TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3)
Berlin, Germany, 25th to 28th May 1999

TSGR2#4(99)376

Agenda Item: 5

Source: Rapporteur (Ericsson)

Title: **Results from the RRC procedures ad-hoc group**

Document for: Decision

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1 Introduction

This contribution contains the results from the RRC Procedures ad-hoc group, which was created after the TSG RAN WG2 meeting #3. The discussion on the e-mail reflector has resulted in change requests to 25.303 and 25.331, on those items where a conclusion was made.

The discussion in the RRC Procedures ad-hoc group was based on the contributions below.

[1] TSGR2#3(99)215, Alcatel, "Change request to S2.31 to include a new procedure for Dynamic Resource Allocation Control of uplink DCH" (plus updates sent on the reflector)
[2] TSGR2#3(99)227, Fujitsu, "Proposal for Cell/URA Update Procedure"
[3] TSGR2#3(99)232, Nokia, "Procedure to release a dedicated physical channel"
[4] TSGR2#3(99)233, Nokia, "Addition to RRC procedures related to UE capabilities".
[5] TSGR2#3(99)234, Nokia, "RRC Status Procedure".
[6] TSGR2#3(99)243, Siemens, "RRC Connection Establishment and Release for TDD"
[7] TSGR2#3(99)244, Siemens, "Radio Access Bearer Establishment/Release for TDD.
[8] TSGR2#3(99)248, Ericsson, "Procedures related to cell and URA update".
[9] TSGR2#3(99)249, Ericsson, "RRC Messages for inter-system handover".
[10] TSGR2#3(99)299, Samsung El, "RRC procedures for gated transmission of DPCCH in control only substate".
[11] TSGR2#3(99)313, Telia, "Intersystem cell reselection in the packet domain".

2 Status of documents

In the table below, for each document and item the status is given, categorised into:

DURING DISCUSSION: The document is still during discussion. Some conclusions may have been made, but nothing yet is agreed to be inserted in any of the output documents.
AGREED: A conclusion has been agreed upon, possibly with some modifications, of the proposal in the document. A change request is given as a result. From the change request a reference to the document is made. Parts of the document may have been transferred to the RRC parameter discussion, regarding information elements, if applicable.
PARTLY AGREED: Same as above, but for parts of the proposal in the document. Other parts are still during discussion.
CLOSED: The discussion of the document has been closed. No change request on procedure level has been produced, but parts of the document may have been moved to the RRC parameter group for further discussion.

Ref	Item	Status	Comment
[1]	Usage of system information procedure	AGREED	IEs moved to RRC parameter group
	Description of usage of DRAC parameters	DURING DISCUSSION	
[2]	Cell and URA update procedure	PARTLY AGREED	Proposal joined with [8].

[3]	RRC connection release	AGREED	
	UE terminated DCH release	DURING DISCUSSION	
[4]	UE capability information	AGREED	
	UE capability enquiry	DURING DISCUSSION	Mechanism still during discussion and kept FFS. Nokia will make a new proposal.
[5]	Release of signalling connection	AGREED	IEs moved to RRC parameter group
	Assignment of RNTI at SRNC relocation	PARTLY AGREED	Proposal joined with [8]. RNTI reallocation procedure used. IEs moved to RRC parameter group
	Update of NAS system information at SRNC relocation	PARTLY AGREED	CELL/URA UPDATE CONFIRM and RNTI REALLOCATION messages used. IEs moved to RRC parameter group. Case when other messages used is still FFS.
[6]	RRC connection establishment and release for TDD	DURING DISCUSSION	Siemens will make a new proposal, based on comments
[7]	RAB establishment and release for TDD	DURING DISCUSSION	Siemens will make a new proposal, based on comments
[8]	RNTI reallocation procedure	PARTLY AGREED	Usage at Paging Response still during discussion. Another alternative is to replace Paging Response with the cell update procedure. Both alternatives exist in the change request, but one is to be selected. IEs moved to RRC parameter group.
	Cell and URA update procedure	AGREED	IEs moved to RRC parameter group
[9]	Inter-system handover	AGREED	IEs moved to RRC parameter group
[10]	DPCCH gating	CLOSED	Existing RRC procedures used. IEs moved to RRC parameter group.
[11]	Inter-system cell reselection	AGREED	

3 Proposal

The proposal is that

- 25.303 is updated according to the changes contained in chapter 4 of this contribution
- 25.331 is updated according to the changes contained in chapter 5 of this contribution

4 Proposed changes to 25.303

In this chapter changes are proposed to 25.303. References are made to those contributions that have been the basis for the proposals. Those references are not meant to be included into the specification.

7.1.3.1 RRC Connection Release from Dedicated Physical Channel

Reference: [3]

The RRC layer entity in the network issues an RRC CONNECTION RELEASE message using acknowledged mode on the DCCH. Upon reception of this message the UE-RRC sends an RRC Signalling Connection Release Indication primitive to NAS The UE replies with an RRC CONNECTION RELEASE COMPLETE message, which is sent in unacknowledged-mode on the dedicated channel. To improve the reliability of the message, quick repeat on RRC-level can be used. The UE will then proceed to release RLC(s), MAC and the radio link(s) after which and requests the release of the radio link(s), MAC and RLC(s). After that the UE RRC enters Idle Mode.

The primary method to detect the release of the signalling link in the NW is the RRC CONNECTION RELEASE COMPLETE-message from the UE. Should the message be lost despite the use of quick repeat, tThe release of the signalling link is detected in the UTRAN by the out-of-sync primitive from either Node-B L1 or RNC-L1 (FFS) to RNC RRC. After receiving this primitive, the RNC-RRC layer releases L2 and L1 resources on the network side and enters the idle mode.

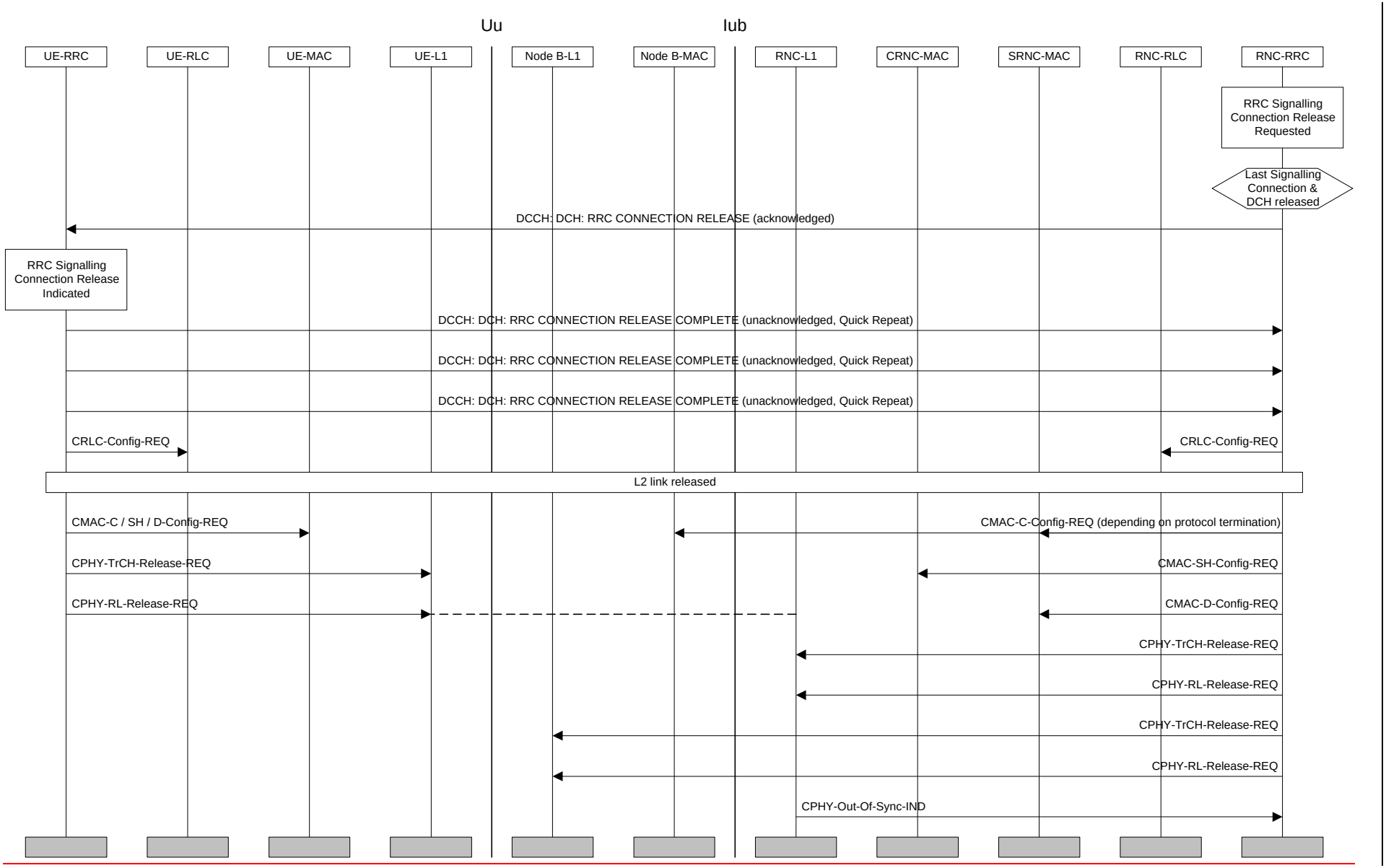


Figure 1: RRC Connection release from a dedicated channel

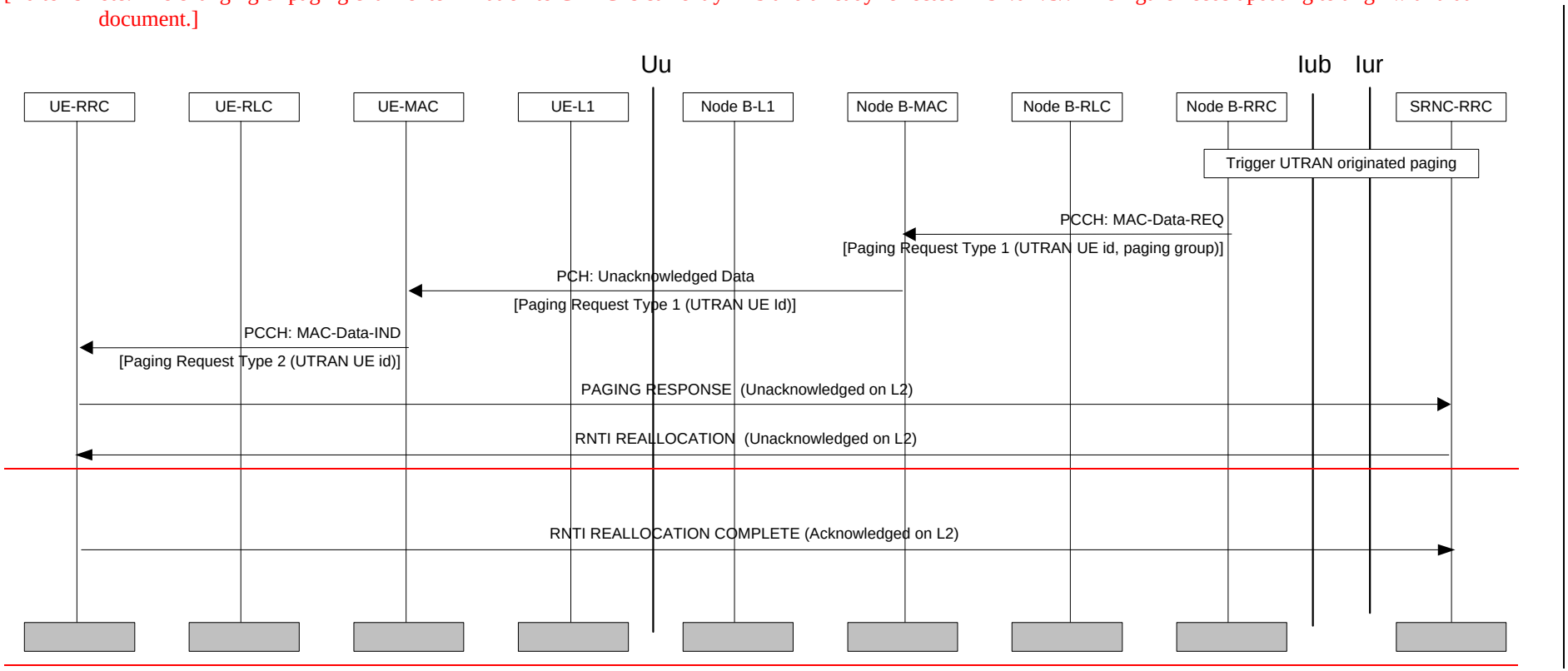
7.6 UTRAN originated paging request and paging response

Reference: [8].

Note: Two possible alternatives are here presented, in separate subchapters. One of them should be selected.

7.6.1 Response to paging using Paging Response message

[Editor's note: The changing of paging channel termination to CRNC is currently FFS and already reflected in S2.01 /5/. This figure needs updating to align with that document.]



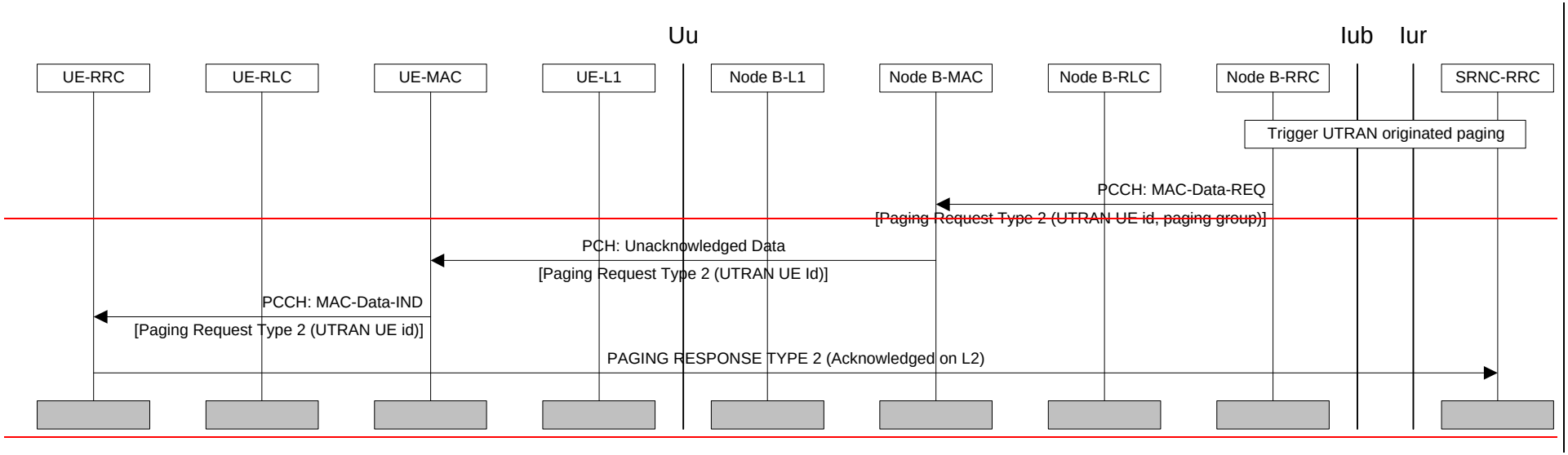


Figure 2. Example sequence for UTRAN initiated paging request with paging response

The RRC layer in the network uses this sequence to trigger a switch to RACH/FACH substate of the cell connected state, when the UE can only be reached on the PCH (the PCH substate of cell connected state or the URA connected state). A Paging ~~Request~~ Type 1~~2~~ message is prepared, containing the UTRAN UE identity (s-RNTI + RNC-ID). The RRC requests the transmission of the message by MAC on the PCCH, indicating the paging group.

In the UE, the RRC layer continuously monitors the paging group on the PCH and compares the UE identities in received paging request messages with its own identities. A match occurs, and in this case the RRC layer changes state to RACH/FACH substate within the cell connected mode.

~~[Editor's note: According to WG2 LS to WG3 (Tdoc 192) from meeting #2, responses to UTRAN initiated paging requests use RNC-ID + s-RNTI. Therefore a separate cell update procedure should not be necessary, but then a c-RNTI needs to be allocated at some point. A general comment about c-RNTI signalling to UE is inserted below by the editor to indicate this.]~~

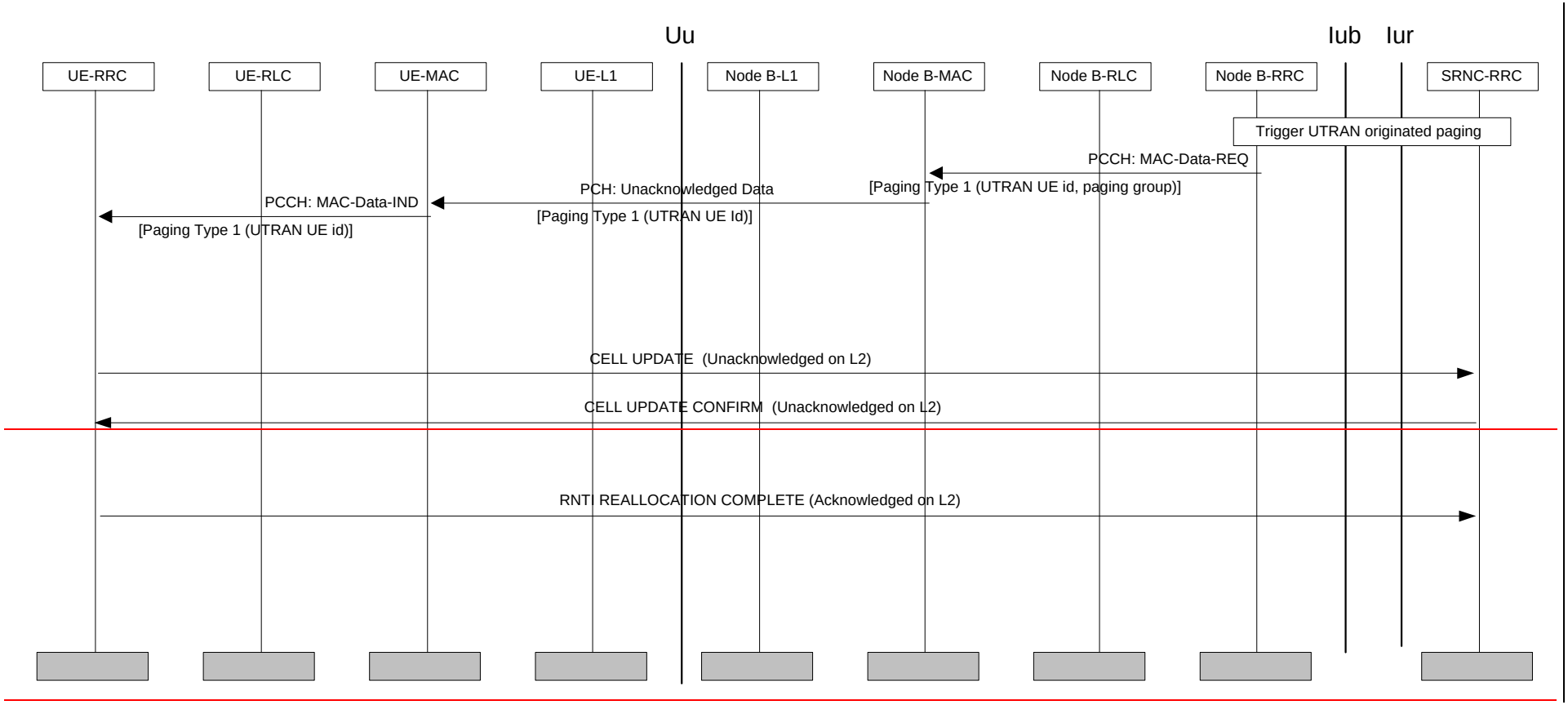
The UE prepares a Paging Response ~~Type 2~~ message, which is sent on CCCH or DCCH (FFS).

[Note: The content of the Paging Response ~~Type 2~~ message is FFS. It could e.g. be measurements.]

When the network receives the Paging Response ~~Type 2~~ message, a c-RNTI is allocated and signalled to UE using the RNTI Reallocation message, which is sent on CCCH or DCCH (FFS) using unacknowledged mode. The UE configures MAC to use the new c-RNTI and prepares a RNTI Reallocation Complete message. When the network receives the RNTI Reallocation Complete message on DCCH it can delete any old c-RNTI and the DCCH/DTCH logical channels can be used also in the downlink using the new c-RNTI.

7.6.2 Response to paging using Cell update procedure

[Editor's note: The changing of paging channel termination to CRNC is currently FFS and already reflected in S2.01 /5/. This figure needs updating to align with that document.]


Uu
Iub
Iur
UE-RRC
UE-RLC
UE-MAC
UE-L1
Node B-L1
Node B-MAC
Node B-RLC
Node B-RRC
SRNC-RRC
Trigger UTRAN originated paging
PCCH: MAC-Data-REQ
[Paging Type 1 (UTRAN UE id, paging group)]
PCH: Unacknowledged Data
[Paging Type 1 (UTRAN UE Id)]
PCCH: MAC-Data-IND
[Paging Type 1 (UTRAN UE id)]
CELL UPDATE (Unacknowledged on L2)
CELL UPDATE CONFIRM (Unacknowledged on L2)
RNTI REALLOCATION COMPLETE (Acknowledged on L2)

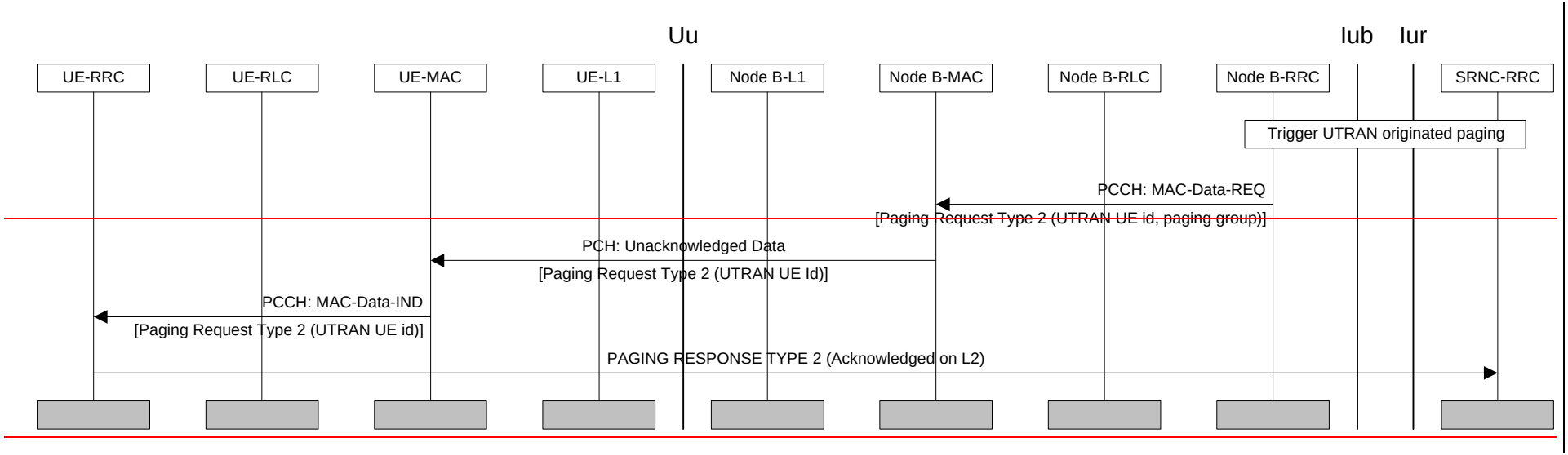


Figure 3. Example sequence for UTRAN initiated paging request with paging response

The RRC layer in the network uses this sequence to trigger a switch to RACH/FACH substate of the cell connected state, when the UE can only be reached on the PCH (the PCH substate of cell connected state or the URA connected state). A Paging ~~Request~~ Type 1~~2~~ message is prepared, containing the UTRAN UE identity (s-RNTI + RNC-ID). The RRC requests the transmission of the message by MAC on the PCCH, indicating the paging group.

In the UE, the RRC layer continuously monitors the paging group on the PCH and compares the UE identities in received paging request messages with its own identities. A match occurs, and in this case the RRC layer changes state to RACH/FACH substate within the cell connected mode.

~~[Editor's note: According to WG2 LS to WG3 (Tdoc 192) from meeting #2, responses to UTRAN initiated paging requests use RNC-ID + s-RNTI. Therefore a separate cell update procedure should not be necessary, but then a c-RNTI needs to be allocated at some point. A general comment about c-RNTI signalling to UE is inserted below by the editor to indicate this.]~~

The UE prepares a ~~Paging Response Type 2~~Cell Update message, which is sent on CCCH or DCCH (FFS).

[Note: The content of the Paging Response Type 2 message is FFS. It could e.g. be measurements.]

When the network receives the ~~Paging Response Type 2~~Cell Update message, a c-RNTI is allocated and signalled to UE using the Cell Update Confirm message, which is sent on CCCH or DCCH (FFS) using unacknowledged mode. The latter message also acknowledges the reception of the Cell Update message. The UE configures MAC to use the new c-RNTI and prepares a RNTI Reallocation Complete message. When the network receives the RNTI Reallocation Complete message on DCCH it can delete any old c-RNTI and the DCCH/DTCH logical channels can be used also in the downlink using the new c-RNTI.

5 Proposed changes to 25.331

In this chapter changes are proposed to 25.331. References are made to those contributions that have been the basis for the proposals. Those references are not meant to be included into the specification.

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

Reference: [9]

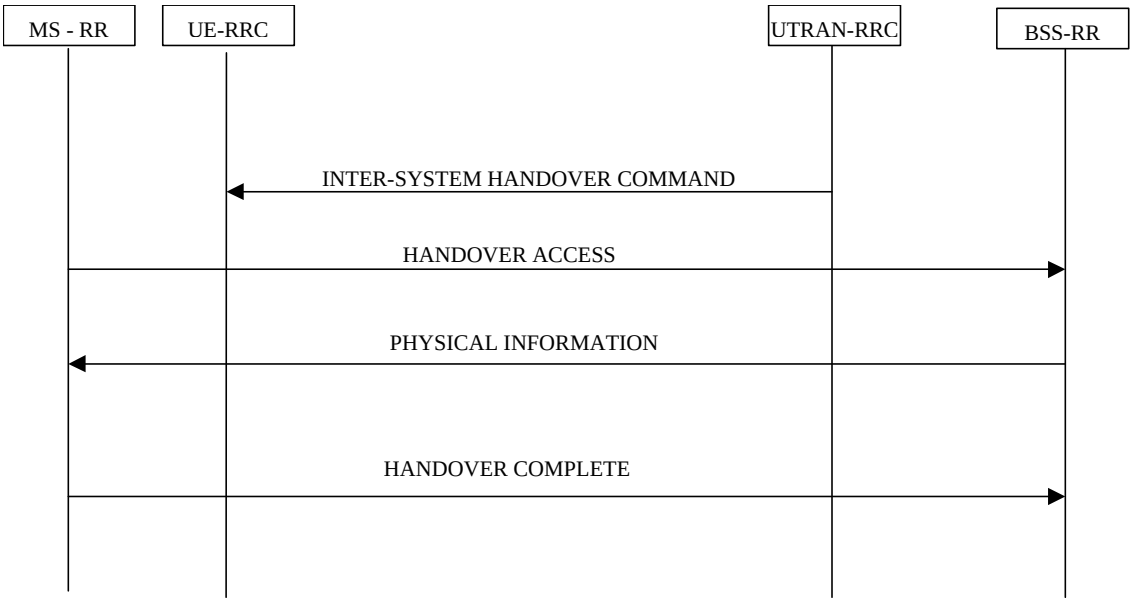


Figure 4) Inter system hard hand-~~off~~ over (UTRAN to GSM/BSS), PSTN/ISDN services, successful case

[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.

If the UE is unable to execute the Inter-System Handover or if low layer failure happens on the UE side on the GSM/BSS channel before HANDOVER COMPLETE has been sent, the UE deactivates the new GSM/BSS channel and reactivates the UTRAN connection.

The UE then sends a INTER-SYSTEM HANDOVER FAILURE message and resumes normal operation as if no Inter-System Handover have occurred.

8.3.5.x Inter system cell reselection (UTRAN to GSM/GPRS, IP domain services)

Reference: [11]
For IP domain services, intersystem cell reselection from UTRAN to GSM/GPRS is initiated by the UE, or ordered by the network with the INTER-SYSTEM HANDOVER COMMAND message.

8.3.5.y Inter system cell reselection (GSM/GPRS to UTRAN, IP domain services)

Reference: [11]
For IP domain services, intersystem cell reselection from GSM/GPRS to UTRAN is initiated by the UE or by GSM/BSS according to GSM/GPRS specifications.

8.3.5.5 URA update

Reference: [8]

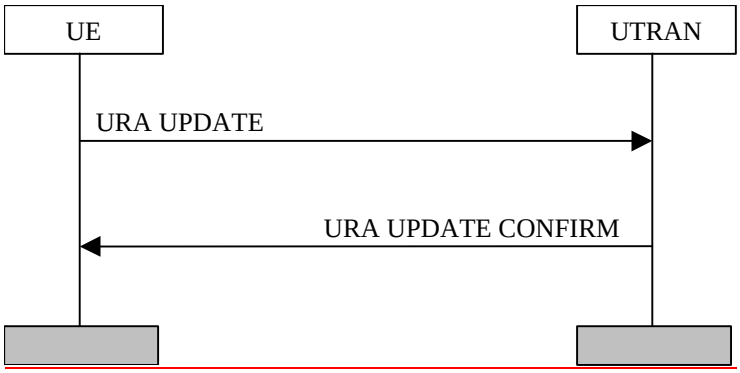


Figure 5) URA update procedure.

The URA update procedure is normally used by the UE to inform the UTRAN that the UE has switched to a new URA. In that case ~~Normally~~ the procedure is triggered after change of cell and after the UE have read information broadcasted by UTRAN indicating change of URA. The procedure can also be triggered by expiry of a URA update periodicity timer in the UE.

The UE establishes a radio link to a cell in the new URA. After that the UE sends a URA UPDATE 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 C-RNTI and/or S-RNTI plus SRNC identity.~~RNTI~~. In the latter case, the UE transmits an RNTI REALLOCATION COMPLETE message as confirmation. The URA UPDATE CONFIRM message may also contain new NAS system information.

[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.]*~~

8.3.5.6 Cell update

Reference: [8]

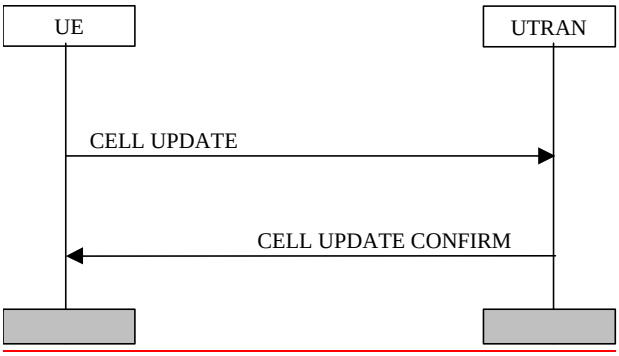


Figure 6) Cell update procedure.

The cell update procedure is normally used by the UE to inform the UTRAN that the UE has switched to a new cell. In this case ~~T~~the procedure is a forward handover procedure, and ~~. Normally the procedure~~ is triggered after change of cell and after the UE has read information broadcasted by UTRAN. The procedure can also be triggered by expiry of a cell update periodicity timer in the UE or in cases when the UE requests a new C-RNTI.

In case of cell reselection, ~~T~~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 any ~~the~~ change of cell, and sends a CELL UPDATE CONFIRM message to the UE.

The CELL UPDATE CONFIRM message may include a new C-RNTI and S-RNTI plus SRNC identity. In this case the UE configures layer 2 to use the new identities and returns an RNTI REALLOCATION COMPLETE message as confirmation. In the CELL UPDATE CONFIRM message, the network can instruct the UE to start updating its location on URA level. It may also contain new NAS system information. ~~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.

In case the UE is assigned a new C-RNTI and/or S-RNTI plus SRNC identity, a RNTI REALLOCATION COMPLETE message is sent by the UE to the network.

[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.]*~~

8.3.5.7 RNTI reallocation

Reference: [8]

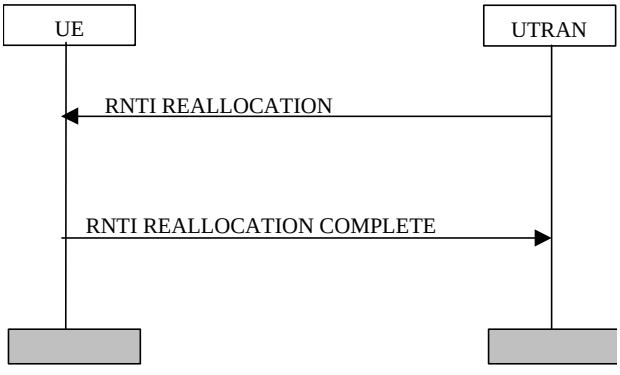


Figure 6) RNTI reallocation procedure

This procedure is used by the network, to assign new Radio Network Temporary Identity (RNTI) information to a UE. It is initiated by the UTRAN, which sends a RNTI REALLOCATION message. The RRC message contains new S-RNTI and SRNC identity, and/or a new C-RNTI. It may also contain new NAS system information.

The UE starts to use the new identities and returns an RNTI REALLOCATION COMPLETE message as confirmation.

8.3.6.2 UTRAN originated paging

Reference: [8]
Two alternatives are here proposed in separate subchapters. One of them is to be selected.

8.3.6.2.1 With paging response message

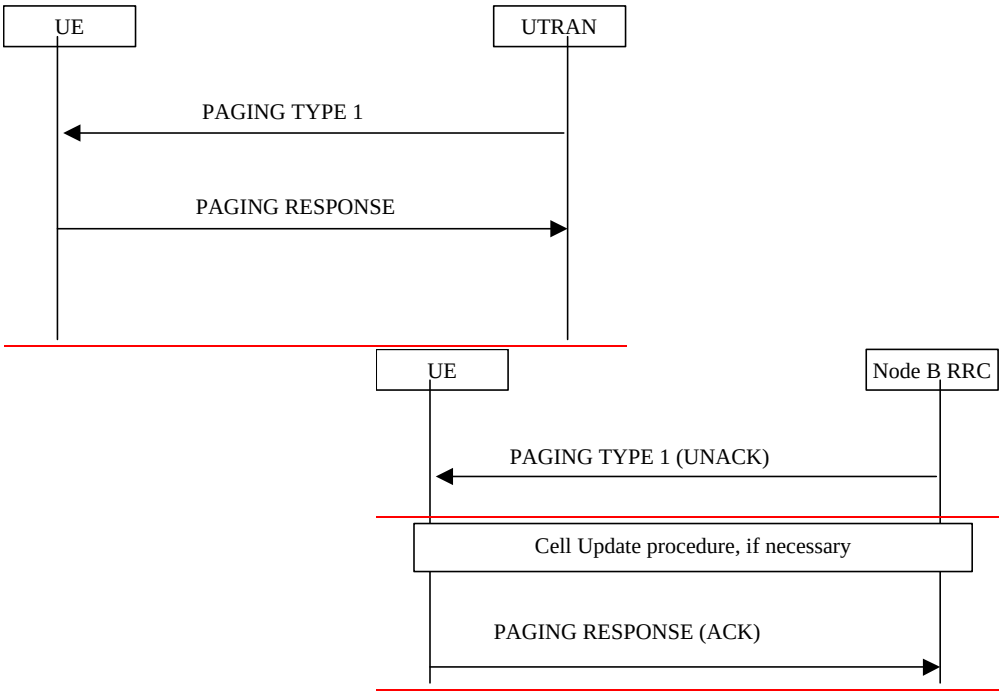


Figure 7) UTRAN originated paging procedure in connected mode

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 TYPE 1 message, containing the S-RNTI and SRNC identity ~~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 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.~~

in t~~T~~he UE ~~then~~ prepares a Paging Response message, containing the S-RNTI and SRNC identity ~~which is sent~~and sends it on the DCCH (or CCCH FFS). *[Note: The content of the Paging Response message is FFS. It could for example contain measurements.]* When the network receives the Paging Response message, the DCCH/DTCH logical channels can also be used in the downlink.

[Note: It is FFS whether only only one paging message is required (as used for idle mode paging) or whether Type 1 and Type 2 paging messages are also required]

8.3.6.2.2 With cell update procedure

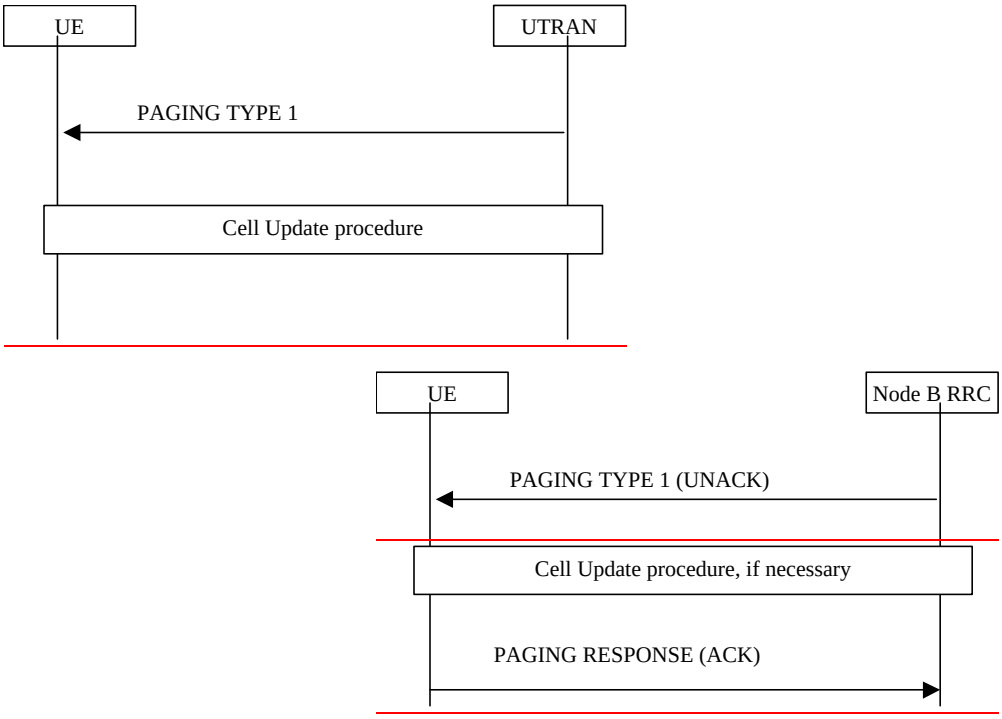


Figure 8) UTRAN originated paging procedure in connected mode

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 TYPE 1 message, containing the S-RNTI and SRNC identity ~~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 messages with its own identities. When a match occurs, the RRC layer ~~may optionally~~ uses the cell update procedure to ~~obtain a new RNTI, before using the DCCH~~acknowledge the reception of paging and optionally obtain a new C-RNTI.

~~The UE then prepares a Paging Response message, which is sent on the DCCH. *[Note: The content of the Paging Response message is FFS. It could for example contain measurements.]* When the network receives the Paging Response message, the DCCH/DTCH logical channels can also be used in the downlink.~~

[Note: It is FFS whether only only one paging message is required (as used for idle mode paging) or whether Type 1 and Type 2 paging messages are also required]

8.3.8.1 Transmission of UE capability information

Reference: [4]

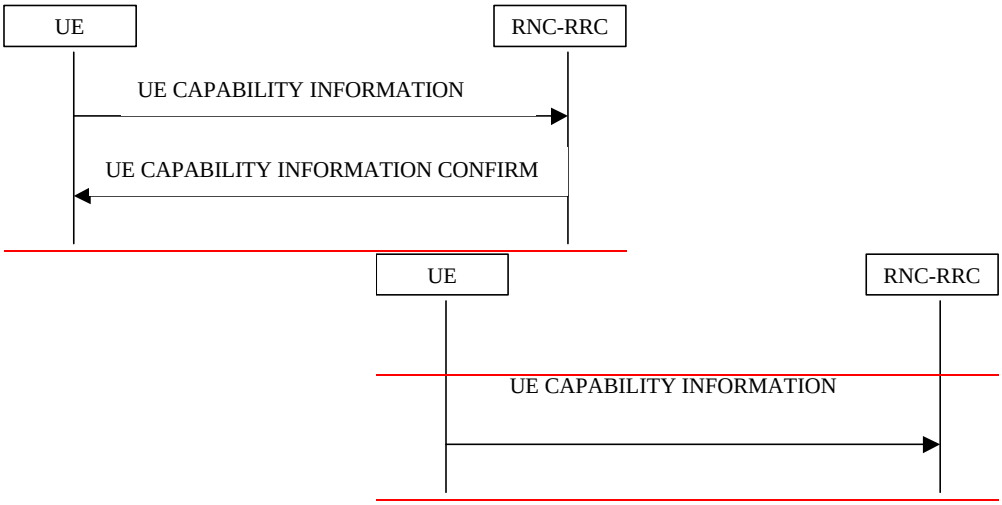


Figure 9) Procedure for transmission of UE capability information

The UE transfers its capability information to the network by transmitting the UE CAPABILITY INFORMATION message ~~using acknowledged mode~~ on the DCCH. UTRAN acknowledges the successful update of UE capability by UE CAPABILITY INFORMATION CONFIRM message. 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 *[Note: The mechanism for this is FFS]*.

8.3.8.2 Sending of system information in RRC connected mode

Reference: [1]

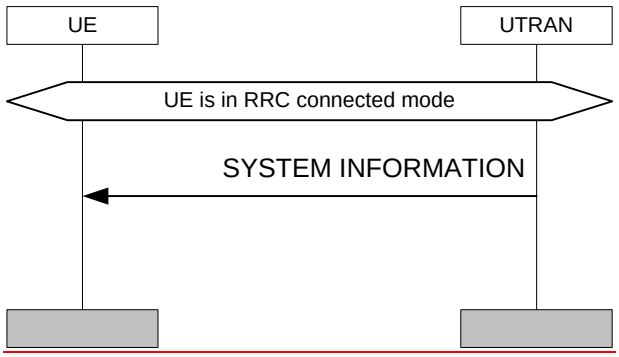


Figure 10) Sending of system information to UE in RRC connected mode

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~~ Three 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]*
- On CCCH mapped onto a FACH or a ACCH transport channel (provided the ACCH transport channel exists). *[Editors note ,the CCCH may be used to convey information to a UE even when a DCCH exists].*

8.3.8.x RRC status procedure

Reference: [5]. Note: I have modified the proposal slightly, to fit into 25.331. An example to 25.303 could be needed but it is not included in this report.

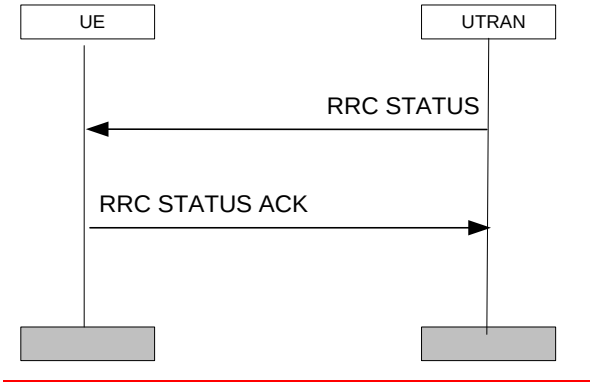


Figure 11: RRC status procedure

[Note: The following describes the use of the RRC status procedure for release of signalling connection. Other use of this procedure is FFS.]

If a UE has signalling connections to CN1 and CN2, one of the nodes may request the UTRAN to release the RRC connection. In this case the UTRAN needs to inform the corresponding MM entity in the UE – without releasing the RRC connection - that the signalling connection has been released, using the RRC status procedure.

When the UTRAN receives a signalling connection release request from a core network node, it informs the UE of a signalling connection release with a RRC STATUS message. After receiving this message the UE RRC informs the corresponding UE MM entity of RRC connection release and sends a RRC STATUS ACK to the UTRAN. When the UTRAN receives the acknowledgement message, it confirms the release of signalling connection to the core network node.