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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 18.0.0 Release 18)

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Contents

Foreword

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1 Scope

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

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

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

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

- When the UE is camped on a UTRA cell;

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

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

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

[18]   3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[19]   3GPP TS 25.321: "MAC Protocol Specification".

[20]   3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[21]   3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[22]   3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[23]   3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[24]   IEEE 802.11-2012, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, IEEE Std.".

[25]   Wi-Fi Alliance Technical Committee, Hotspot 2.0 Technical Task Group: "Hotspot 2.0 (Release 2) Technical Specification".

[26]   3GPP TS 25.215: "Physical layer – Measurements (FDD)".

[27]   3GPP TS 25.225: "Physical layer – Measurements (TDD)".

[28]   3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks".

3   Definitions and abbreviations

3.1   Definitions

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

Absolute priority layer: A priority level can be defined for a UTRA frequency, a group of GSM frequencies or a E-UTRA frequency.

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

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

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

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

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

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

Closed Subscriber Group (CSG): A Closed Subscriber Group identifies subscribers of an operator who are permitted to access one or more cells of the PLMN but which have restricted access (CSG cells).

CSG cell: A cell broadcasting a CSG Indicator that is set to TRUE and a specific CSG identity. All the UTRAN CSG cells sharing the same identity and PLMN identity are identifiable as a single group for the purposes of mobility management and charging.

CSG identity: An identifier broadcast by a CSG or hybrid cell/cells and used by the UE to facilitate access for authorised members of the associated Closed Subscriber Group.

CSG member cell: a cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN and for which the Permitted CSG list of the UE includes an entry comprising cell's CSG ID and the respective PLMN identity.

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

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

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

HNB Name: The Home NodeB Name is a broadcast string in free text format that provides a human readable name for the Home NodeB CSG identity and any broadcasted PLMN identity.

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.

Hybrid cell: A cell not broadcasting a CSG Indicator but broadcasting a specific CSG identity.

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

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

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

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

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

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

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

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

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

Permitted CSG list: A list provided by NAS containing all the CSG identities and their associated PLMN IDs of the CSGs to which the subscriber belongs.

   NOTE: This list is known as Allowed CSG List in Rel-8 Access Stratum specifications.

Power saving mode: Mode allowing the UE to reduce its power consumption, as defined in TS 24.008 [16], TS 23.060 [21], TS 23.682 [22].

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, for a GSM cell the criteria are defined in [1] and for a E-UTRA cell the criteria are defined in [18].

3.2 Abbreviations

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

ACDC	Application specific Congestion control for Data Communication
ANDSF	Access Network Discovery and Selection Function
ANR	Automatic Neighbor Relation
AS	Access Stratum
BCCH	Broadcast Control Channel
BSS	Basic Service Set
CM	Connection Management
CMAS	Commercial Mobile Alert System
CN	Core Network
CSG	Closed Subscriber Group
DRX	Discontinuous Reception
DSCH	Downlink Shared Channel
E-UTRA	Evolved UMTS Terrestrial Radio Access
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
ETWS	Earthquake and Tsunami Warning System
FDD	Frequency Division Duplex
GC	General Control (SAP)
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HCS	Hierarchical Cell Structure
IMB	Integrated Mobile Broadcast
IMSI	International Mobile Subscriber Identity
MBMS	Multimedia Broadcast-Multicast Service
MBSFN	MBMS over a Single Frequency Network
MCC	Mobile Country Code
MCCH	MBMS point-to-multipoint Control Channel
MDT	Minimization of Drive Tests
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
PSM	Power Saving Mode
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].

Search of available CSGs may be triggered by NAS to support manual CSG selection.

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, cause #15 or cause #25, 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, receive ETWS, and receive CMAS.

The idle mode tasks can be subdivided into four processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration;

- Support for manual CSG selection.

The relationship between these processes is illustrated in Figure 1.
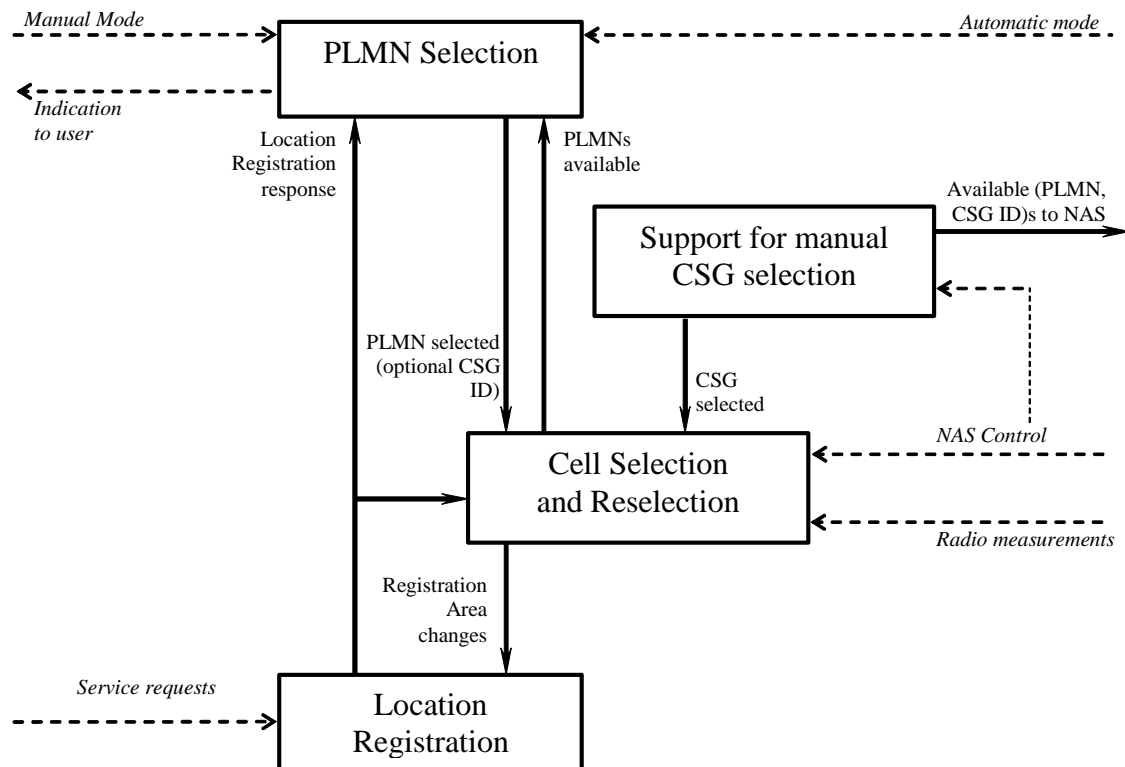
Figure 1: Overall Idle Mode process

When NAS indicates that PSM starts, the AS configuration (e.g. priorities provided by dedicated signalling and logged measurements) is kept, all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while the UE is in PSM it is up to UE implementation whether it performs the corresponding action immediately or the latest when PSM ends. When NAS indicates that PSM ends, the UE shall perform all idle mode tasks.

When NAS indicates that extended DRX in Idle mode parameters have been received, the AS configuration (e.g. priorities provided by dedicated signalling and logged measurements) is kept, all running timers continue to run but the UE need not perform any idle mode tasks. When NAS indicates that extended DRX in Idle mode parameters have been received, the AS starts a timer to indicate the start of the paging transmission window.If a timer expires while the UE is in extended DRX it is up to UE implementation whether it performs the corresponding action immediately or the latest when the paging transmission window starts. When the timer of the extended DRX expires, the AS re-starts the timer of the extended DRX, the AS starts a timer to indicate the end of the paging transmission window, and the UE shall perform all idle mode tasks until the timer of the paging transmission window expires.

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. 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. Evaluate reports of available PLMNs from AS for PLMN selection. Maintain a list of equivalent PLMN identities.	Search for available PLMNs. 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]. Perform measurements to support PLMN selection. Synchronise to a broadcast channel to identify found PLMNs. Report available PLMNs with associated PLMN type and RAT to NAS on request from NAS or autonomously. 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 and a Permitted CSG list. NAS provides these lists to AS.	Perform measurements needed to support cell selection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Search for a suitable cell. The cells broadcast their 'PLMN identity' (GSM-MAP) or 'SID' and may broadcast a CSG ID and CSG indicator in the system information. Respond to NAS whether such cell is found or not. 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]. 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. Maintain a list of equivalent PLMN identities and provide the list to AS. Maintain a list of forbidden LAs and provide the list to AS. Maintain a Permitted CSG list and provide the list to AS.	Perform measurements needed to support cell reselection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Change cell if a more suitable cell is found.
Location registration	Register the UE as active after power on. Register the UE's presence in a registration area, for instance regularly or when entering a new registration area. Maintain lists of forbidden LAs. Deregister UE when shutting down.	Report registration area information to NAS.

Idle Mode Process	UE Non-Access Stratum	UE Access Stratum
MBMS	Maintain priority information for various services and participate in service selection. Indicate to AS if an offered session has previously been received.	Maintain a list of TMGIs of activated services. Notify NAS of service availability and request NAS to prioritise in case of service conflicts. Report to NAS when an activated service requires action. Receive and handle the MCCH and MTCH, and, if applicable, the MSCH and MICH.
Support for manual CSG selection	Provide request to search for available CSG(s). Evaluate reports of available CSG(s) from AS for CSG selection. Select a CSG and request AS to select a suitable cell belonging to this CSG.	Search for cells with a CSG ID. Read the HNB name from system information if a cell with a CSG ID is found. Report CSG ID(s) of the found cells broadcasting a CSG ID together with the HNB name and PLMN(s) to NAS. On selection of a CSG by NAS, select any cell belonging to the selected CSG fulfilling the cell selection criteria and not barred or reserved for operator use for UEs not belonging to AC 11 or 15 and give an indication to NAS that access is possible (for the registration procedure).

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, ETWS if supported, and CMAS if supported 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, receive ETWS if supported, and receive CMAS if supported). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS primary notification and ETWS secondary notification and to receive CMAS notification 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

- For a CSG cell, the cell is a CSG member cell for the UE;

  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].

Following 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.

- as an outcome of the manual CSG selection procedure the UE is allowed to access an acceptable cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to AC 11 or 15 and inform NAS that access is possible (for location registration procedure).

  NOTE: UE is not required to support manual search and selection of CSG(s) while in RRC CONNECTED state.

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.

suitable MBSFN cluster:

A cell is part of an MBSFN cluster if it is indicated in system information [4]. An MBSFN cluster provides exclusively MBMS services. A suitable MBSFN cluster shall fulfil all the following requirements:

- For FDD, 3.84 Mcps TDD IMB and 3.84/7.68 Mcps TDD the MBSFN cluster shall be part of either:

  - the registered PLMN, or:

  - a PLMN of the Equivalent PLMN list

The MBSFN cluster shall be indicated as:

- providing MBSFN only service

For FDD, 3.84 Mcps TDD IMB and 3.84/7.68 Mcps TDD MBSFN cluster selection/reselection process for MBSFN clusters operating on the same frequency shall be based on reception quality. Details of the process are not specified.

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.

If a CSG ID is provided by NAS as part of PLMN selection, the UE shall search for an acceptable or suitable cell belonging to the provided CSG ID to camp on. When the UE is no longer camped on a cell with the provided CSG ID, AS shall inform NAS.

5.1.2.3 GSM case

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

5.1.2.4 E-UTRA case

Support for network selection in E-UTRA is described in [18].

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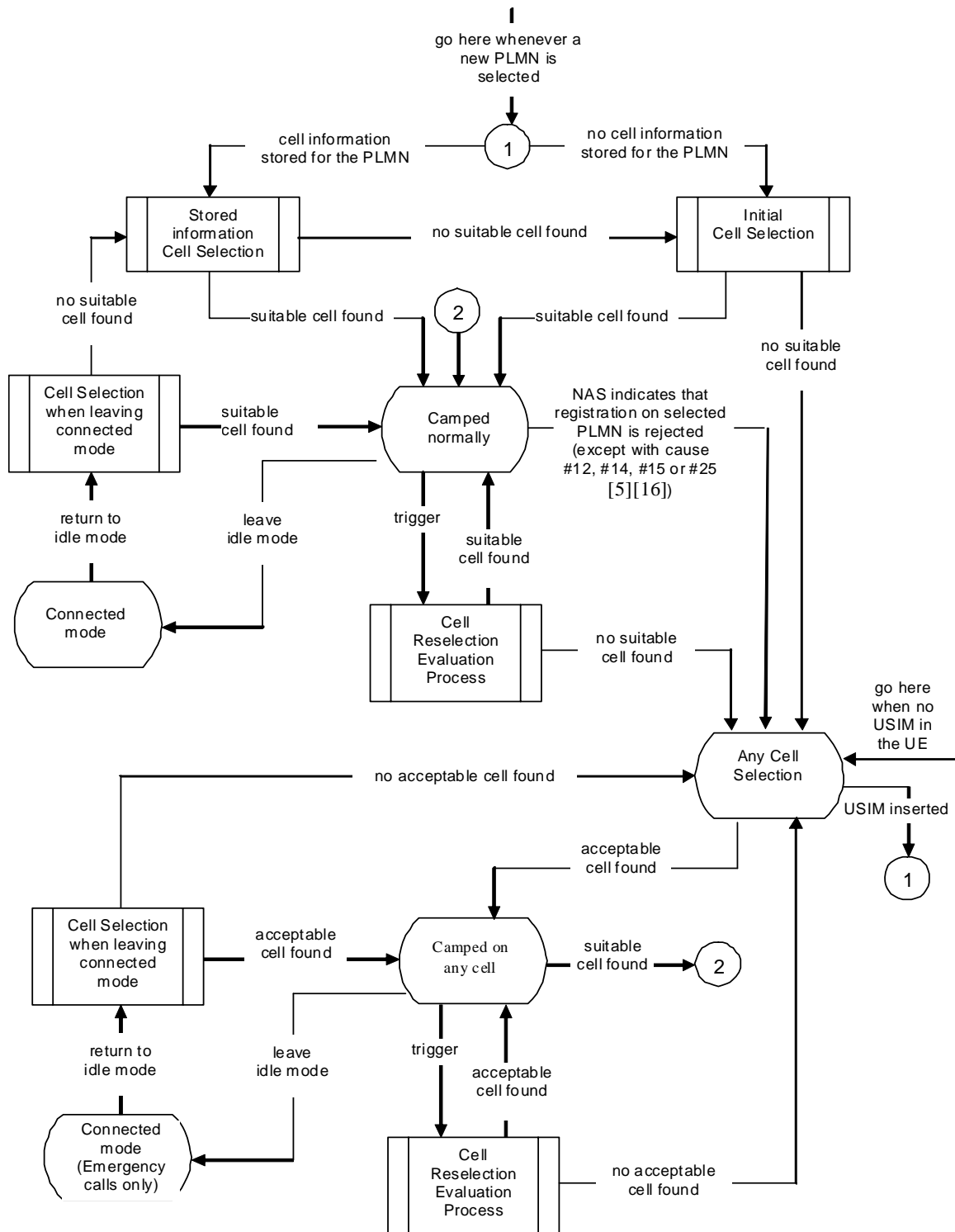
Figure 2: Idle Mode Cell Selection and Reselection
In any state, a new PLMN selection causes an exit to number 1

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, cause #15 or cause #25. 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, cause #15 or cause #25, see [5] and [16], or if there is no USIM in the UE.

If the UE received an LR reject with cause #12, cause #14, cause #15 or cause #25, 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. In this state if the UE supports CS voice services, the UE shall avoid reselecting an acceptable cell of E-UTRA regardless of priorities provided in system information of current cell. 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:

$$
\begin{array}{ll}
\text{for FDD cells:} & \text{Srxlev} > 0 \ \text{ AND Squal} > 0 \\[4pt]
\text{for TDD cells:} & \text{Srxlev} > 0
\end{array}
$$

Where:

$$
\begin{aligned}
\text{Squal} &= Q_{qualmeas} - (Qqualmin + QqualminOffset) - Qoffset_{temp} \\
\text{Srxlev} &= Q_{rxlevmeas} - (Qrxlevmin + QrxlevminOffset) - Pcompensation - Qoffset_{temp}
\end{aligned}
$$

Where:

the signalled values QqualminOffset and QrxlevminOffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN [5]. During this periodic search for higher priority PLMN the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

Squal	Cell Selection quality value (dB) Applicable only for FDD cells.
Srxlev	Cell Selection RX level value (dB)
Qoffset$_{temp}$	Offset temporarily applied to a cell as specified in [4] (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.
QqualminOffset	Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN [5]
Qrxlevmin	Minimum required RX level in the cell (dBm)
QrxlevminOffset	Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN [5]
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].

5.2.3.3 E-UTRA case

The cell selection criteria and procedures in E-UTRA are specified in [18].

5.2.3.4 CSG cells and Hybrid cells in Cell Selection

In addition to normal cell selection rules a manual selection of CSGs shall be supported by the UE upon request from higher layers as defined in subclause 5.6.

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].

5.2.5.3 E-UTRA case

The Camped Normally State is specified in [18].

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. For FDD, 3.84 Mcps TDD and 7.68 Mcps TDD, in CELL_FACH state the measurement rules below apply only if HS-DSCH discontinuous reception, with or without second DRX cycle, is configured, as specified in [4] and according to the requirements specified in [10]. Otherwise, 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]. For 1.28 Mcps TDD, 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 [11]. 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.

If the system information broadcast in the serving cell indicates that HCS is not used and absolute priorities for inter-frequency layers are not provided, then for inter-frequency measurements the UE shall:

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.
   If Dedicated CSG frequencies have been indicated by system information the UE may choose not to perform inter-frequency measurments of these frequencies.

If the system information broadcast in the serving cell indicates that HCS is not used and absolute priorities for some inter-RAT layers are not provided, then for inter-RAT measurements on RATs for which absolute priority information is not provided the UE shall:

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 state, 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$_{CR}$, or if the network (via RRC signalling) has ordered the UE to consider itself to be in high-mobility state, then 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 state is not detected during time period non-HCS-T$_{CrmaxHyst}$:

  - exit high-mobility state.

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. For FDD, 3.84 Mcps TDD and 7.68 Mcps TDD, in CELL_FACH state the measurement rules below apply only if HS-DSCH discontinuous reception, with or without second DRX cycle, is configured, as specified in [4] and according to the requirements specified in [10]. Otherwise, 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]. For 1.28 Mcps TDD, 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 [11]. 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).

The UE shall not use HCS for inter-frequency reselection if absolute priority based cell reselection (see subclause 5.2.6.1.4a) is used for inter-frequency reselection. The UE shall not use HCS for inter-RAT reselection if absolute priority based cell reselection (see subclause 5.2.6.1.4a) is used for that RAT.

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

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 not in high-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 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 state

   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. UEs in high-mobility state 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 UEs in high-mobility state 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 UE's in high-mobility state:

   If the number of cell reselections during time period T$_{CRmax}$ exceeds N$_{CR}$, or if the network (via RRC signalling) has ordered the UE to consider itself in high-mobility state, then high-mobility state has been detected. In this high-mobility state, the 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 state is not detected during time period T$_{CrmaxHyst}$:

     - exit high-mobility state.

If Dedicated CSG frequencies have been indicated by System Information the UE may choose not to perform inter-frequency measurements of these frequencies.

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 state

   IF ($Srxlev_s <= S_{HCS,RATm}$) or (if FDD and $S_x <= S_{SearchRATm}$) 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 UEs in high-mobility state

   - If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, or if the network (via RRC signalling) has ordered the UE to consider itself in high-mobility state, then high-mobility state has been detected. In this high-mobility state, the UE shall

   - IF ($Srxlev_s <= S_{HCS,RATm}$) or (if FDD and $S_x <= S_{SearchRATm}$), 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 state is not detected during time period $T_{CrmaxHyst}$

         - exit high-mobility state.

5.2.6.1.2a Measurement rules for inter-frequency and inter-RAT cell reselection when absolute priorities are used

The measurement rules below apply in Idle, URA_PCH, CELL_PCH states. In CELL_FACH state, if (High Priority Layers is indicated in CELL_FACH Absolute Priority Measurement Indicator [4] and SrxlevServingCell > Sprioritysearch1 and SqualServingCell > Sprioritysearch2) or (All Layers is indicated in CELL_FACH Absolute Priority Measurement Indicator [4]) then the measurement rules below apply, otherwise the measurement rules in 5.2.6.1.1 and 5.2.6.1.2 apply.

The UE is required to perform measurements of inter-frequency and inter-RAT cells listed in system information according to Measurement requirements are specified in [10]. UE specific priorities are not applied in camped on any cell state.

If the UE has received absolute priority information for inter-frequency layers, the UE shall follow these rules:

- The UE shall perform measurements of inter-frequency layers with a priority higher than the priority of the current serving layer.

 NOTE: The rate of these measurements may vary depending on whether Srxlev and Squal of the serving cell are above or below $S_{prioritysearch1}$ and $S_{prioritysearch2}$. This is specified in [10].

- When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of network configured values).

- For inter-frequency layers with a priority equal or lower than the priority of the current serving layer:

 - If $Srxlev_{ServingCell} > S_{prioritysearch1}$ and $Squal_{ServingCell} > S_{prioritysearch2}$ the UE may choose not to perform measurements of inter-frequency layers of equal or lower priority.

 - If $Srxlev_{ServingCell} <= S_{prioritysearch1}$ or $Squal_{ServingCell} <= S_{prioritysearch2}$ the UE shall perform measurements of inter-frequency layers of equal or lower priority.

- The UE may choose not to perform measurements of inter-frequency layers for which the UE has no absolute priority.

If the UE has received absolute priority information for inter-RAT layers, the UE shall follow these rules:

- The UE shall perform measurements of inter-RAT layers with a priority higher than the priority of the current serving cell.

 NOTE: The rate of these measurements may vary depending on whether Srxlev and Squal of the serving cell are above or below $S_{prioritysearch1}$ and $S_{prioritysearch2}$. This is specified in [10].

- For inter-RAT layers with a priority lower than the priority of the current serving cell:

 - If $Srxlev_{ServingCell} > S_{prioritysearch1}$ and $Squal_{ServingCell} > S_{prioritysearch2}$ the UE may choose not to perform measurements of inter-RAT layers of lower priority.

 - If $Srxlev_{ServingCell} <= S_{prioritysearch1}$ or $Squal_{ServingCell} <= S_{prioritysearch2}$ the UE shall perform measurements of inter-RAT layers of lower priority.

- If absolute priority information is provided for any inter-RAT layers in a RAT, the UE may choose not to perform measurements on layers in that RAT for which the UE has no absolute priority.

- The UE shall perform measurements according to subclause 5.2.6.1.1 for inter-RAT layers for which the UE has no absolute priority. For all inter-RAT layers belonging to one RAT, either the rules above or the rules in subclause 5.2.6.1.1 or 5.2.6.1.2 shall apply.

- In CELL_FACH state: If there are UTRAN inter-frequency, GERAN and E-UTRAN neighbours configured and required to be measured according to the measurement rules above, then the UE shall perform measurements on UTRAN inter-frequency and E-UTRAN layers (i.e. the UE is not required to measure GERAN, regardless of whether GERAN has absolute priorities assigned).

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, or for the best cell according to absolute priority reselection criteria specified in subclause 5.2.6.1.4a, 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 or best cell according to absolute priority reselection rules 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 UE is redirected under UTRAN control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules 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 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 UE is redirected under UTRAN control to a frequency for which the timer is running, any limitation on that frequency 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 if no absolute priority information for any inter-frequency layer is available to the UE, and inter-RAT cells if no absolute priority information for any inter-RAT layer is available to the UE for that RAT. For inter-frequency and inter-RAT layers in a RAT for which absolute priorities are defined, then the cell reselection criteria in subclause 5.2.6.1.4a shall apply.

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:

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

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

where:

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

- for a CSG cell not included in the neighbour cell list, then $Qoffset_{s,n}$ and Qoffmbms have the value 0.

where:

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

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

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

$TEMP\_OFFSET_n$ 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.

For a CSG cell not included in the neighbour cell list, then $TEMP\_OFFSET_n$ has the value of 0.

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
for E-UTRAN cells:	Srxlev > 0 AND Squal > 0

Where :

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

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

Squal	Cell Selection quality value (dB) Applicable only for FDD cells and E-UTRA cells.
Srxlev	Cell Selection RX level value (dB)
Qoffset$_{temp}$	Offset temporarily applied to a cell as specified in [4] (dB)
Q$_{qualmeas}$	Measured cell quality value. The quality of the received signal expressed in CPICH E$_c$/N$_0$ (dB) for FDD cells, and RSRQ for E-UTRA cells. CPICH Ec/N0 and RSRQ shall be averaged as specified in [10]. Applicable only for FDD cells and E-UTRA 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), the averaged received signal level as specified in [10] for GSM cells (dBm) and the averaged RSRP as specified in [10] for E-UTRA cells (dBm). CPICH RSCP, P-CCPCH RSCP, the received signal level for GSM cells and the RSRP for E-UTRA cells shall be averaged as specified in [10] and [11].
Qqualmin	Minimum required quality level in the cell (dB). Applicable only for FDD cells and E-UTRA 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)

For a CSG cell not included in the neighbour cell list, the cell specific parameter values to be used shall be the same as the serving cell.

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, then from the cells that fulfil the criterion S, the UE shall perform ranking of all cells among

1. when not in high-mobility state (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 state (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 the preceding 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. In case the UE reselects to a cell on an MBMS preferred frequency to receive an MBMS service not available on the current frequency the UE may reduce interval $Treselection_s$, $Treselection_{s,PCH}$ and $Treselection_{s,FACH}$.

   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.

- For FDD the UE does not have an allocated common E-DCH resource.

- For 1.28 Mcps TDD, the UE does not have CELL Reselection Indication procedure ongoing.

For FDD the UE continues taking intra-frequency measurements and ranking cells while it has an allocated common E-DCH resource. If supported by the UE and configured to perform Cell Reselection Indication Reporting, the UE shall inform the MAC layer that the cell reselection criteria are met.

For 1.28 Mcps TDD, the UE continues taking measurements and ranking cells while it has the CELL Reselection Indication procedure ongoing as in [19].

5.2.6.1.4a   Absolute priority based criteria for inter-frequency and inter-RAT cell reselection

Absolute priorities of different absolute priority layers may be provided to the UE. The following cell reselection criteria are used for inter-frequency cells if absolute priority information for inter-frequency is available to the UE, and inter-RAT cells if absolute priority information for inter-RAT is available to the UE.

If System Information Block 18 with UTRAN information is provided then the UE shall apply the inter-frequency priority rules below only to UTRAN cells of the selected PLMN or equivalent PLMNs. If System Information Block 18 is not provided, or is provided but contains no information for UTRAN, then the rules below apply for the entire UTRAN RAT.

If System Information Block 18 with GERAN information is provided then the UE shall apply the GERAN RAT priority rules below only to GERAN cells of the selected PLMN or equivalent PLMNs. If System Information Block 18 is not provided, or is provided but contains no information for GERAN, then the rules below apply for the entire GERAN RAT.

If priority information is provided for any inter-frequency layers, cells belonging to inter-frequency layers for which no priority or no threshold is assigned shall not be considered for reselection.

If priority information is provided for any inter-RAT layers in a RAT, cells belonging to layers in that RAT for which no priority or no threshold is assigned shall not be considered for reselection.

If none of the inter-frequency layers in UTRAN are provided with both priority and threshold parameters, the cell reselection criteria in subclause 5.2.6.1.4 shall apply for inter-frequency layers in UTRAN.

If none of the inter-RAT layers in a RAT are provided with both priority and threshold parameters, the cell reselection criteria in subclause 5.2.6.1.4 shall apply for that RAT.

If both criteria in subclause 5.2.6.1.4 and criteria in subclause 5.2.6.1.4a are simultaneously fullfilled, the order in which the reselection criteria are evaluated is left to UE implementation.

NOTE: In order not to apply absolute priority but the cell reselection criteria in subclause 5.2.6.1.4 for inter-frequencies cell reselection in UTRAN or for inter-RAT cell reselection, the network may choose to configure no inter-frequency layers in UTRAN or no inter-RAT layers in a RAT in SIB19 even though dedicated priorities are provided.

For all inter-frequency layers or all inter-RAT layers belonging to one RAT, either the criteria below or the criteria in subclause 5.2.6.1.4 shall apply.

The UE may apply either priorities broadcast in system information or priorities received through dedicated signalling. The rules regarding which set of priorities shall apply are defined in [4]. UE specific priorities shall be cleared when the validity time of the UE specific priorities expires, or when a PLMN selection is performed on request by NAS. UE specific priorities are not applied in camped on any cell state.

When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of network configured values).

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

The following definitions apply for the layers for which $Thresh_{x,high2}$ or $Thresh_{x,low2}$ are not provided:

- Criterion 1: the $Srxlev_{nonServingCell,x}$ of a cell on an evaluated higher absolute priority layer is greater than $Thresh_{x,high}$ during a time interval Treselection;

- Criterion 2: ($Srxlev_{ServingCell} < Thresh_{serving,low}$ or $Squal_{ServingCell} <= Thresh_{serving,low2}$) and the $Srxlev_{nonServingCell,x}$ of a inter-frequency cell on an evaluated equal absolute priority layer is greater than $Thresh_{x,low}$ during a time interval Treselection;

- Criterion 3: ($Srxlev_{ServingCell} < Thresh_{serving,low}$ or $Squal_{ServingCell} <= Thresh_{serving,low2}$) and the $Srxlev_{nonServingCell,x}$ of a cell on an evaluated lower absolute priority layer is greater than $Thresh_{x,low}$ during a time interval Treselection;

The following definitions apply for the layers for which both $Thresh_{x,high2}$ and $Thresh_{x,low2}$ are provided:

- Criterion 4: the $Squal_{nonServingCell,x}$ of a cell on an evaluated higher absolute priority layer is greater than $Thresh_{x,high2}$ during a time interval Treselection;

- Criterion 5: for FDD, ($Srxlev_{ServingCell} <= Thresh_{serving,low}$ or $Squal_{ServingCell} < Thresh_{serving,low2}$) and the $Squal_{nonServingCell,x}$ of a cell on an evaluated lower absolute priority layer is greater than $Thresh_{x,low2}$ during a time interval Treselection; for 1.28 Mcps TDD, ($Srxlev_{ServingCell} < Thresh_{serving,low}$) and the $Squal_{nonServingCell,x}$ of a cell on an evaluated lower absolute priority layer is greater than $Thresh_{x,low2}$ during a time interval Treselection;

Cell reselection to a cell on a higher absolute priority layer than the camped frequency shall be performed if criterion 1 or 4 is fulfilled.

Cell reselection to an inter-frequency cell on an equal absolute priority layer to the camped frequency shall be performed if criterion 2 is fulfilled.

Cell reselection to a cell on a lower absolute priority layer than the camped frequency shall be performed if criterion 3 or 5 is fulfilled.

If more than one cell meets the above criteria, the UE shall reselect the cell with the highest $Srxlev_{nonServingCell,x}$ among the cells meeting the criteria on the highest absolute priority layer.

The UE shall not perform cell reselection to cells for which the cell selection criterion S is not fulfilled.

The UE shall not perform cell reselection until more than 1 second has elapsed since the UE camped on the current serving cell.

The UE shall not consider any exclude-listed cells as candidate for cell reselection to E-UTRA.

In CELL_FACH state, the UE shall not perform cell reselection to E-UTRA when E-UTRA measurement for CELL_FACH is configured. Except in the case that the cell reselection is to an E-UTRA CSG member cell, in this case cell reselection is performed as defined in [18].

The UE should not perform cell reselection while the UE has an allocated common E-DCH resource.

For UE in RRC connected mode states CELL_PCH or URA_PCH the interval $\text{Treselection}_{s,PCH}$ applies, if provided in SIB4 (see [4]), while for UE in RRC connected mode state CELL_FACH the interval $\text{Treselection}_{s,FACH}$ applies, if provided in SIB4 (see [4]).

In all the above criteria the values of Treselection_s, $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$ apply for Treselection and are scaled according to the UE mobility state, as specified in 5.2.6.1.1a. For UTRA cells apply the scaling rules in 5.2.6.1.4. For GSM cells apply the scaling rules in 5.2.6.1.4 if "GSM ScalingFactor for Treselection" is not sent on system information, else follow the rules below for GSM. For EUTRA cells apply the scaling rules in 5.2.6.1.4 if "E-UTRA ScalingFactor for Treselection" is not sent on system information, else follow the rules below for EUTRA.

- The UE shall apply the following scaling rules to Treselection_s or $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$:

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

  - for GERAN cells multiply Treselection_s or $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$ by the IE "GSM ScalingFactor for Treselection" if sent on system information.

  - for EUTRA cells multiply Treselection_s or $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$ by the IE "E-UTRA ScalingFactor for Treselection" if sent on system information.

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

  - for GERAN cells multiply Treselection_s or $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$ by both the IEs "Speed dependent ScalingFactor for Treselection" if sent on system information and "GSM ScalingFactor for Treselection" if sent on system information.

  - for EUTRA cells multiply Treselection_s or $\text{Treselection}_{s,PCH}$ or $\text{Treselection}_{s,FACH}$ by both the IEs "Speed dependent ScalingFactor for Treselection" if sent on system information and "E-UTRA ScalingFactor for Treselection" if sent on system information.

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

Cell reselection from UTRAN to E-UTRAN, for which Squal (RSRQ) based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria (criterion 4 or 5) if the UE supports Squal based cell reselection from E-UTRAN to UTRAN. Otherwise, cell reselection to E-UTRAN shall be performed based on Srxlev criteria.

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.

Qoffset$_{temp}$

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used for FDD cells in case the RRC Connection Establishment fails on the cell as specified in [4].

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.

Squal$_{ServingCell}$

This is the Squal value of the serving cell.

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".

$Srxlev_{nonServingCell,x}$

This is the Srxlev value of an evaluated neighbour cell on an absolute priority layer.

$Srxlev_{ServingCell}$

This is the Srxlev value of the serving cell.

$S_{prioritysearch1}$

This threshold is used in the measurement rules for cell re-selection when absolute priorities are used. It specifies the value of Srxlev in the serving cell controlling the rate of inter-frequency and inter-RAT measurements.

$S_{prioritysearch2}$

This threshold is used in the measurement rules for cell re-selection when absolute priorities are used. It specifies the value of Squal in the serving cell controlling the rate of inter-frequency and inter-RAT measurements.

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.

GSM 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 GSM case. This scaling is only applicable at absolute priority based criteria for cell reselection to GSM.

E-UTRA 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 EUTRA case. This scaling is only applicable at absolute priority based criteria for cell reselection to EUTRA.

$Thresh_{x,high}$

A Srxlev based threshold used by the UE for cell reselection towards a higher absolute priority layer when absolute priorities are applied. A threshold is defined for each absolute priority layer.

$Thresh_{x,high2}$

A Squal based threshold used by the UE for cell reselection towards a higher absolute priority layer when absolute priorities are applied. A threshold is defined for each absolute priority layer.

$Thresh_{x,low}$

A Srxlev based threshold used by the UE for cell reselection towards an equal or lower absolute priority layer when absolute priorities are applied. A threshold is defined for each absolute priority layer.

$Thresh_{x,low2}$

A Squal based threshold used by the UE for cell reselection towards a lower absolute priority layer when absolute priorities are applied. A threshold is defined for each absolute priority layer.

Thresh$_{serving,low}$

This threshold is used in the rules for cell reselection when absolute priorities are used. It specifies the limit for Srxlev in the serving cell below which the UE may perform cell reselection to a cell on an equal or lower absolute priority layer.

Thresh$_{serving,low2}$

This threshold is used in the rules for cell reselection when absolute priorities are used. It specifies the limit for Squal in the serving cell below which the UE may perform cell reselection to a cell on an equal or lower absolute priority layer.

Dedicated CSG frequency

This specifies a frequency which is used for CSG deployment only.

5.2.6.2 GSM case

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

5.2.6.3 E-UTRA case

The cell reselection procedure in E-UTRA, including inter-RATs reselection, is specified in [18].

5.2.6.4 Cell reselection with CSG cells

5.2.6.4.1 Cell reselection from a non-CSG cell to a CSG cell

In addition to normal cell reselection, the UE shall use an autonomous search function to detect at least previously visited CSG member cells on serving frequency, non serving frequencies and inter-RAT frequencies, according to the performance requirements specified in [10], when at least one CSG with associated PLMN identity ID is included in the UE's Permitted CSG list. The UE is required to perform autonomous search function in Idle, Cell_PCH, URA_PCH and CELL_FACH states. For CELL_FACH, the autonomous search function for reselection to non-serving frequencies and inter-RAT frequencies needs only to be performed when second DRX is used. The UE shall disable the autonomous search function for CSG cells if the UE's Permitted CSG list is empty. If "Dedicated CSG frequency(ies) " IE is present, the UE may use the autonomous search function only on these dedicated frequencies and on the other frequencies listed in the system information.

   NOTE: The UE autonomous search function, per UE implementation, determines when and/or where to search for CSG member cells.

When the UE has no or an empty Permitted CSG list, the UE may ignore cells with PSC in the stored range "CSG PSC Split Information" [4] reserved for CSG cells for intra-frequency and inter-frequency measurements and cell re-selections.

If the UE detects a suitable CSG cell on the same frequency it shall reselect this cell if the concerned CSG cell is the highest ranked cell, according to 5.2.6.1.4.

If the UE detects a suitable CSG cell on a different frequency it shall reselect this cell irrespective of the cell reselection rules applicable for the cell the UE is currently camped on, if the detected suitable CSG cell is the strongest cell on that frequency. If suitable CSG cells are detected on different frequencies and these are the strongest cells on their frequencies, then the UE shall reselect to any one of them.

If the UE detects one or more suitable CSG cell on another RAT, the UE shall reselect to one of them according to [18].

5.2.6.4.2 Cell reselection from a CSG cell to non-CSG cell

While camped on a suitable CSG cell, the UE shall consider the frequency of the serving cell to be the highest priority frequency (i.e. higher than any of network configured values or highest HCS priority) and shall not reselect to non-CSG cell as long as the serving cell remains the highest ranked cell on that frequency (This includes the case when the UE has only dedicated priorities for other frequencies but not for the current frequency, i.e. the UE does not consider the

current frequency to be the lowest priority frequency according to rules in 5.2.6.1.2a and 5.2.6.1.4a). Cell reselection rules as defined in section 5.2.6.1 are applied for cell reselection from a CSG cell to non-CSG cell.

5.2.6.4.3   Cell reselection from a CSG cell to a CSG cell

To search for CSG cells not listed in the system information of the serving CSG cell, the UE may use the autonomous search function when at least one CSG ID with associated PLMN identity is included in the UE's Permitted CSG list. The UE is required to perform autonomous search function in Idle, Cell_PCH, URA_PCH and CELL_FACH states. For CELL_FACH, the autonomous search function for reselection to non-serving frequencies and inter-RAT frequencies needs only to be performed when second DRX is used. If "Dedicated CSG frequency(ies)" IE is present, the UE may use the autonomous search function only on dedicated frequencies and on other frequencies listed in the system information.

If the UE detects a suitable CSG cell on the same frequency, it shall reselect to this cell if the concerned CSG cell is the highest ranked cell, according to 5.2.6.1.4.

While camped on a suitable CSG cell, the UE shall consider the frequency of the serving cell to be the highest priority frequency (i.e. higher than any of network configured values or highest HCS priority) as long as the serving cell is the highest ranked cell on that frequency (This includes the case when the UE has only dedicated priorities for other frequencies but not for the current frequency, i.e. the UE does not consider the current frequency to be the lowest priority frequency according to rules in 5.2.6.1.2a and 5.2.6.1.4a).

If the UE detects one or more suitable CSG cell on another RAT, the UE may reselect to one of them according to [18].

For reselection to neighbour CSG cells listed in the system information of the serving CSG cell the UE shall apply cell measurement rules according to 5.2.6. If the UE detects a suitable CSG cell that is listed in the system information of the serving cell on other frequencies, and the detected CSG cell is the strongest cell on that frequency, then the UE shall consider these frequencies to have a priority equal to the current frequency and shall follow cell reselection rules according to 5.2.6.1.4 and 5.2.6.1.4a.

5.2.6.5   Cell Reselection with Hybrid Cells

In addition to normal cell reselection rules, the UE shall use an autonomous search function to detect at least previously visited hybrid cells whose CSG ID and associated PLMN identity is in the UE's Permitted CSG list according to the performance requirements specified in [10]. The UE shall treat detected hybrid cells as CSG cells if the CSG ID and any of the broadcasted PLMN identity of the hybrid cell is in the UE's Permitted CSG list and as normal cells otherwise.

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].

5.2.7.3   E-UTRA case

Cell selection when leaving connected mode in E-UTRA is specified in [18].

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].

5.2.9.3   E-UTRA case

The camped on any cell state in E-UTRA is specified in [18].

5.3   Cell Reservations and Access Restrictions (cells not operating in MBSFN mode)

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 four 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").

- Cell reserved for CSG (IE type: "true" or not present).

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),

- If Cell Reserved for CSG is indicated then CSG capable UEs shall behave as if cell status is indicated as "not reserved" for future extension (Cell Reservation Extension).

- If Cell Reserved for CSG is not indicated then 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,

- If the UE is assigned an Access Class 11 or 15 and if the cell belongs to the home PLMN or to any EHPLMN:

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

- else:

- 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 "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.

If the "Intra-frequency cell re-selection indicator" IE has been read from a CSG cell it shall be ignored by the UE and the UE is allowed to reselect another cell on the same frequency if the cell reselection criteria are fulfilled.

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 and ACDC are 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. Access Class related cell access restrictions, if it is sent as a part of Paging Permission with Access Control Parameters, shall be checked by the UE before sending a response to Paging message or before initiating a Location/Registration procedure. Access Class related cell access restrictions, if it is sent as a part of Extended Access Barring parameters, shall be checked by the UE before sending an RRC CONNECTION REQUEST message or INITIAL DIRECT TRANSFER message subject to extended access barring as indicated by higher layers. Otherwise, cell access restrictions associated with the Access Classes shall not apply for a UE which already is in Connected Mode.

For Access Class 0 to 9, ACDC related cell access restrictions, if it is sent in ACDC Barring Information paramerers shall be checked by the UE before sending an RRC CONNECTION REQUEST message when entering Connected Mode from UTRAN Idle mode in PS domain.

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].

5.3.3 E-UTRA cells

The cell access restrictions applicable to E-UTRA are specified in [18].

5.3a Cell Reservations and Access Restrictions (MBSFN cells only for FDD, 3.84 Mcps TDD IMB and 3.84/7.68 Mcps TDD)

For an MBSFN cluster (see [4]) when cell status is indicated "not reserved" for operator use and "not reserved" for future extension (Cell Reservation Extension), and Cell Barred is set to "barred" or "not barred",

- All UEs shall treat this MBSFN cluster as a candidate during the MBSFN cluster selection and MBSFN cluster re-selection procedures.

For an MBSFN cluster (see [4]) when cell status is indicated as "not reserved" for operator use and "reserved" for future extension (Cell Reservation Extension),

- UEs shall not consider this MBSFN cluster as a candidate during the MBSFN cluster selection and MBSFN cluster re-selection procedures. The UE may choose to not recheck the status of this MBSFN cluster during the time corresponding to the maximum value for T_{barred} (see [4]).

For an MBSFN cluster (see [4]) when cell status is indicated as "reserved" for operator use,

- if a UE is assigned to Access Class 11 or 15 and the MBSFN cluster belongs to the home PLMN or to any EHPLMN:

    - the UE shall treat this MBSFN cluster as a candidate during the MBSFN cluster selection and MBSFN cluster re-selection procedures.

- else:

    - UEs shall not consider this MBSFN cluster as candidate during the MBSFN cluster selection and MBSFN cluster re-selection procedures The UE may choose to not recheck the status of this MBSFN cluster during the time corresponding to the maximum value for T_{barred} (see [4]).

NOTE: The UE should in all cases assume "intra-frequency cell re-selection" has the value "allowed".

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].

5.6 Support for manual CSG Selection

5.6.1 UTRA case

In the UE on request of NAS, the AS shall scan all RF channels in the UTRA bands according to its capabilities to find available CSGs. On each carrier, the UE shall at least search for the strongest cell, read its system information and

report available CSG ID(s) together with their "HNB name" (if broadcast) and PLMN(s) to the NAS. The search for available CSGs may be stopped on request of the NAS.

If NAS has selected a CSG and provided this selection to AS, the UE shall search for an acceptable or suitable cell belonging to the selected CSG to camp on.

5.6.2 E-UTRA case

Support for manual CSG selection in E-UTRA is described in [18].

5.7 Logged Measurements

The UE may be configured to perform logging of measurement results in idle mode, CELL_PCH, URA_PCH states and CELL_FACH state when second DRX cycle is used with LOGGING MEASUREMENT CONFIGURATION message specified in TS 25.331 [4]. This configuration is valid while the logging duration timer is running.

If the configuration of logged measurements is valid, the UE shall perform logging of measurement results if all of the following conditions are met:

- the UE is in *camped normally* state in idle mode, CELL_PCH or URA_PCH states or CELL_FACH state when second DRX cycle is used;

- the RPLMN of the UE is present in the MDT PLMN identity list, if received in the LOGGING MEASUREMENT CONFIGURATION message, or the RPLMN of the UE is the same as the RPLMN at the point of time of LOGGING MEASUREMENT CONFIGURATION message reception;

- the UE is camped on a cell belonging to Area Configuration (see TS 25.331 [4]), if configured;

- the UE is camped on the RAT where the logged measurement configuration was received.

Otherwise, the logging of measurement results shall be suspended.

NOTE: Even if logging of measurement results is suspended, the logging duration timer and time stamp will continue, and the logged measurement configuration and corresponding log are kept.

5.8 Logged UTRAN ANR

5.8.1 General

The UE may be configured to perform UTRAN ANR measurement and logging in IDLE mode, CELL_PCH, URA_PCH state and CELL_FACH state when second DRX cycle is used with Logging Measurement Configuration message as specified in [4]. If configured, the UE will

- perform measurements and evaluation on the cells which are not included in the neighbour cell list in IDLE mode, CELL_PCH, URA_PCH state and CELL_FACH state when second DRX cycle is used.

- log information of the detected cells meeting the logging rules as specified in [4].

5.8.2 UTRAN ANR measurement process

5.8.2.1 Intra-freq and inter-freq ANR case

If configured via the Logging Measurement Configuration message, the UE may perform intra-freq and inter-freq ANR measurements and logging only when:

- in IDLE mode, CELL_PCH, URA_PCH state and CELL_FACH state when second DRX cycle is used.

- the UE is camping normally on a UTRAN cell belonging to the PLMN or the list of Equivalent PLMNs where the Logging Measurement Configuration is received.

During the intra-freq and inter-freq ANR process, the UE may measure on the frequencies associated with the cells listed in the neighbour cell list and log corresponding information of the detected set cells as specified in TS 25.331 [4].

5.8.2.2 Inter-RAT ANR case

If configured to perform inter-RAT ANR via the Logging Measurement Configuration message, the UE may perform inter-RAT ANR logging only when:

- after inter-RAT cell reselection from E-UTRAN or GSM to a normal UTRAN cell belonging to the PLMN or the list of Equivalent PLMNs where the Logging Measurement Configuration is received.

During the inter-RAT ANR process, the UE may log the corresponding information of the previously camped E-UTRAN or GSM cell as specified in TS 25.331 [4].

5.9 Accessibility measurements

The UE logs failure information when the RRC connection establishment procedure fails as specified in TS 25.331 [4].

5.10 RAN-assisted WLAN interworking

The purpose of this procedure is to facilitate RAN-assisted WLAN interworking.

5.10.1 RAN assistance parameter handling in Idle mode, CELL_PCH, URA_PCH and CELL_FACH

UEs in idle mode or in CELL_FACH, CELL_PCH or URA_PCH state shall store and apply RAN assistance parameters for the rules in sub-clause 5.10.2 as defined in the following:

- RAN assistance parameters received in System information block type 23 are used only if the UE is in camped *normally* state;

- upon cell reselection, and cell selection to another cell than the serving cell (or the best cell in case of UEs previously in CELL_DCH state and configured with DCHs only), the UE shall discard the RAN assistance parameters received in the UTRAN MOBILITY INFORMATION message or in the CELL UPDATE CONFIRM message and apply the RAN assistance parameters received in System information block type 23.

5.10.2 Access network selection and traffic steering rules

The rules in this sub-clause are only applicable for WLANs for which identifiers have been signaled to the UE by UTRAN and the UE is capable of access network selection and traffic steering rules. Coexistence with ANDSF based WLAN selection and traffic steering methods on the UE is based on mechanism described in TS 23.402 [23]. The rules refer to the following WLAN quantities:

ChannelUtilizationWLAN	WLAN channel utilization as defined in sub-clause 8.4.2.30 in [24].
BackhaulRateDlWLAN	WLAN DLBandwidth as defined in sub-clause 9.1.2 in [25].
BackhaulRateUlWLAN	WLAN ULBandwidth as defined sub-clause 9.1.2 in in [25].
BeaconRSSI	WLAN Beacon RSSI as defined in [26] and [27].

The upper layers in the UE shall be notified (see TS 24.302 [28]) when and for which WLAN(s), that matches all the provided identifiers (in sub-clause 5.10.3) for a specific entry in the list, the following conditions 1 and 2 for steering traffic from UTRAN to WLAN are satisfied for a time interval $Tsteering_{WLAN}$:

1) In the UTRAN serving cell:

$Qrxlevmeas < Thresh_{ServingOffloadWLAN, Low}$; or

$Qqualmeas < Thresh_{ServingOffloadWLAN, Low2}$.

2) In the target WLAN:

ChannelUtilizationWLAN < $\text{Thresh}_{\text{ChUtilWLAN, Low}}$; and

BackhaulRateDlWLAN > $\text{Thresh}_{\text{BackhRateDLWLAN, High}}$; and

BackhaulRateUlWLAN > $\text{Thresh}_{\text{BackhRateULWLAN, High}}$; and

BeaconRSSI > $\text{Thresh}_{\text{BeaconRSSIWLAN, High}}$.

The UE shall not consider the metrics for which a threshold has not been provided. The UE shall evaluate the UTRAN conditions on the serving cell in Idle mode, URA_PCH, CELL_PCH, CELL_FACH and CELL_DCH. If not all metrics related to the provided thresholds can be acquired for a WLAN BSS, the UE shall exclude that WLAN BSS from the evaluation of the above rule.

The upper layers in the UE shall be notified (see TS 24.302 [28]) when the following conditions 3 or 4 for steering traffic from WLAN to UTRAN are satisfied for a time interval $\text{Tsteering}_{\text{WLAN}}$:

1) In the source WLAN:

ChannelUtilizationWLAN > $\text{Thresh}_{\text{ChUtilWLAN, High}}$; or

BackhaulRateDlWLAN < $\text{Thresh}_{\text{BackhRateDLWLAN, Low}}$; or

BackhaulRateUlWLAN < $\text{Thresh}_{\text{BackhRateULWLAN, Low}}$; or

BeaconRSSI < $\text{Thresh}_{\text{BeaconRSSIWLAN, Low}}$.

2) In the target UTRANcell:

Qrxlevmeas > $\text{Thresh}_{\text{ServingOffloadWLAN, High}}$; and

Qqualmeas > $\text{Thresh}_{\text{ServingOffloadWLAN, High2}}$.

The UE shall not consider the metrics for which a threshold has not been provided. The UE shall evaluate the UTRAN conditions on the serving cell in Idle mode, URA_PCH, CELL_PCH, CELL_FACH and CELL_DCH.

If the FDD UE is configured with DCH only, the reference cell to use, for the rules defined in this sub-clause, is the best cell in active set.

5.10.3 RAN assistance parameters definition

The following RAN assistance parameters for RAN-assisted WLAN interworking may be provided:

$\text{Thresh}_{\text{ServingOffloadWLAN, Low}}$

This specifies the CPICH RSCP for FDD cells (dBm) and P-CCPCH RSCP for TDD cells (dBm) used by the UE for traffic steering from UTRAN to WLAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, High}}$

This specifies the CPICH RSCP for FDD cells (dBm) and P-CCPCH RSCP for TDD cells (dBm) used by the UE for traffic steering from WLAN to UTRAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, Low2}}$

This specifies the CPICH E_c/N_0 (dB) for FDD cells used by the UE for traffic steering from UTRAN to WLAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, High2}}$

This specifies the CPICH E_c/N_0 (dB) for FDD cells used by the UE for traffic steering from WLAN to UTRAN.

$\text{Thresh}_{\text{ChUtilWLAN, Low}}$

This specifies the WLAN channel utilization (BSS load) threshold used by the UE for traffic steering from UTRAN to WLAN.

Thresh$_{\text{ChUtilWLAN, High}}$

This specifies the WLAN channel utilization (BSS load) threshold used by the UE for traffic steering from WLAN to UTRAN.

Thresh$_{\text{BackhRateDLWLAN, Low}}$

This specifies the backhaul available downlink bandwidth threshold used by the UE for traffic steering from WLAN to UTRAN.

Thresh$_{\text{BackhRateDLWLAN, High}}$

This specifies the backhaul available downlink bandwidth threshold used by the UE for traffic steering from UTRAN to WLAN.

Thresh$_{\text{BackhRateULWLAN, Low}}$

This specifies the backhaul available uplink bandwidth threshold used by the UE for traffic steering from WLAN to UTRAN.

Thresh$_{\text{BackhRateULWLAN, High}}$

This specifies the backhaul available uplink bandwidth threshold used by the UE for traffic steering from UTRAN to WLAN.

Thresh$_{\text{BeaconRSSIWLAN, Low}}$

This specifies the Beacon RSSI threshold used by the UE for traffic steering from WLAN to UTRAN.

Thresh$_{\text{BeaconRSSIWLAN, High}}$

This specifies the Beacon RSSI threshold used by the UE for traffic steering from UTRAN to WLAN.

Tsteering$_{\text{WLAN}}$

This specifies the timer value during which the rules should be fulfilled before starting traffic steering between UTRAN and WLAN.

WLAN identifiers

Only the SSIDs, BSSIDs and HESSIDs which are provided in this parameter shall be considered for traffic steering between UTRAN and WLAN based on the rules in this chapter.

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.

The second system information broadcast channel (BCH on SCCPCH) is mapped on a separate SCCPCH, i.e. different from the SCCPCH which carriers the FACH with CTCH. In case CTCH occasions collide with transmissions of the second system information broadcast channel, the UE supporting second system information broadcast channel may decide not to receive the second broadcast channel.

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.

6.3.1 MBSFN cluster selection and reselection

6.3.1.1 MBSFN cluster selection

MBSFN cluster selection/reselection process for MBSFN clusters operating on the same frequency may be based on reception quality of the CPICH for FDD and 3.84 Mcps TDD IMB or P-CCPCH for TDD. Details of the process are not specified.

The UE shall search for MBSFN clusters if the frequencies on which MBSFN clusters are available are not indicated in the cell that the UE is camping on for normal service if the mobile is configured to receive services via MBSFN mode. Details of the process are not specified.

For 1.28 Mcps TDD, the UE that needs receive MBMS services delivered in an MBSFN cluster may at the first step select a non MBSFN cell (i.e. a unicast cell), that the MBSFN cluster is associated with. The UE can get synchronized to the MBSFN cluster with the help of the information indicated in system information broadcast by the associated unicast cell,and receive the system information and MCCH messages in the MBSFN Special Timeslot. The details of the association between MBSFN clusters and non MBSFN cells operating in a unicast carrier are not specified. In case there are more than one MBSFN clusters indicated in system information broadcast by a unicast cell, the process of which MBSFN cluster should be selected for searching is not specified.

6.3.1.2 Camped on MBSFN cluster

When camped on a MBSFN cluster, the UE shall perform the following tasks:

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

- monitor the available MBMS services on the MBSFN cluster that the UE is camping on

The UE may:

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

- receive the MSCH.

6.3.1.3 MBSFN inter frequency neighbour information

Upon detection of one MBSFN cluster all other frequencies on which MBMS service is provided in MBSFN mode for one of the PLMN assigned to the MBSFN cluster are indicate as specified in [4].

The UE chooses the frequency for the MBSFN cluster to be received based on the information on the services that are provided on the MBSFN clusters of those frequencies.

In the case that the UE does not receive a service from the current MBSFN cluster and the UE is configured to receive an MBMS service in MBSFN mode it should attempt to receive information on ongoing services as specified in [4].

7   Void

8   Paging and SCCPCH selection and in FDD and 1.28 Mcps TDD the H-RNTI selection

8.1   Paging Channel selection

System information block type 5 (SIB 5) and System information block type 5bis (SIB 5bis)define 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 or SIB 5bis, the UE shall perform a selection according to the following rule:

- The UE shall select a SCCPCH from the ones listed in SIB 5 or SIB 5bis 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 or SIB 5bis 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

If HS-DSCH operation in CELL_FACH state (FDD and 1.28 Mcps TDD) is not configured to the cell, 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) or System Information Block type 5bis (SIB 5bis) 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 or SIB 5bis, 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.

8.2b H-RNTI selection when entering Connected mode (FDD and 1.28 Mcps TDD)

If HS-DSCH operation in CELL_FACH state is configured to the cell in System Information Block type 5 (SIB 5) or System Information Block type 5bis, when entering Connected mode from Idle mode by sending an RRC CONNECTION REQUEST message, the UE shall start listening to the HS-SCCH indicated in System Information Block type 5 (SIB 5) or in System Information Block type 5bis (SIB 5bis).

The detection of HS-SCCH is based on Common H-RNTI listed in System Information Block type 5 (SIB 5) or System Information Block type 5bis (SIB 5bis). The UE shall select the Common H-RNTI to be used for reception of the RRC CONNECTION SETUP message according to the following rule:

- the UE shall select a Common H-RNTI from the Common H-RNTIs listed in System Information Block type 5 (SIB 5) or System Information Block type 5bis (SIB 5bis) based on "Initial UE Identity" as follows:

"Index of selected Common H-RNTI" = "Initial UE Identity" mod K,

- where K is equal to the number of listed Common H-RNTI. These Common H-RNTIs shall be indexed from 0 to K-1 in the order of their occurrence in SIB 5 or SIB 5bis, and "Index of selected Common H-RNTI" identifies the selected Common H-RNTI. "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.

After detecting the HS-SCCH with Common H-RNTI, the UE start reception of the corresponding HS-PDSCH(s) TTI.

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.

For TDD, and for FDD in IDLE mode as well as in RRC Connected mode, if HS-DSCH operation in CELL_PCH and URA_PCH state is not configured to the cell, or for 1.28 Mcps TDD if both HS-DSCH operation in CELL_PCH and URA_PCH state and legacy PCH are configured to the cell but no dedicated H-RNTI is allocated to the UE, 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.

For FDD, if HS-DSCH operation in CELL_PCH and URA_PCH state is configured to the cell, the UE in RRC Conneced mode shall use the IMSI, the number of indexed PICH for HSDPA supported paging (K) as derived from System Information Block Type 5 or System Information Block Type 5bis, the Cell System Frame Number (SFN), Np (Np is the number of page indicators within a frame), Frame offset (Frame offset = 0), PBP and the DRX cycle length to determine the Paging Occasions.

For 1.28 Mcps TDD, if HS-DSCH operation in CELL_PCH and URA_PCH state is configured to the cell and no legacy PCH is configured in the cell, or if both HS-DSCH operation in CELL_PCH and URA_PCH state and legacy PCH are configured to the cell and the dedicated H-RNTI is allocated to the UE, the UE in RRC Conneced mode shall use the IMSI, the number of indexed PICH for HSDPA supported paging (K) as derived from System Information Block Type 5 or System Information Block Type 5bis, the Cell System Frame Number (SFN), Np (Np is the number of page indicators within a frame), Frame offset, 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, in case of PCCH mapping on PCH, 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

For 1.28 Mcps TDD, in case of PCCH on HS-DSCH, 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_{HS-PCH} } *m

Where N_{HS-PCH} is the number of Paging sub-channels for PCCH on HS-DSCH and m is the length of each sub-channel in Radio Frame. The timing of PICH and Paging Message on HS-DSCH as well as the transmission pattern of PCCH on HS-DSCH is defined in [8].

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 (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

<table>
<tr><th colspan="9">Change history</th></tr>
<tr><th>Date</th><th>TSG #</th><th>TSG Doc.</th><th>CR</th><th>Rev</th><th>Cat</th><th>Subject/Comment</th><th colspan="2">New version</th></tr>
<tr><td>10/1999</td><td>RP-05</td><td>RP-99464</td><td>-</td><td>-</td><td></td><td>Approved at TSG-RAN #5 and placed under Change Control</td><td colspan="2">3.0.0</td></tr>
<tr><td>12/1999</td><td>RP-06</td><td>RP-99632</td><td>001</td><td>2</td><td></td><td>Modification and editorial changes</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99633</td><td>002</td><td>3</td><td></td><td>Specification of Cell reselection procedures in</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99633</td><td>003</td><td>2</td><td></td><td>Integration of Cell Broadcast Service (CBS)</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99633</td><td>004</td><td>2</td><td></td><td>Measurement used as a quality estimate for cell</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99632</td><td>006</td><td></td><td></td><td>Discontinuous reception</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99633</td><td>008</td><td>3</td><td></td><td>Barred Cells and Access Control</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99633</td><td>009</td><td></td><td></td><td>Introduction of network control of UE measurement</td><td colspan="2">3.1.0</td></tr>
<tr><td></td><td>RP-06</td><td>RP-99631</td><td>011</td><td></td><td></td><td>Editorial issues</td><td colspan="2">3.1.0</td></tr>
<tr><td>03/2000</td><td>RP-07</td><td>RP-000037</td><td>007</td><td>2</td><td></td><td>Cell Selection for DS-41 mode</td><td colspan="2">3.2.0</td></tr>
<tr><td></td><td>RP-07</td><td>RP-000037</td><td>014</td><td></td><td></td><td>Modified description of cell search procedure</td><td colspan="2">3.2.0</td></tr>
<tr><td></td><td>RP-07</td><td>RP-000037</td><td>018</td><td>1</td><td></td><td>UE individual DRX cycles in CELL_PCH and URA_PCH states</td><td colspan="2">3.2.0</td></tr>
<tr><td></td><td>RP-07</td><td>RP-000037</td><td>019</td><td>1</td><td></td><td>Cell re-selection criteria including HCS</td><td colspan="2">3.2.0</td></tr>
<tr><td></td><td>RP-07</td><td>RP-000037</td><td>021</td><td></td><td></td><td>Modified description of DRX</td><td colspan="2">3.2.0</td></tr>
<tr><td>06/2000</td><td>RP-08</td><td>RP-000217</td><td>025</td><td></td><td></td><td>Triggering of inter-system measurements for cell re-selection when HCS is used</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>026</td><td>5</td><td></td><td>Cell re-selection</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>027</td><td>4</td><td></td><td>Access Control</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>028</td><td></td><td></td><td>Downlink signalling failure</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>029</td><td></td><td></td><td>Cell-reselection parameter signalling</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>030</td><td></td><td></td><td>Cell Selection and Reselection</td><td colspan="2">3.3.0</td></tr>
<tr><td></td><td>RP-08</td><td>RP-000217</td><td>031</td><td>1</td><td></td><td>CN DRX cycle coefficient</td><td colspan="2">3.3.0</td></tr>
<tr><td>09/2000</td><td>RP-09</td><td>RP-000355</td><td>035</td><td>2</td><td></td><td>Paging channel selection</td><td colspan="2">3.4.0</td></tr>
<tr><td></td><td>RP-09</td><td>RP-000355</td><td>037</td><td>1</td><td></td><td>Editorial corrections</td><td colspan="2">3.4.0</td></tr>
<tr><td></td><td>RP-09</td><td>RP-000355</td><td>039</td><td></td><td></td><td>HCS measurement rules</td><td colspan="2">3.4.0</td></tr>
<tr><td></td><td>RP-09</td><td>RP-000355</td><td>042</td><td>2</td><td></td><td>Usage of Ec/N0 measurement quantity for cell ranking</td><td colspan="2">3.4.0</td></tr>
<tr><td></td><td>RP-09</td><td>RP-000355</td><td>044</td><td></td><td></td><td>Correction and restructuring</td><td colspan="2">3.4.0</td></tr>
<tr><td>12/2000</td><td>RP-10</td><td>RP-000565</td><td>046</td><td>1</td><td></td><td>Support for PLMN selection</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>049</td><td>1</td><td></td><td>Correction of algorithm for paging channel selection</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>050</td><td></td><td></td><td>Alignment of use of TEMP_OFFSET parameters with TS 25.331</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>051</td><td>2</td><td></td><td>Clarifications and Editorial Corrections</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>052</td><td>1</td><td></td><td>Clarifications to cell selection and reselection procedures</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>053</td><td></td><td></td><td>Removal of immediate cell evaluation</td><td colspan="2">3.5.0</td></tr>
<tr><td></td><td>RP-10</td><td>RP-000565</td><td>054</td><td></td><td></td><td>One step cell selection</td><td colspan="2">3.5.0</td></tr>
<tr><td>03/2001</td><td>RP-11</td><td>RP-010022</td><td>055</td><td>1</td><td></td><td>Usage of HCS Parameters in Cell Reselection</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>056</td><td></td><td></td><td>Clarification of usage of "Initial UE-Id" for SCCPCH selection</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>058</td><td></td><td></td><td>Clarification of paging occasion</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>059</td><td>1</td><td></td><td>Correction in Any Cell Selection State</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>061</td><td></td><td></td><td>Correction to the definition of a suitable cell</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>062</td><td></td><td></td><td>Correction to discontinuous reception in TDD</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>063</td><td>1</td><td></td><td>Correction of PI calculation for Paging DRX</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010200</td><td>064</td><td>3</td><td></td><td>Equivalent PLMN codes</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>065</td><td></td><td></td><td>High quality cell in PLMN selection</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010022</td><td>066</td><td></td><td></td><td>Clean-up</td><td colspan="2">3.6.0</td></tr>
<tr><td></td><td>RP-11</td><td>RP-010037</td><td>057</td><td>1</td><td></td><td>Support of 1.28Mcps TDD</td><td colspan="2">4.0.0</td></tr>
<tr><td>06/2001</td><td>RP-12</td><td>RP-010305</td><td>072</td><td></td><td></td><td>Corrections to 25.304</td><td colspan="2">4.1.0</td></tr>
<tr><td></td><td>RP-12</td><td>RP-010435</td><td>074</td><td>1</td><td></td><td>Emergency calls in barred cells</td><td colspan="2">4.1.0</td></tr>
<tr><td></td><td>RP-12</td><td>RP-010305</td><td>078</td><td></td><td></td><td>Clarification to usage of measurement thresholds</td><td colspan="2">4.1.0</td></tr>
<tr><td>09/2001</td><td>RP-13</td><td>RP-010539</td><td>080</td><td></td><td></td><td>Clarification to usage of measurement thresholds for HCS</td><td colspan="2">4.2.0</td></tr>
<tr><td></td><td>RP-13</td><td>RP-010539</td><td>082</td><td></td><td></td><td>Definition of strongest cell in cell search procedures</td><td colspan="2">4.2.0</td></tr>
<tr><td></td><td>RP-13</td><td>RP-010539</td><td>084</td><td>1</td><td></td><td>Miscellaneous corrections</td><td colspan="2">4.2.0</td></tr>
<tr><td></td><td>RP-13</td><td>RP-010539</td><td>086</td><td></td><td></td><td>Correction to cells reserved for operator use</td><td colspan="2">4.2.0</td></tr>
<tr><td></td><td>RP-13</td><td>RP-010539</td><td>088</td><td>1</td><td></td><td>Service type also valid in connected mode</td><td colspan="2">4.2.0</td></tr>
<tr><td></td><td>RP-13</td><td>RP-010539</td><td>090</td><td></td><td></td><td>Cell Access Restrictions for emergency calls</td><td colspan="2">4.2.0</td></tr>
<tr><td>12/2001</td><td>RP-14</td><td>RP-010756</td><td>092</td><td></td><td></td><td>Clarification on DRX cycle length in connected mode</td><td colspan="2">4.3.0</td></tr>
<tr><td></td><td>RP-14</td><td>RP-010756</td><td>094</td><td></td><td></td><td>Correction to search for available PLMNs</td><td colspan="2">4.3.0</td></tr>
<tr><td>03/2002</td><td>RP-15</td><td>RP-020063</td><td>096</td><td></td><td></td><td>Correction to TDD paging message receiving occasion</td><td colspan="2">4.4.0</td></tr>
<tr><td></td><td>RP-15</td><td>RP-020063</td><td>098</td><td></td><td></td><td>Clarification of IMSI at Paging channel selection and DRX calculation</td><td colspan="2">4.4.0</td></tr>
<tr><td></td><td>RP-15</td><td>-</td><td>-</td><td></td><td></td><td>Upgrade to Release 5 - no technical change</td><td colspan="2">5.0.0</td></tr>
<tr><td>06/2002</td><td>RP-16</td><td>RP-020324</td><td>101</td><td></td><td></td><td>Limitations of CBS reception</td><td colspan="2">5.1.0</td></tr>
<tr><td>12/2002</td><td>RP-18</td><td>RP-020716</td><td>104</td><td></td><td></td><td>Highest HCS priority</td><td colspan="2">5.2.0</td></tr>
<tr><td>06/2003</td><td>RP-20</td><td>RP-030289</td><td>107</td><td></td><td></td><td>Correction to cell selection process to include RRC connected mode</td><td colspan="2">5.3.0</td></tr>
<tr><td>12/2003</td><td>RP-22</td><td>-</td><td>-</td><td></td><td></td><td>Upgrade to Release 6 - no technical changes</td><td colspan="2">6.0.0</td></tr>
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03/2005	RP-27	RP-050081	125	1	Correction to "selected PLMN" in access stratum	6.5.0
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	RP-27	RP-050073	139	1	Intra frequency measurement rules for HCS	6.5.0
06/2005	RP-28	RP-050314	0140		Addition of idle mode cell selection due to FLD	6.6.0
	RP-28	RP-050314	0141		MBMS Frequency Layer Convergence	6.6.0
	RP-28	RP-050314	0142		Removal of sentences in brackets in 25.304	6.6.0
09/2005	RP-29	RP-050460	0145		Correction to condition for starting penalty timer in HCS reselection	6.7.0
	RP-29	RP-050479	0146		Selecting the correct priority layer in HCS high mobility	6.7.0
	RP-29	RP-050479	0147		Correction to inter-frequency cell reselection when HCS is not used	6.7.0
	RP-29	RP-050468	0148		Correction to cell reselection when HCS is not used and MBMS PL is indicated	6.7.0
12/2005	RP-29	RP-050788	0150		Structure and use of TMGI for MBMS notification	6.8.0
03/2006	RP-31	RP-060188	0151	2	Effect of partial roaming restrictions on cell reselection and proposed performance enhancement	6.9.0
	RP-31	RP-060090	0152	1	Corrected UE behaviour at LR reject	6.9.0
	RP-31	RP-060090	0153		Clarification regarding Access Class and Initial Direct Transfer	6.9.0
	RP-31	RP-060098	0154		7.68 Mpcs TDD Option (Release 7)	7.0.0
12/2006	RP-34	RP-060712	0155	1	Introduction high mobility detection on RRC state change	7.1.0
06/2007	RP-36	RP-070403	0156		Introduction of HS-DSCH operation in CELL_FACH state	7.2.0
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	RP-36	RP-070407	0158		PLMN selection ping-pong control	7.2.0
	RP-36	RP-070400	0159		MBMS FDD and TDD Physical Layer Improvements	7.2.0
09/2007	RP-37	RP-070671	0160		H-RNTI selection	7.3.0
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05/2008	RP-40	RP-080403	0166	1	Correction to HCS	8.2.0
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	RP-41	RP-080701	0169	-	Correction and Clarification in HCS Reselection	8.3.0
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	RP-44	RP-090517	0202	1	Correction of Manual CSG ID selection	8.6.0
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	RP-44	RP-090517	0210	1	Addition of CSG cell reservation behaviour	8.6.0
	RP-44	RP-090519	0211	-	Correction of mobility states	8.6.0
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06/2018	RP-80					Upgrade to Rel-15, no technical change	15.0.0
2020-07	RP-88e	-	-	-	-	Upgrade to Rel-16 version without technical change	16.0.0
2022-03	RP-95e	-	-	-	-	Upgrade to Rel-17 version without technical change	17.0.0
2022-06	RP-96	RP-221629	0394	-	D	Inclusive language review	17.1.0
2024-03	RP-103	-	-	-	-	Upgrade to Rel-18 version without technical change	18.0.0

History

Document history		
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