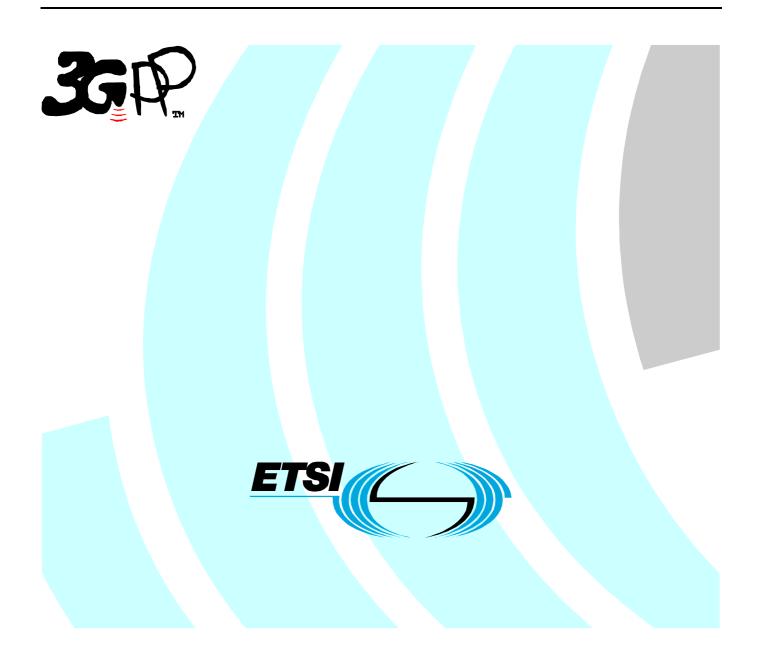# ETSI TS 125 304 V7.0.0 (2006-03)

*Technical Specification*

**Universal Mobile Telecommunications System (UMTS);
User Equipment (UE) procedures in idle mode and
procedures for cell reselection in connected mode
(3GPP TS 25.304 version 7.0.0 Release 7)**

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# Contents

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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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.

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

**Equivalent PLMN list:** List of PLMNs considered as equivalent by the UE for cell selection, cell 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.

**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 |
| 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.
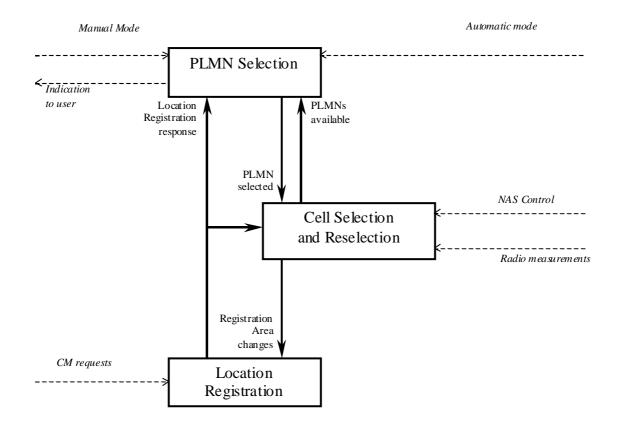
**Figure 1: Overall Idle Mode process**

## 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.

**Table 1: Functional division between AS and NAS in idle mode**

| Idle Mode Process | UE Non-Access Stratum | UE Access Stratum |
|---|---|---|
| PLMN Selection | Maintain the list of allowed PLMN types. It can be GSM-MAP only, ANSI-41 only or both.<br><br>Maintain a list of PLMNs in priority order according to [5]. Select a PLMN using automatic or manual mode as specified in [5] and request AS to select a cell belonging to this PLMN. For each PLMN, associated RAT(s) may be set.<br><br>Evaluate reports of available PLMNs from AS for PLMN selection.<br><br>Maintain a list of equivalent PLMN identities. | Search for available PLMNs.<br><br>If associated RAT(s) is (are) set for the PLMN, search in this (these) RAT(s) and other RAT(s) for that PLMN as specified in [5].<br><br>Perform measurements to support PLMN selection.<br><br>Synchronise to a broadcast channel to identify found PLMNs.<br><br>Report available PLMNs with associated PLMN type and RAT to NAS on request from NAS or autonomously.<br><br>It shall respect allowed PLMN types indications from NAS. |
| Cell Selection | Control cell selection for example by indicating RAT(s) associated with the selected PLMN to be used initially in the search of a cell in the cell selection. NAS is also maintaining lists of forbidden registration areas. | Perform measurements needed to support cell selection.<br><br>Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.<br><br>Search for a suitable cell. The cells broadcast their 'PLMN identity' (GSM-MAP) or 'SID' in the system information. Respond to NAS whether such cell is found or not.<br><br>If associated RATs is (are) set for the PLMN, perform the search in this (these) RAT(s) and other RATs for that PLMN as specified in [5].<br><br>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.<br><br>Maintain a list of equivalent PLMN identities and provide the list to AS.<br><br>Maintain a list of forbidden LAs and provide the list to AS | Perform measurements needed to support cell reselection.<br><br>Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.<br><br>Change cell if a more suitable cell is found. |
| Location registration | Register the UE as active after power on.<br><br>Register the UE's presence in a registration area, for instance regularly or when entering a new registration area.<br><br>Maintain lists of forbidden LAs.<br><br>Deregister UE when shutting down. | Report registration area information to NAS. |

| MBMS | Maintain priority information for various services and participate in service selection.<br><br>Indicate to AS if an offered session has previously been received. | Maintain a list of TMGIs of activated services.<br><br>Notify NAS of service availability and request NAS to prioritise in case of service conflicts.<br><br>Report to NAS when an activated service requires action.<br><br>Receive and handle the MCCH and MTCH, and, if applicable, the MSCH and MICH. |

# 4.3 Service type in Idle and Connected Mode

This clause defines the level of service that may be provided by the network to a UE in Idle mode and Connected Mode.

The action of camping on a cell is necessary to get access to some services. Three levels of services are defined for UE:

- Limited service (emergency calls on an acceptable cell)

- Normal service (for public use on a suitable cell)

- Operator service (for operators only on a reserved cell)

Furthermore, the cells are categorised according to which services they offer:

acceptable cell:

An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call in a UTRAN network:

- The cell is not barred, see subclause 5.3.1.1;

- The cell selection criteria are fulfilled, see subclause 5.2.3.1.2;

suitable cell:

A "suitable cell" is a cell on which the UE may camp on to obtain normal service. Such a cell shall fulfil all the following requirements.

- The cell shall be part of either:

    ▪ the selected PLMN, or:

    ▪ the registered PLMN, or:

    ▪ a PLMN of the Equivalent PLMN list

    according to the latest information provided by the NAS.

- The cell is not barred, see subclause 5.3.1.1;

- The cell is part of at least one LA that is not part of the list of "forbidden LAs for roaming" [9], which belongs to a PLMN that fulfills the first bullet above;

- The cell selection criteria are fulfilled, see subclause 5.2.3.1.2.

If the IE 'Multiple PLMN List' [4] is broadcast in the cell, the cell is considered to be part of all LAs with LAIs constructed from the PLMN identities in the 'Multiple PLMN List' and the LAC broadcast in the cell.

barred cell:

A cell is barred if it is so indicated in the system information [4].

reserved cell:

A cell is reserved if it is so indicated in system information [4].

Exceptions to these definitions are applicable for UEs camped on a cell that belongs to a LA that is forbidden for regional provision of service, and during emergency calls.

A cell that belongs to a LA that is forbidden for regional provision service ([5], [16]) is suitable but provides only limited service.

If a UE has an ongoing emergency call, all acceptable cells of that PLMN are treated as suitable for cell reselection for the duration of the emergency call.

# 5 Process and procedure descriptions

## 5.1 PLMN selection

### 5.1.1 General

In the UE, the AS shall report available PLMNs to the NAS on request from the NAS or autonomously.

UE shall maintain a list of allowed PLMN types. The allowed PLMN type can be GSM-MAP only, ANSI-41 only or both. During PLMN selection, based on the list of allowed PLMN types and a list of PLMN identities in priority order, the particular PLMN may be selected either automatically or manually. Each PLMN in the list of PLMN identities can be identified by either 'PLMN identity' (GSM-MAP) or 'SID'. In the system information on the broadcast channel, the UE can receive a 'PLMN identity' (GSM-MAP) or a 'SID' or a 'PLMN identity' (GSM-MAP) and a 'SID', in a given cell. For a given cell, the UE might receive several 'PLMN identities' from the system information on the broadcast channel. The result of the PLMN selection is an identifier of the selected PLMN, the choice being based on the allowed PLMN types, UE capability or other factors. This identifier is one of either 'PLMN identity' for GSM-MAP type of PLMNs or 'SID' for ANSI-41 type of PLMNs.

In case that the list of allowed PLMN types includes GSM-MAP, the non-access part of the PLMN selection process is specified in [5]. In the case that list of allowed PLMN types includes ANSI-41, the non-access stratum part of the PLMN selection is specified in TIA/EIA/IS-2000.5 and TIA/EIA/IS-707.

### 5.1.2 Support for PLMN Selection

#### 5.1.2.1 General

On request of the NAS the AS should perform a search for available PLMNs and report them to NAS.

#### 5.1.2.2 UTRA case

The UE shall scan all RF channels in the UTRA bands according to its capabilities to find available PLMNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN the cell belongs to. If the UE can read one or several PLMN identities in the strongest cell, each found PLMN (see the PLMN reading in [4]) shall be reported to the NAS as a high quality PLMN (but without the RSCP value), provided that the following high quality criterion is fulfilled:

1. For an FDD cell, the measured primary CPICH RSCP value shall be greater than or equal to -95 dBm.

2. For a TDD cell, the measured P-CCPCH RSCP shall be greater than or equal to -84 dBm.

Found PLMNs that do not satisfy the high quality criterion, but for which the UE has been able to read the PLMN identities are reported to the NAS together with the CPICH RSCP value for UTRA FDD cells and P-CCPCH RSCP for UTRA TDD cells. The quality measure reported by the UE to NAS shall be the same for each PLMN found in one cell.

The search for PLMNs on the rest of the carriers may be stopped on request of the NAS. The UE may optimise this search by using stored information of carrier frequencies and optionally also information on cell parameters, e.g. scrambling codes, from previously received measurement control information elements.

Once the UE has selected a PLMN, the cell selection procedure shall be performed in order to select a suitable cell of that PLMN to camp on.

### 5.1.2.3    GSM case

Support for network selection in GSM is described in [1].

# 5.2    Cell selection and reselection in idle mode

## 5.2.1    Introduction

As stated in clause 1, the present document applies to UEs that support at least UTRA.

Different types of measurements are used in different RATs and modes for the cell selection and reselection. The performance requirements for the measurements are specified in [10] and [11].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell and the radio access mode based on idle mode measurements and cell selection criteria.

In order to speed up the cell selection process, stored information for several RATs may be available in the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in [10] and [11].

The NAS 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

    -   Receive 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.

## 5.2.2 States and state transitions in Idle Mode

Figure 2 shows the states and procedures in Idle Mode.



**Figure 2: Idle Mode Cell Selection and Reselection**
**In any state, a new PLMN selection causes an exit to number 1**

### 5.2.2.1 Cell Selection process overview

Whenever a PLMN has been selected by NAS, the UE shall attempt to find a suitable cell to camp on.

The NAS may control the cell selection by:

- providing information on RAT(s) associated with the selected PLMN;

- maintaining lists of forbidden registration areas;

- providing a list of equivalent PLMNs;

One or several RATs may be associated with the selected PLMN. In [5] it is specified which RAT a UE shall select to search for a suitable cell of the selected PLMN.

The AS shall attempt to find a suitable cell to camp on as specified in clause 5.2.3.

When the MBMS frequency layer dispersion is triggered, the UE actions are specified in [4].

If a suitable cell is found, the UE shall select this cell to camp on, and report this event to NAS so that the necessary NAS registration procedures can be performed. When the registration is successful, the UE enters in state *Camped normally* in order to obtain normal service.

If the UE is unable to find any suitable cell of selected PLMN the UE shall enter the *Any cell selection* state.

## 5.2.2.2 Camped normally state overview

In this state, the UE obtains normal service and performs the tasks specified in 5.2.5.

If after a *Cell reselection evaluation process* a better cell is found, the *Cell reselection procedure* is performed. If no suitable cell is found, the UE shall enter the state *Any cell selection*.

If a necessary NAS registration is rejected, the UE shall enter the *Any cell selection* state, except if the LR is rejected with cause #12, cause #14 or cause #15. In this case the UE shall behave as specified in [5] and [16].

When UE leaves idle mode in order to enter the state *Connected mode*, the UE shall attempt to access the current serving cell. If the access attempt to the serving cell fails, the UE shall use the *Cell reselection evaluation* procedure.

## 5.2.2.3 Connected mode State overview

The procedures in *Connected mode* state are specified in [4]

When returning to idle mode, the UE shall use the procedure *Cell selection when leaving connected mode* in order to find a suitable cell to camp on and enter state *Camped normally*. If a suitable cell is found, then the AS reports this event to NAS to be capable to perform necessary NAS registration procedures. If no suitable cell is found, the *Stored information cell selection* procedure shall be used.

If no suitable cell is found in *cell reselection evaluation* process, the UE enters the state *Any cell selection*.

## 5.2.2.4 Any cell selection State overview

In this state the UE performs the tasks specified in subclause 5.2.8

The state *Any cell selection* is also entered if the NAS indicates that a location registration is rejected except if the LR is rejected with cause #12, cause #14 or cause #15, see [5], or if there is no USIM in the UE.

If the UE received an LR reject with cause #12, cause #14 or cause #15, the UE shall behave as specified in [5] and [16].

If an acceptable cell is found, the UE shall inform the NAS and camp on this cell and obtain limited service, state *Camped on any cell*. The subsequent actions of the NAS regarding the PLMN selection are specified in [5].

## 5.2.2.5 Camped on any cell State overview

In this state the UE obtains limited service and shall behave as specified in subclause 5.2.9. The UE shall regularly attempt to find a suitable cell, trying all RATs that are supported by the UE. If a suitable cell is found, this causes an exit to number 2 in figure 2.

NOTE: The 'PLMN selection' process may select a new PLMN at any time in idle mode, which in Figure 2 causes an exit to number 1.

## 5.2.3 Cell Selection Process

### 5.2.3.1 UTRA case

#### 5.2.3.1.1 Description

The UE shall use one of the following two search procedures:

a) Initial Cell Selection

This procedure requires no prior knowledge of which RF channels are UTRA carriers. The UE shall scan all RF channels in the UTRA bands according to its capabilities to find a suitable cell. On each carrier, the UE need only search for the strongest cell. Once a suitable cell is found this cell shall be selected.

b) Stored Information Cell Selection

This procedure requires stored information of carrier frequencies and optionally also information on cell parameters, e.g. scrambling codes, from previously received measurement control information elements. Once the UE has found a suitable cell the UE shall select it. If no suitable cell is found the Initial cell selection procedure shall be started.

#### 5.2.3.1.2 Criteria

The cell selection criterion S is fulfilled when:

$$
\begin{array}{ll}
\text{for FDD cells:} & Srxlev > 0 \ \text{AND} \ Squal > 0 \\
\\
\text{for TDD cells:} & Srxlev > 0
\end{array}
$$

Where:

$$
\begin{array}{l}
Squal = Q_{qualmeas} - Qqualmin \\
\\
Srxlev = Q_{rxlevmeas} - Qrxlevmin - Pcompensation
\end{array}
$$

| Squal | Cell Selection quality value (dB) Applicable only for FDD cells. |
|---|---|
| Srxlev | Cell Selection RX level value (dB) |
| $Q_{qualmeas}$ | Measured cell quality value. The quality of the received signal expressed in CPICH $E_C/N_0$ (dB) for FDD cells. CPICH Ec/N0 shall be averaged as specified in [10]. Applicable only for FDD cells. |
| $Q_{rxlevmeas}$ | Measured cell RX level value. This is received signal, CPICH RSCP for FDD cells (dBm) and P-CCPCH RSCP for TDD cells (dBm). |
| Qqualmin | Minimum required quality level in the cell (dB). Applicable only for FDD cells. |
| Qrxlevmin | Minimum required RX level in the cell (dBm) |
| Pcompensation | max(UE_TXPWR_MAX_RACH – P_MAX, 0) (dB) |
| UE_TXPWR_MAX_RACH | Maximum TX power level an UE may use when accessing the cell on RACH (read in system information) (dBm) |
| P_MAX | Maximum RF output power of the UE (dBm) |

### 5.2.3.2 GSM case

The cell selection criteria and procedures in GSM are specified in [1].

## 5.2.4 Void

## 5.2.5 Camped Normally State

### 5.2.5.1 UTRA case

When camped normally, the UE shall perform the following tasks:

- select and monitor the indicated PICH and PCH of the cell as specified in clause 8 according to information sent in system information;

- monitor relevant System Information. This is specified in [4];

- perform necessary measurements for the cell reselection evaluation procedure;

- execute the cell reselection evaluation process on the following occasions/triggers:

    1) UE internal triggers, so as to meet performance as specified in [10] and [11];

    2) When information on the BCCH used for the cell reselection evaluation procedure has been modified

If the UE supports MBMS and MBMS is active in the cell and the UE is permitted to receive MBMS services in the cell, the UE shall perform MBMS tasks as specified in subclause 6.3.

### 5.2.5.2 GSM case

The Camped Normally State is specified in [1].

## 5.2.6 Cell Reselection Evaluation Process

### 5.2.6.1 UTRA case

The cell reselection process is specified in the following sub-clauses:

#### 5.2.6.1.0 Use of MBMS PL

In the cell reselection process, an MBMS PL shall only be applicable while the UE is receiving an MBMS session from one or more of the ongoing activated MBMS services for which this PL is indicated.

#### 5.2.6.1.1 Measurement rules for cell re-selection when HCS is not used

The measurement rules below apply in Idle, URA_PCH, CELL_PCH states. In CELL_FACH state the UE is required to perform measurements on all intra-frequency, inter-frequency and inter-RAT cells listed in system information according to requirements specified in [10]. In Idle, URA_PCH, CELL_PCH and CELL_FACH states the UE shall only consider those cells the UE is mandated to measure according to the measurement rules below as measured cells in the cell reselection criteria (subclause 5.2.6.1.4).

If the system information broadcast in the serving cell indicates that HCS is not used, then for intra-frequency and inter-frequency measurements and inter-RAT measurements, the UE shall:

- use Squal for FDD cells and Srxlev for TDD for Sx, and apply the following rules.

1. If $Sx > S_{intrasearch}$, UE may choose to not perform intra-frequency measurements.
   If $Sx <= S_{intrasearch,}$ perform intra-frequency measurements.
   If $S_{intrasearch,}$ is not sent for serving cell, perform intra-frequency measurements.

2. If $Sx > S_{intersearch}$ and MBMS PL has not been indicated, and $Srxlev > S_{searchHCS}$ if $S_{searchHCS}$ is signalled, UE may choose to not perform inter-frequency measurements.
   If $Sx > S_{intersearch}$ and MBMS PL has been indicated and the serving cell belongs to the MBMS PL, and $Srxlev > S_{searchHCS}$ if $S_{searchHCS}$ is signalled, UE may choose to not perform inter-frequency measurements.
   If $Sx > S_{intersearch}$, and MBMS PL has been indicated and the serving cell does not belong to the MBMS PL, and $Srxlev > S_{searchHCS}$ if $S_{searchHCS}$ is signalled, UE shall at least perform inter-frequency measurements on the MBMS PL.
   If $Sx <= S_{intersearch}$, or $Srxlev <= S_{searchHCS}$ if $S_{searchHCS}$ is signalled, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If $Sx > Ssearch_{RAT\ m}$, and $Srxlev > S_{HCS,RATm}$ if $S_{HCS,RATm}$ is signalled, UE may choose to not perform measurements on cells of RAT "m".
   If $Sx <= Ssearch_{RAT\ m}$, or $Srxlev <= S_{HCS,RATm}$ if $S_{HCS,RATm}$ is signalled, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

If HCS is not used and if $S_{limit,SearchRATm}$ is sent for serving cell, UE shall ignore it.

NOTE: The presence of $S_{searchHCS}$ and $S_{HCS,RATm}$ thresholds in system information are used to avoid introducing new parameters to system information and their presence does not imply that HCS is used.

### 5.2.6.1.1a High mobility state when HCS is not used

High-mobility, as applied in HCS case, is also applicable in non-HCS if the parameters non-HCS_ $T_{CRmax}$, non-HCS_$N_{CR}$ and non-HCS_$T_{CRmaxhyst}$ are sent on the system information broadcast.

If in non-HCS environment the number of cell reselections during time period non-HCS_$T_{CRmax}$ exceeds non-HCS_$N_{CR}$, high-mobility state has been detected.

When the number of cell reselections during time period non-HCS_$T_{CRmax}$ no longer exceeds non-HCS_$N_{CR}$, the UE shall:

- continue in high-mobility state.

- if the criteria for entering high mobility is not detected during time period non-HCS-$T_{CrmaxHyst}$:

  - exit high-mobility.

If the UE is in non-HCS environment and in high-mobility state, the UE shall apply the speed dependent scaling rules as defined in subclause 5.2.6.1.4.

### 5.2.6.1.2 Measurement rules for cell re-selection when HCS is used

The measurement rules below apply in Idle, URA_PCH, CELL_PCH states. In CELL_FACH state the UE is required to perform measurements on all intra-frequency, inter-frequency and inter-RAT cells listed in system information according to requirements specified in [10]. In Idle, URA_PCH, CELL_PCH and CELL_FACH states the UE shall only consider those cells the UE is mandated to measure according to the measurement rules below as measured cells in the cell reselection criteria (subclause 5.2.6.1.4).

If the system information broadcast in the serving cell indicates that HCS is used, then for intra-frequency and inter-frequency measurements, the UE shall:

use HCS priority$_1$ as the HCS priority broadcast in the system information and apply the following rule:

IF an MBMS PL is used THEN

- If the UE is in HCS low mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS priority$_1$ + HCS_OFF$_{mbms}$.

- If the UE is in HCS high mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS priority$_1$.

- for serving cell and neighbour cells not belonging to the MBMS PL, set the HCS priority = HCS priority$_1$.

IF an MBMS PL is not used THEN

For serving cell and all neighbour cells set HCS priority = HCS priority$_1$

Then apply this to the following:

1. For intra-frequency and inter-frequency measurement rules for UEs not in high-mobility

   use Squal for FDD cells and Srxlev for TDD cells for Sx and apply the following rules.

   IF (Srxlev$_s$ <= Ssearch$_{HCS}$) or (if FDD and $S_x$ <= $S_{intersearch}$) THEN

       measure on all intra-frequency and inter-frequency cells.

   ELSE

       IF ($S_x$ > $S_{intrasearch}$) THEN

           measure on all intra-frequency and inter-frequency cells, which have higher HCS priority level than the serving cell

       ELSE

           measure on all intra-frequency and inter-frequency cells, which have equal or higher HCS priority level than the serving cell

       ENDIF

       IF ($S_{intrasearch}$ is not sent for the serving cell) THEN

           measure on all intra-frequency cells. Fast-moving UEs may also use this rule.

           measure on all inter-frequency cells, which have higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered.

       ENDIF

   ENDIF

   If HCS is used and if $S_{searchHCS}$ or $S_{intersearch}$ (in FDD) are not sent for the serving cell, UE shall:

   - measure on all intra-frequency and inter-frequency cells.

2. For intra-frequency and inter-frequency measurement rules for fast-moving UEs:

   If the number of cell reselections during time period $T_{CRmax}$ exceeds $N_{CR}$, high-mobility has been detected. In this high-mobility state, UE shall

   - IF (Srxlev$_s$ <= Ssearch$_{HCS}$) or (if FDD and $S_x$ <= $S_{intersearch}$), or $S_{searchHCS}$ or $S_{intersearch}$ (in FDD) are not sent for the serving cell THEN

       measure on all intra-frequency and inter-frequency cells.

   ELSE

   - measure intra-frequency and inter-frequency neighbouring cells, which have equal or lower HCS priority than serving cell.

   ENDIF

   When the number of cell reselections during time period $T_{CRmax}$ no longer exceeds $N_{CR}$, UE shall

   - continue these measurements during time period $T_{CrmaxHyst}$

   - if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$:

- exit high-mobility.

When serving cell belongs to a hierarchical cell structure, the UE shall follow these rules for Inter-RAT measurements:

1. Inter-RAT threshold-based measurement rules for UEs not in high-mobility

   use Squal for FDD cells and Srxlev for TDD cells for Sx and apply the following rules.

   IF ($Srxlev_s <= S_{HCS,RATm}$) or (if FDD and $S_{qual} <= S_{SearchRATm}$) THEN

   UE shall measure on all inter-RATm cells.

   ELSE

   IF ($S_x > S_{limit,SearchRATm}$) THEN

   UE may choose to not measure neighbouring cells in RAT "m".

   ELSE

   UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell

   ENDIF

   ENDIF

   If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells.

2. Inter-RAT measurement rules for fast-moving UEs

   - If the number of cell reselections during time period $T_{CRmax}$ exceeds $N_{CR}$, high-mobility has been detected. In this high-mobility state, UE shall

   - IF ($Srxlev_s <= S_{HCS,RATm}$) or (if FDD and $S_{qual} <= S_{SearchRATm}$), or $S_{HCS,RATm}$ or $S_{SearchRATm}$ are not sent for the serving cell THEN

     - UE shall measure on all inter-RATm cells.

   ELSE

     - measure the neighbouring cells in RAT "m", which have an equal or lower HCS priority than the serving cell

   - ENDIF


   When the number of cell reselections during time interval $T_{CRmax}$ no longer exceeds $N_{CR}$, UE shall

   - continue these measurements during time period $T_{CrmaxHyst}$

   - if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$

     - exit high-mobility.

### 5.2.6.1.3 Highest ranked cells with cell reservations, access restrictions or unsuitable for normal camping

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in subclause 5.2.6.1.4, the UE shall check if the access is restricted according to the rules in subclause 5.3.1.1.

If that cell and other cells have to be excluded from the candidate list, as stated in subclause 5.3.1.1, the UE shall not consider these as candidates for cell reselection. This limitation is removed when the highest ranked cell changes.

If the highest ranked cell is an intra-frequency or inter-frequency cell which is not suitable due to being part of the "list of forbidden LAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered

PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300s. If the UE has to perform an *any cell selection* procedure any limitation shall be removed.

If the highest ranked cell is an inter-RAT cell which is not suitable due to being part of the "list of forbidden LAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell as a candidate for reselection for a maximum of 300s. If the UE has to perform an *any cell selection* procedure any limitation shall be removed.

### 5.2.6.1.4 Cell Reselection Criteria

The following cell re-selection criteria are used for intra-frequency cells, inter-frequency cells and inter-RAT cells:

The quality level threshold criterion H for hierarchical cell structures is used to determine whether prioritised ranking according to hierarchical cell re-selection rules shall apply, and is defined by:

$$H_s = Q_{meas,s} - Qhcs_s$$

$$H_n = Q_{meas,n} - Qhcs_n - TO_n * L_n$$

If it is indicated in system information that HCS is not used, the quality level threshold criterion H is not applied.

The cell-ranking criterion R is defined by:

$$R_s = Q_{meas,s} + Qhyst_s + Qoffmbms$$

$$R_n = Q_{meas,n} - Qoffset_{s,n} + Qoffmbms - TO_n * (1 - L_n)$$

where:

the signalled value Qoffmbms is only applied to those cells (serving or neighbouring) belonging to the MBMS PL

where:

$$TO_n = TEMP\_OFFSET_n * W(PENALTY\_TIME_n - T_n)$$

$$L_n = 0 \quad \text{if } HCS\_PRIO_n = HCS\_PRIO_s$$
$$L_n = 1 \quad \text{if } HCS\_PRIO_n <> HCS\_PRIO_s$$

$$W(x) = 0 \quad \text{for } x < 0$$
$$W(x) = 1 \quad \text{for } x >= 0$$

$TEMP\_OFFSET_n$ applies an offset to the H and R criteria for the duration of $PENALTY\_TIME_n$ after a timer $T_n$ has started for that neighbouring cell.

$TEMP\_OFFSET_n$ and $PENALTY\_TIME_n$ are only applicable if the usage of HCS is indicated in system information.

The timer $T_n$ is implemented for each neighbouring cell. $T_n$ shall be started from zero when one of the following conditions becomes true:

- if $HCS\_PRIO_n <> HCS\_PRIO_s$ and

$$Q_{meas,n} >= Qhcs_n$$

Or

- if $HCS\_PRIO_n = HCS\_PRIO_s$ and

    - for serving FDD and neighbour FDD cells if the quality measure for cell selection and reselection is set to CPICH RSCP in the serving cell, and:

$$Q_{meas,n} > Q_{meas,s} + Qoffset1_{s,n}$$

    - for serving FDD and neighbour FDD cells if the quality measure for cell selection and reselection is set to CPICH Ec/No in the serving cell, and:

$$Q_{meas,n} > Q_{meas,s} + Qoffset2_{s,n}$$

    - for all other serving and neighbour cells:

$$Q_{meas,n} > Q_{meas,s} + Qoffset1_{s,n}$$

$T_n$ for the associated neighbour cell shall be stopped as soon as any of the above conditions are no longer fulfilled. Any value calculated for $TO_n$ is valid only if the associated timer $T_n$ is still running else $TO_n$ shall be set to zero.

At cell-reselection, a timer $T_n$ is stopped only if the corresponding cell is not a neighbour cell of the new serving cell, or if the criteria given above for starting timer $T_n$ for the corresponding cell is no longer fulfilled with the parameters of the new serving cell. On cell re-selection, timer $T_n$ shall be continued to be run for the corresponding cells but the criteria given above shall be evaluated with parameters broadcast in the new serving cell if the corresponding cells are neighbours of the new serving cell.

| $S_n$ | Cell Selection value of the neighbouring cell, (dB) |
|---|---|
| $Q_{meas}$ | Quality value. The quality value of the received signal derived from the averaged CPICH Ec/No or CPICH RSCP for FDD cells, from the averaged P-CCPCH RSCP for TDD cells and from the averaged received signal level for GSM cells. The averaging of these measurement quantities are performed as specified in [10] and [11]. For FDD cells, the measurement that is used to derive the quality value is set by the Cell_selection_and_reselection_quality_measure information element. |

Cell reselection parameters broadcast in system information are listed in subclause 5.2.6.1.5.

The cell selection criterion S used for cell reselection is fulfilled when:

| | |
|---|---|
| for FDD cells: | Srxlev > 0  AND Squal > 0 |
| for TDD cells: | Srxlev > 0 |
| for GSM cells: | Srxlev > 0 |

Where :

$$\text{Squal} = Q_{qualmeas} - Qqualmin$$

$$\text{Srxlev} = Q_{rxlevmeas} - Qrxlevmin - Pcompensation$$

| | |
|---|---|
| Squal | Cell Selection quality value (dB)<br>Applicable only for FDD cells. |
| Srxlev | Cell Selection RX level value (dB) |
| $Q_{qualmeas}$ | Measured cell quality value. The quality of the received signal expressed in CPICH $E_C/N_0$ (dB) for FDD cells. CPICH Ec/N0 shall be averaged as specified in [10].<br>Applicable only for FDD cells. |
| $Q_{rxlevmeas}$ | Measured cell RX level value. This is received signal, CPICH RSCP for FDD cells (dBm), P-CCPCH RSCP for TDD cells (dBm) and the averaged received signal level as specified in [10] for GSM cells (dBm). CPICH RSCP, P-CCPCH RSCP and the received signal level for GSM cells shall be averaged as specified in [10] and [11]. |
| Qqualmin | Minimum required quality level in the cell (dB). Applicable only for FDD cells. |
| Qrxlevmin | Minimum required RX level in the cell (dBm) |
| Pcompensation | max(UE_TXPWR_MAX_RACH – P_MAX, 0) (dB) |
| UE_TXPWR_MAX_RACH | Maximum TX power level an UE may use when accessing the cell on RACH (read in system information) (dBm) |
| P_MAX | Maximum RF output power of the UE (dBm) |

If HCS is not used in the serving cell the UE shall perform ranking of all cells that fulfil the criterion S, among:

- all measured cells (see subclause 5.2.6.1.1).

If HCS is used in the serving cell the UE shall perform ranking of all cells that fulfil the criterion S among

1. when in low-mobility (see subclause 5.2.6.1.2),

   - all measured cells, that have the highest HCS_PRIO among those cells that fulfil the criterion H >= 0.

   - all measured cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0.

2. when in high-mobility (see subclause 5.2.6.1.2),

   - all measured cells, and among these cells:

     - if there are cells with a lower HCS priority than the serving cell that fulfil the criterion H >= 0:

       - from the cells that have a lower HCS priority than the serving cell, all cells that have the highest HCS_PRIO among those cells that fulfil the criterion H >=0;

     - else:

       - if there are cells that fulfil the criterion H >= 0 with an HCS priority higher or equal to the HCS priority of the serving cell:

         - from the cells that have an HCS priority higher or equal to the HCS priority of the serving cell, all cells that have the lowest HCS_PRIO among those cells that fulfil the criterion H >=0;

       - else

         - all cells not considering HCS priority levels.

The cells shall be ranked according to the R criteria specified above, deriving $Q_{meas,n}$ and $Q_{meas,s}$ and calculating the R values using CPICH RSCP, P-CCPCH RSCP and the averaged received signal level as specified in [10] and [11] for FDD, TDD and GSM cells, respectively.

The offset $Qoffset1_{s,n}$ is used for $Qoffset_{s,n}$ to calculate $R_n$, the hysteresis $Qhyst1_s$ is used for $Qhyst_s$ to calculate $R_s$. For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,PCH}$ to

calculate $R_s$, if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,FACH}$ to calculate $R_s$, if provided in SIB4 [see 4].

If the usage of HCS is indicated in system information, $TEMP\_OFFSET1_n$ is used for $TEMP\_OFFSET_n$ to calculate $TO_n$. If it is indicated in system information that HCS is not used, $TEMP\_OFFSET_n$ is not applied when calculating $R_n$. The best ranked cell is the cell with the highest R value.

If a TDD or GSM cell is ranked as the best cell, then the UE shall perform cell re-selection to that TDD or GSM cell.

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH RSCP, the UE shall perform cell re-selection to that FDD cell. If this cell is found to be not suitable, the UE shall behave according to subclause 5.2.6.1.3.

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH Ec/No, the UE shall perform a second ranking of the FDD cells according to the R criteria specified above, but using the measurement quantity CPICH Ec/No for deriving the $Q_{meas,n}$ and $Q_{meas,s}$ and calculating the R values of the FDD cells. The offset $Qoffset2_{s,n}$ is used for $Qoffset_{s,n}$ to calculate $R_n$, the hysteresis $Qhyst2_s$ is used for $Qhyst_s$ to calculate $R_s$. For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Qhyst_s$ takes the value $Qhyst2_{s,PCH}$ to calculate $R_s$, if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Qhyst_s$ takes the value $Qhyst2_{s,FACH}$ to calculate $R_s$, if provided in SIB4 [see 4]. If the usage of HCS is indicated in system information, $TEMP\_OFFSET2_n$ is used to calculate $TO_n$. If it is indicated in system information that HCS is not used, $TEMP\_OFFSET_n$ is not applied when calculating $R_n$. Following this second ranking, the UE shall perform cell re-selection to the best ranked FDD cell. If this cell is found to be not suitable, the UE shall behave according to subclause 5.2.6.1.3.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval Treselection. For UE in RRC connected mode states CELL_PCH or URA_PCH the interval $Treselection_{s,PCH}$ applies, if provided in SIB4 [see 4], while for UE in RRC connected mode state CELL_FACH the interval $Treselection_{s,FACH}$ applies, if provided in SIB4 [see 4]. For hierarchical cell structures when high mobility state has not been detected, if according to the HCS rules the serving cell is not ranked then all the ranked cells are considered to be better ranked than the serving cell.

    Additionally the UE shall apply the following scaling rules to $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$:

  - For intra-frequency cells and high mobility state not detected:

    - no scaling applied.

  - For intra-frequency cells and high mobility state is detected:

    - multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by the IE "Speed dependent ScalingFactor for_Treselection" if sent on system information.

  - For inter-frequency cells and high mobility state not detected:

    - multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by the IE "Inter-Frequency ScalingFactor for Treselection" if sent on system information.

  - For inter-frequency cells and high mobility state is detected:

    - multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by both the IEs "Speed dependent ScalingFactor for_Treselection" if sent on system information and "Inter-Frequency ScalingFactor for Treselection" if sent on system information.

  - For inter-RAT cells and high mobility state not detected:

    - multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by the IE "Inter-RAT ScalingFactor for Treselection" if sent on system information.

  - For inter-RAT cells and high mobility state is detected:

- multiply Treselection$_s$ or Treselection$_{s,PCH}$ or Treselection$_{s,FACH}$ by both the IEs 'Speed dependent ScalingFactor for_Treselection' if sent on system information and 'Inter-RAT ScalingFactor for Treselection" if sent on system information.

In case scaling is applied to Treselection$_s$ or Treselection$_{s,PCH}$, the UE shall round up the result after all scalings to the nearest second. In case scaling is applied to Treselection$_{s,FACH}$, the UE shall round up the result after all scalings to the nearest 0.2 seconds.

- more than 1 second has elapsed since the UE camped on the current serving cell.

### 5.2.6.1.5 Cell reselection parameters in system information broadcasts

The selection of values for network controlled parameters can be optimised by means of different methods. Examples of methods are described in [6]. Cell reselection parameters are broadcast in system information and are read in the serving cell as follows:

**Qoffset1$_{s,n}$**

This specifies the offset between the two cells. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP.

**Qoffset2$_{s,n}$**

This specifies the offset between the two cells. It is used for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH Ec/No.

**Qhyst1$_s$**

This specifies the hysteresis value (Qhyst). It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP.

**Qhyst1$_{s,PCH}$**

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, Qhyst1$_s$ shall be used.

**Qhyst1$_{s,FACH}$**

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, Qhyst1$_s$ shall be used.

**Qhyst2$_s$**

This specifies the hysteresis value (Qhyst). It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No.

**Qhyst2$_{s,PCH}$**

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, Qhyst2$_s$ shall be used.

**Qhyst2$_{s,FACH}$**

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, Qhyst2$_s$ shall be used.

**HCS_PRIO$_s$, HCS_PRIO$_n$**

This specifies the HCS priority level (0-7) for serving cell and neighbouring cells.

HCS priority level 0 means lowest priority and HCS priority level 7 means highest priority.

**HCS_OFF$_{mbms}$**

This specifies the offset to the normal HCS priority level that is used for cells belonging to the MBMS PL.

**Qhcs$_s$, Qhcs$_n$**

This specifies the quality threshold levels for applying prioritised hierarchical cell re-selection.

**Qoffmbms**

This specifies the additional offset added to cells belonging to the MBMS PL.

**Qqualmin**

This specifies the minimum required quality level in the cell in dB. It is not applicable for TDD cells or GSM cells.

**Qrxlevmin**

This specifies the minimum required RX level in the cell in dBm.

**PENALTY_TIME$_n$**

This specifies the time duration for which the TEMPORARY_OFFSET$_n$ is applied for a neighbouring cell.

**TEMPORARY_OFFSET1$_n$**

This specifies the offset applied to the H and R criteria for a neighbouring cell for the duration of PENALTY_TIME$_n$. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP.

**TEMPORARY_OFFSET2$_n$**

This specifies the offset applied to the H and R criteria for a neighbouring cell for the duration of PENALTY_TIME$_n$. It is used for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH Ec/No.

**T$_{CRmax}$**

This specifies the duration for evaluating allowed amount of cell reselection(s).

**N$_{CR}$**

This specifies the maximum number of cell reselections.

**T$_{CRmaxHyst}$**

This specifies the additional time period before the UE can exit high-mobility.

**non-HCS_T$_{CRmax}$**

This specifies the duration for evaluating allowed amount of cell reselection(s) in case of non-HCS usage.

**non-HCS_N$_{CR}$**

This specifies the maximum number of cell reselections in case of non-HCS usage.

**non-HCS_T$_{CRmaxHyst}$**

This specifies the additional time period before the UE can revert to low-mobility measurements in case of non-HCS usage.

**Treselection$_s$**

This specifies the cell reselection timer value.

**Treselection$_{s,PCH}$**

This specifies the cell reselection timer value the UE shall use in RRC connected mode states CELL_PCH and URA_PCH if provided in SIB4, otherwise Treselection$_s$ shall be used.

**Treselection$_{s,FACH}$**

This specifies the cell reselection timer value the UE shall use in RRC connected mode state CELL_FACH if provided in SIB4, otherwise Treselection$_s$ shall be used.

**Ssearch$_{HCS}$**

This threshold is used in the measurement rules for cell re-selection. When HCS is used, it specifies the limit for Srxlev in the serving cell below which the UE shall initiate measurements of all neighbouring cells of the serving cell. When HCS is not used, it specifies the limit for Srxlev in the serving cell below which the UE ranks inter-frequency neighbouring cells of the serving cell.

**Ssearch$_{RAT\,1}$ - Ssearch$_{RAT\,k}$**

This specifies the RAT specific threshold in the serving cell used in the inter-RAT measurement rules.

**S$_{HCS,RATm}$**

This threshold is used in the measurement rules for cell re-selection. When HCS is used, it specifies the RAT specific threshold in the serving cell used in the inter-RAT measurement rules. When HCS is not used, it specifies the limit for Srxlev in the serving cell below which the UE ranks inter-RAT neighbouring cells of the serving cell.

**S$_{intrasearch}$**

This specifies the threshold (in dB) for intra frequency measurements and for the HCS measurement rules.

**S$_{intersearch}$**

This specifies the threshold (in dB) for inter-frequency measurements and for the HCS measurement rules.

**S$_{limit,SearchRATm}$**

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the RAT specific threshold (in dB) in the serving UTRA cell above which the UE may choose to not perform any inter-RAT measurements in RAT "m".

**Speed dependent ScalingFactor for Treselection**

This specifies the scaling (multiplication) factor to be used by the UE in idle mode or RRC connected mode states for the parameters Treselection$_s$ or Treselection$_{s,PCH}$ or Treselection$_{s,FACH}$ in case high-mobility state has been detected.

**Inter-frequency ScalingFactor for Treselection**

This specifies the scaling (multiplication) factor to be used by the UE for scaling the parameters Treselection$_s$ or Treselection$_{s,PCH}$ or Treselection$_{s,FACH}$ for the inter-frequency case.

**Inter-RAT ScalingFactor for Treselection**

This specifies the scaling (multiplication) factor to be used by the UE for scaling the parameters Treselection$_s$ or Treselection$_{s,PCH}$ or Treselection$_{s,FACH}$ for the inter-RAT case.

## 5.2.6.2    GSM case

The cell reselection procedure in GSM, including reselection from GSM to UTRA, is specified in [1].

## 5.2.7    Cell Selection when leaving connected mode

### 5.2.7.1    UTRA case

When returning to idle mode from connected mode, the UE shall select a suitable cell to camp on. Candidate cells for this selection are the cell(s) used immediately before leaving connected mode. If no suitable cell is found, the UE shall use the Stored information cell selection procedure in order to find a suitable cell to camp on.

When returning to idle mode after an emergency call on any PLMN, the UE shall select an acceptable cell to camp on. Candidate cells for this selection are the cell(s) used immediately before leaving connected mode. If no acceptable cell is found, the UE shall continue to search for an acceptable cell of any PLMN in state Any cell selection.

### 5.2.7.2 GSM case

Cell selection when leaving connected mode in GSM is specified in [1].

## 5.2.8 Any Cell Selection state

In this state, the UE shall attempt to find an acceptable cell of an any PLMN to camp on, trying all RATs that are supported by the UE and searching first for a high quality cell, as defined in subclause 5.1.2.2.

The UE, which is not camped on any cell, shall stay in this state until an acceptable cell is found.

## 5.2.9 Camped on Any Cell State

### 5.2.9.1 UTRA case

In this state, the UE shall perform the following tasks:

- select and monitor the indicated PICH and PCH of the cell as specified in clause 8;

- monitor relevant System Information; This is specified in [4];

- perform necessary measurements for the cell reselection evaluation procedure;

- Execute the cell reselection evaluation process on the following occasions/triggers:

    1) UE internal triggers, so as to meet performance as specified in [10] and [11];

    2) When information on the BCCH used for the cell reselection evaluation procedure has been modified;

- regularly attempt to find a suitable cell trying all RATs that are supported by the UE. If a suitable cell is found, this causes an exit to number 2 in Figure 2.

In this state the UE is not permitted to receive any MBMS services.

### 5.2.9.2 GSM case

The camped on any cell state in GSM is specified in [1].

# 5.3 Cell Reservations and Access Restrictions

## 5.3.1 UTRA cells

There are two mechanisms which allow an operator to impose cell reservations or access restrictions. The first mechanism uses indication of cell status and special reservations for control of cell selection and re-selection procedures. The second mechanism, referred to as Access Control, shall allow to prevent selected classes of users from sending initial access messages for load control reasons. At subscription, one or more Access Classes are allocated to the subscriber and stored in the USIM [9], which are employed for this purpose.

### 5.3.1.1 Cell status and cell reservations

Cell status and cell reservations are indicated with the *Cell Access Restriction* Information Element in the System Information Message [4] by means of three Information Elements:

- Cell barred (IE type: "barred" or "not barred"),

- Cell Reserved for operator use (IE type: "reserved" or "not reserved"),

- Cell reserved for future extension (IE type: "reserved" or "not reserved").

When cell status is indicated as "not barred", "not reserved" for operator use and "not reserved" for future extension (Cell Reservation Extension),

- All UEs shall treat this cell as candidate during the cell selection and cell re-selection procedures in Idle mode and in Connected mode.

When cell status is indicated as "not barred", "not reserved" for operator use and "reserved" for future extension (Cell Reservation Extension),

- UEs shall behave as if cell status "barred" is indicated using the value "not allowed" in the IE "Intra-frequency cell re-selection indicator" and the maximum value for $T_{barred}$, see [4] (see also below).

When cell status is indicated as "not barred" and "reserved" for operator use,

- UEs assigned to Access Class 11 or 15 shall treat this cell as candidate during the cell selection and cell re-selection procedures in Idle mode and in Connected mode if the cell belongs to the home PLMN.

- UEs assigned to an Access Class in the range 0 to 9 and 12 to 14 shall behave as if cell status "barred" is indicated using the value "not allowed" in the IE "Intra-frequency cell re-selection indicator" and the maximum value for $T_{barred}$, see [4] (see also below).

When cell status "barred" is indicated,

- The UE is not permitted to select/re-select this cell, not even for emergency calls.

- The UE shall ignore the "Cell Reserved for future extension (Cell Reservation Extension) use" IE.

- The UE is not permitted to receive any MBMS services.

- The UE shall select another cell according to the following rule:

  - If the "Intra-frequency cell re-selection indicator" IE in Cell Access Restriction IE is set to value "allowed", the UE may select another cell on the same frequency if selection/re-selection criteria are fulfilled.

    - If the UE is camping on another cell, the UE shall exclude the barred cell from the neighbouring cell list until the expiry of a time interval $T_{barred}$. The time interval $T_{barred}$ is sent via system information in a barred cell together with Cell status information in the Cell Access Restriction IE.

    - If the UE does not select another cell, and the barred cell remains to be the "best" one, the UE shall after expiry of the time interval $T_{barred}$ again check whether the status of the barred cell has changed.

  - If the "Intra-frequency cell re-selection indicator" IE is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell. During an ongoing emergency call, the Intra-frequency cell re-selection indicator IE" shall be ignored, i.e. even if it is set to "not allowed" the UE may select another intra-frequency cell.

    - If the barred cell remains to be the "best" one, the UE shall after expiry of the time interval $T_{barred}$ again check whether the status of the barred cell has changed.

The reselection to another cell may also include a change of RAT.

## 5.3.1.2      Access Control

Information on cell access restrictions associated with the Access Classes is broadcast as system information, [4].

The UE shall ignore Access Class related cell access restrictions when selecting a cell to camp on, i.e. it shall not reject a cell for camping on because access on that cell is not allowed for any of the Access Classes of the UE. A change of the indicated access restriction shall not trigger cell re-selection by the UE.

Access Class related cell access restrictions shall be checked by the UE before sending an RRC CONNECTION REQUEST message when entering Connected Mode from UTRAN Idle mode. Access Class related cell access restrictions, if it is sent as a part of Domain Specific Access Restriction parameters, shall also be checked by the UE before sending INITIAL DIRECT TRANSFER message. Otherwise, cell access restrictions associated with the Access Classes shall not apply for a UE which already is in Connected Mode.

### 5.3.1.3    Emergency Call

A restriction on emergency calls, if needed, shall be indicated in the "Access class barred list" IE [4]. If access class 10 is indicated as barred in a cell, UEs with access class 0 to 9 or without an IMSI are not allowed to initiate emergency calls in this cell. For UEs with access classes 11 to 15, emergency calls are not allowed if both access class 10 and the relevant access class (11 to 15) are barred. Otherwise, emergency calls are allowed for those UEs.

Full details of operation under "Access class barred list" are described in [9].

## 5.3.2    GSM cells

The cell access restrictions applicable to GSM are specified in [1].

# 5.4    Cell Selection and Reselection Processes in RRC Connected Mode

## 5.4.1    Void

## 5.4.2    Void

## 5.4.3    Cell Reselection Process in RRC connected mode

The *cell reselection* process in Connected Mode is the same as *cell reselection evaluation process* used for idle mode, described in subclause 5.2.6.

## 5.4.4    Cell Selection Process in RRC connected mode

The *cell selection* process in Connected Mode is for "out of service" conditions [4] is the same as the *cell selection process* used for idle mode, described in subclause 5.2.3.

Selection of a suitable cell during a state transition or a change of frequency in Connected Mode is the same as the selection of a suitable UTRA cell used for idle mode, described in subclause 5.2.3.1. If the UE is ordered to select a suitable UTRA cell on a given frequency, it shall attempt to select a suitable cell on that frequency before considering cells on other frequencies.

# 5.5    Location Registration

In the UE, the AS shall report registration area information to the NAS.

If the UE reads more than one PLMN identity in the current cell, the UE shall report the found PLMN identities that make the cell suitable in the registration area information to NAS.

The non-access part of the location registration process is specified in [5].

Actions for the UE AS upon reception of Location Registration reject are specified in [9] and [16].

# 6    Broadcast information receiving

# 6.1    Reception of System Information

Requirements are specified in [4].

## 6.2 Cell Broadcast in Idle Mode, CELL_PCH and URA_PCH

A UE supporting Cell Broadcast Service (CBS) shall be capable to receive BMC messages in the Idle mode, in URA_PCH and CELL_PCH. When several PCHs exist in the cell, the FACH which carries the CTCH may be mapped to a different SCCPCH than the PCH selected by the UE for paging in Idle mode (as specified in Sec. 8.1). In this case, UEs with basic service capabilities shall be capable to change from the SCCPCH that carries the PCH selected for paging to another SCCPCH which carries Cell Broadcast messages (i.e. the CTCH mapped to an FACH) and receive BMC messages during time intervals which do not conflict with the UE specific paging occasions.

> NOTE: In case certain BMC messages conflict with the UE specific paging occasions the reception of CBS cannot be guaranteed and depends on UE capabilities.

## 6.3 MBMS Services

If the UE has activated MBMS services and MBMS is available in the cell (i.e., the MCCH information is provided on the BCCH) and the UE is permitted to receive MBMS in the cell, the UE shall:

- receive the MCCH as specified in clause 8.4 and in [4];

- participate in MBMS counting as specified in [4];

- receive each FACH on which the MTCH carrying an MBMS activated service that does not require the establishment of an RRC connection is mapped.

The UE may:

- monitor the MICH as specified in clause 8a and in [4];

- receive the MSCH.

# 7 Void

# 8 Paging and SCCPCH selection

## 8.1 Paging Channel selection

System information block type 5 (SIB 5) defines common channels to be employed in Idle mode [4]. In a cell, a single or several PCHs may be established. Each Secondary Common Control Physical Channel (SCCPCH) indicated to the UE in system information may carry up to one PCH. Thus, for each defined PCH there is one uniquely associated PICH also indicated.

In case that more than a single PCH and associated PICH are defined in SIB 5, the UE shall perform a selection according to the following rule:

- The UE shall select a SCCPCH from the ones listed in SIB 5 based on IMSI as follows:

"Index of selected SCCPCH" = IMSI mod K,

where K is equal to the number of listed SCCPCHs which carry a PCH (i.e. SCCPCHs carrying FACH only shall not be counted). These SCCPCHs shall be indexed in the order of their occurrence in SIB 5 from 0 to K-1.
For GSM-MAP, i.e. "IMSI (GSM-MAP)" is given as sequence of digits of type Integer(0..9), IMSI shall in the formula above be interpreted as a decimal integer number, where the first digit given in the sequence represents the highest order digit.
For DS-41, i.e. "IMSI (DS-41)" is given as octet string, IMSI shall in the formulae above correspond to the decoded decimal representation of the IMSI-S part included in the octet string (see TIA/EIA/IS-2000-5).

For example:

IMSI (GSM-MAP) = 12 (digit1=1, digit2=2)

In the calculations, this shall be interpreted as the decimal integer "12", not "1x16+2 = 18".

"Index of selected SCCPCH" identifies the selected SCCPCH with the PCH and the uniquely associated PICH to be used by the UE.

If the UE has no IMSI, for instance when making an emergency call without USIM, the UE shall use as default number IMSI = 0.

## 8.2 SCCPCH selection when entering Connected mode

When entering Connected mode from Idle mode by sending an RRC CONNECTION REQUEST message, the UE shall select the S-CCPCH which carries an FACH to be used for reception of the RRC CONNECTION SETUP message according to the following rule:

- the UE shall select an SCCPCH from the SCCPCHs listed in System Information Block type 5 (SIB 5) based on "Initial UE Identity" as follows:

    "Index of selected SCCPCH" = "Initial UE Identity" mod K,

    where K is equal to the number of listed SCCPCHs which carry a FACH (i.e. SCCPCHs carrying PCH only shall not be counted). These SCCPCHs shall be indexed from 0 to K-1 in the order of their occurrence in SIB 5, and "Index of selected SCCPCH" identifies the selected SCCPCH. "Initial UE Identity" refers to the Information Element included by the UE into the RRC CONNECTION REQUEST message. In the above formula, the parameter "Initial UE Identity" shall be interpreted as follows, depending on the choice of UE-Id type of the respective IE:

    For UE-Id type "IMSI (GSM-MAP)", i.e. the IE is given as sequence of digits of type Integer(0..9), "Initial UE Identity" shall be interpreted as an integer number, where the first digit given in the sequence represents the highest order digit.

    For UE-Id types "TMSI and LAI (GSM-MAP)" or "P-TMSI and RAI (GSM-MAP)", only the TMSI or P-TMSI parts given as Bitstring(32) shall be used, and "Initial UE Identity" shall be interpreted as a binary representation of an integer number, where the first bit in the Bitstring represents the highest order bit.

    For UE-Id type "IMEI", i.e. the IE is given as sequence of hexadecimal digits of type Integer(0..15), "Initial UE Identity" shall be interpreted as a hexadecimal representation of an integer number, where the first digit given in the sequence represents the highest order digit.

    For UE-Id type "IMSI (DS-41)", i.e. the IE is given as octet string, "Initial UE Identity" shall correspond to the decoded decimal representation of the IMSI-S part included in the octet string (see TIA/EIA/IS-2000-5).

    For UE-Id types "ESN (DS-41)" or "TMSI (DS-41)", i.e. the IE is given as Bitstring(32), "Initial UE Identity" shall be interpreted as a binary representation of an integer number, where the first bit in the Bitstring represents the highest order bit.

    For UE-Id type "IMSI and ESN (DS-41)" only the ESN part shall be used as "Initial UE Identity", as defined above.

## 8.3 Discontinuous Reception for Paging

The UE may use Discontinuous Reception (DRX) in idle mode in order to reduce power consumption. When DRX is used the UE needs only to monitor one Page Indicator, PI, (see definition in [7] and [8]) in one Paging Occasion per DRX cycle.

The DRX cycle length shall be $MAX(2^k, PBP)$ frames, where k is an integer and PBP is the Paging Block Periodicity. PBP is only applicable for TDD and is equal to the PICH repetition period that is broadcast in system information. For FDD, PBP=1.

The UE may be attached to different CN domains with different CN domain specific DRX cycle lengths. The UE shall store each CN domain specific DRX cycle length for each CN domain the UE is attached to and use the shortest of those DRX cycle lengths. The CS CN specific DRX cycle length coefficient shall be updated locally in the UE using information given in system information. On the other hand, the PS CN specific DRX cycle length coefficient shall be updated after the negotiation between the UE and PS CN by NAS procedure. If no specific value "k" is negotiated in NAS procedure, the UE and PS CN shall use the DRX cycle length given for PS CN domain in system information.

The DRX cycle lengths to use for UTRAN connected mode is the shortest of the following:

- UTRAN DRX cycle length;

- any of the stored CN domain specific DRX cycle length for the CN domains the UE is only attached to with no signalling connection established.

The UE shall use the IMSI, the number of available SCCPCH which carry a PCH (K) as derived according to subclause 8.1, the Cell System Frame Number (SFN), Np (for FDD, Np is the number of page indicators within a frame; for TDD, Np is the number of page indicators within a paging block), Frame offset (For FDD, Frame offset = 0; for TDD, PICH frame offset values are given in system information), PBP and the DRX cycle length to determine the Paging Occasions.

In FDD the UE shall monitor its paging indicator in the PICH frame with SFN given by the Paging Occasion

In TDD the UE shall monitor its paging indicator in the paging block given by the Paging Occasion. The Paging Occasion gives the SFN of the first frame of the paging block.

The value of the Paging Occasion is determined as follows:

Paging Occasion= {(IMSI div K) mod (DRX cycle length div PBP)} * PBP + n * DRX cycle length + Frame Offset

Where n = 0,1,2… as long as SFN is below its maximum value.

The actual Page Indicator within a Paging Occasion that the UE shall read is similarly determined based on IMSI.

The Page Indicator to use is calculated by using the following formula:

PI = DRX Index mod Np

where DRX Index = IMSI div 8192

In FDD mode, Np = (18,36,72,144) is the number of Page Indicators per frame, and is given in IE "Number of PI per frame", part of system information in FDD mode. In TDD mode, Np is the number of Page Indicators per paging block and is calculated by the Paging Indicator Length $L_{PI,}$ the Burst Type (long or short midamble for 3.84/7.68 Mcps TDD) and the PICH repetition length, which are given in system information.

If the UE has no IMSI, for instance when making an emergency call without USIM, the UE shall use as default numbers, IMSI = 0 and DRX cycle length = 256 (2.56 s), in the formulas above.

For FDD, see [7] for details about the timing between a PICH frame and when the paging message is transmitted on the PCH in the associated S-CCPCH frame.

In TDD mode, the Paging Message Receiving Occasion is calculated using the following formula:

Paging Message Receiving Occasion =Paging Occasion + $N_{PICH}$ + $N_{GAP}$ + {(DRX Index mod Np) mod $N_{PCH}$ } *2

The value $N_{PICH}$ is the number of frames for PICH transmission and is equal to the PICH repetition length given in system information. The value $N_{GAP}$ is the number of frames between the last frame carrying PICH for this Paging Occasion and the first frame carrying paging messages for this Paging Occasion. The value $N_{PCH}$ is the number of Paging Groups. $N_{PCH}$ and $N_{GAP}$ are given in system information.

For GSM-MAP, i.e. "IMSI (GSM-MAP)" is given as sequence of digits of type Integer(0..9), IMSI shall in the formulae above be interpreted as a decimal integer number, where the first digit given in the sequence represents the highest order digit.

For DS-41, i.e. "IMSI (DS-41)" is given as octet string, IMSI shall in the formulae above correspond to the decoded decimal representation of the IMSI-S part included in the octet string (see TIA/EIA/IS-2000-5).

For example:

$$IMSI (GSM-MAP) = 12 \text{ (digit1=1, digit2=2)}$$

In the calculations, this shall be interpreted as the decimal integer "12", not "1x16+2 = 18".

# 8.4 Discontinuous Reception for MBMS

The UE may use discontinuous reception (DRX) on MBMS channels (MCCH, MSCH, MTCH) to reduce power consumption while subscribed to MBMS services.

## 8.4.1 Discontinuous Reception for MCCH

The UE may operate DRX on the MCCH either by monitoring the MICH to determine when it needs to receive the MCCH or by using the MODIFIED SERVICES INFORMATION message on the MCCH to determine that it does not need to acquire the remainder of the MCCH information.

The timing of the MCCH information transmission and the need to receive the MCCH are described in detail in [4].

### 8.4.1.1 Discontinuous Reception via MICH

When the UE operates DRX on the MCCH through monitoring the MICH, the UE needs to monitor one Notification Indicator (NI), as defined in [7], [8], for each MBMS service it is subscribed to. For each service, a corresponding NI will be set continuously through the entire length of the modification period preceding a change in the associated MCCH information. The modification period should be long enough that a UE that only receives the MICH during its paging occasions can still reliably detect a notification.

For each service, the 16 bit Notification Indicator to use is calculated as a function of the TMGI:

$$NI = \left( TMGI + \lfloor TMGI / G \rfloor \right) \bmod G \text{, where } G = 2^{16}.$$

A UE with one or more activated MBMS services may monitor the MICH. The exact timing with which the UE reads the MICH within a given modification period is left to the UE implementation, with the proviso that the UE needs to be able to detect notifications reliably for its activated MBMS service(s).

The TMGI is structured as follows [16]:

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Temporary Mobile Group Identity IEI ||||||||Octet 1 |
| Length of Temporary Mobile Group Identity contents ||||||||Octet 2 |
| MBMS Service ID ||||||||Octet 3 |
| ||||||||Octet 4 |
| ||||||||Octet 5 |
| MCC digit 2 |||| MCC digit 1 ||||Octet 6 |
| MNC digit 3 |||| MCC digit 3 ||||Octet 7 |
| MNC digit 2 |||| MNC digit 1 ||||Octet 8 |

NOTE: The MBMS Service identity, which is signalled in [4] (see subclause 10.3.9a.8), concerns a signalling optimisation of the TMGI.

For the calculation of the NI, the TMGI shall be interpreted as a binary representation of an integer number, represented by the bitstring formed by the exclusive OR operation of the MBMS Service ID (octets 3 to 5 of the TMGI) and the PLMN identity (octets 6 to 8 of the TMGI) with the first/ leftmost/ most significant bit corresponding with b8 of the first octet.

### 8.4.1.2 Discontinuous Reception via MODIFIED SERVICES INFORMATION

If the UE receives the MODIFIED SERVICES INFORMATION message on the MCCH and determines from its contents that no service whose information the UE needs to acquire has been modified, the UE may refrain from receiving the MCCH for the remainder of the modification period.

## 8.4.2 Discontinuous Reception for MTCH

If the UE operates DRX on the MTCH, the UE shall receive the MSCH as described in [4] to obtain scheduling information for the MTCH.

The reception intervals for MBMS services are given by the IE 'Service transmissions list' in the MBMS SCHEDULING INFORMATION message on the MSCH.

# 8a MBMS Notification

The structure of the MICH is described in [7] and [14].

The RRC-layer behaviour of a UE receiving an MBMS notification indicator is specified in [4].

# 9 Void

# 10 Void

# Annex A (informative): Change history

| Change history | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | | **Old** | **New** |
| 10/1999 | RP-05 | RP-99464 | - | - | Approved at TSG-RAN #5 and placed under Change Control | | - | 3.0.0 |
| 12/1999 | RP-06 | RP-99632 | 001 | 2 | Modification and editorial changes | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99633 | 002 | 3 | Specification of Cell reselection procedures in | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99633 | 003 | 2 | Integration of Cell Broadcast Service (CBS) | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99633 | 004 | 2 | Measurement used as a quality estimate for cell | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99632 | 006 | | Discontinuous reception | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99633 | 008 | 3 | Barred Cells and Access Control | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99633 | 009 | | Introduction of network control of UE measurement | | 3.0.0 | 3.1.0 |
| | RP-06 | RP-99631 | 011 | | Editorial issues | | 3.0.0 | 3.1.0 |
| 03/2000 | RP-07 | RP-000037 | 007 | 2 | Cell Selection for DS-41 mode | | 3.1.0 | 3.2.0 |
| | RP-07 | RP-000037 | 014 | | Modified description of cell search procedure | | 3.1.0 | 3.2.0 |
| | RP-07 | RP-000037 | 018 | 1 | UE individual DRX cycles in CELL_PCH and URA_PCH states | | 3.1.0 | 3.2.0 |
| | RP-07 | RP-000037 | 019 | 1 | Cell re-selection criteria including HCS | | 3.1.0 | 3.2.0 |
| | RP-07 | RP-000037 | 021 | | Modified description of DRX | | 3.1.0 | 3.2.0 |
| 06/2000 | RP-08 | RP-000217 | 025 | | Triggering of inter-system measurements for cell re-selection when HCS is used | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 026 | 5 | Cell re-selection | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 027 | 4 | Access Control | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 028 | | Downlink signalling failure | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 029 | | Cell-reselection parameter signalling | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 030 | | Cell Selection and Reselection | | 3.2.0 | 3.3.0 |
| | RP-08 | RP-000217 | 031 | 1 | CN DRX cycle coefficient | | 3.2.0 | 3.3.0 |
| 09/2000 | RP-09 | RP-000355 | 035 | 2 | Paging channel selection | | 3.3.0 | 3.4.0 |
| | RP-09 | RP-000355 | 037 | 1 | Editorial corrections | | 3.3.0 | 3.4.0 |
| | RP-09 | RP-000355 | 039 | | HCS measurement rules | | 3.3.0 | 3.4.0 |
| | RP-09 | RP-000355 | 042 | 2 | Usage of Ec/N0 measurement quantity for cell ranking | | 3.3.0 | 3.4.0 |
| | RP-09 | RP-000355 | 044 | | Correction and restructuring | | 3.3.0 | 3.4.0 |
| 12/2000 | RP-10 | RP-000565 | 046 | 1 | Support for PLMN selection | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 049 | 1 | Correction of algorithm for paging channel selection | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 050 | | Alignment of use of TEMP_OFFSET parameters with TS 25.331 | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 051 | 2 | Clarifications and Editorial Corrections | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 052 | 1 | Clarifications to cell selection and reselection procedures | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 053 | | Removal of immediate cell evaluation | | 3.4.0 | 3.5.0 |
| | RP-10 | RP-000565 | 054 | | One step cell selection | | 3.4.0 | 3.5.0 |
| 03/2001 | RP-11 | RP-010022 | 055 | 1 | Usage of HCS Parameters in Cell Reselection | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 056 | | Clarification of usage of "Initial UE-Id" for SCCPCH selection | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 058 | | Clarification of paging occasion | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 059 | 1 | Correction in Any Cell Selection State | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 061 | | Correction to the definition of a suitable cell | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 062 | | Correction to discontinuous reception in TDD | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 063 | 1 | Correction of PI calculation for Paging DRX | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010200 | 064 | 3 | Equivalent PLMN codes | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 065 | | High quality cell in PLMN selection | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010022 | 066 | - | Clean-up | | 3.5.0 | 3.6.0 |
| | RP-11 | RP-010037 | 057 | 1 | Support of 1.28Mcps TDD | | 3.6.0 | 4.0.0 |
| 06/2001 | RP-12 | RP-010305 | 072 | | Corrections to 25.304 | | 4.0.0 | 4.1.0 |
| | RP-12 | RP-010435 | 074 | 1 | Emergency calls in barred cells | | 4.0.0 | 4.1.0 |
| | RP-12 | RP-010305 | 078 | | Clarification to usage of measurement thresholds | | 4.0.0 | 4.1.0 |
| 09/2001 | RP-13 | RP-010539 | 080 | | Clarification to usage of measurement thresholds for HCS | | 4.1.0 | 4.2.0 |
| | RP-13 | RP-010539 | 082 | | Definition of strongest cell in cell search procedures | | 4.1.0 | 4.2.0 |
| | RP-13 | RP-010539 | 084 | 1 | Miscellaneous corrections | | 4.1.0 | 4.2.0 |
| | RP-13 | RP-010539 | 086 | | Correction to cells reserved for operator use | | 4.1.0 | 4.2.0 |
| | RP-13 | RP-010539 | 088 | 1 | Service type also valid in connected mode | | 4.1.0 | 4.2.0 |
| | RP-13 | RP-010539 | 090 | | Cell Access Restrictions for emergency calls | | 4.1.0 | 4.2.0 |
| 12/2001 | RP-14 | RP-010756 | 092 | | Clarification on DRX cycle length in connected mode | | 4.2.0 | 4.3.0 |
| | RP-14 | RP-010756 | 094 | | Correction to search for available PLMNs | | 4.2.0 | 4.3.0 |
| 03/2002 | RP-15 | RP-020063 | 096 | | Correction to TDD paging message receiving occasion | | 4.3.0 | 4.4.0 |
| | RP-15 | RP-020063 | 098 | | Clarification of IMSI at Paging channel selection and DRX calculation | | 4.3.0 | 4.4.0 |
| | RP-15 | - | - | | Upgrade to Release 5 - no technical change | | 4.4.0 | 5.0.0 |
| 06/2002 | RP-16 | RP-020324 | 101 | | Limitations of CBS reception | | 5.0.0 | 5.1.0 |
| 12/2002 | RP-18 | RP-020716 | 104 | | Highest HCS priority | | 5.1.0 | 5.2.0 |

| 06/2003 | RP-20 | RP-030289 | 107 | | Correction to cell selection process to include RRC connected mode | 5.2.0 | 5.3.0 |
|---------|-------|-----------|-----|---|---------------------------------------------------------------------|-------|-------|
| 12/2003 | RP-22 | - | - | | Upgrade to Release 6 - no technical changes | 5.3.0 | 6.0.0 |
| 03/2004 | RP-23 | RP-040094 | 111 | 1 | H criteria & High mobility reselection | 6.0.0 | 6.1.0 |
| 06/2004 | RP-24 | RP-040208 | 113 | 1 | Correction to UE selection of reserved cells | 6.1.0 | 6.2.0 |
| | RP-24 | RP-040208 | 116 | | Modification of the Sintersearch and Ssearch$_{RAT,m}$ behaviour | 6.1.0 | 6.2.0 |
| | RP-24 | RP-040208 | 114 | 3 | Selection of suitable cell | 6.1.0 | 6.2.0 |
| 09/2004 | RP-25 | RP-040332 | 119 | | HCS measurement rules & high-mobility | 6.2.0 | 6.3.0 |
| 12/2004 | RP-26 | RP-040526 | 121 | 2 | Cell selection and reselection parameters | 6.3.0 | 6.4.0 |
| | RP-26 | RP-040506 | 123 | | Use of access class restrictions at Inter-RAT cell change | 6.3.0 | 6.4.0 |
| | RP-26 | RP-040494 | 124 | | Network Sharing and multiple PLMN identities | 6.3.0 | 6.4.0 |
| | RP-26 | RP-040488 | 126 | | TS 25.304 Introduction of MBMS | 6.3.0 | 6.4.0 |
| | RP-26 | RP-040488 | 127 | | Addition of MBMS Frequency Layer Convergence to 25.304 | 6.3.0 | 6.4.0 |
| 03/2005 | RP-27 | RP-050081 | 125 | 1 | Correction to "selected PLMN" in access stratum | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050073 | 129 | 1 | Reselection procedure (1235) | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050073 | 131 | 1 | RSCP Thresholds | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050073 | 132 | 2 | HCS High-mobility measurement rules | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050112 | 133 | | H criterion in HCS high-mobility | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050077 | 134 | | MBMS Scope | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050128 | 137 | 1 | Correction to cell selection and reselection parameters to enable enhanced cell reselection | 6.4.0 | 6.5.0 |
| | RP-27 | RP-050073 | 139 | 1 | Intra frequency measurement rules for HCS | 6.4.0 | 6.5.0 |
| 06/2005 | RP-28 | RP-050314 | 0140 | | Addition of idle mode cell selection due to FLD | 6.5.0 | 6.6.0 |
| | RP-28 | RP-050314 | 0141 | | MBMS Frequency Layer Convergence | 6.5.0 | 6.6.0 |
| | RP-28 | RP-050314 | 0142 | | Removal of sentences in brackets in 25.304 | 6.5.0 | 6.6.0 |
| 09/2005 | RP-29 | RP-050460 | 0145 | | Correction to condition for starting penalty timer in HCS reselection | 6.6.0 | 6.7.0 |
| | RP-29 | RP-050479 | 0146 | | Selecting the correct priority layer in HCS high mobility | 6.6.0 | 6.7.0 |
| | RP-29 | RP-050479 | 0147 | | Correction to inter-frequency cell reselection when HCS is not used | 6.6.0 | 6.7.0 |
| | RP-29 | RP-050468 | 0148 | | Correction to cell reselection when HCS is not used and MBMS PL is indicated | 6.6.0 | 6.7.0 |
| 12/2005 | RP-29 | RP-050788 | 0150 | | Structure and use of TMGI for MBMS notification | 6.7.0 | 6.8.0 |
| 03/2006 | RP-31 | RP-060188 | 0151 | 2 | Effect of partial roaming restrictions on cell reselection and proposed performance enhancement | 6.8.0 | 6.9.0 |
| | RP-31 | RP-060090 | 0152 | 1 | Corrected UE behaviour at LR reject | 6.8.0 | 6.9.0 |
| | RP-31 | RP-060090 | 0153 | | Clarification regarding Access Class and Initial Direct Transfer | 6.8.0 | 6.9.0 |
| | RP-31 | RP-060098 | 0154 | | 7.68 Mpcs TDD Option (Release 7) | 6.9.0 | 7.0.0 |

# History

| Document history | | |
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