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Universal Mobile Telecommunications System (UMTS);
User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode
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Foreword

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Contents

Foreword

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1 Scope

The present document specifies the Access Stratum (AS) part of the Idle Mode procedures applicable to a UE. The non-access stratum (NAS) part of Idle mode procedures and processes is specified in [5].

The present document also specifies cell selection and reselection processes applicable to UEs in connected mode. Invocation of these processes is described in [4].

The present document specifies the model for the functional division between the NAS and AS in a UE.

The present document applies to all UEs that support at least UTRA, including multi-RAT UEs as described in 3GPP specifications, in the following cases:

- When the UE is camped on a UTRA cell;
- When the UE is searching for a cell to camp on;

NOTE: The details for those cases are described in the specifications of the other RAT.

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

The present document also specifies how idle-mode and reselection procedures are affected by the provision of MBMS services.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 43.022: "Functions related to Mobile Station in idle mode and group receive mode".

[2] 3GPP TS 25.301: "Radio Interface Protocol Architecture".

[3] 3GPP TS 25.303: "Interlayer Procedures in Connected Mode".

[4] 3GPP TS 25.331: "Radio Resource Control (RRC); protocol specification".

[5] 3GPP TS 23.122: "NAS functions related to Mobile Station (MS) in idle mode ".

[6] 3GPP TR 25.922: "Radio Resource Management Strategies".

[7] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[8] 3GPP TS 25.221: "Physical channels and mapping of transport channels onto physical channels (TDD)".

[9] 3GPP TS 22.011: "Service accessibility".

[10] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[11] 3GPP TS 25.123: "Requirements for Support of Radio Resource Management (TDD)".

[12] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[13] 3GPP TS 45.008: "Radio subsystem link control".

[14] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[15] 3GPP TS 25.224: "Physical Layer Procedures (TDD)".

[16] 3GPP TS 24.008: "Mobile radio interface layer 3 specification, Core Network Protocols - Stage 3".

[17] 3GPP TS 25.346: "Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (Stage-2)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions and the definitions in [12] apply.

Acceptable Cell: A cell that satisfies certain conditions as specified in 4.3. A UE can always attempt emergency calls on an acceptable cell.

Available PLMN: A PLMN for which the UE has found at least one cell and read its PLMN identity.

Barred Cell: A cell a UE is not allowed to camp on.

Camped on a cell: UE has completed the cell selection/reselection process and has chosen a cell. The UE monitors system information and (in most cases) paging information.

Camped on any cell: UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell irrespective of PLMN identity.

Camped on MBSFN cluster: UE has completed the MBSFN Cluster selection/reselection process and has chosen a MBSFN Cluster. The UE monitors system information and receives notifications for MBMS services and possibly receives a MBMS service.

DRX cycle: Individual time interval between monitoring Paging Occasion for a specific UE.

EHPLMN: Any of the PLMN entries contained in the Equivalent HPLMN list stored on the USIM [5].

Equivalent PLMN list: List of PLMNs considered as equivalent by the UE for cell selection, cell reselection , MBSFN Cluster selection MBSFN Cluster reselection and handover according to the information provided by the NAS.

Home PLMN: 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): UE registers its presence in a registration area, for instance regularly or when entering a new registration area.

Maximum DRX cycle: Time interval for the longest possible DRX cycle in a cell.

MBMS Activated Service: An MBMS service that the UE has joined (multicast) or is interested in (broadcast).

MBMS Preferred Layer (PL): A frequency layer that is indicated by the UTRAN to be preferred for camping for MBMS purposes.

MBSFN cluster: Set of cells operating in MBSFN mode providing only MBMS service in PtM mode and seen as one cell by a UE.

MBSFN mode: In order to achieve higher spectral efficiency synchronized cells operate in MBSFN mode which implies that they transmit exactly the same content over an area that is seen as one MBSFN cell by the UE.

Paging Block Periodicity (PBP): Period of the occurrence of Paging Blocks. (For FDD, PBP = 1).

Paging Message Receiving Occasion (TDD only)**:** The frame where the UE receives actual paging message.

Paging occasion:
(FDD) The SFN of the PICH frame where the UE monitors its paging indicator (i.e. the SFN of the PCCPCH frame in which the PICH frame begins).
(TDD) The paging block, which consists of several frames. The value of Paging Occasion is equal to the first frame of the Paging Block.

Process: A local action in the UE invoked by a RRC procedure or an Idle Mode procedure.

Radio Access Mode: Radio access mode of the cell, FDD or TDD.

Radio Access Technology: Type of technology used for radio access, for instance UTRA or GSM.

Registered PLMN: This is the PLMN on which certain Location Registration outcomes have occurred [5].

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

Reserved Cell: A cell on which camping is not allowed, except for particular UEs, if so indicated in the system information.

Restricted Cell: A cell on which camping is allowed, but access attempts are disallowed for UEs whose access classes are indicated as barred.

Selected PLMN: This is the PLMN that has been selected by the NAS, either manually or automatically.

Serving cell: The cell on which the UE is camped.

Strongest cell: The cell on a particular carrier that is considered strongest according to the layer 1 cell search procedure [14][15]. As the details of the layer 1 cell search are implementation dependent, the precise definition of 'strongest cell' is also implementation dependent.

Suitable Cell: This is a cell on which an UE may camp. For a UTRA cell, the criteria are defined in subclause 4.3, and for a GSM cell the criteria are defined in [1].

3.2 Abbreviations

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

AS	Access Stratum
BCCH	Broadcast Control Channel
CM	Connection Management
CN	Core Network
DRX	Discontinuous Reception
DSCH	Downlink Shared Channel
FDD	Frequency Division Duplex
GC	General Control (SAP)
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HCS	Hierarchical Cell Structure
IMSI	International Mobile Subscriber Identity
MBMS	Multimedia Broadcast-Multicast Service
MBSFN	MBMS over a Single Frequency Network
MCC	Mobile Country Code
MCCH	MBMS point-to-multipoint Control Channel
MICH	MBMS notification Indicator Channel
MM	Mobility Management
MNC	Mobile Network Code
MSCH	MBMS point-to-multipoint Scheduling Channel
MTCH	MBMS point-to-multipoint Traffic Channel
NAS	Non-Access Stratum
NI	(MBMS) Notification Indicator
PCH	Paging Channel

PI	Page Indicator
PICH	Page Indication Channel
PLMN	Public Land Mobile Network
RAT	Radio Access Technology
RRC	Radio Resource Control
SAP	Service Access Point
TDD	Time Division Duplex
TMGI	Temporary Mobile Group Identity
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

4 General description of Idle mode

4.1 Overview

When a UE is switched on, a public land mobile network (PLMN) is selected and the UE searches for a suitable cell of this PLMN to camp on. Criteria for cell selection and cell re-selection between radio access technologies (RATs) described in this document only consider radio criteria. In addition to RAT, the PLMN type may differ as well. In this specification, the term PLMN is used as a generic term covering both GSM MAP and ANSI-41 type of PLMNs. According to the type of PLMN, the way to identify it can be different. If the PLMN type is GSM, the PLMN is identified by 'PLMN identity' and if the PLMN type is ANSI-41, the PLMN is identified by 'SID'

The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

The UE searches for a suitable cell of the selected 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, if necessary, then register its presence, by means of a NAS registration procedure, in the registration area of the chosen cell and as outcome of a successful Location Registration the selected PLMN becomes the registered PLMN [5].

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

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in [9] and search for a suitable cell if another PLMN has been selected by NAS.

NOTE: For RRC connected mode the requirements for the search for higher priority PLMNs are defined in [4].

If the UE loses coverage of the registered 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 UEs only capable of services that need no registration.

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

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

b) When registered and if the UE wishes to establish an RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) 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.

d) It enables the UE to receive cell broadcast services.

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 (except for LR rejected with cause #12, cause #14 or cause #15, see [5] and [16]), 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 three processes:

- PLMN selection;
- Cell selection and reselection;
- Location registration.

The relationship between these processes is illustrated in Figure 1.

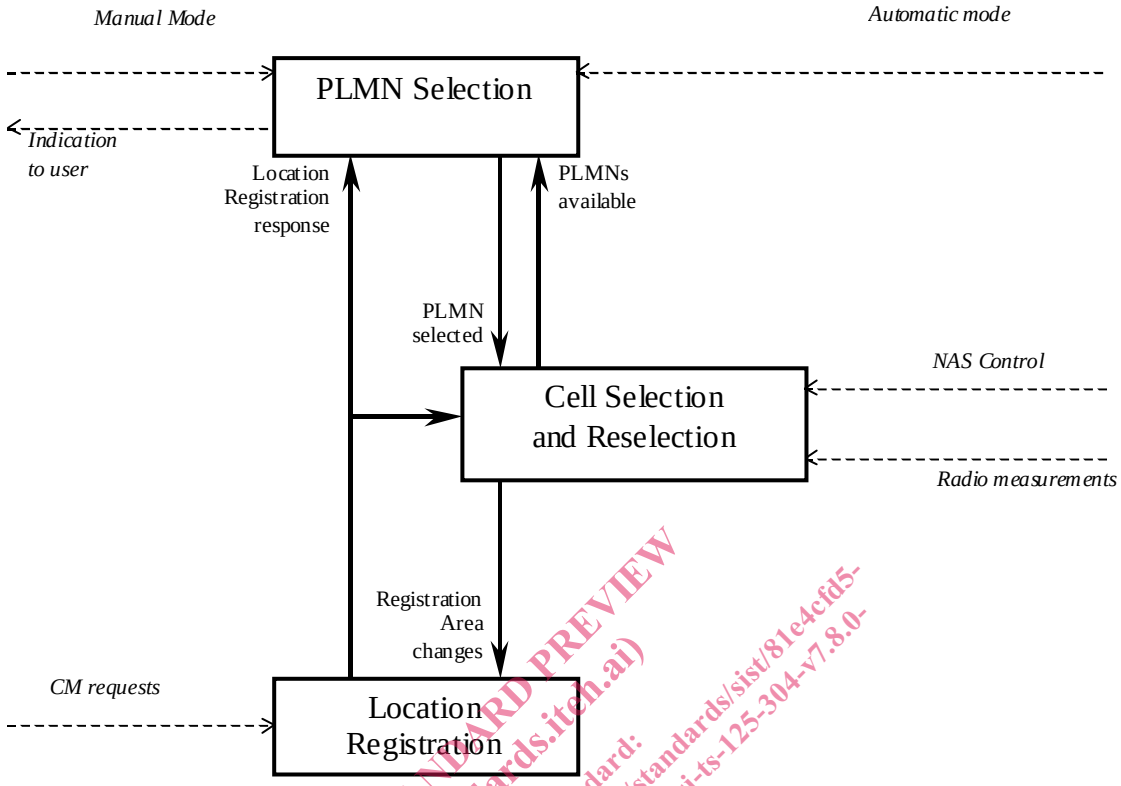

Figure 1: Overall Idle Mode process

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 NAS part is specified in [5] and the AS part in the present document. Examples of different idle mode procedures are presented in Clause 10.