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UE Procedures in Idle Mode

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[Editor's note: This section needs to be reviewed. It is assumed here than a 3GPP IPR report will be available in the near future.]

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project, Technical Specification Group RAN.

The contents of this TS may be subject to continuing work within the 3GPP and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version m.t.e

where:

m indicates [major version number]

x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated into the specification.

1. Scope

The present document ~~scope of this specification is to~~ shall describe the overall idle mode process for the UE and the functional division between the non-access stratum and access stratum in the UE. The UE is in idle mode when the connection of the UE is closed on all layers, e.g. there is neither an MM connection nor an RRC connection.

This document presents also examples of inter-layer procedures related to the idle mode processes and describes idle mode functionality of a dual mode UMTS/GSM UE.

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 TS shall also be taken to refer to later versions published as an EN with the same number.

~~References may be made to:~~

~~a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply;~~

~~b) all versions up to and including the identified version (identified by "up to and including" before the version identity);~~

~~c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or~~

~~d) publications without mention of a specific version, in which case 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] ETSI GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode"
[2] 3GPP RAN S2.01, "Radio Interface Protocol Architecture"
[3] 3GPP RAN S2.03, "UE Functions and Inter-Layer Procedures in Connected Mode"
[4] 3GPP RAN S2.31, "RRC Protocol Specification"

3. Definitions, abbreviations and symbols

3.1 Definitions

Acceptable Cell This is a cell that the UE may camp on to make emergency calls. It must satisfy certain conditions.

Allowable PLMN This is a PLMN which is not in the list of forbidden PLMNs in the UE.

Available PLMN This is a PLMN where the UE has found a cell that satisfies certain conditions.

Camped on a cell The UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell. The UE monitors system information and (in most cases) paging information. Note that the services may be limited, and that the PLMN may not be aware of the existence of the UE within the chosen cell.

Home PLMN This is a PLMN where the Mobile Country Code (MCC) and Mobile Network Code (MNC) of the PLMN identity are the same as the MCC and MNC of the IMSI.

Location Registration (LR) The UE registers its presence in a registration area, for instance regularly or when entering a new registration area.

LSA Localised Service Area. A LSA is an operator-defined group of cells for which specific access conditions applies. This may correspond to an area in which the Core Network offers specific services. A LSA may be defined within a PLMN or globally. Therefore, a LSA may offer a non-contiguous radio coverage.

LSA exclusive access cell A UE may only camp on this cell if the cell belongs to the LSAs to which the user has subscribed. Nevertheless, if no other cells are available, the UE of non-LSA users may originate emergency calls from this cell.

LSA ID Localised Service Area Identity.

LSA only access When LSA only access applies to the user, the UE can only access cells that belong to the LSAs to which the user has subscribed. Outside the coverage area of the subscribed LSAs, the UE may camp on other cells and limited services apply.

LSA preferential access cell A LSA preferential access cell is a cell which is part of the LSA. UEs of users that have subscribed to a LSA of a LSA-preferential-access cell have higher priority to resources than non-LSA users in the same cell. The availability of LSA preferential access cells impact the following procedure(s):

radio resource allocation (controlled by UTRAN-Access Stratum). This function is out of the scope of the standards.

Registered PLMN (RPLMN) This is the PLMN on which the UE has performed a location registration successfully.

Registration Area A (NAS) registration area is an area in which the UE may roam without a need to perform location registration, which is a NAS procedure.

Selected PLMN This is the PLMN that has been selected by the non-access stratum, either manually or automatically.

Suitable Cell This is a cell on which an UE may camp. It must satisfy certain conditions.
[Note: These certain conditions are FFS.]

Visited PLMN of home country This is a PLMN, different from the home PLMN, where the MCC part of the PLMN identity is the same as the MCC of the IMSI.

3.2 Abbreviations

AS	Access Stratum
BCCH	Broadcast Control Channel
CN	Core Network
DSCH	Downlink Shared Channel
FDD	Frequency Division Duplex
GC	General Control (SAP)
GPRS	General Packet Radio System
GSM	Global System for Mobile
IMSI	International Mobile Subscriber Identity
MCC	Mobile Country Code
MM	Mobility Management
MNC	Mobile Network Code
NAS	Non-Access Stratum
ODMA	Opportunity Driven Multiple Access
ORACH	ODMA Random Access Channel
PCH	Paging Channel
PLMN	Public Land Mobile Network
RRC	Radio Resource Control
SAP	Service Access Point
TDD	Time Division Duplex
UE	User Equipment
UE_R	User Equipment with ODMA relay operation enabled[N1]
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

3.3 Symbols

4. General description of Idle mode

[NOTE: The Idle mode in UMTS also includes the Idle mode of GSM. Further details are invited.]

4.1 Overview

When a multi-mode UE is switched on, it attempts to make contact with a public land mobile network (PLMN) using a certain radio access mode. The choice of radio access mode, for instance UTRA, GSM or GPRS may be done automatically or manually.

The particular PLMN to be contacted may be selected either automatically or manually.

The UE looks for a suitable cell of the chosen PLMN and chooses that cell to provide available services, and tunes to its control channel. This choosing is known as "camping on the cell". The UE will then register its presence in the registration area of the chosen cell if necessary, by means of a location registration procedure.

If the UE finds a more suitable cell, it reselects onto that alternative cell of the selected PLMN and camps on that cell. If the new cell is in a different registration area, location registration is performed.

If necessary, the UE will look for more suitable cells on other PLMNs at regular time intervals, which is referred to as PLMN-reselection. Particularly, in the home country of the UE, the UE will try to get back to its Home PLMN.

If the UE loses coverage of a PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of which PLMNs are available is given to the user, so that a manual selection can be made (manual mode).

Registration is not performed by UE’s only capable of services that need no registration.

The purpose of camping on a cell in idle mode is fourfold:

It enables the UE to receive system information from the PLMN.

When registered and if the UE wishes to initiate a call, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

If the PLMN receives a call for the registered UE, it knows (in most cases) the registration area of the cell in which the UE is camped. It can then send a "paging" message for the UE on control channels of all the cells in the registration area. The UE will then receive the paging message because it is tuned to the control channel of a cell in that registration area and the UE can respond on that control channel.

It enables the UE to receive cell broadcast messages

If the UE is unable to find a suitable cell to camp on, or the USIM is not inserted, or if the location registration failed, it attempts to camp on a cell irrespective of the PLMN identity, and enters a "limited service" state in which it can only attempt to make emergency calls.

The idle mode tasks can be subdivided into four processes:

Radio access mode selection and reselection; *[FFS]*
PLMN selection and reselection;
Cell selection and reselection;
Location registration.

The relationship between these processes is illustrated in the Figure 1.

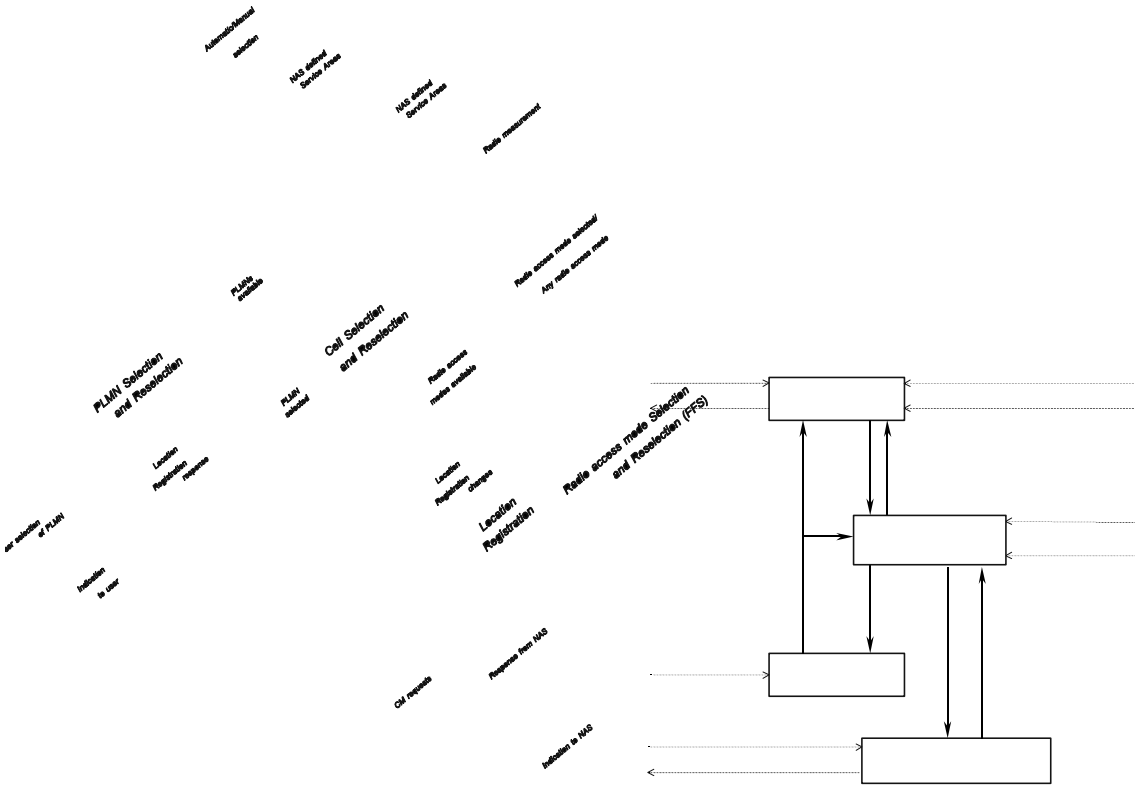

Figure 1. Overall Idle Mode process.

[Note: The idle mode process for radio access mode selection/reselection and the impact of NAS defined service areas is FFS.]

[Note: Whether it is possible to be active in more than one radio access mode at the time is FFS.]

4.2 Functional division between AS and NAS in Idle mode

Table 1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in idle mode. The primary purpose of this functional division is to serve as a basis for the work division between SMG2 UMTS L23 and other groups. Examples of different idle mode procedures are presented in chapter 0.

Idle Mode Process	UE Non-Access Stratum	UE Access Stratum
PLMN Selection and Reselection	Maintain a list of PLMNs in priority order. Request AS to select a cell either belonging to the PLMN having the highest priority (in automatic mode) or belonging to the	Report available PLMNs to NAS on request from NAS or autonomously.

	manually selected PLMN. In automatic mode, if a PLMN with higher priority is found, request AS to select a cell belonging to that PLMN.	
Cell Selection	Control cell selection by for example, maintaining lists of forbidden registration areas and a list of NAS defined service areas in priority order.	Perform measurements needed to support cell selection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Search for a suitable cell belonging to the PLMN requested by NAS. The cells are identified with PLMN identity in the system information. Respond to NAS whether such cell is found or not. If such a cell is found, the cell is selected to camp on.
Cell Reselection	Control cell reselection by for example, maintaining lists of forbidden registration areas and a list of NAS defined service areas in priority order.	Perform measurements needed to support cell reselection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Change cell if a more suitable cell is found. Perform ODMA probing in an ODMA Relay Node.
Location registration	Register the UE as active after power on. Register the UE's presence in a registration area, for instance regularly or when entering a new registration area. Deregister UE when shutting down.	Report registration area information to NAS.

Table 1. Functional division between AS and NAS in idle mode.

4.3 Service type in Idle mode

This chapter provides some definitions regarding the level of service that may be provided by the UTRAN to an UE in Idle mode.

The action of camping on a cell is generally presented as mandatory to receive some service from the cell. This notion of service should be distinguished in 3 categories, so that the network may eventually not provide all kind of services in every cells for UE in idle mode:

Emergency calls
- Normal services (for public use)
- Operator related services

Furthermore, the cells can be categorised according to services they can offer:

acceptable cell:

An "acceptable cell" is a cell on which the UE may camp on to originate emergency calls. Such a cell fulfills the following requirements, which is the minimum set of requirements to initiate an emergency call in a UTRAN network:

the cell may or may not belong to the allowable PLMN list stored on the USIM
- the path loss between the UE and the radio site is below a threshold which is set by the operator
- the cell is not reserved for operator use only

high priority suitable cell:

A "high priority suitable cell" is a cell on which the UE may camp on. Such a cell fulfill the following requirements:

the cell belongs to the selected PLMN
- the path loss between the UE and the radio site is below a threshold which is set by the operator
- the cell is not barred or reserved for operator use only
- the cell priority is provided by the network on the BCCH.

low priority suitable cell:

An UE may only camp on this cell if no other high priority suitable cells are available. This may be used as an example for the support of multilayered networks

barred cell:

An UE cannot camp on this kind of cell for standard services, but may eventually initiate an emergency call from this cell if no other suitable cell is available, either low or high priority.

This type of cell may be used by operators for traffic load balancing, as an example.

Whether or not the cell is barred, is provided by the network on the BCCH.

"operator only" cell:

The aim of this type of cells is to allow the operator using and test newly deployed cells without being disturbed by normal traffic. UE cannot camp on this cell, or initiate an emergency call from this cell, except for some classes of UE. The clearance for accessing to initiate a call within such a cell is part of the information stored on the USIM.

Whether or not the cell is reserved for operator use only, is provided by the network on the BCCH.

Table 2 quickly summarizes all the different cases above as well as the level of service provided by UTRAN, as seen from the UE in Idle mode.

acceptable cell	high priority suitable cell	low priority suitable cell	barred cell	operator only cell

emergency	Y	Y	Y	Y	N
standard	N	Y	Y (backup)	N	N
operator	N	Y	Y	N	Y

Table 2. Summary of service provided by UTRAN.

FFS.]

[Note: Whether it is possible to be active in more than one radio access mode at the time is FFS.]

4.2 Functional division between AS and NAS in Idle mode

Table 1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in i mode. The primary purpose of this functional division is to serve as a basis for the work division between SMG2 UM L23 and other groups. Examples of different idle mode procedures are presented in chapter 0.

Idle Mode Process	**UE Non-Access Stratum**	**UE Access Stratum**
PLMN Selection and Reselection	Maintain a list of PLMNs in priority order. Request AS to select a cell either belonging to the PLMN having the highest priority (in automatic mode) or belonging to the manually selected PLMN. In automatic mode, if a PLMN with higher priority is found, request AS to select a cell belonging to that PLMN. Report available PLMNs to NAS on request from NAS or autonomously.	
Cell Selection	Control cell selection by for example, maintaining lists of forbidden registration areas and a list of NAS defined service areas in priority order. Perform measurements needed to support cell selection.	Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Search for a suitable cell belonging to the PLMN requested by NAS. The cells are identified with PLMN identity i the system information. Respond to NAS whether such cell is found or not. If such a cell is found, the cell is selected to camp on.
Cell Reselection	Control cell reselection by for example, maintaining lists of forbidden registration areas and a list of NAS defined service areas in priority order. Perform measurements needed to support cell reselection.	Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Change cell if a more suitable cell is found. Perform ODMA probing in an ODMA Relay Node.
Location registration	Register the UE as active after power on. Register the UE's presence in a registration area, for instance regularly or when entering a new registration area. Deregister UE when shutting down. Report registration area information to NAS.	

Table 1. Functional division between AS and NAS in idle mode.

4.3 Service type in Idle mode

This chapter provides some definitions regarding the level of service that may be provided by the UTRAN to an UE Idle mode.

5.1 Radio access mode selection and reselection (FFS)

5.2 PLMN selection and reselection

The non-access stratum selects a suitable PLMN. Normally, the UE operates on its Home PLMN (HPLMN). However, a visited PLMN (VPLMN) may be selected, e.g., if the UE loses coverage with its HPLMN. There are two modes for PLMN selection:

Automatic mode - This mode utilizes a list of PLMNs in priority order. The highest priority PLMN that is available and allowable is selected.

Manual mode - Here the UE indicates which PLMNs are available to the user. Only when the user makes a manual selection does the UE try to obtain normal service on the VPLMN.

In the automatic mode, the UE will look for more suitable PLMNs regularly, if necessary. This is referred to as PLMN-reselection. Particularly, in the home country of the UE, the UE will try to get back to its Home PLMN.

5.3 Cell selection and reselection

The UE selects the most suitable cell based on idle mode measurements and cell selection criteria. The non-access stratum can control the cell selection, for instance in terms of a list of forbidden registration area(s) and a list of NAS defined service area(s) in priority order.

When camped on a cell, the UE regularly searches a better cell according to the cell reselection criteria. If a more suitable cell is found, that cell is selected.

The non-access stratum is informed if the cell selection and reselection results in changes in the received system information.

For normal service, the UE has to camp on a suitable cell, tune to that cell's control channel(s) so that the UE can:

Receive system information from the PLMN

Receive registration area information from the PLMN, e.g., location area and routing area, and,
Identify the NAS defined service area(s) to which the serving cell belongs
Other AS and NAS Information

If registered,

receive paging and notification messages from the PLMN, and,
initiate call setup for outgoing calls or other actions from the UE.

5.3.1 Cell Selection Process

5.3.2 Cell Reselection Process

5.3.2.1 ODMA probing sub-process

In addition to UE cell selection process the UE_R will initiate or continue to evaluate the relay link via probing. The ODMA probing process state machine controls the rate of ODMA relay node probing. The ODMA probing state machines and mechanisms for controlling the rate of ODMA probing are discussed in the following section.

5.3.2.1.1 ODMA probing state machines

Probing is a mechanism used by the ODMA relay node to build a neighbour list which should contain at least a predefined minimum number of neighbours. The probing activity levels of an ODMA relay node may also be influenced by a number of key system parameters such as

Number of neighbours
Gradient information
Path loss to neighbours
Speed of the terminal
Battery power level

The probing state machines are characterised by the level of probing opportunities. The objective of the probing state machines is to optimise ORACH activity to provide reduced interference and regulate power consumption. The difference between these state machines can generally be characterised by the number of ORACH channels which may be used for probing. Thus the probing opportunities within one N multiframe may vary depending upon the active state machine. Additionally, the ratio of probe transmission to reception is controlled by a probing activity parameter *K*. The state machines are full probing, duty maintained probing, and relay prohibited. The function of each of these state machines is described below:

Full probing
Full probing is the case where probing is allowed on every ORACH timeslot within a *N* multiframe. The UE_R will probe on the ORACH at a rate defined by the probing activity parameter *K*.

Duty Maintained probing
The duty maintained probing is the case where probing is allowed on *M* slots of an *N* multiframe. The UE_R will probe on the *M* ORACH slots in an *N* multiframe at a rate defined by the probing activity parameter *K*.

Relay Prohibited
In this mode the UE_R would cease all of its ODMA probing activities and will fall into standard TDD or FDD operation.

The probing activity levels for given state machines are illustrated in Figure 2 for a system with an ORACH for M slots per $N \times 16$ multiframe.

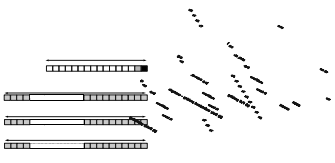

Figure 2. Probing state machines and mechanism.

Note that the distribution of probing opportunities within a multiframe may not necessarily be consecutive and located at the beginning of a multiframe.

A practical illustration of these probing state machines within the ODMA system is shown in Figure 3.

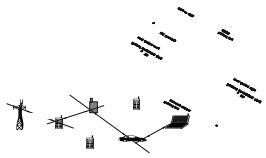

Figure 3. Illustration of probing process assignment.

5.3.3 Barred Cells and Access Control

FFS

5.3.4 Regional Provision of Service

FFS

5.4 Location Registration

When first camped on a suitable cell after power on, the non-access stratum will register the UE as active and present in the registration area of the chosen cell, if necessary.

The non-access stratum will register the UE's presence in a registration area, for instance regularly and when entering a new registration area.

The access stratum will inform the non-access stratum in which NAS defined service area(s) the UE is located, for instance regularly and when entering a new NAS defined service area.

Prior to power off, the non-access stratum will deregister the UE, if necessary.

Note that the distribution of probing opportunities within a multiframe may not necessarily be consecutive and located the beginning of a multiframe.

A practical illustration of these probing state machines within the ODMA system is shown in Figure 3.

Figure 3. Illustration of probing process assignment.

5.3.3 Barred Cells and Access Control

FFS

5.3.4 Regional Provision of Service

FFS

5.4 Location Registration

When first camped on a suitable cell after power on, the non-access stratum will register the UE as active and present in the registration area of the chosen cell, if necessary.

The non-access stratum will register the UE's presence in a registration area, for instance regularly and when entering a new registration area.

The access stratum will inform the non-access stratum in which NAS defined service area(s) the UE is located, for instance regularly and when entering a new NAS defined service area.

Prior to power off, the non-access stratum will deregister the UE, if necessary.

6. Broadcast information receiving

Figure 0. Probing state machines and mechanism.

6.1 System Information

The following information are broadcast by UTRAN on the BCH in each cell:

PLMN identity
Registration Area Identity
LSA IDs. There may be several LSA IDs broadcast, since a cell may belong to several LSAs.
cell priority (high | low)
access allowed (standard | barred | operator only | LSA exclusive)
minimum received level
maximum UE transmit power
neighbouring cells with corresponding scrambling code
...

[Note: This list is not exhaustive due to the fact that some information related to L1 aspects may be further needed. Details are FFS.]

[Editor's note: The complete list of BCH parameters will be listed in the RRC protocol specification.]

6.2 Cell Broadcast

7. Idle mode measurements

8. Multicast services

8.1 State diagram between the multicast service and DSCH

[NOTE: The use of DSCH for multicast services is FFS.]

The multicast service relative to the DSCH consists of the following states:

MT_Null State
- MT_Monitor State
- MT_Saving State
- MT_Active State

Figure 4 shows the multicast state diagram relative to the DSCH. The MT_Monitor State is a state for decoding the DSCH in order to monitor its multicast control data and the MT_Saving State is a state in which the UE savings for the supporting power saving feature.

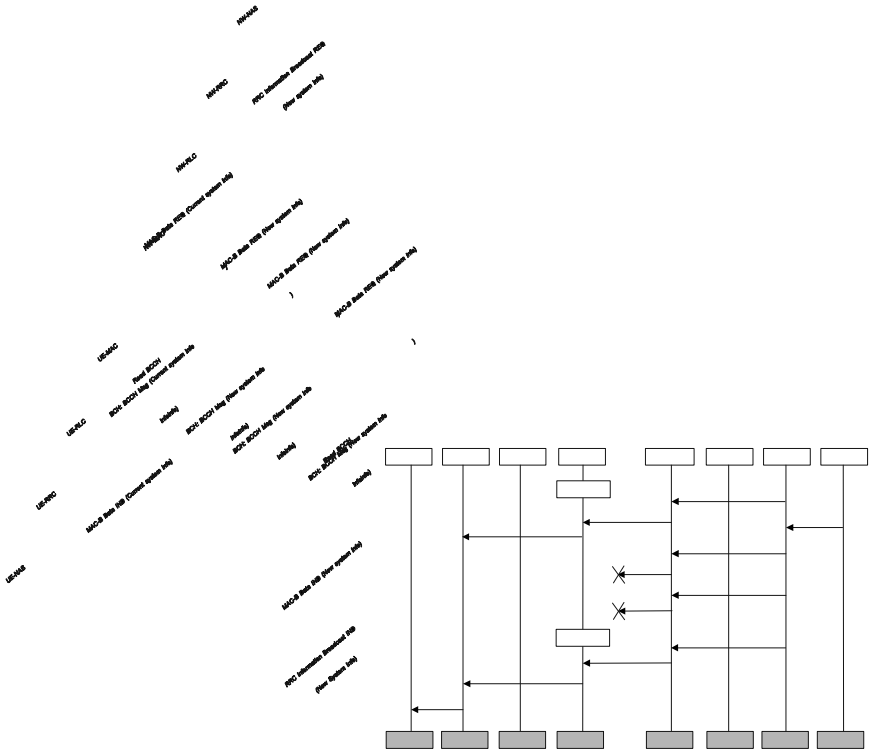

Figure 4. Multicast State Diagram relative to the DSCH, MT=MulTicast service.

8.1.1 MT_Null State

Attributes

Multicast service has not been activated.

- DSCH is not established.

Behavior

Waits for activation of multicast service.

8.1.2 MT_Monitor State

Attributes

DSCH is monitored in order to decode the multicast control data that contains the assigned multicast identifier.

Behavior

Receives the DSCH control data on DSCH and confirms the assigned multicast identifier.

8.1.3 MT_Saving State

Attributes

DSCH is not monitored for the control nor the user data.

Behavior

FFS

8.1.4 MT_Active State

Attributes

DSCH is not monitored for the control data.

-) DSCH is monitored for the user data.

Behavior

Receives the multicast user data on the established DSCH.

8.1.1 MT_Null State

Attributes

Multicast service has not been activated.

-) DSCH is not established.

Behavior

Waits for activation of multicast service.

8.1.2 MT_Monitor State

Attributes

DSCH is monitored in order to decode the multicast control data that contains the assigned multicast identifier.

Behavior

Receives the DSCH control data on DSCH and confirms the assigned multicast identifier.

8.1.3 MT_Saving State

Attributes

DSCH is not monitored for the control nor the user data.

Behavior

FFS

8.1.4 MT_Active State

Attributes

DSCH is not monitored for the control data.

-) DSCH is monitored for the user data.

Behavior

Receives the multicast user data on the established DSCH.

9. Examples of Procedures

Figure 4. Multicast State Diagram relative to the DSCH, MT=MulTicast service.

9.1 NAS initiated change of system information

The sequence in Figure 5 shows the change of broadcast system information initiated from the non-access stratum (NAS).

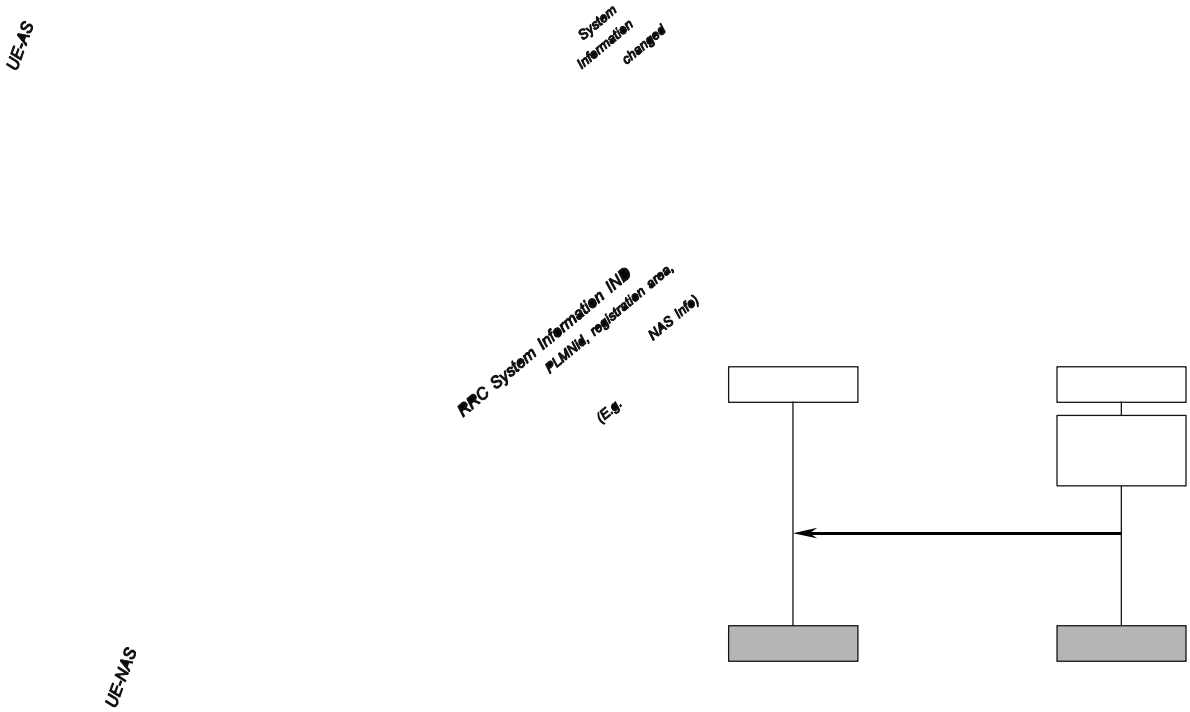

Figure 5. Example sequence, non-access stratum initiated change of broadcast system info.

A non-access stratum entity in the network issues a request for change of the broadcast system information, by issuing a RRC Information Broadcast REQ primitive over the General Control (GC) SAP.

The change in system information in this example is such that it is not necessary for the UEs to be forced to receive BCCH immediately after the change. All UEs will eventually read the new system information either at e.g. cell reselection or at UE state change.

When the UE reads system information on BCCH and the RRC layer finds out that the non-access part of the information has been changed, an RRC Information Broadcast IND primitive is issued to the non-access stratum entity in the UE over the General Control (GC) SAP.

[Note: The network may force the UEs in a paging group to read system information by sending a page request message, but this is not shown in the example above.]

9.2 System Information Update to NAS

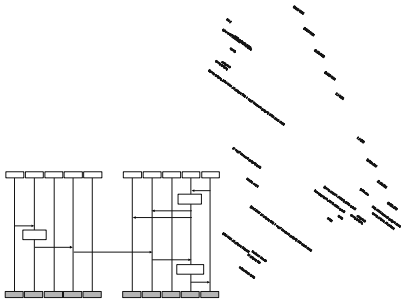

Figure 6. System Information Update to NAS.

AS sends system information to NAS when a change of system information is detected in the cell currently camped on. This happens for instance when a new cell is selected due to cell reselection. The information sent can include PLMN identity, registration area and NAS information. The NAS information includes the identity of the NAS defined service area.

9.3 CN originated paging in idle mode

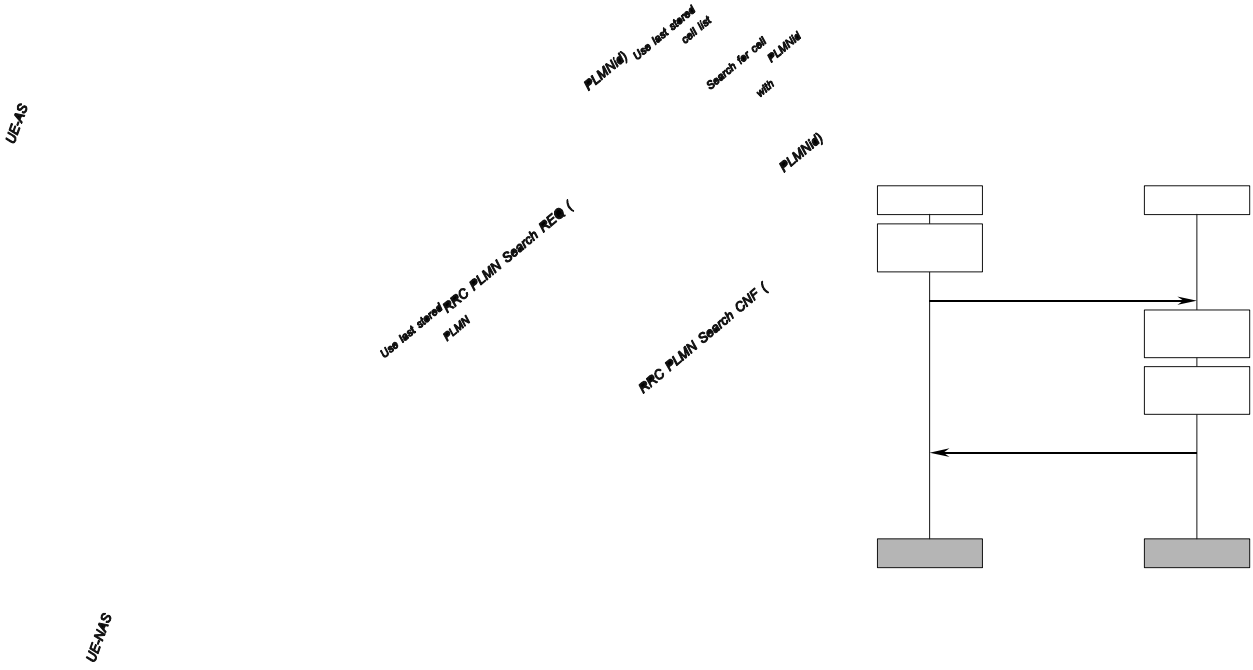

Figure 7. Example sequence of CN initiated paging request in idle mode.

Figure 7 illustrates a CN originated paging request when the UE is in idle mode.

In the UE, a NAS entity issues the primitive RRC Paging Control REQ, which tells RRC to listen to paging and notifications addressed to a given UE paging identity and on a paging group which can be calculated using information given from NAS. *[Note: The paging group calculation info can e.g. be the IMSI of the UE.]*

A NAS entity on the network side requests paging of an UE using the RRC Paging REQ primitive over the Nt-SAP. The primitive contains a UE paging identity, an area where the page request is to be broadcast, information for calculation of the paging group and NAS information to be transparently transmitted to the UE by the paging request.

The RRC layer calculates the paging group, and formats a Paging Request Type 1 message containing the UE paging identity and the NAS information The RRC layer then requests MAC to transmit the message on the PCH on the selected paging group.

In the UE, the RRC layer continuously monitors the paging group compares the UE paging identities in received paging request messages with its own identities. A match occurs, and in this case the UE paging identity and the NAS information is forwarded to the NAS entity of the UE.

9.4 PLMN Selection, automatic mode, normal case

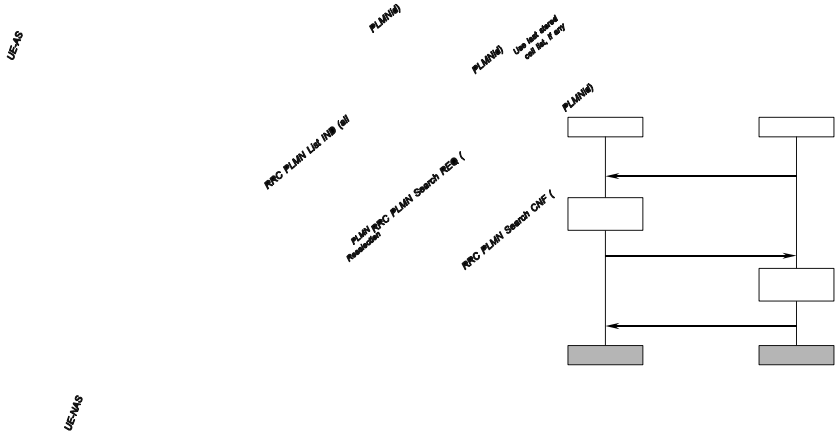

Figure 8. PLMN Selection, automatic mode, normal case.

At power-on, the non-access stratum (NAS) selects the PLMN with highest priority, possibly the last PLMN stored prior to previous power off. The access stratum (AS) is requested to find a cell belonging to that PLMN. When searching for the requested PLMN and in order to speed up the search, AS may use a list of cell information stored prior to previous power-off. When a cell belonging to the requested PLMN is found, that cell is selected and NAS is notified that the PLMN was found.

9.5 PLMN Reselection, automatic mode

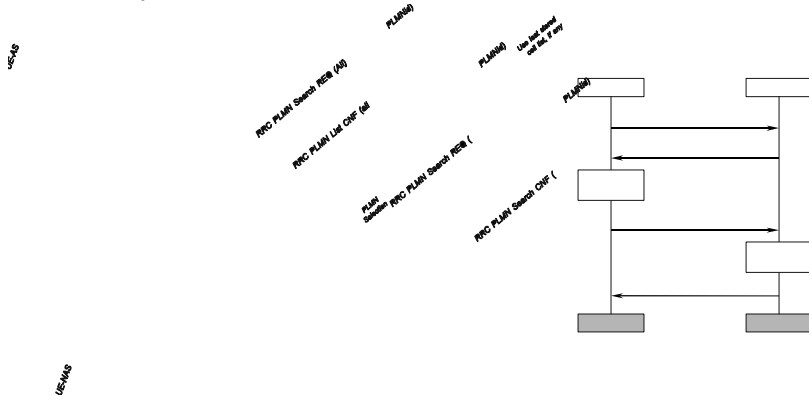

Figure 9. PLMN Reselection, automatic mode.

Triggered by, for instance, a timer, AS sends a list to NAS with all PLMNs currently available. The list includes the identities of available PLMNs and possibly information about their NAS defined service area(s). Assuming that a PLMN with higher priority is found, NAS requests AS to select a cell belonging to the PLMN with highest priority. When searching for the requested PLMN and in order to speed up the search, AS may use a list of cell information previously stored, if any. When a cell belonging to the requested PLMN is found, that cell is selected and NAS is notified that the PLMN was found.

9.6 PLMN Reselection, manual mode

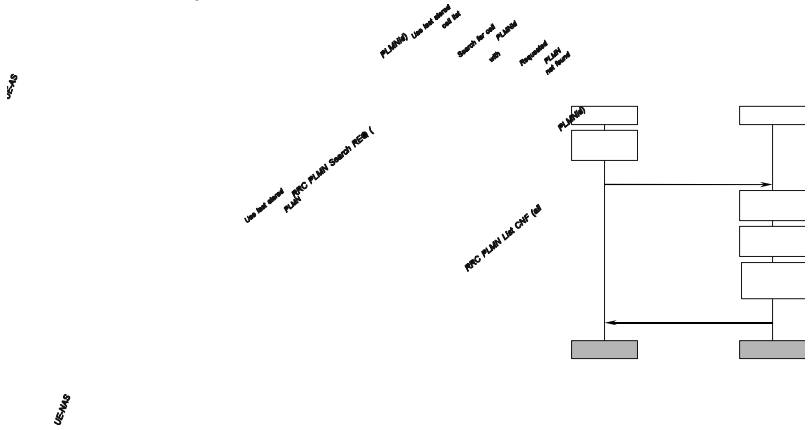

Figure 10. PLMN Reselection, manual mode.

NAS requests AS to report all PLMNs currently available, for instance as a response to a user request. AS sends a list to NAS with all PLMNs currently available. The list includes the identities of available PLMNs and possibly information about their NAS defined service area(s). Assuming that a PLMN with higher priority is selected by for instance the user, NAS requests AS to select a cell belonging to the PLMN with highest priority. When searching for the requested PLMN and in order to speed up the search, AS may use a list of cell information previously stored, if any. When a cell belonging to the requested PLMN is found, that cell is selected and NAS is notified that the PLMN was found.

9.7 PLMN Selection, automatic mode, selected PLMN not found

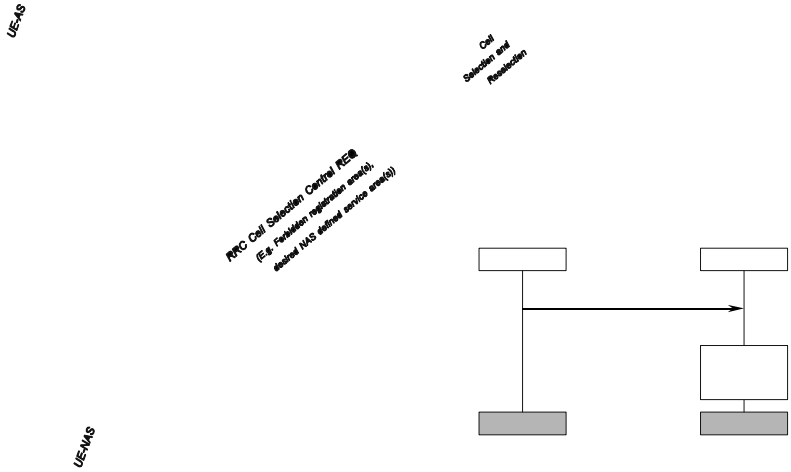

Figure 11. PLMN Selection, automatic mode, selected PLMN not found.

At power-on, the non-access stratum selects the PLMN with highest priority, possibly from the list of PLMNs stored prior to previous power off. The access stratum is requested to find a cell belonging to that PLMN. When searching for the requested PLMN and in order to speed up the search, AS may use a list of cell information stored prior to previous power-off. If no cell is found belonging to the requested PLMN, a list of available PLMNs is sent to NAS, indicating which PLMN has been temporarily chosen by AS.

9.8 NAS Controlled Cell Selection

9.8.1 Execution in Access Stratum

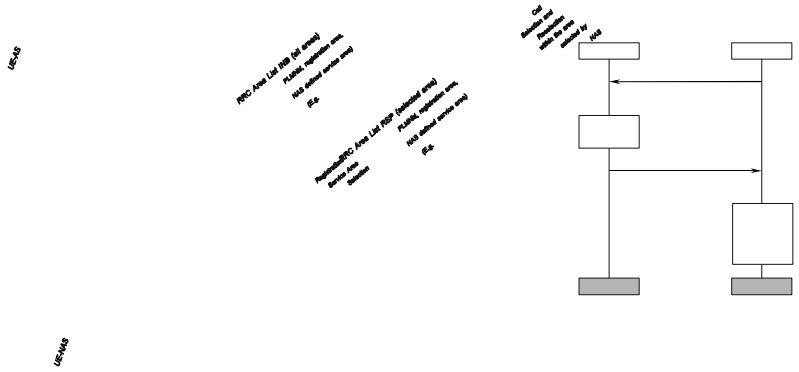

Figure 12. NAS Controlled Cell Selection, execution in AS.

NAS may influence the cell selection and reselection by sending control information to AS. This information can include, for example, lists of forbidden registration areas and a list of NAS defined service areas in priority order. The control information is used by AS in cell selection and reselection:

Cells belonging to a forbidden registration area will only be selected if no better cell is found. At this point, the services provided the UE might be limited.

Cells belonging to a NAS defined service area with higher priority than current service area will be considered better than the cell currently camped on. Depending on radio access mode, the most suitable cell in idle mode may not be the most suitable cell in connected mode.

9.8.2 Execution in Non-Access Stratum

Figure 13. NAS Controlled Cell Selection, execution in NAS.

As an alternative to the example in section 11.8.1, AS sends cell selection information to NAS. This information can include PLMN identity, registration area and NAS defined service area. The information contains the full set of available registration areas and NAS defined service areas. The information is typically sent when there is a change of available areas, for instance when a neighbour cell belonging to a new registration area/NAS defined service area is found. Correspondingly, a new list of available areas is sent from AS to NAS when for instance coverage is lost from the cell currently camped on and that is the only cell belonging to the current NAS defined service area.

AS performs cell selection and reselection for the selected registration area/NAS defined service area without interaction with NAS. However, before reselecting a cell in another registration area/NAS defined service area, AS must check with NAS.

10. History

Document history_