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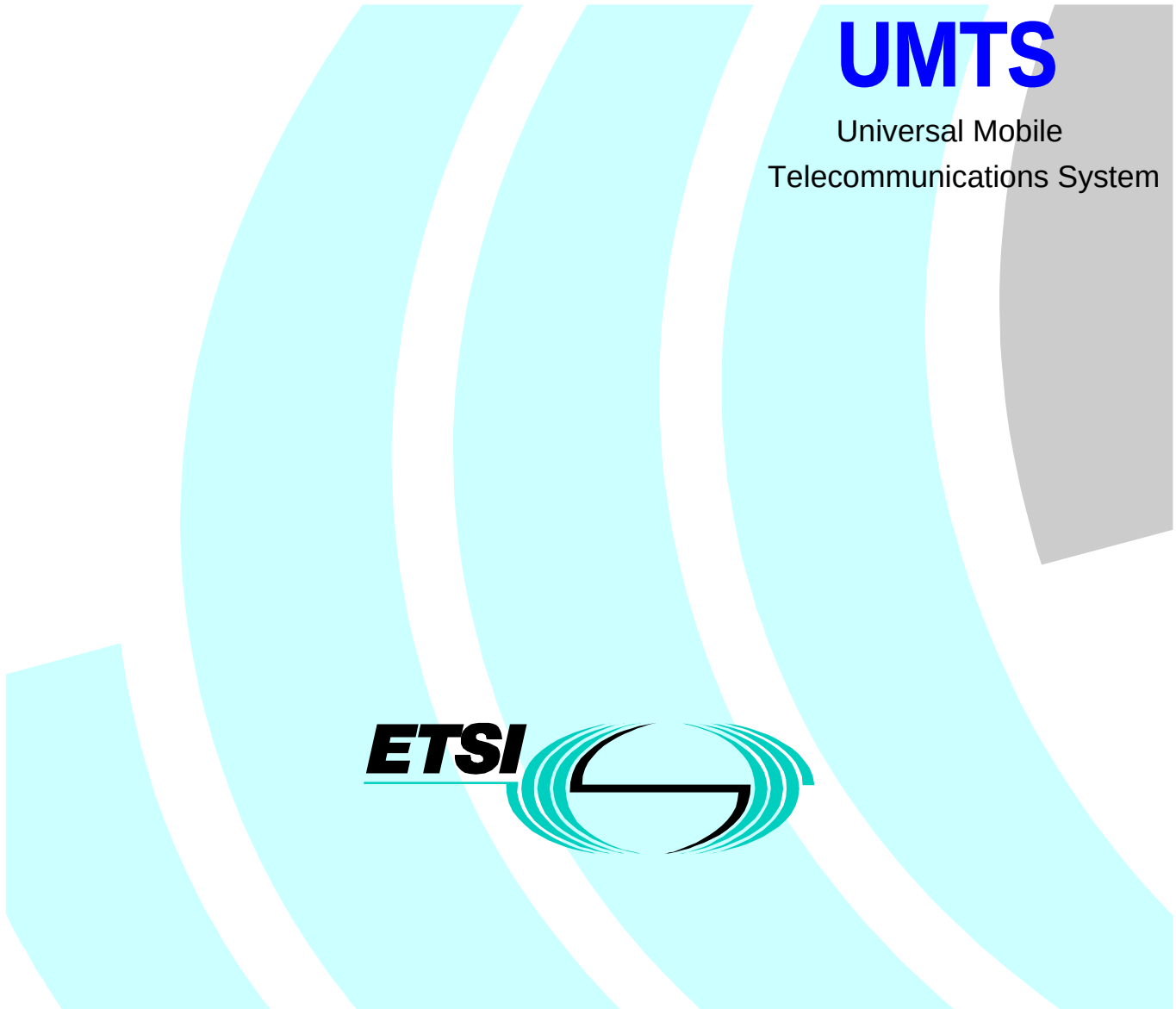
UMTS YY.31 V1.0.0 (1999-01)

Technical Report

UMTS Terrestrial Radio Access Network (UTRAN); Description of the RRC protocol (UMTS YY.31 version 1.0.0)



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Contents

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Foreword

This Description document has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).
This Description document is intermediate between a stage 2 document and a protocol specification, it defines the RRC protocol which is used in the UTRAN.
The contents of this Description are subject to continuing work within TC-SMG and may change following formal TC-SMG approval.

1 Scope

The scope of this document is to describe the RRC protocol. Once completed, it should be sufficient for manufacturers to start some « high level design » activities. It should allow as well to assess the complexity of the associated protocol. After the completion of a description document, the drafting of the protocol specification should not have to face difficulties which would impact the other protocols i.e. the radio interface protocol architecture should be stable. This means that some procedures which are felt critical in terms of complexity will need to be studied in more details in the description document so that no problem is faced in the writing of the final protocol.
The following lists typical contents for a description document :

1. list of procedures
2. logical flow diagrams for normal procedures
3. logical description of message (where it should be possible to guess roughly the size of the various information elements)
4. principles for error handling
5. some exceptional procedures which are felt critical
6. It should, as far as possible, have the same format and outline as the final specification

The following is not covered

1. exact message format
2. all scenarios

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Tdoc SMG2/UMTS Layer 2/3 356/98, Vocabulary used in the UMTS L2/3 Expert group, Ver 0.1.0
[2] Tdoc SMG2/UMTS Layer 2/3 355/98, UMTS YY.01 V1.0.0 1998-12, 'MS-UTRAN Radio Interface Protocol Architecture'; Stage 2;
[3] UMTS YY.03 V0.3.0 1998-12,'Description of UE states and procedures in connected mode'

3 Definitions and Abbreviations

3.1 Definitions

See [1] for definition of fundamental concepts and vocabulary

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BCCH	Broadcast Control Channel
BCFE	Broadcast Control Functional Entity
CCCH	Common Control Channel
DCCH	Dedicated Control Channel
DCFE	Dedicated Control Functional Entity
DCH	Dedicated Channel
FACH	Forward Access Channel
FAUSCH	Fast Uplink Signalling Channel
ODMA	Opportunity Driven Multiple Access
PNFE	Paging and Notification Control Functional Entity
QoS	Quality of Service
RNTI	Radio Network Temporary Identifier
RFE	Routing Functional Entity
RRC	Radio Resource Control
SAP	Service Access Point
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network

4 General

The functional entities of the RRC layer are described below:

- Routing of higher layer messages to different MM/CM entities (UE side) or different core network domains (UTRAN side) is handled by the Routing Function Entity (**RFE**)
- Broadcast functions are handled in the broadcast control function entity (**BCFE**). BCFE offers RRC services by the GC-SAP and uses the lower layer services provided by Tr-SAP.
- Paging of idle mode UE(s) is controlled by the paging and notification control function entity (**PNFE**). PNFE offers RRC services by the Nt-SAP and uses the lower layer services provided by Tr-SAP.
- The Dedicated Control Function Entity (**DCFE**) handles all functions specific to one UE. The DCFE offers RRC services by the DC-SAP and can use lower layer services of UM/AM-SAP and Tr-SAP depending on the message to be sent and on the current UE service state.

Logical information exchange is necessary also between the RRC sublayer functional entities. Most of that is implementation dependent and not necessary to present in detail in a specification.

Figure 1shows the RRC model for the UE side and Figure 2 shows the RRC model for the UTRAN side.

*[Editors note: Some further clarification in the diagrams may be beneficial to acknowledge the fact that a DC-SAP for example might be offered over a dedicated channel (with RRC terminated in SRNC) whereas GC-SAP and Nt-SAP may be offered over BCCH, PCH respectively in which cases RRC is located in Node B. It could be concluded from the figure that these channels use the same SAP offered by RLC (Tr-SAP, UM-SAP, AM-SAP) whereas in fact they will use different SAP's, though the SAP **type** might be the same]*

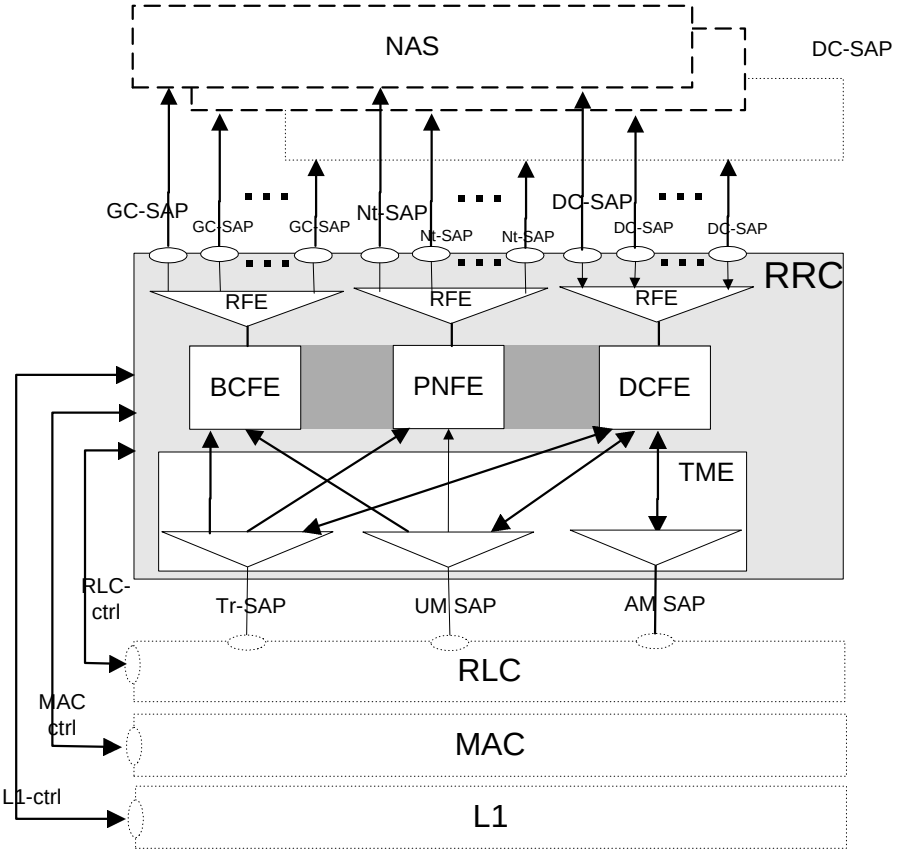

Figure 1) UE side model of RRC

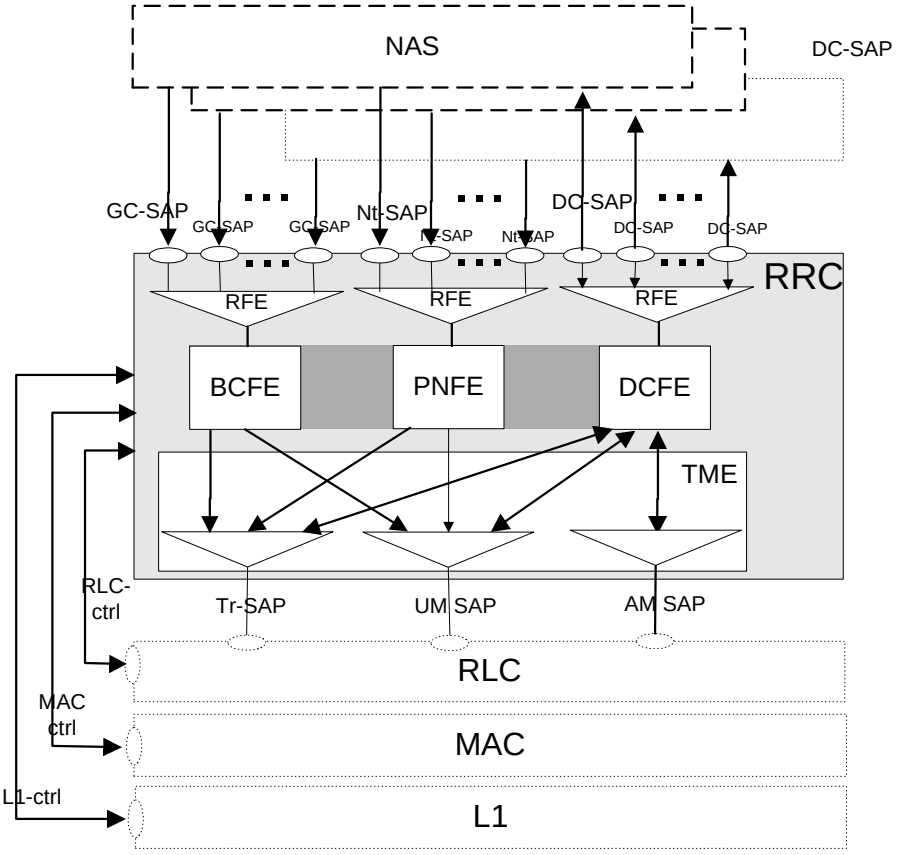

Figure 2) UTRAN side RRC model

5 Functions

The RRC performs the functions listed below, a more detailed description of these functions is provided in YY.01:

- Broadcast of information provided by the non-access stratum (Core Network).
- Broadcast of information related to the access stratum.
- Establishment, maintenance and release of an RRC connection between the UE and UTRAN.
- Establishment, reconfiguration and release of Radio Access Bearers
- Assignment, reconfiguration and release of radio resources for the RRC connection.
- RRC connection mobility functions.
- Arbitration of the radio resource allocation between the cells.
- Control of requested QoS.
- UE measurement reporting and control of the reporting.
- Outer loop power control.
- Control of ciphering.
- Slow DCA.
- Broadcast of ODMA relay node neighbour information
- Collation of ODMA relay nodes neighbour lists and gradient information
- Maintenance of number of ODMA relay node neighbours
- Establishment, maintenance and release of a route between ODMA relay nodes
- Interworking between the Gateway ODMA relay node and the UTRAN
- Contention resolution (TDD mode)
- Paging/notification.

The following functions are regarded as further study items:

- Initial cell selection and re-selection in idle mode.
- Congestion control.
- Routing of higher layer PDU's (in UE side to correct higher layer entity and in UTRAN side to correct RANAP entity). The requirement for this function will be dependent on the decision made by SMG12.

6 RRC services provided to upper layers

The RRC offers the following services to upper layers, a description of these services is provided in [2].

- General Control
- Notification
- Dedicated control

7 Services expected from lower layers

7.1 Services expected from Layer 2

7.2 Services expected from Layer 1

8 Elementary RRC procedures

This section describes elementary RRC procedures used in the idle mode and in the connected mode. More description on the different UE modes is provided in [2].This section also describes procedures for establishing and releasing an RRC connection.

8.1 Idle mode procedures

8.1.1 Broadcast of system information

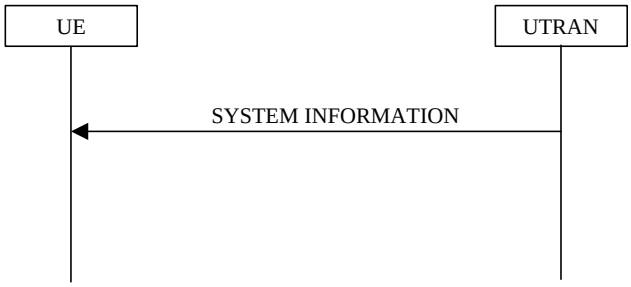

Figure 3) Procedure for broadcast of system information

This procedure is used for broadcasting system information from the network to all UEs in a cell. Only UEs that listen to the logical channel BCCH can be reached by this procedure. The system information is repeated on a regular basis and it includes information from both the access stratum and the non-access stratum. The initiative to change the system information can come from both the access stratum and non-access stratum.

[Note: The set of messages that forms the system information is FFS. However, basically the same elementary procedure can be applied for all messages.]

8.1.2 Paging request

Figure 4) Paging request procedure

This procedure is used to broadcast a PAGING REQUEST message from the network to selected UEs in a cell. Only UEs which listen to the correct paging group can be reached by this procedure. A PAGING REQUEST message can be sent to either one or many UEs at the same time.

8.1.3 Notification request

Figure 5) Notification request procedure

This procedure is used for broadcast of notification information to selected UEs in a cell. Only UEs that listen to the correct notification group can be reached by this procedure. The initiative to send a NOTIFICATION REQUEST can come from both the access stratum and the non-access stratum. NOTIFICATION REQUEST can be sent to either one or many UEs at the same time.

[Note: The usage of this procedure is FFS.]

8.2 RRC connection establishment and release procedures

8.2.1 RRC Connection Establishment

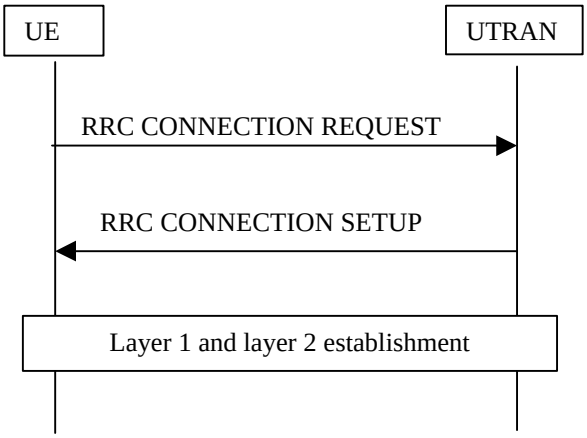

Figure 6) Procedure for RRC connection establishment

This procedure is initiated from the UE side to establish an RRC connection, as a result of either:

1) A request from the non-access stratum to establish the first signalling connection for the UE [Note: For a GSM-based Core Network some examples of reasons are: CM Establishment Request and Location Update Request.], or
2) A received paging request. [Note: Whether the RRC connection is established with or without an explicit request from UE non-access stratum in this case is FFS.]

The RRC connection establishment is initiated by the UE, which leaves the idle mode and sends an RRC CONNECTION REQUEST message using unassured mode on the uplink CCCH. *[Note: The initial identification of the UE is FFS.]*

The UTRAN makes an assignment of radio resources and the Radio Network Temporary Identity (RNTI) to be used by the UE.The UTRAN sends an RRC CONNECTION SETUP message to the UE using unassured mode on the downlink CCCH. The message includes radio resource parameters and the RNTI.

The UE configures the layer 2 and layer 1 processing for the DCCH using the radio resource parameters. The procedure successfully ends when the layer 2 signalling link is established on the DCCH.

[Note: The necessity of an explicit RRC CONNECTION SETUP COMPLETE MESSAGE from the UE to the UTRAN on layer 3 is FFS. One assumption is, that there is an explicit layer 2 peer-to-peer signalling to establish the signalling link, making an explicit RRC CONNECTION SETUP COMPLETE message on layer 3 unnecessary.]

Note also that on receipt of an RRC CONNECTION REQUEST message, the RNC can allocate a FAUSCH channel for the UE for the particular cell, in which the UE is camping on, or FAUSCH channels for a number of cells of the URA, in which the UE is currently staying depending on the type of UE. The FAUSCH channels allocated are conveyed to the UE in the RRC CONNECTION SETUP message.The following procedure which could be used during RRC connection establishment is for further study:

On receipt of an RRC CONNECTION REQUEST message, the RNC may allocate a dedicated channel to the mobile station. It is also possible to setup macrodiversity at this point. To do so means that the RRC CONNECTION REQUEST message must contain a measurement report. In this case, the RNC executes branch addition (physical channel activation) to each cell (/NodeB) that will be included in the active set. After the physical channel(s) are setup on the UTRAN side, the RRC CONNECTION SETUP message is sent to the UE on the FACH channel.

8.2.2 RRC Connection Release

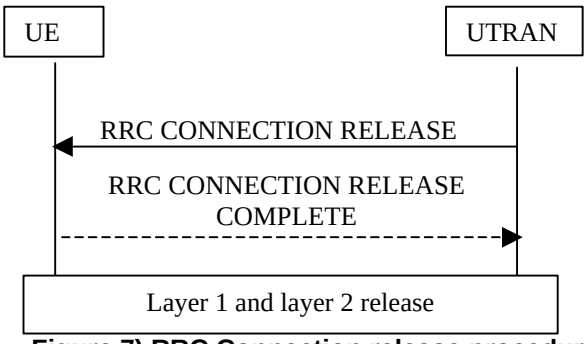

Figure 7) RRC Connection release procedure

A normal RRC connection release procedure is initiated from the UTRAN, e.g. when the last Signaling Connection is released. [Note: Release in case of RRC connection failure is FFS.] [Note: Possibility for UE initiated RRC connection release is FFS.]
Two variants of this procedure have been identified:
1) RRC connection release from state where dedicated physical channel is available
2) RRC connection release from state where there is no dedicated physical channel
In the former case (a) the UTRAN sends an RRC CONNECTION RELEASE message to the UE using acknowledged mode on the DCCH. The UE then leaves the Connected Mode and initiates release of the layer 2 signalling link. The RRC Connection Release procedure ends when all UE dedicated resources (such as radio resources and radio access bearers) tied to the RRC connection are released and the RRC layer is transferred to idle mode.
In the latter case (b) the RRC layer entity in the network issues an RRC CONNECTION RELEASE message using unacknowledged mode on the DCCH. Upon reception of this message the UE-RRC sends an RRC CONNECTION RELEASE COMPLETE message to UTRAN using acknowledged mode on the DCCH. *[Note: Depending on RLC design, the acknowledgement to RRC CONNECTION RELEASE could be piggybacked to the RRC CONNECTION RELEASE COMPLETE MESSAGE, resulting in no additional messages. Therefore acked / unacked transmission is considered FFS.].* After receiving the RRC CONNECTION RELEASE COMPLETE message the network RRC layer releases L2 resources and the RRC entity dedicated to this UE goes to Idle Mode.On receipt of the RRC CONNECTION RELEASE COMPLETE message the network releases the FAUSCH channels allocated for the UE going to idle mode if FAUSCH channels have been allocated during RRC connection establishment.

8.2.3 RRC Connection re-establishment

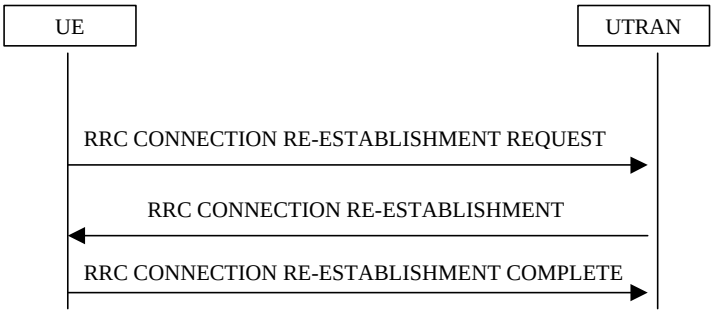

Figure 8) RRC Connection re-establishment

RRC connection re-establishment is needed, when a UE loses radio connection due to e.g. radio link failure. After having selected a new cell, the UE RRC sends the NW RRC an RRC CONNECTION RE-ESTABLISHMENT REQUEST message. The NW RRC configures the NW and acknowledges the connection re-establishment to the UE RRC with an RRC CONNECTION RE-ESTABLISHMENT message. This message may contain the FAUSCH channel(s) valid for this cell, and possibly other cells of the same URA, if FAUSCH channels have been allocated earlier. The UE RRC configures the UE L1 to activate the new radio link(s). After the UE has synchronised to at least one radio link, the MAC and RLC layers can be configured (if necessary). When the procedure is completed on the UE side, an RRC CONNECTION RE-ESTABLISHMENT COMPLETE message is sent.

8.3 RRC connected mode procedures

8.3.1 Radio Access Bearer Related Procedures

8.3.1.1 Radio Access Bearer Establishment

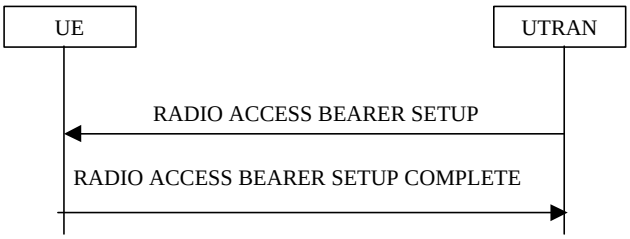

Figure 9) Radio Access Bearer Establishment Procedure

This procedure establishes a new radio access bearer. The establishment includes, based on QoS, assignment of RLC parameters, multiplexing priority for the DTCH, scheduling priority for DCH, TFS for DCH and update of TFCS. It may also include assignment of a physical channel(s) and change of the used transport channel types / RRC state.
There are a number of alternative methods by which radio access bearers may be established:

a) Radio Access Bearer Establishment with Dedicated Physical Channel Activation
b) Radio Access Bearer Establishment with Unsynchronised Dedicated Physical Channel Modification
c) Radio Access Bearer Establishment with Synchronised Dedicated Physical Channel Modification
d) Radio Access Bearer Establishment without Dedicated Physical Channel

A Radio Access Bearer Establishment is initiated when the RRC layer in the network sends a RADIO ACCESS BEARER SETUP message to its peer entity. This message contains L1, MAC and RLC parameters and in the synchronised case an activation time. RRC on the UE side then configures L1 and MAC and creates a new RLC entity associated with the new radio access bearer. A similar reconfiguration is also done on the network side. The UE then sends a RADIO ACCESS BEARER SETUP COMPLETE message back to the network.

8.3.1.2 Radio Access Bearer Release

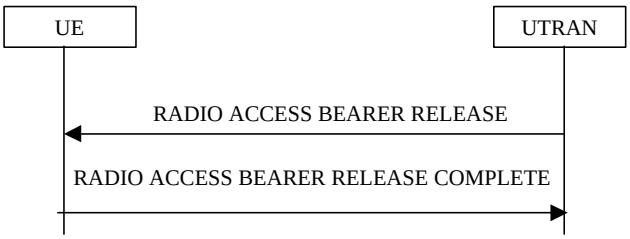

Figure 10) Radio Access Bearer Release Procedure

This procedure releases a radio access bearer. The RLC entity for the radio access bearer is released. The procedure may also release a DCH, which affects the TFCS. It may include release of physical channel(s) and change of the used transport channel types / RRC state.
The Radio Access Bearer Release procedure is initiated by the RRC layer on the NW side. A RADIO ACCESS BEARER RELEASE message is sent from the RRC layer in the network to its peer entity in the UE. This message includes possible new L1, MAC and RLC parameters for remaining radio access bearers and indentification of the radio access bearer to be released. *[Note: In synchronised case a specific activation time would be needed for the change of L1 and L2 configuration to avoid data loss.]*
The RRC on the UE side configures L1 and MAC, and releases the RLC entity associated to the released radio access bearer . A similar reconfiguration is also done on the network side.
Finally, RRC on the UE side sends a RADIO ACCESS BEARER RELEASE COMPLETE message to the network.
Currently the following alternative methods have been identified by which Radio Access Bearers may be released:

a) Radio Access Bearer Release with unsynchronised dedicated physical channel modification
b) Radio Access Bearer Release with synchronised dedicated physical channel modification
c) Radio Access Bearer Release without dedicated physical channel modification

8.3.1.3 Radio Access Bearer and signalling link Reconfiguration

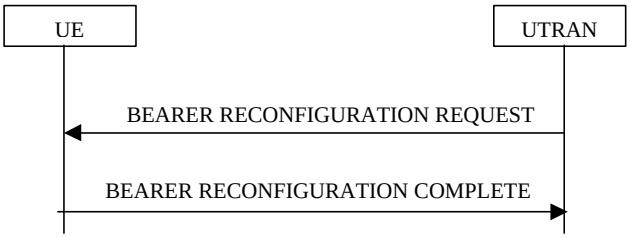

Figure 11) Radio Access Bearer Reconfiguration Procedure

This procedure reconfigures parameters for a radio access bearer or the signalling link to reflect a change in QoS. It may include change of RLC parameters, change of multiplexing priority for DTCH/DCCH, change of DCH scheduling priority, change of TFS for DCH, change of TFCS, assignment or release of physical channel(s) and change of used transport channel types. *[Note: The necessity of this procedure is FFS.]*
Currently identified options by which Radio Access Bearers may be reconfigured:
a) Synchronised Radio Access Bearer reconfiguration
b) Unsynchronised Radio Access Bearer reconfiguration

8.3.2 Transport Channel Reconfiguration

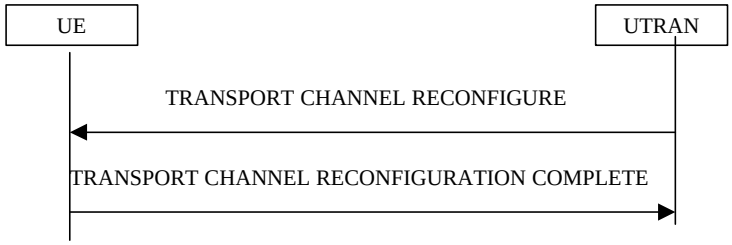

Figure 12) Procedure for transport channel reconfiguration

This procedure configures parameters related to a transport channel such as the TFS. The procedure also assigns a TFCS and may change physical channel parameters to reflect a reconfiguration of a transport channel in use.
A change of the transport format set for a transport channel is triggered in the RRC layer in the network. A TRANSPORT CHANNEL RECONFIGURE message is then sent from the RRC layer in the network to its peer entity. This message contains the new transport format set, a new transport format combination Set and may include physical channel parameters, i.e. new parameters for L1 and MAC. *[Note1: In a synchronised procedure a specific activation time is needed for the change of L1 and L2 configuration to avoid data loss.]* When this message is received in the UE a reconfiguration of L1 and MAC is done. A similar reconfiguration is also done on the network side. Finally, a TRANSPORT CHANNEL RECONFIGURE COMPLETE message is returned to the network.
Currently identified options by which transport channels may be reconfigured:
a) Synchronised transport format set reconfiguration
b) Unsynchronised transport format set reconfiguration
c) Pre-configuration of TFS/TFCS for a transport channel not yet in use

8.3.3 Transport Format Combination Control

Figure 13) Transport Format Combination Control Procedure

The network uses this procedure to control which transport format combinations (within the transport format combination set) can be used by the UE in the uplink. An example of when this procedure might be used is when a congestion situation occurs such that it is desirable to temporarily restrict the TFC's in use.
This procedure is initiated with a TRANSPORT FORMAT COMBINATION CONTROL message sent from the network to the UE. This message defines the subset of the complete Transport Format Combination Set which the UE is allowed to use, or in case of relieving a temporary restriction, a TFCS which is identical to the complete original set. The UE then reconfigures MAC which thereafter uses the new TFC set. The TRANSPORT FORMAT COMBINATION CONTROL message may be sent as unacknowledged data transfer (FFS) since it is assumed that it does not matter if one UE out of many misses this information and stays with the old TFCS.

8.3.4 Physical Channel Reconfiguration

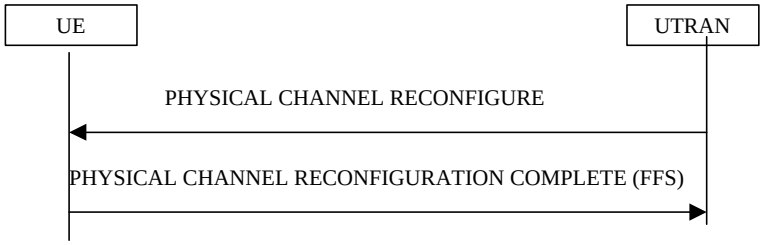

Figure 14) Physical Channel Reconfiguration procedure

This procedure may assign, replace or release a set of physical channels used by an UE. As a result of this, it may also change the used transport channel type (and RRC state). For example, when the first physical channel is assigned the UE enters the DCH/DCH state. When the last physical channel is released the UE leaves the DCH/DCH state and enters a state (and transport channel type) indicated by the network. A special case of using this procedure is to change the DL channelization code of a dedicated physical channel. *[Note: The procedure does not change the active set, in the downlink the same number of physical channels are added or replaced for each radio link.]*
Currently identified motivations for using this procedure (methods by which physical channels may be reconfigured):
a) Assignment of dedicated physical channel (switch from common channels to dedicated physical channel)
b) Synchronised replacement (modification) of dedicated physical channel (eg. for D/L code tree re-organisation)
c) Release dedicated physical channel (switch from dedicated physical channel to common channels).
d) This procedure can also be used to add further FAUSCH channels (e.g. for use in other cells of the URA, to which a UE might move in the future when the UE already has an RRC connection.)

8.3.5 Mobility Related Procedures

8.3.5.1 Modification of the active set when in Soft hand-over

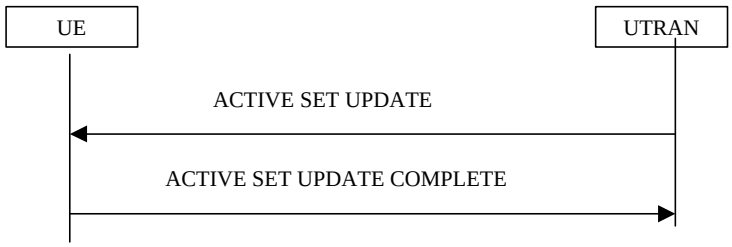

Figure 15) Procedure for modifying the active set when in soft hand-over

There are three alternative ways of modifying the active set which have been identified:
a) Radio link addition
b) Radio link removal
c) Combined radio link addition and removal
Radio link addition is triggered in the network RRC layer. The NW RRC first configures the new radio link. Transmission and reception begin immediately. The NW RRC then sends an ACTIVE SET UPDATE message to the UE RRC. The UE RRC configures layer 1 to begin reception. After confirmation from the physical layer in UE an ACTIVE SET UPDATE COMPLETE message is sent to the NW RRC
Radio link removal is triggered by the network RRC layer. The radio link is first deactivated by the UE and then in the NW. The NW RRC sends an ACTIVE SET UPDATE message to the UE RRC. The UE RRC requests UE L1 to terminate reception of the radio link(s) to be removed. After this the UE RRC acknowledges radio link removal with an

ACTIVE SET UPDATE COMPLETE message to the NW RRC. The NW RRC proceeds to request the NW L1 to release the radio link.
The NW RRC determines the need for radio link replacement. When radio links are to be replaced, the NW RRC first configures the NW L1 to activate the radio link(s) that are being added. The NW RRC then sends an ACTIVE SET UPDATE message to the UE RRC, which configures the UE L1 to terminate reception on the removed radio link(s) and begin reception on the added radio link(s). If the UE active set is full, an old radio link has to be removed before a new one can be added. If the UE has only one radio link, then the replacement must be done in reverse order (first add, then remove). *Note: The present assumption is that the order of the replacement can be left to the UE.* The UE RRC acknowledges the replacement with an ACTIVE SET UPDATE COMPLETE message. The NW RRC then configures the NW L1 to terminate reception and transmission on the removed radio link.
[Editors note: Presumably the radio link replacement procedure can be used for intra-frequency(make before break) hard hand-off]
[Editor's note: TDD active set update will also be supported if the L1 group identifies the requirement]

8.3.5.2 Hard handover (FDD and TDD hard)

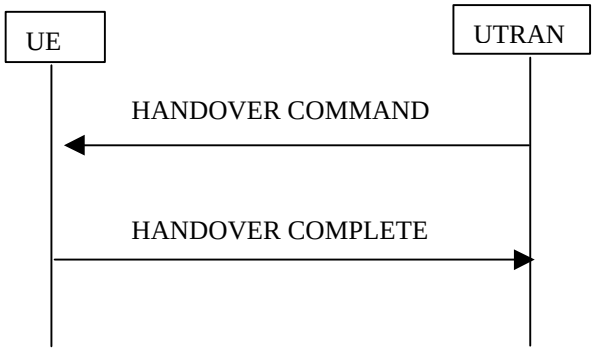

Figure 16) Inter-frequency hard handover

The NW RRC determines the need for inter-frequency hard handover and then configures the NW L1 to activate the new radio links. The NW L1 begins transmission and reception on the new links immediately. The NW RRC then sends the UE RRC a HANDOVER COMMAND message. The message indicates the radio resources that should be used for the new radio link, and can include a FAUSCH channel for the new cell, if the UE has not already been assigned a valid FAUSCH channel for the new cell.The UE RRC configures the UE L1 to terminate reception on the old radio link and begin reception on the new radio link.
After the UE L1 has achieved downlink synchronisation on the new frequency, a L2 link is established and the UE RRC sends a HANDOVER COMPLETE message to the NW RRC. After the L3 acknowledgement has been received, the NW RRC configures the NW L1 to terminate reception and transmission on the old radio link.
[Note 1: Whether it should be possible to setup several radio links immediately on the new frequency is FFS.]
[Note 2: The suspension and resuming of the CC and MM signalling during handover is FFS.]

8.3.5.5 Inter system hard hand-over (GSM/BSS to UTRAN)

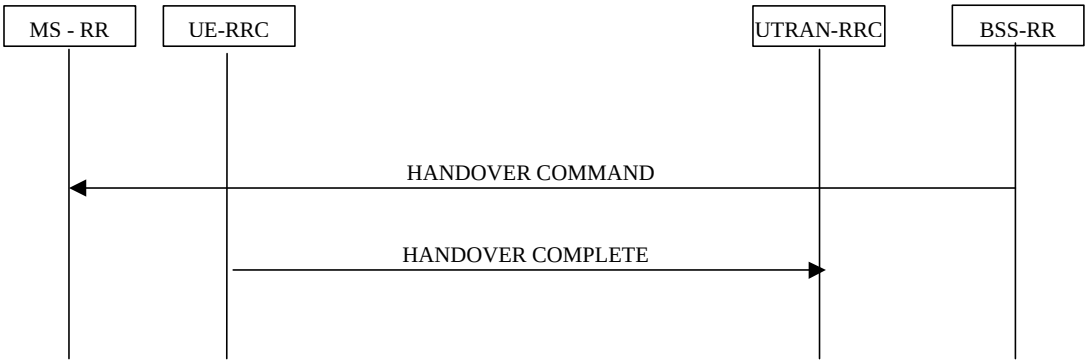

Figure 17) Procedure for Inter-system hard hand-over - GSM to UTRAN

The handover from GSM/BSS to UTRAN for a dual-mode GSM MS / UMTS UE is described.

On the network side, the RRC layer performs admission control and radio resource allocation, assigning an RNTI for the RRC connection and selecting radio resource parameters (such as transport channel type, transport format sets, etc). The selected parameters including the RNTI, aretransmitted to the UE via the upgraded GSM RR message HANDOVER COMMAND. Upon reception of the HANDOVER COMMAND message, the UE RRC configures L1 and L2 using these parameters to locally establish the DCCH logical channel . Layer 1 indicates to RRC when it has reached synchronisation. An RLC signalling link establishment is then initiated by the UE. A HANDOVER COMPLETE message is finally sent by the UE RRC.

8.3.5.6 Inter system hard hand-off (UTRAN to GSM/BSS, PSTN/ISDN domain services)

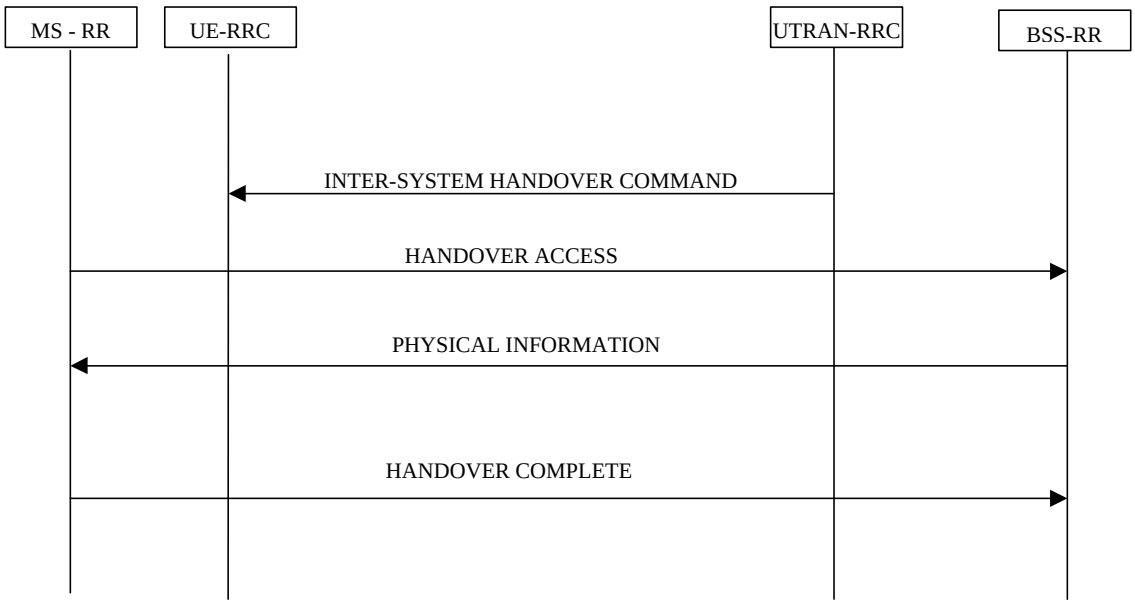

Figure 18) Inter system hard hand-off (UTRAN to GSM/BSS), PSTN/ISDN services

[Note: The scope of this description is restricted to a UE having a connection only to PSTN/ISDN services, i.e. no simultaneous IP connection]

For PSTN/ISDN domain services UTRAN Inter-System Handover procedure is initiated from the UTRAN.

The UTRAN RRC sends an INTER-SYSTEM HANDOVER COMMAND (type UTRAN-to-BSS HARD HANDOVER) to the UE to start the execution of the handover. This message contains all the information needed for the UE to be able to switch to the GSM cell and perform a GSM handover.

Upon reception of the HANDOVER COMMAND message, the UE RRC layer can then locally release the resources on the RLC, MAC and physical layers of the UE.

After having switched to the assigned GSM channel specified in the INTER-SYSTEM HANDOVER COMMAND, the MS RR sends a HANDOVER ACCESS message in successive layer 1 frames, just as it typically would have done for a conventional GSM handover initiation.

When the BSS-RR has received the HANDOVER ACCESS it indicates this to the CN/AS by sending a HANDOVER DETECT message. The BSS-RR sends a PHYSICAL INFORMATION message to the GSM MS in unacknowledged mode that contains various fields of physical layer -related information allowing a proper transmission by the MS.

After layer 1 and layer 2 connections are successfully established, the GSM MS returns the HANDOVER COMPLETE message.

The UTRAN is then able to release the resources that were used by the UE in UTRAN Connected Mode.

8.3.5.7 URA updating

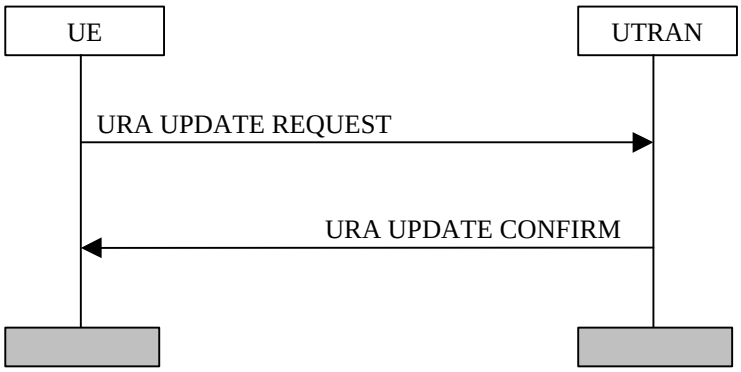

Figure 19) URA update procedure.

The URA update procedure is used by the UE to inform the UTRAN that the UE has switched to a new URA. Normally the procedure is triggered after change of cell and after the UE have read information broadcasted by UTRAN indicating change of URA.
The UE establishes a radio link to a cell in the new URA. After that the UE sends a URA UPDATE REQUEST message to the UTRAN. Upon reception of the message the UTRAN registers the change of URA, and sends a URA UPDATE CONFIRM message to the UE. The URA UPDATE CONFIRM message may include a new RNTI.
[Note1: Whether it should be possible for the UTRAN to trigger a URA update request from the UE is FFS.]
[Note 2: The need for a completing message, sent from the UE to finalize the procedure, is FFS.]

8.3.5.8 Cell updating

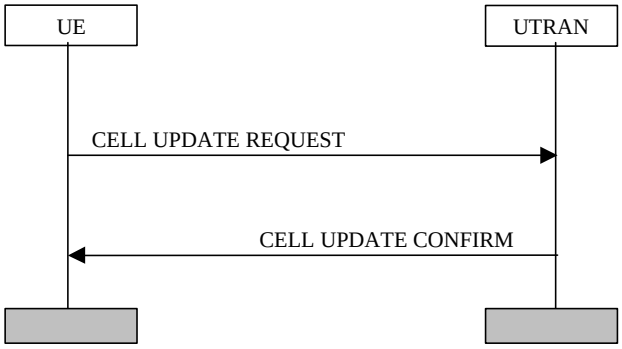

Figure 20) Cell update procedure.

The cell update procedure is used by the UE to inform the UTRAN that the UE has switched to a new cell. The procedure is a forward handover procedure. Normally the procedure is triggered after change of cell and after the UE has read information broadcasted by UTRAN.
The UE abandons the radio link to the old cell and establishes a radio link to the new cell. After that the UE sends a CELL UPDATE REQUEST message to the UTRAN. Upon reception of the message the UTRAN registers the change of cell, and sends a CELL UPDATE CONFIRM message to the UE. The CELL UPDATE CONFIRM message may include a new RNTI.
The cell update procedure can also include the updating of which FAUSCH channel should be used in the new cell.
[Note1: Whether it should be possible for the UTRAN to trigger a cell update request from the UE is FFS.]
[Note 2: The need for a completing message, sent from the UE to finalize the procedure, is FFS.]

8.3.6 RRC Connected mode procedures which use Paging

8.3.6.1 Core network originated paging

Figure 21) Core network originated paging procedure in connected mode

So far only one example of this procedure has been identified (two others are FFS):
a) UTRAN co-ordinates, UE is on DCCH
b) UTRAN co-ordinates, UE is on PCCH (FFS)
c) UE co-ordinates (FFS)
Consider case (a): This procedure enables the CN to request paging of a UE. Since the UE can be reached on the DCCH, the RRC layer formats a Paging Request Type 1 message containing the UE paging identity and the NAS information, and the message is transmitted directly to the UE using unacknowledged data transfer.

8.3.6.2 UTRAN originated paging

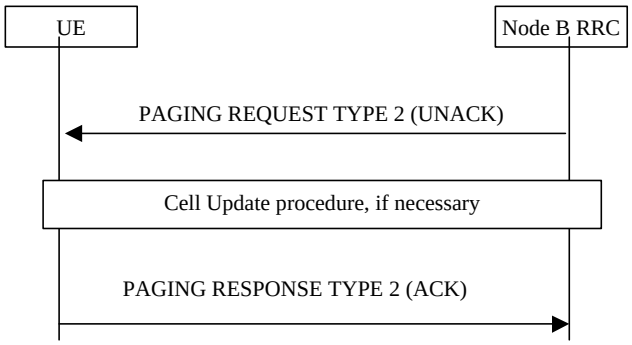

Figure 22) UTRAN originated paging procedure in connected mode

The RRC layer in the network can use this procedure to trigger a switch from PCH or URA connected state to RACH/FACH or RACH+FAUSCH/FACH state. A Paging Request Type 2 message, containing the UTRAN UE identity (e.g. RNTI) is sent on the PCCH.
In the UE, the RRC layer continuously monitors the paging group on the PCH and compares the UE identities in the received paging request messages with its own identities. When a match occurs, the RRC layer may optionally use the cell update procedure to obtain a new RNTI, before using the DCCH.
The UE then prepares a Paging Response Type 2 message, which is sent on the DCCH. *[Note: The content of the Paging Response Type 2 message is FFS. It could for example contain measurements.]* When the network receives the Paging Response Type 2 message, the DCCH/DTCH logical channels can also be used in the downlink.

8.3.7 Procedures related to measurement and monitoring

8.3.7.1 Measurement control

Figure 23) Measurement Control procedure

This procedure is initiated from the UTRAN side to control a measurement in a specific UE. The UTRAN sends a MEASUREMENT CONTROL message to the UE on the DCCH. The message includes the information that controls the UE measurement. Examples of such information are:

1) **Measurement type**: One of the types from a predefined list where each type describes what the UE shall measure.
2) **Measurement identity number**: A reference number that is used by the UTRAN at modification of the measurement and by the UE in the measurement report.
3) **Measurement command**: One out of three different measurement commands
   - Setup: Setup a new measurement.
   - Modify: Modify a previously specified measurement, e.g. change the reporting criteria.
   - Release: Stop a measurement and clear all information in the UE that are related to that measurement.
4) **Measurement objects:** The objects the UE shall measure on, and corresponding object information.
5) **Measurement quantity:** The quantity the UE shall measure. This also includes the filtering of the measurements.
6) **Measurement reporting criteria**: The triggering of the measurement report, e.g. periodical, event-triggered or immediate reporting. Here is also specified if the measurement report should be transmitted using either acknowledged or unacknowledged data transfer on the DCCH.

[Editor's note: Details of how this procedure can make use of slotted mode operation is still under investigation]

8.3.7.2 Measurement reporting

Figure 24) Measurement Report procedure

The Measurement Report procedure is initiated from the UE side when the reporting criteria are met. The message is sent using either acknowledged or unacknowledged data transfer on the DCCH. The UE sends a MEASUREMENT REPORT message to the UTRAN that includes the measurement identity and the measured values of the requested measurement objects.

[Note: UE measurement reports can be sent without prior Measurement Control message, e.g. reports of measurements that are predefined in the standard or defined via system information.]

8.3.8 Other procedures in connected mode

8.3.8.1 Transmission of UE capability information

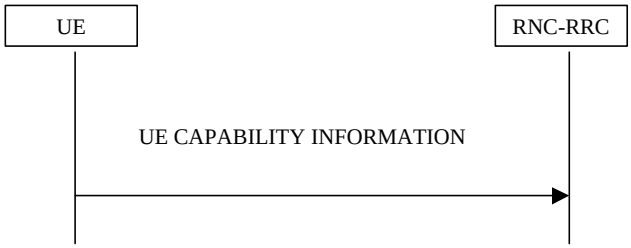

Figure 25) Procedure for transmission of UE capability information

The UE transfers its capability information to the network by transmitting the UE CAPABILITY INFORMATION message using acknowledged mode on the DCCH. This procedure can (optionally) be performed after RRC Connection Setup procedure and also during the lifetime of the RRC Connection if the UE capability information changes (e.g. due to change in UE power class). UE capability information can also explicitly be requested by UTRAN.

8.3.8.2 Sending of system information in RRC connected mode

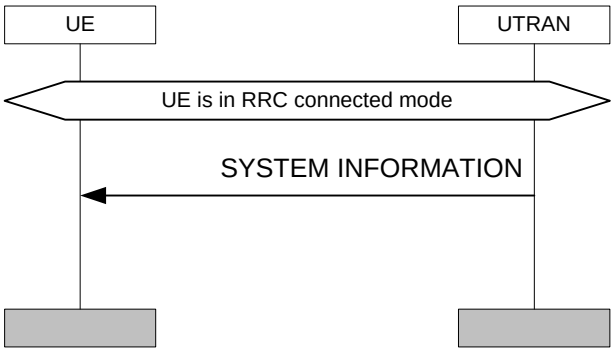

Figure 26) Sending of system information to UE in RRC connected mode

The UTRAN may send dedicated system information messages to the UE in RRC connected mode in order to update e.g. neighbouring cell and MM information. The UE RRC forwards received MM information to the UE MM sublayer. The system information messages transmitted in connected mode include different combinations of parameters than system information messages for idle mode MSs. The grouping of of system information messages is FFS.
Two ways have been identified by which this signalling can be conveyed:

- On DCCH
- On BCCH *[Editors note,the BCCH may be used to convey information to a UE even when a DCCH exists, and the current assumption is that where DCH exists BCCH is not used]*

8.3.8.3 Direct transfer

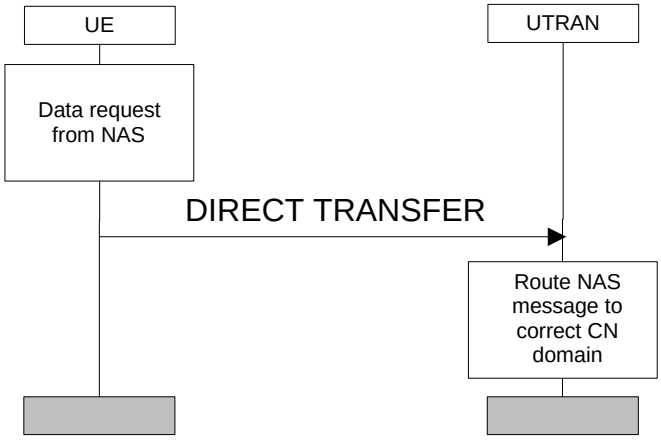

Figure 27) Direct Transfer procedure in uplink

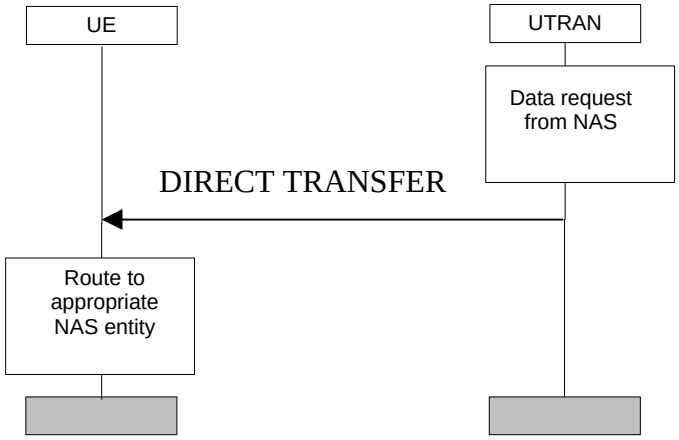

Figure 28) Direct Transfer procedure in downlink

The direct transfer procedure is used to carry all higher layer (NAS) messages over the radio interface. The DIRECT TRANSFER message includes the higher layer (NAS) message as payload and a CN domain identifier of the destination (in uplink) or originating (in downlink) core network node.
The DIRECT TRANSFER message is used both in uplink and in downlink.
Upon reception of the DIRECT TRANSFER message the higher layer PDU is routed – using the CN domain identifier parameter – in UE side to correct higher layer entity and in UTRAN side to correct CN domain.

9 Primitives between RRC and upper layers

10 Elements for peer-to-peer communication

10.1 Message functional definition and content

Below is a list of parameters identified so far to be used in RRC elementary procedure messages. Some of these parameters are mandatory and some are not.
[Note1: The need of subdividing some of these identified parameters into several separate parameters is FFS.]
Radio Access Bearer Parameters
Radio access bearer parameters are associated with each RAB.
For multiple RAB control, a “number of RABs” parameter is needed. For each RAB there is a set of radio access bearer parameters.
Transport CH Parameters
Transport CH parameters are associated with each transport CH.
For multiple DCH control, “number of DCHs” is also needed (there will be transport channel parameters for each of them).
Physical CH Parameters
Physical CH parameters define the physical channels which should be used.
UE Parameters
UE parameters are used to characterize the UE behavior.

10.1.1 Radio Access Bearer parameters

- RAB ID
  An identification number for the RAB affected by a certain message.
- NAS Info
  A field with Non Access Stratum information to bind a RAB to the Non Access Sratum. This information is transparent to RRC.
- RLC Mode
  Indicates if the RLC entity for a certain RAB should use Acknowledged, Non Acknowledged or Transparent mode data transfer.

- RLC PDU Size
  Size of RLC Packet Data Units. *[Note: RLC PDU size may be derived from transport block size and not explicitly transfered across the radio interface]*
- RLC Transmission Window Size
  A flow control parameter used to set the maximum number of RLC PDUs sent without getting them acknowledged.
- RLC Retransmission Info
  This could be the number of attempts to retransmit a RLC PDU before it is discarded, or different timer values.
- RLC In-sequence delivery
  Indication if RLC should preserve the order of higher layer PDUs that were transmitted through RLC.
- MAC Logical Channel Priority
  This includes both priority between different users traffic when using a common or shared channel, and between different RABs (or logical channels) traffic for a certain user. Different priorities for one users´ RABs are mapped (through the MAC´s T and C/T MUXes) to the TFC selection algorithm. *[Editors note: added shared channel to Ericsson's original text]*
- Logical channel ID
  This parameter is used to distinguish logical channels which are multiplexed in MAC.

10.1.2 Transport channel parameters

- TF Set
  Dynamic part attributes (Transport block size(s), Transport Block Set Size(s)) and Semi-static attributes (Transmission time interval, Type of channel coding, Rate matching) for the RAB effected by a certain message.
- TFC Set
  Indicates only the allowed combinations of already defined Transport Formats.
- TFC Subset
  Indicates which TFCs in the already defined TFC set that are allowed.
- Transport Channel ID
  This parameter is used to distinguish transport channels.
- List of radio links in active set for each transport channel

10.1.3 Physical Channel parameters

Frequency parameters

- Radio frequency
  This parameter indicates the frequency used by the UE

Uplink radio resources

- Uplink I branch code
- I-branch channelization code for the uplink.
- Uplink Q branch code
- Q-branch channelization code for the uplink.
- Uplink scrambling code
- What short or long uplink scrambling code a certain UE should use.
- Timselot (TDD)
- Identifies timeslot assigned
- FAUSCH spreading code+timing offset
- Identifies code and timing offset which UE can use for signalling on FAUSCH

Downlink radio resources

- Downlink channelisation code
- Downlink scrambling code
- This parameter indicates which D/L scrambling code should be used
- Timeslot (TDD)
- Identifies timeslot assigned

10.1.**4** UE parameters

- Activation Time
  A timestamp e.g. frame number for simultaneous change of parameters in the network and the UE.
- RNTI
  Radio Network Temporary Identity used to identify a UE having a RRC connection , when the UE uses common channels.

10.2 Message format and information element coding

10.3 Protocol states

10.4 Timers

10.5 Protocol Parameters (if applicable)

10.6 Specific functions (if applicable)

11 Handling of unknown, unforeseen and erroneous protocol data

History

Document history		
Date	Version	Comment
August 1998	0.0.0	Created
September 1998	0.0.1	Rapporteur details entered
November 1998	0.1.0	Incorporated changes agreed at the Layer 2/3 experts group meeting in Milan, 6-9th October 1998 5 RRC functions – List of functions added 6 Services to upper layers – List of services added 8.1 Idle mode procedures – Broadcast of system information. Paging request and Notification request procedures added 8.2 RRC Connection Establishment procedures - Procedure description added
November 1998	0.1.1	8.3 RRC Connected mode procedures – RRC connection release and Switch from FAUSCH/FACH state to
November 1998	0.1.2	DCH/DCH state procedures added
December 1998	0.1.3	Version 0.1.0 approved at L2/3 meeting, Paris, 12-13 Nov. 1998. Version 0.1.1 presented at SMG2#28 Version incorporating new text as agreed at Layer 2/3 meeting, 12-13 Nov 1998. New RRC functions added. This version incorporates minor modifications made at the Sophia Antipolis meeting, 9-11 Dec

Document history		
Date	Version	Comment
January 1999	0.2.0	RRC connection release procedure updated Text on FAUSCH added to some procedures Diagrams for RRC model added to section 4 Functional description of messages added to Section 10.1, covering Radio access bearer parameters, Transport channel parameters, Physical channel parameters and UE parameters Added new RRC elementary procedures: RRC connection re-establishment Radio Access bearer establishment Radio access bearer release Radio access bearer reconfiguration Transport channel reconfiguration Transport format combination control Physical channel reconfiguration Modification of the active set when in soft handover Hard handover (FDD and TDD hard) Inter system hard handover (GSM/BSS to UTRAN) Inter system hard hand-off (UNTRAN to GSM/BSS, PSTN/ISDN domain services) URA updating Cell updating Core network originated paging UTRAN originated paging Measurement control Measurement reporting Transmission of UE capability information Sending of system information in RRC connected mode Direct Transfer v0.2.0 is the final version of YY.31, as approved by the ETSI SMG2 L23/EG. Submitted to SMG2 meeting 25-29 Jan 1999 as Tdoc 096/99

January 1999	1.0.0	Re-formatted for SMG#28

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