TSG-RAN Meeting #6
Nice, France, 13 – 15 December 1999

TSGRP#6(99)740

Title: **Agreed CRs of category "D" (Editorial) to TS 25.410**

Source: **TSG-RAN WG3**

Agenda item: **5.4.3**

Doc #	Status-	Spec	CR	Rev	Subject	Cat	Versio	Versio
R3-99k01	agreed	25.410	001	1	Editorial Improvements &	D	3.0.0	3.1.0
R3-99k22	agreed	25.410	003		Cleanup of Iu Functions	D	3.0.0	3.1.0

3GPP TSG-RAN Meeting #6 **Document** ***R3-99k01***

Nice, France, 13-15 December 1999

3G CHANGE REQUEST

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25.410 **CR** **001r1** Current Version: 3.0.0

3G specification number ↑ *↑ CR number as allocated by 3G support team*

For submision to TSG-RAN#6 for approval [X] *(only one box should*
list TSG meeting no. here ↑ For information [ ] *Be marked with an X)*

Form: 3G CR cover sheet, version 1.0 *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf*

Proposed change affects: USIM [ ] ME [ ] UTRAN [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG3 **Date:** 8/12/99

Subject: Editorial Improvements & Clarifications to 25.410

3G Work item: UTRAN Iu Interface

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[X]

Reason for change:
1) The existing text regarding Iu Interface connection possibilities is ambiguous – the CR proposes a change of verb form to clarify.
2) Several of the functional descriptions are misleading or ambiguous – the CR clarifies these.

Clauses affected: 3.2, 4.1.1, 4.1.2, 6.1

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other 2G core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:


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3.2 Abbreviations

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

3G-MSC	3rd Generation Mobile Switching Centre
3G-SGSN	3rd Generation Serving GPRS Support Node
ATM	Asynchronous Transfer Mode
BSSMAP	Base Station Subsystem Management Application Part
CC	Connection Confirm
CN	Core Network
CR	Connection Release
CREF	Connection Refusal
CS	Circuit Switched
GT	Global Title
IMSI	International Mobile Subscriber Identity
ISDN	Integrated Services Digital Network
LA	Location Area
NAS	Non Access Stratum
O&M	Operation and Maintenance
PS	Packet Switched
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Circuit
QoS	Quality of Service
RA	Routing Area
RAB	Radio Access Bearer
RANAP	Radio Access Network Application Part
RLP	Radio Link Protocol
RNC	Radio Network Controller
RNL	Radio Network Layer
RRC	Radio Resource Control
SAP	Service Access Point
SCCP	Signalling Connection Control Part
SPC	Signalling Point Code
SRNS	Serving Radio Network Subsystem
SSN	Sub-System Number
SVC	Switched Virtual Circuit
UE	User Equipment
UP	User Plane
URA	UTRAN Registration Area
UTRAN	UMTS Terrestrial Radio Access Network
VC	Virtual Circuit

4 General Aspects

4.1 UTRAN Architecture

4.1.1 Iu Interface Architecture

The overall UMTS architecture and UTRAN architectures are described in [1]. This section specifies only the architecture of the Iu interface, and shall not constrain the network architecture of either Core or Radio Access Networks.

The I_u interface is specified at the boundary between the Core Network and UTRAN. Figure 4.1 depicts the logical division of the I_u interface. From the Iu perspective, the UTRAN access point is an RNC.

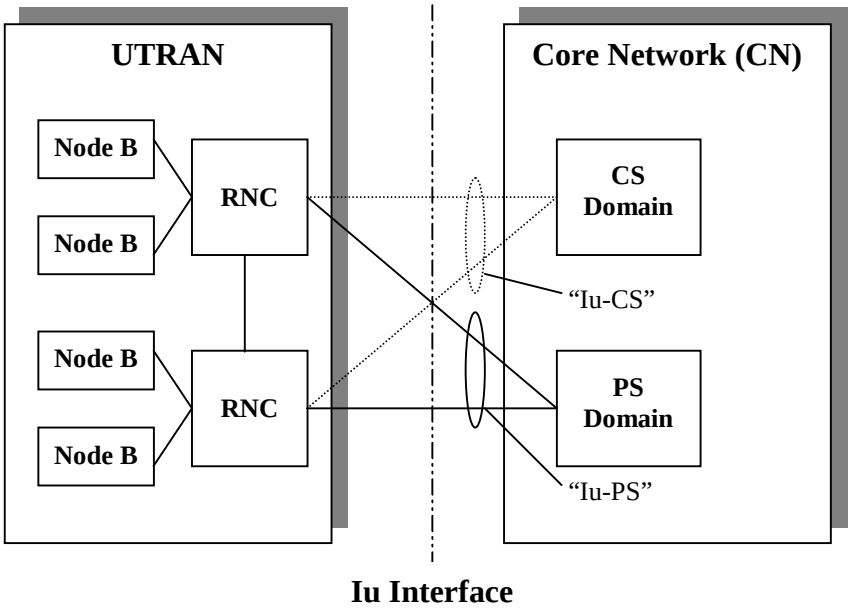

Figure 4.1: Iu Interface Architecture

The Iu interface towards the PS-domain of the core network is called Iu-PS, and the Iu interface towards the CS-domain is called Iu-CS. The differences between Iu-CS and Iu-PS are treated elsewhere in this specification.

There shall not be more than ~~may be at most~~ two distinct Iu interfaces for any RNC - one (Iu-CS) towards the CS domain and one (Iu-PS) towards the PS-domain.

In the separated core network architecture, this means that there ~~are~~ shall be separate signalling and user data connections towards the two domains – this applies in both transport and radio network layers.

In the combined architecture, there ~~are~~ shall be separate connections in the user plane (in both transport and radio network layers). In the control plane, there ~~are~~ shall be separate SCCP connections to the two logical domains.

In either architecture, there can be several RNCs within UTRAN and so UTRAN may have several I_u access points towards the Core Network. As a minimum, each Iu access point (in UTRAN or CN) shall independently fulfil the requirements of the Iu specifications (25.41x series – see section 7).

4.1.2 Iu connection principles

The Iu interface has a hierarchical architecture where one higher layer entity controls several lower layer entities. The hierarchy for the CN - UTRAN signalling connection end points is described below.

- Each CN Access Point may be connected to one or more UTRAN Access Points;
- Each UTRAN Access Point ~~may~~ shall not be connected to ~~no~~ more than one CN Access Point per CN domain.

6 I_u Interface Protocol Structure

6.1 General

The Radio Network signalling over Iu consists of the Radio Access Network Application Part (RANAP). The RANAP protocol consists of mechanisms to handle all procedures between the CN and UTRAN. It is also capable of conveying messages transparently between the CN and the UE without interpretation or processing by the UTRAN.

Over the Iu interface the RANAP protocol is, e.g. used for:

- Facilitate a set of general UTRAN procedures from the Core Network such as paging -notification as defined by the notification SAP in [3].
- Separate each User Equipment (UE) on the protocol level for mobile specific signalling management as defined by the dedicated SAP in [3].
- Transfer of transparent non-access signalling as defined in the dedicated SAP in [3].
- Request of various types of UTRAN Radio Access Bearers through the dedicated SAP in [3].
- Perform the SRNS Relocation function.

The Radio Access Bearers are provided by the Access Stratum.

3GPP TSG-RAN Meeting #6 *Document* ***R3(99)k22***

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3G CHANGE REQUEST

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25.410 **CR** **003** Current Version: 3.0.0

3G specification number ↑ *↑ CR number as allocated by 3G support team*

For submision to TSG-RAN #6 for approval [X] *(only one box should be marked with an X)*
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Form: 3G CR cover sheet, version 1.0 *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf*

Proposed change affects: USIM [ ] ME [ ] UTRAN [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG3 **Date:** 9/12/99

Subject: Cleanup of Iu Functions

3G Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[X]

Reason for change: Many of the specified functions are not visible over Iu, and so should be removed. Some of the others require some clarification.
It is also proposed to remove an unnecessary respecification of the transport layer technologies.

Clauses affected: 5 (and sub-clauses)

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other 2G core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

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5 Functions of the I_u Interface Protocols & Functional Split

5.1 General

This section defines the functional split between the core network and the UMTS radio access network. In addition, the possible interaction between the functions is defined. The functional split is shown in table 5.1.

Table 5.1: Iu interface functional split

Function	UTRAN	CN
RAB management functions:		
RAB establishment, modification and release	X	X
RAB characteristics mapping Iu transmission bearers	X	
RAB characteristics mapping Uu bearers	X	
RAB queuing, pre-emption and priority	X	X
Radio Resource Management functions:		
Radio Resource admission control	X	
Broadcast Information	X	X
~~**Rate Adaptation:**~~		
~~Rate Adaptation for External Network~~		~~X~~
Iu link Management functions:		
Iu signalling link management	X	X
ATM VC management	X	X
AAL2 establish and release	X	X
AAL5 management	X	X
GTP-U Tunnels management	X	X
Buffer Management	X	
Iu U-plane (RNL) Management:		
Iu U-plane frame protocol management		X
Iu U-plane frame protocol initialization	X	
Mobility management functions:		
~~Mobility Management~~		~~X~~
Location information reporting	X	X
Handover and Relocation		
~~Active cell management, intra RNC~~	~~X~~	
~~Active cell management, inter RNC when Iur available (intra/inter MSC)~~	~~X~~	
_Inter RNC hard HO, Iur not used or not available	X	X
_Serving RNS Relocation (intra/inter MSC)	X	X
_Inter system hard HO (UMTS-GSM)	X	X
Paging Triggering		X
~~Paging triggering~~		~~X~~
~~Paging execution~~	~~X~~	
~~Location Management~~	~~X~~	~~X~~
Security Functions:		
Data confidentiality		
Radio interface ciphering	X	
Ciphering key management		X
User identity confidentiality	X	X
~~User Authentication~~		~~X~~
Data integrity		
Integrity checking	X	
Integrity key management		X
Service and Network Access functions:		
CN Signalling data	X	X
~~Transcoding~~		X
~~CS Data- Network Interworking function~~		X
~~Charging~~Data Volume Reporting	X	~~X~~
UE Tracing	X	X
Location reporting	X	X
Iu Co-ordination functions:		
Paging co-ordination	X	X

5.2 RAB management Functions

5.2.1 RAB establishment, modification and release function

The RAB, Radio Access Bearer, is defined to be set-up between UE and CN. Depending on subscription, service, requested QoS etc. different types of RABs will be used. It is the CN that controls towards the UTRAN the establishment , modification or release of a RAB.

The RAB identity is allocated by CN and is locally significant over one Iu signalling instance.

RAB establishment, modification and release is a CN initiated function.

RAB establishment, modification and release is a UTRAN executed function.

RAB release request is a UTRAN initiated function, triggered when UTRAN fails to keep the RAB established with the UE.

5.2.2 RAB characteristics mapping to Uu bearers function

The RAB characteristics mapping function is used to map the radio access bearers to the Uu bearers. The mapping is performed during the establishment of the RAB. UTRAN shall perform the mapping between the bearers.

RAB mapping to Uu transmission bearers is a UTRAN function.

5.2.3 RAB characteristics mapping to Iu transport bearers

The RAB characteristics mapping function is used to map the radio access bearers to the Iu interface transport bearers. The mapping is performed during the establishment of the RAB.

UTRAN shall perform this mapping between the bearers if AAL2 is used, since it is the UTRAN that establish the AAL2 connections.

In case of RAB towards the IP domain, UTRAN shall perform the mapping between the radio access bearers and the IP layer.

RAB characteristics mapping to Iu transport bearers is a UTRAN function.

5.2.4 RAB queuing, pre-emption and priority function

The allocation/retention priority level of a RAB is determined by the CN based on e.g. subscription information , QoS information etc.. Accordingly, the CN shall request RAB establishment or modification with an indication of the priority level and the pre-emption capability of that RAB and the queuing vulnerability. Queuing and resource pre-emption shall be performed by UTRAN accordingly.

RAB queuing, pre-emption and allocation/retention priority handling is a UTRAN controlled function.

RAB queuing, pre-emption and allocation/retention priority setting is a CN function.

5.3 Radio Resource Management over Iu

5.3.1 Radio resource admission control

This function is used at radio access bearer establishment and it is divided in two parts:

a) Subscription based admission control

When CN receives a request to establish or modify a radio access bearer, the CN verifies if the subscriber is allowed to use a radio access bearer with the requested parameters. Based on the verification the CN will accept or reject the request. This part is called "Subscription based admission control" and it is handled by the CN.

b) Radio resource admission control

When UTRAN receives a request to establish or modify a radio access bearer from the CN, the current radio resource situation is analysed and the admission control either accepts or rejects the request. This part is called "Radio resource admission control" and it handled by the UTRAN. If the request is queued, this part is handled by the RAB queuing, pre-emption and priority function.

Part b) is only performed if CN accept the request to establish a radio access bearer

5.3.2 Broadcast information management

This function consists in the broadcast from network toward UE of some information in the coverage area of the whole network or different parts of the network.

There are two kinds of Broadcast information management. UTRAN broadcast information and CN broadcast information management. All UTRAN broadcast information management shall be be handled locally within UTRAN. All CN related broadcast information is controlled by CN. UTRAN executes the broadcast of CN information.

~~5.4 Rate adaptation for external networks~~

~~The rate adaptation function is used to adapt the radio interface data transmission rates with the terrestrial link transmission rates and with the external networks (such as PSTN and ISDN) rates.~~

~~The Rate adaptation for external network is a CN function.~~

5.~~5~~4 Iu link Management functions

5.~~4~~5.1 Iu Signalling Link Management function

The Iu signalling link management function provides a reliable transfer of the radio network signalling between UTRAN and CN. Both CN and UTRAN manage the function.

This function is in particular responsible for Iu signalling connection establishment, which can be established either by the CN or the RNC and for Iu signalling connection release, which is controlled by CN possibly upon UTRAN request.

5.~~4~~5.2 ATM Virtual Connection Management function

This function refers to handling of ATM Virtual Connections (VCs) between CN and UTRAN.

This function shall be used to establish, maintain and release the ATM VCs. For permanent VCs, it is regarded to be an O&M function.

This function also includes the selection of a Virtual Circuit to be used for a particular RAB. The selection of ATM VC upon an Iu radio access bearer service request, shall be done by UTRAN. The selected VC shall fulfil the requirements of the request. ~~AAL5 adaptation layer will be used over a virtual circuit for signalling. AAL5 and AAL2 adaptation layers will be used over virtual connections for used data.~~ The VC may consist of several sublinks: such as SCCP connections, AAL2 connections or IP flows.

5.~~4~~5.3 AAL2 connection establish and release function

This function is used to establish and release the AAL type 2 connections between CN and UTRAN upon an Iu radio access bearer service request. Both UTRAN and CN are taking part in the establishment of AAL2 connection. UTRAN shall initiate the establishment. UTRAN shall perform the release of the AAL2 connection upon request of the CN. The use of AAL2 for Iu transmission bearers depends on type of CN.

5.~~4~~5.4 AAL5 management function

AAL5 connections between CN and UTRAN shall be pre-configured at system initialisation. Basic configuration is

PVCs. For user data, SVC is possible.

The AAL5 management is a function handled by both the CN and the UTRAN.

5.45.5 GTP-U tunnels management function

This function is used to establish and release GTP-U tunnels between CN and UTRAN upon a radio access bearer service request. This involves assigning a tunnel identifier for each direction and the creation of a context containing the tunnel information. The tunnel identifier for the downlink is allocated by the UTRAN, and the tunnel identifier for the uplink is allocated by the CN. Both CN and UTRAN should maintain the context. The use of GTP-U for Iu transport bearers depends on type of CN.

5.45.6 Buffer Management

Congestion control shall be performed over the Iu user plane ~~toward the PS domain~~ using buffer management and no flow control.

This function includes buffers to store received packet data units that at reception can not be processed due to e.g. congestion. In UTRAN, there must be a buffer management function handling received packets from the peer CN node.

~~Congestion control shall be performed over Iu user plane towards to PS domain using buffer management and no flow control.~~

The used mechanism is not in the scope of this document and not relevant to be standardised.

Buffer management is a UTRAN function.

5.56 Iu U-plane (RNL)Management Functions

5.56.1 Iu U-plane frame protocol mode selection function

The Iu UP in the Radio Network Layer provides modes of operation that can be activated on RAB basis. For a given RAB, the Iu UP operates either in a Transparent or in Support mode. Iu U-plane frame protocol mode is selected by the CN.

This function is a CN function.

5.56.2 Iu U-plane frame protocol initialisation

Iu U-plane frame protocol is initialised by the UTRAN.

5.67 Mobility Management Functions

~~5.7.1 Mobility Management~~

~~The mobility management is used to maintain the information in the CN about the location of the terminal. The function is needed for support of UE roaming and for support of UE terminating traffic. All Mobility Management signalling between UE and CN are transferred transparently through UTRAN, except paging.~~

~~For Mobility Management purposes, the location information shall be at Location and Routing Area level.~~

5.67.12 Location information update function

Some ~~F~~functionality within the CN, ~~such as Charging,~~ needs information about the present location of active UE, i.e. UE with established signalling connection. The Location information update function is used to transfer this information from the UTRAN to the CN. It is the UTRAN responsibility to send this information initially at the signalling connection establishment for an UE and at any change of the UE location as long as the signalling connection exists. For

this function, ~~Mobility Management purposes~~, the location information shall be at Location and Routing Area level.

5.~~6~~7.2~~3~~ Handover and Relocation functions

~~5.7.3.1 Active Cell Management, intra RNC~~

~~This functionality includes procedures for adding and removing cells controlled by one RNC to and from the active set. The handovers may be hard or soft. This functionality is handled by UTRAN and it does not involve the CN.~~

~~5.7.3.2 Active Cell Management, inter RNC, when Iur is available~~

~~This functionality includes procedures for adding and removing cells controlled by an other RNC to and from the active set. This is possible only when Iur interface is available between the RNCs in question. As long as the Iur is available, the RNCs may be controlled by different MSCs, i.e. both intra and inter MSC cases are applicable. The handovers may be hard or soft. This functionality is handled by UTRAN and it does not involve the CN.~~

5.~~6~~7.~~3~~2.~~3~~1 Inter RNC hard HO function, Iur not used or not available

This functionality includes procedures for handover from one RNC to other RNC when Iur interface is not used or is not available, i.e. soft handover is not possible. The connection is switched in the CN, so both UTRAN and CN are involved. Both intra and inter CN entity cases are applicable.

5.~~7~~6.~~3~~2.4~~2~~ Serving RNS Relocation function

This functionality allows moving the Serving RNS functionality from one RNC to an other RNC, e.g. closer to where the UE has moved during the communication. The Serving RNS Relocation procedure may be applied when active cell management functionality has created a suitable situation for it. Both UTRAN and CN are involved.

5.~~7~~6.~~3~~2.~~5~~3 Inter system Handover (e.g. GSM-UMTS) function

Inter system handover is performed when a mobile hands over between cells belonging to different systems such as GSM and UMTS. This may imply also a change of radio access type. For intersystem handover between UMTS and GSM, the GSM procedures are used with the GSM network. Both UTRAN and CN are involved.

NOTE: The GSM BSSMAP procedures are outside the scope of this specification.

5.~~7~~6.4~~3~~ Paging Triggering

~~5.7.4.1 Paging triggering function~~

The Core Network shall, when considered necessary, trigger the Location/Routing/RNC Area paging in the UTRAN system.

~~5.7.4.2 Paging execution function~~

~~The paging function shall be executed by UTRAN.~~

~~5.7.5 Location Management~~

~~The location management is used to maintain the information about the location of the terminal.~~

~~The location management of an idle terminal is handled within the CN at the level of Location/Routing Area. The UTRAN controls the location management of active terminals, i.e. the UTRAN knows which cells/URA are used by the active terminal.~~

5.78 Security Functions

5.78.1 Data Confidentiality

5.78.1.1 Radio interface ciphering function

The radio interface shall be ciphered upon request of the Core Network. Both Signalling and user data may be subject to ciphering. The ciphering shall be done within UTRAN.

5.78.1.2 Ciphering key management function

The ciphering key and the permitted algorithm shall be supplied by the CN. UTRAN selects the used algorithm.

~~5.8.1.3 User identity confidentiality function~~

~~The UMTS user identity confidentiality is obtained by using a temporary UE identity rather than the permanent UE identity (i.e. IMSI) over the radio path.~~

~~The CN allocates to each visiting UE a temporary identity. This identity is used by the UE when establishing a new connection between the CN and the UE. It is used by the CN when requesting a page.~~

~~In addition, UTRAN allocates to each UE with established RRC connection a temporary identity (Radio Network Temporary Identity, RNTI). This identity is used to identify an UE when on common radio channels.~~

~~5.8.2 Terminal identity check function~~

~~The terminal identity check be provided by the CN. The Iu interface is required to transport necessary request and response messages between the CN and UE.~~

~~5.8.3 User Authentication function~~

~~The user authentication shall be provided by the CN. The authentication functions are transparent for the Iu Interface, and therefore outside the scope of Iu Interface documents.~~

5.78.24 Data integrity

5.78.42.1 Integrity checking

The purpose of the integrity check is to make sure that the signalling continues between the same elements as by authentication. The integrity check shall be done within the UTRAN.

5.78.24.2 Integrity key management

The integrity key and the permitted algorithm shall be supplied by the CN. UTRAN selects the used algorithm.

5.98 Service and Network Access Functions

5.98.1 Core Network signalling data transfer function

The ~~PS respective the CS~~ NAS CN signalling data such as Call Control (CC), Session Management (SM), Mobility Management (MM), Short Message Services Point to Point and Supplementary Services (SS) shall be transparently conveyed over the Iu interface. The signalling information shall be conveyed transparently over the same Iu interface channel that is used for the UTRAN-CN signalling.

~~5.9.2 Transcoding function~~

~~The transcoding functionality is needed for changing the coding of a voice call from one coding scheme to another. The transcoder placement is within the CN. The transcoding functionality is therefore placed in the CN only. Over the Iu interface, transcoded speech shall be treated a data service with specific Quality of Service requirement.~~

~~5.9.3 CS data – Network Interworking function~~

~~The network interworking function is used to modify the Iu UP frames to match the requirements of the external network such as PSTN or ISDN. The network interworking function may consist of rate adaptation and/or error correcting link protocol such as GSM RLP.~~

~~The network interworking function between the CN and external networks (such as PSTN and ISDN) shall be handled by CN.~~

5.~~9~~8.42 ~~Charging~~Data Volume Reporting

~~Charging shall be handled by CN. The charging may be based on the used radio resources, received Quality of Service or on the amount of transmitted data.~~ The data volume reporting function is used to report the volume of unacknowledged data to the CN. The function shall be in the UTRAN and is triggered from the CN.

5.~~9~~8.~~3~~5 UE Tracing

This feature allows tracing of various events related to the UE and its activities. This is an O&M functionality.

5.~~9~~8.~~6~~4 Location reporting function

The positioning function performs the determination of the geographical position for an UE. The location reporting function transfer the positioning information between the UTRAN and the CN according to CN commands. This function involves UTRAN and CN.

5.~~9~~10 Co-ordination Functions

5.~~9~~10.1 Paging Co-ordination function

The two CN domain architecture implies need for a page co-ordination, i.e. handling of page triggered by one CN node when UE has a signalling connection to the other CN node. The paging co-ordination is performed by UTRAN and/or optionally by CN. The Common ID is used for UTRAN paging co-ordination. The CN provides the UTRAN with the Common ID.

The paging co-ordination is a UTRAN function. Optionally the paging co-ordination may be performed in the CN.