DUE TO ANCHORING FOR PS DATA BACKG
M1001C114	RAB SETUP FAILURES DUE TO FROZEN BTS FOR PS DATA BACKG
M1001C115	RAB ACCESS COMPLETIONS FOR CS VOICE
M1001C116	RAB ACCESS COMPLETIONS FOR CS DATA CONV
M1001C120	RAB ACCESS COMPLETIONS FOR PS DATA INTERA
M1001C121	RAB ACCESS COMPLETIONS FOR PS DATA BACKG
M1001C122	RAB SETUP ACC FAIL FOR CS VOICE CALL DUE TO UE
M1001C123	RAB SETUP ACC FAIL FOR CS VOICE CALL DUE TO RNC INTERNAL
M1001C124	RAB SETUP ACC FAIL FOR CS DATA CALL CONV CLASS DUE TO UE
M1001C125	RAB SETUP ACC FAIL FOR CS DATA CALL CONV CLASS DUE TO RNC INTERNAL
M1001C126	RAB SETUP ACC FAIL FOR CS DATA CALL STREAM CLASS DUE TO UE
M1001C127	RAB SETUP ACC FAIL FOR CS DATA CALL STREAM CLASS DUE TO RNC INTERNAL
M1001C132	RAB SETUP ACC FAIL FOR PS DATA CALL INTERA CLASS DUE TO UE
M1001C133	RAB SETUP ACC FAIL FOR PS DATA CALL INTERA CLASS DUE TO RNC INTERNAL
M1001C134	RAB SETUP ACC FAIL FOR PS DATA CALL BACKG CLASS DUE TO UE
M1001C135	RAB SETUP ACC FAIL FOR PS DATA CALL BACKG CLASS DUE TO RNC INTERNAL
M1001C136	RAB ACTIVE COMPLETIONS FOR CS VOICE
M1001C137	RAB ACTIVE COMPLETIONS FOR CS DATA CONV

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C138	RAB ACTIVE COMPLETIONS FOR CS DATA STREAM
M1001C141	RAB ACTIVE COMPLETIONS FOR PS DATA INTERA
M1001C142	RAB ACTIVE COMPLETIONS FOR PS DATA BACKG
M1001C143	RAB ACTIVE RELEASES DUE TO SRNC RELOC FOR CS VOICE
M1001C144	RAB ACTIVE RELEASES DUE TO PRE-EMPTION FOR CS VOICE
M1001C145	RAB ACTIVE FAILURES DUE TO IU FOR CS VOICE
M1001C146	RAB ACTIVE FAILURES DUE TO RADIO INT FOR CS VOICE
M1001C147	RAB ACTIVE FAILURES DUE TO BTS FOR CS VOICE
M1001C148	RAB ACTIVE FAILURES DUE TO IUR FOR CS VOICE
M1001C150	RAB ACTIVE FAILURES DUE TO RNC FOR CS VOICE
M1001C151	RAB ACTIVE RELEASES DUE TO SRNC RELOC FOR CS DATA CONV
M1001C152	RAB ACTIVE RELEASES DUE TO PRE-EMPTION FOR CS DATA CONV
M1001C153	RAB ACTIVE RELEASES DUE TO SRNC RELOC FOR CS DATA STREAM
M1001C154	RAB ACTIVE RELEASES DUE TO PRE-EMPTION FOR CS DATA STREAM
M1001C155	RAB ACTIVE FAILURES DUE TO IU FOR CS DATA CONV
M1001C156	RAB ACTIVE FAILURES DUE TO RADIO INT FOR CS DATA CONV
M1001C157	RAB ACTIVE FAILURES DUE TO BTS FOR CS DATA CONV
M1001C158	RAB ACTIVE FAILURES DUE TO IUR FOR CS DATA CONV
M1001C159	RAB ACT FAIL FOR CS DATA CONV CLASS CALL DUE TO INTEGRITY CHECK
M1001C160	RAB ACTIVE FAILURES DUE TO RNC FOR CS DATA CONV
M1001C161	RAB ACTIVE FAILURES DUE TO IU FOR CS DATA STREAM
M1001C162	RAB ACTIVE FAILURES DUE TO RADIO INT FOR CS DATA STREAM
M1001C163	RAB ACTIVE FAILURES DUE TO BTS FOR CS DATA STREAM

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C164	RAB ACTIVE FAILURES DUE TO IUR FOR CS DATA STREAM
M1001C165	RAB ACT FAIL FOR CS DATA CALL STREAM CLASS DUE TO INTEGRITY CHECK
M1001C166	RAB ACTIVE FAILURES DUE TO RNC FOR CS DATA STREAM
M1001C171	RAB ACTIVE RELEASES DUE TO SRNC RELOC FOR PS DATA INTERA
M1001C172	RAB ACTIVE RELEASES DUE TO SRNC RELOC FOR PS DATA BACKG
M1001C185	RAB ACTIVE FAILURES DUE TO IU FOR PS DATA INTERA
M1001C186	RAB ACTIVE FAILURES DUE TO RADIO INT FOR PS DATA INTERA
M1001C187	RAB ACTIVE FAILURES DUE TO BTS FOR PS DATA INTERA
M1001C188	RAB ACTIVE FAILURES DUE TO IUR FOR PS DATA INTERA
M1001C189	RAB ACT FAIL FOR PS DATA CALL INTERA CLASS DUE TO INTEGRITY CHECK
M1001C190	RAB ACTIVE FAILURES DUE TO RNC FOR PS DATA INTERA
M1001C191	RAB ACTIVE FAILURES DUE TO IU FOR PS DATA BACKG
M1001C192	RAB ACTIVE FAILURES DUE TO RADIO INT FOR PS DATA BACKG
M1001C193	RAB ACTIVE FAILURES DUE TO BTS FOR PS DATA BACKG
M1001C194	RAB ACTIVE FAILURES DUE TO IUR FOR PS DATA BACKG
M1001C195	RAB ACT FAIL FOR PS DATA CALL BACKG CLASS DUE TO INTEGRITY CHECK
M1001C196	RAB ACTIVE FAILURES DUE TO RNC FOR PS DATA BACKG
M1001C199	AVE RAB HOLDING TIME FOR CS VOICE CALL
M1001C200	DENOMINATOR FOR RAB HOLDING TIME FOR CS VOICE
M1001C201	AVE RAB HOLDING TIME FOR CS DATA CALL WITH CONVERSATIONAL CLASS
M1001C202	DENOMINATOR FOR RAB HOLDING TIME FOR CS DATA CONV

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C203	AVE RAB HOLDING TIME FOR CS DATA CALL WITH STREAMING CLASS
M1001C204	DENOMINATOR FOR RAB HOLDING TIME FOR CS DATA STREAM
M1001C209	AVE RAB HOLDING TIME FOR PS CALL WITH INTERACTIVE CLASS
M1001C210	DENOMINATOR FOR RAB HOLDING TIME FOR PS DATA INTERA
M1001C211	AVE RAB HOLDING TIME FOR PS CALL WITH BACKGROUND CLASS
M1001C212	DENOMINATOR FOR RAB HOLDING TIME FOR PS DATA BACKG
M1001C213	AVERAGE DCH HOLDING TIME FOR PS RAB WITH INTERACTIVE CLASS
M1001C214	DENOMINATOR FOR DCH HOLDING TIME FOR PS DATA INTERA
M1001C215	AVERAGE DCH HOLDING TIME FOR PS RAB WITH BACKGROUND CLASS
M1001C216	DENOMINATOR FOR DCH HOLDING TIME FOR PS DATA BACKG
M1001C217	NUMBER OF INT RNC INTER FREQ HHO ATTEMPTS
M1001C218	NUMBER OF UNSUCCESSFUL INT RNC INTER FREQ HHO ATTEMPTS
M1001C219	NUMBER OF INTER SYS HHO ATTEMPTS
M1001C220	NUMBER OF UNSUCCESSFUL INTER SYS HHO ATTEMPTS
M1001C221	SUM OF RRC SETUP TIMES
M1001C222	DENOMINATOR FOR SUM OF RRC SETUP TIMES
M1001C223	SUM OF RAB SETUP TIMES FOR CS VOICE
M1001C224	DENOMINATOR FOR SUM OF RAB SETUP TIMES FOR CS VOICE
M1001C225	SUM OF RAB SETUP TIMES FOR CS DATA CONV
M1001C226	DENOMINATOR FOR SUM OF RAB SETUP TIMES FOR CS DATA CONV
M1001C227	SUM OF RAB SETUP TIMES FOR CS DATA STREAM
M1001C228	DENOMINATOR FOR SUM OF RAB SETUP TIMES FOR CS DATA STREAM
M1001C233	SUM OF RAB SETUP TIMES FOR PS DATA INTERA

Table 13. RAN1.010 Radio Access Bearer Establishment and Release (cont.)

M1001C234	DENOMINATOR FOR SUM OF RAB SETUP TIMES FOR PS DATA INTERA
M1001C235	SUM OF RAB SETUP TIMES FOR PS DATA BACKG
M1001C236	DENOMINATOR FOR SUM OF RAB SETUP TIMES FOR PS DATA BACKG
M1001C237	RAB ACT FAIL FOR MULTI RAB WITH AMR AND NRT
M1001C241	RRC CONNECTION ACCESS RELEASE DUE TO CELL RESELECTION
M1001C242	RRC CONNECTION SETUP ATTEMPT REPEATS

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services

PI ID	Counter name
M1004C0	RL SETUP REQ FOR INTER RNC SHO ON SRNC
M1004C1	RL SETUP REQ FOR INTER RNC SHO ON DRNC
M1004C2	RL SETUP SUCC FOR INTER RNC SHO ON SRNC
M1004C3	RL SETUP SUCC FOR INTER RNC SHO ON DRNC
M1004C4	RL SETUP FAIL FOR INTER RNC SHO ON SRNC DUE TO RN LAYER CAUSE
M1004C5	RL SETUP FAIL FOR INTER RNC SHO ON SRNC DUE TO TR LAYER CAUSE
M1004C6	RL SETUP FAIL FOR INTER RNC SHO ON SRNC DUE TO PROT CAUSE
M1004C7	RL SETUP FAIL FOR INTER RNC SHO ON SRNC DUE TO MISC CAUSE
M1004C8	RL SETUP FAIL FOR INTER RNC SHO ON DRNC DUE TO RN LAYER CAUSE
M1004C9	RL SETUP FAIL FOR INTER RNC SHO ON DRNC DUE TO TR LAYER CAUSE
M1004C10	RL SETUP FAIL FOR INTER RNC SHO ON DRNC DUE TO PROT CAUSE
M1004C11	RL SETUP FAIL FOR INTER RNC SHO ON DRNC DUE TO MISC CAUSE
M1004C12	RL ADD REQ FOR INTER RNC SHO ON SRNC
M1004C13	RL ADD REQ FOR INTER RNC SHO ON DRNC
M1004C14	RL ADD SUCC FOR INTER RNC SHO ON SRNC

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1004C15	RL ADD SUCC FOR INTER RNC SHO ON DRNC
M1004C16	RL ADD FAIL FOR INTER RNC SHO ON SRNC DUE TO RN LAYER CAUSE
M1004C17	RL ADD FAIL FOR INTER RNC SHO ON SRNC DUE TO TR LAYER CAUSE
M1004C18	RL ADD FAIL FOR INTER RNC SHO ON SRNC DUE TO PROT CAUSE
M1004C19	RL ADD FAIL FOR INTER RNC SHO ON SRNC DUE TO MISC CAUSE
M1004C20	RL ADD FAIL FOR INTER RNC SHO ON DRNC DUE TO RN LAYER CAUSE
M1004C21	RL ADD FAIL FOR INTER RNC SHO ON DRNC DUE TO TR CAUSE
M1004C22	RL ADD FAIL FOR INTER RNC SHO ON DRNC DUE TO PROT CAUSE
M1004C23	RL ADD FAIL FOR INTER RNC SHO ON DRNC DUE TO MISC CAUSE
M1004C24	RL FAIL FOR INTER RNC SHO ON SRNC DUE TO SYN FAIL
M1004C25	RL FAIL FOR INTER RNC SHO ON SRNC DUE TO RN LAYER CAUSE
M1004C26	RL FAIL FOR INTER RNC SHO ON SRNC DUE TO TR CAUSE
M1004C27	RL FAIL FOR INTER RNC SHO ON SRNC DUE TO PROT CAUSE
M1004C28	RL FAIL FOR INTER RNC SHO ON SRNC DUE TO MISC CAUSE
M1004C29	RL FAIL FOR INTER RNC SHO ON DRNC DUE TO SYN FAIL
M1004C30	RL FAIL FOR INTER RNC SHO ON DRNC DUE TO RN LAYER CAUSE
M1004C31	RL FAIL FOR INTER RNC SHO ON DRNC DUE TO TR CAUSE
M1004C33	RL FAIL FOR INTER RNC SHO ON DRNC DUE TO MISC CAUSE
M1004C34	RL DEL FOR INTER RNC SHO ON SRNC
M1004C35	RL DEL RESP FOR INTER RNC SHO ON SRNC
M1004C36	RL DEL FOR INTER RNC SHO ON DRNC
M1004C37	RL DEL RESP FOR INTER RNC SHO ON DRNC

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1004C38	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD ON SRNC
M1004C39	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD ON SRNC
M1004C40	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL ON SRNC
M1004C41	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD ON DRNC
M1004C42	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD ON DRNC
M1004C43	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL ON DRNC
M1004C44	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD ON SRNC READY
M1004C45	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD ON SRNC READY
M1004C46	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL ON SRNC READY
M1004C47	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD ON DRNC READY
M1004C48	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD ON DRNC READY
M1004C49	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL ON DRNC READY
M1004C50	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON SRNC DUE TO RN LAYER CAUSE
M1004C51	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON SRNC DUE TO TR CAUSE
M1004C52	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON SRNC DUE TO PROT CAUSE
M1004C53	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON SRNC DUE TO MISC CAUSE
M1004C54	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON SRNC DUE TO RN LAYER CAUSE
M1004C55	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON SRNC DUE TO TR CAUSE
M1004C56	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON SRNC DUE TO PROT CAUSE
M1004C57	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON SRNC DUE TO MISC CAUSE

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1004C58	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON SRNC DUE TO RN LAYER CAUSE
M1004C59	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON SRNC DUE TO TR CAUSE
M1004C60	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON SRNC DUE TO PROT CAUSE
M1004C61	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON SRNC DUE TO MISC CAUSE
M1004C62	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON DRNC DUE TO RN LAYER CAUSE
M1004C63	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON DRNC DUE TO TR CAUSE
M1004C64	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON DRNC DUE TO PROT CAUSE
M1004C65	RL RECONF PREP SYNCH OVER IUR FOR DCH ADD FAIL ON DRNC DUE TO MISC CAUSE
M1004C66	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON DRNC DUE TO RN LAYER CAUSE
M1004C67	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON DRNC DUE TO TR CAUSE
M1004C68	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON DRNC DUE TO PROT CAUSE
M1004C69	RL RECONF PREP SYNCH OVER IUR FOR DCH MOD FAIL ON DRNC DUE TO MISC CAUSE
M1004C70	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON DRNC DUE TO RN LAYER CAUSE
M1004C71	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON DRNC DUE TO TR CAUSE
M1004C72	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON DRNC DUE TO PROT CAUSE
M1004C73	RL RECONF PREP SYNCH OVER IUR FOR DCH DEL FAIL ON DRNC DUE TO MISC CAUSE
M1004C74	RL RECONF COMM SYNCH ON SRNC OVER IUR
M1004C75	RL RECONF COMM SYNCH ON DRNC OVER IUR
M1004C76	RL RECONF CANC SYNCH ON SRNC OVER IUR
M1004C77	RL RECONF CANC SYNCH ON DRNC OVER IUR
M1004C78	RL RECONF PREP SYNCH OVER IUR ON SRNC
M1004C79	RL RECONF PREP SYNCH OVER IUR ON DRNC

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1004C80	RL RECONF PREP SYNCH OVER IUR ON SRNC READY
M1004C81	RL RECONF PREP SYNCH OVER IUR ON DRNC READY
M1004C82	RL RECONF PREP SYNCH OVER IUR FAIL ON SRNC
M1004C83	RL RECONF PREP SYNCH OVER IUR FAIL ON DRNC
M1004C84	NBR OF SENT COMP MODE CMDS ON SRNC
M1004C85	NBR OF REC COMP MODE CMDS ON DRNC
M1004C86	NBR OF SENT DED MEA INI ON SRNC
M1004C87	NBR OF REC DED MEA RES ON SRNC
M1004C88	NBR OF REC DED MEA FAIL ON SRNC
M1004C89	NBR OF REC DED MEA INI ON DRNC
M1004C90	NBR OF SENT DED MEA RES ON DRNC
M1004C91	NBR OF SENT DED MEA FAIL ON DRNC
M1004C92	NBR OF REC DED MEA REP ON SRNC
M1004C93	NBR OF SENT DED MEA REP ON DRNC
M1004C94	NBR OF SENT DED MEA TER REQ ON SRNC
M1004C95	NBR OF REC DED MEA TER REQ ON DRNC
M1004C96	NBR OF REC DED MEA FAIL IND ON SRNC
M1004C97	NBR OF SENT DED MEA FAIL IND ON DRNC
M1004C98	NBR OF REC RL PRE EMP REQ IND ON SRNC
M1004C99	NBR OF SENT RL PRE EMP REQ IND ON DRNC
M1004C100	NBR OF REC RL RES IND ON SRNC
M1004C101	NBR OF SENT RES IND ON DRNC
M1004C102	NBR OF REC PHY CHA RECONF REQ ON SRNC
M1004C103	NBR OF SENT PHY CHA RECONF COM ON SRNC
M1004C104	NBR OF SENT PHY CHA RECONF REQ ON DRNC
M1004C105	NBR OF REC PHY CHA RECONF COM ON DRNC
M1004C106	NBR OF SENT ERROR IND ON IUR
M1004C107	NBR OF REC ERROR IND ON IUR
M1005C0	RL SETUP ATT FOR FIRST RL
M1005C1	RL SETUP ATT FOR SHO ON SRNC
M1005C2	RL SETUP ATT FOR HHO ON SRNC
M1005C3	RL SETUP ATT FOR SHO ON DRNC

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1005C4	RL SETUP ATT FOR HHO ON DRNC
M1005C5	RL SETUP SUCC FOR FIRST RL
M1005C6	RL SETUP SUCC FOR SHO ON SRNC
M1005C7	RL SETUP SUCC FOR HHO ON SRNC
M1005C8	RL SETUP SUCC FOR SHO ON DRNC
M1005C9	RL SETUP SUCC FOR HHO ON DRNC
M1005C14	RL SETUP FAIL FOR FIRST RL DUE TO BTS NOT RESP
M1005C20	RL SETUP FAIL FOR SHO ON SRNC DUE TO BTS NOT RESP
M1005C26	RL SETUP FAIL FOR HHO ON SRNC DUE TO BTS NOT RESP
M1005C32	RL SETUP FAIL FOR SHO ON DRNC DUE TO BTS NOT RESP
M1005C38	RL SETUP FAIL FOR HHO ON DRNC DUE TO BTS NOT RESP
M1005C42	RL BRANCH ADD ATT FOR SHO ON SRNC
M1005C43	RL BRANCH ADD ATT FOR SHO ON DRNC
M1005C44	RL BRANCH ADD SUCC FOR SHO ON SRNC
M1005C45	RL BRANCH ADD SUCC FOR SHO ON DRNC
M1005C50	RL BRANCH ADD FAIL FOR SHO ON SRNC DUE TO BTS NOT RESP
M1005C56	RL BRANCH ADD FAIL FOR SHO ON DRNC DUE TO BTS NOT RESP
M1005C58	RL FAIL ON SRNC DUE TO INI SYN FAIL
M1005C62	RL FAIL ON DRNC DUE TO INI SYN FAIL
M1005C66	RL DEL ON SRNC DUE TO NORM REL
M1005C67	RL DEL ON SRNC DUE TO INI SYN FAIL
M1005C68	RL DEL ON SRNC DUE TO ACT RL SYN FAIL
M1005C69	RL DEL ON SRNC DUE TO BTS HW OVERL
M1005C70	RL DEL ON SRNC DUE TO BTS EQUIP FAIL
M1005C72	RL DEL ON DRNC DUE TO NORM REL
M1005C73	RL DEL ON DRNC DUE TO INI SYN FAIL
M1005C74	RL DEL ON DRNC DUE TO ACT RL SYN FAIL
M1005C75	RL DEL ON DRNC DUE TO BTS HW OVERL

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1005C76	RL DEL ON DRNC DUE TO BTS EQUIP FAIL
M1005C77	RL DEL RESP ON DRNC
M1005C78	RL RECONF PREP SYNCH FOR DCH ADD ON SRNC
M1005C79	RL RECONF PREP SYNCH FOR DCH MOD ON SRNC
M1005C80	RL RECONF PREP SYNCH FOR DCH DEL ON SRNC
M1005C81	RL RECONF PREP SYNCH FOR DCH ADD ON DRNC
M1005C82	RL RECONF PREP SYNCH FOR DCH MOD ON DRNC
M1005C83	RL RECONF PREP SYNCH FOR DCH DEL ON DRNC
M1005C84	RL RECONF PREP SYNCH FOR DCH ADD ON SRNC READY
M1005C85	RL RECONF PREP SYNCH FOR DCH MOD ON SRNC READY
M1005C86	RL RECONF PREP SYNCH FOR DCH DEL ON SRNC READY
M1005C87	RL RECONF PREP SYNCH FOR DCH ADD ON DRNC READY
M1005C88	RL RECONF PREP SYNCH FOR DCH MOD ON DRNC READY
M1005C89	RL RECONF PREP SYNCH FOR DCH DEL ON DRNC READY
M1005C94	RL RECONF PREP SYNCH FOR DCH ADD FAIL ON SRNC DUE TO BTS NOT RESP
M1005C97	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON SRNC DUE TO ALREADY ACTIV
M1005C98	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON SRNC DUE TO HW RES NOT AVAIL
M1005C99	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON SRNC DUE TO NOT ENOUGH RES
M1005C100	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON SRNC DUE TO BTS NOT RESP
M1005C101	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON SRNC DUE TO BTS GEN REA
M1005C106	RL RECONF PREP SYNCH FOR DCH DEL FAIL ON SRNC DUE TO BTS NOT RESP
M1005C112	RL RECONF PREP SYNCH FOR DCH ADD FAIL ON DRNC DUE TO BTS NOT RESP
M1005C118	RL RECONF PREP SYNCH FOR DCH MOD FAIL ON DRNC DUE TO BTS NOT RESP

Table 14. RAN1.012 Radio link allocation for real-time radio access bearer services (cont.)

M1005C126	RL RECONF COMM SYNCH ON SRNC
M1005C127	RL RECONF COMM SYNCH ON DRNC
M1005C128	RL RECONF CANC SYNCH ON SRNC DUE TO TRANSMISSION SETUP FAIL
M1005C129	RL RECONF CANC SYNCH ON SRNC DUE TO OTHER BTS NOT READY
M1005C130	RL RECONF CANC SYNCH ON DRNC DUE TO TRANSMISSION SETUP FAIL
M1005C131	RL RECONF CANC SYNCH ON DRNC DUE TO OTHER BTS NOT READY
M1005C132	RL RECONF PREP SYNCH ON SRNC
M1005C133	RL RECONF PREP SYNCH FOR DCH MOD DUE TO DYN LINK OPT ON SRNC
M1005C134	RL RECONF PREP SYNCH ON DRNC
M1005C135	RL RECONF PREP SYNCH ON SRNC READY
M1005C136	RL RECONF PREP SYNCH ON DRNC READY
M1005C137	RL RECONF PREP SYNCH FAIL ON SRNC
M1005C138	RL RECONF PREP SYNCH FAIL ON DRNC
M1005C139	NBR OF SENT COMP MODE CMDS

Table 15. RAN2.0051 Streaming packet switched quality of service

PI ID	Counter name
	Existing (RAN1.5) PS RAB Streaming counters in Service Level and Traffic Measurement

The measurement types introduced in the list below are relevant to call setup and release. For more information, see the reference document RNC counters – RNW part.

- Service level (RRC and RAB connections)
- Intra-system hard handover
- Inter-system handover
- RRC signalling

- L3 signalling at Iub
- L3 signalling at Iur
- L3 signalling at Iu
- L3 relocation signalling

16.3 Parameters

This section lists the parameters per feature.

For more information, see *WCDMA RAN Parameter Dictionary* in WCDMA RAN System Library. See also the Reference Information Service in NOLS.

Table 16. RAN134 : Transcoder and Tandem Free Operation (TrFO and TFO)

Parameter name	Modifiable/system-defined	Object
Intelligent Emergency Call ISHO Support	Modifiable	RNC
Period for CS AMR RRC TFC control requests	Modifiable	RNC

Table 17. RAN763 Basic HSDPA with QPSK and 5 codes

Parameter name	Modifiable/system-defined	Object
HSDPA Capability	System-defined	Cell

Table 18. RAN834 : Flexible Iu

Parameter name	Modifiable/system-defined	Object
NRI length for PS Core Networks	Modifiable	Iu
NRI length for CS Core Networks	Modifiable	Iu

Table 18. RAN834 : Flexible Iu (cont.)

Parameter name	Modifiable/system-defined	Object
Null NRI value for PS Pool	Modifiable	Iu
Null NRI value for CS Pool	Modifiable	Iu
NRI list for PS Core routing	Modifiable	Iu
Minimum value of NRI range for PS Core routing	Modifiable	Iu
Maximum value of NRI range for PS Core	Modifiable	Iu
NRI list for CS Core routing	Modifiable	Iu
Minimum value of NRI range for CS Core routing	Modifiable	Iu
Maximum value of NRI range for CS Core	Modifiable	Iu
State of Iu interface	Modifiable	Iu

Table 19. RAN930 : PS RAB Reconfiguration

Parameter name	Modifiable/system-defined	Object
NodeB PS RAB reconfiguration Support	Modifiable	WBTS

Table 20. RAN1759 : Support for I-HSPA Sharing and Iur Mobility Enhancements

Parameter name	Modifiable/system-defined	Object
DCH Scheduling Over Iur	Modifiable	RNC

Table 21. RAN1.007 RAN Procedures for the idle UEs

Parameter name	Modifiable/system-defined	Object
Mobile Country Code	Modifiable	Iu
Mobile Network Code	Modifiable	Iu
Mobile Network Code Length	Modifiable	Iu
RNC Identifier	Modifiable	RNC
CN Domain Indicator	Modifiable	Iu
Attach-detach allowed	Modifiable	Iu
T3212	Modifiable	Iu
N300	Modifiable	Cell
N302	System-defined	RNC
N304	Modifiable	RNC
T300	Modifiable	Cell
T302	Modifiable	RNC
T304	Modifiable	RNC
T305	Modifiable	RNC
T307	Modifiable	RNC
T308	Modifiable	RNC
T309	Modifiable	RNC
T316	Modifiable	RNC
T317	Modifiable	RNC
Access Class Barred list	Modifiable	Cell
Cell identifier	Modifiable	Cell
Cell Barred	Modifiable	Cell
Cell Reserved for operator use	Modifiable	Cell
HCS priority level for a cell	Modifiable	Cell
Intra-frequency cell re-selection indicator	Modifiable	Cell
Location area code	Modifiable	Cell
N312	Modifiable	Cell
N313	Modifiable	Cell
N315	Modifiable	Cell
PRACH Preamble Retrans Max	Modifiable	Cell

Table 21. RAN1.007 RAN Procedures for the idle UEs (cont.)

Parameter name	Modifiable/system-defined	Object
Quality threshold level for HCS	Modifiable	Cell
Cell reselection hysteresis 1	Modifiable	Cell
Cell reselection hysteresis 2	Modifiable	Cell
Minimum required quality level in the cell	Modifiable	Cell
Minimum required RX level in the cell	Modifiable	Cell
RACH random backoff upper bound	Modifiable	Cell
RACH random backoff lower bound	Modifiable	Cell
RACH maximum number of preamble cycles	Modifiable	Cell
Service Area Code	Modifiable	Cell
Threshold for inter- RAT measurement rules in HCS	Modifiable	Cell
Shutdown step amount	Modifiable	Cell
Shutdown window	Modifiable	Cell
S intersearch	Modifiable	Cell
S intrasearch	Modifiable	Cell
S limit, SearchRAT	Modifiable	Cell
S searchHCS	Modifiable	Cell
S searchRAT	Modifiable	Cell
T312	Modifiable	Cell
T313	Modifiable	Cell
T314	Modifiable	RNC
T315	Modifiable	Cell
Cell barred period	Modifiable	Cell
Evaluating period for amount of cell reselections	Modifiable	Cell
Hysteresis to revert from UE high-mobility measurements	Modifiable	Cell
Cell reselection triggering time	Modifiable	Cell
Use of HCS	Modifiable	Cell

Table 22. RAN1.008 RAN - UE connection establishment

Parameter name	Modifiable/system-defined	Object
Number of PI per frame	Modifiable	Cell

Table 23. RAN1.009 Management of the connected mode UE

Parameter name	Modifiable/system-defined	Object
Core Network (Iu interface) list	Modifiable	RNC
Iu item information	Modifiable	Iu
Network indicator	Modifiable	Iu
Network Mode of Operation	Modifiable	Iu
Signalling point code	Modifiable	Iu
TRafC	Modifiable	Iu
TRatC	Modifiable	Iu
Neighbour RNC (Iur interface) list	Modifiable	RNC
Iur item information	Modifiable	Iu
Neighbour RNC identifier	Modifiable	Iu
Network indicator of neighbour RNC	Modifiable	Iu
Signalling point code of neighbour RNC	Modifiable	Iu
N308	Modifiable	RNC

17 Limitations and restrictions

This functionality has no limitations or restrictions.

Related Topics

Call setup and release

Descriptions

Real-time and non-real time services

RRC state

Paging

RRC connection setup and release

Signalling connection setup and release

Radio link setup, reconfiguration and deletion

Radio access bearer setup, reconfiguration and release

Ciphering and integrity protection setup

Cell and URA updates

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