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

TSGRP#6(99)632

Title: **Agreed CRs of category "C" (Modification) and "F" (Correction) to TS 25.304**

Source: **TSG-RAN WG2**

Agenda item: **5.2.3**

Doc #	Status-	Spec	CR	Rev	Subject	Cat	Versio	Versio
R2-99k77	agreed	25.304	001	2	Modification and editorial changes	F	3.0.0	3.1.0
R2-99j00	agreed	25.304	006		Discontinuous reception	C	3.0.0	3.1.0

3GPP TSG-RAN Meeting #6
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Document* *(R2-99k77)
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.304	**CR**	**001r2**	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #6 *list expected approval meeting # here ↑*	for approval	X	strategic		*(for SMG use only)*
	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 29 Nov 1999

Subject: Modification and editorial changes of 3G TS 25.304

Work item:

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

Improved readability, clarifications and some modifications.

Most important changes:

- Cell selection and reselection process description/figure rewritten
- Text added for Any cell re/selection and Camped on any cell
- Immediate cell evaluation only prior to RACH transmission
- RAT Priority list removed from release 99.
- High/low priority cells concept removed
- TDD neighbours treated as inter-frequency cells to be consistent with the measurement concept used in connected mode
- Text about DRX updated. PICH Monitoring Occasion replaced by Page Indicator, as in 25.211.

Clauses affected: Chapter 1-8

Other specs affected:

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

Other comments:

25.331, section 8.5.7.3.7, should be updated according to the changes in the DRX chapter of 25.304. Such changes are proposed in the Ericsson CR 018 on 25.331 “Corrections and editorial changes”, R2-99e67.

1. Scope

~~The present document shall describe~~This document shall specify the overall idle mode process for the UE and the functional division between the non-access stratum and access stratum in the UE. The non-access stratum part is specified in 3G TS 23.022: "Functions related to MS in idle mode and group receive mode" and the access stratum part in this document. The UE is in idle mode when there is no RRC connection. ~~of the UE is closed on all layers, e.g. there is neither an MM connection nor an RRC connection.~~ In idle mode the UE is identified by non-access stratum identities such as IMSI, TMSI and P-TMSI. In addition, the UTRAN has no own information about the individual idle mode UEs, and can only address e.g. all UEs in a cell or all UEs monitoring a specific paging occasion.

This document applies to UEs that support at least UTRA and possibly also other radio access ~~system~~technologies, for instance GSM.

In addition to the specification of the idle mode process, there is a specification of the cell selection and reselection procedures applicable to UEs in connected mode in some cases, which are specified in 3G TS 25.331: "RRC Protocol Specification".

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

Support for radio access technology priority list is not included in Release 99.

2. References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an TS shall also be taken to refer to later versions published as an EN with the same number.

[1] ~~ETSI~~ GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode"
[2] 3G~~PP~~ TS 25.301: "Radio Interface Protocol Architecture"
[3] 3G~~PP~~ TS 25.303: "UE Functions and Inter-Layer Procedures in Connected Mode"
[4] 3G~~PP~~ TS 25.331: "RRC Protocol Specification"
[5] 3G~~PP~~ TS 23.022: "Functions related to MS in idle mode and group receive mode"
[6] 3G TR 25.922, "Radio Resource Management Strategies"
[7] 3G TS 25.211, "Physical channels and mapping of transport channels onto physical channels (FDD)"
[8] 3G TS 25.221, "Physical channels and mapping of transport channels onto physical channels (TDD)"

3. Definitions, abbreviations and symbols

3.1 Definitions

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

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

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

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

~~**DRX** — Discontinuous Reception.~~

DRX cycle — The individual time interval between monitoring Paging Occasion for a specific UE.

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

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

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

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

LSA ID — Localised Service Area Identity.

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

LSA preferential access cell — A LSA preferential access cell is a cell which is part of the LSA. UEs of users that have subscribed to a LSA of a LSA-preferential-access cell have higher priority to resources than non-LSA users in the same cell. The availability of LSA preferential access cells impact the radio resource allocation (controlled by UTRAN-Access Stratum). This function is out of the scope of the standards.~~following procedure(s):~~

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

Maximum DRX cycle — The time interval for the longest possible DRX cycle in a cell.

Paging Block Periodicity (PBP)	The period of the occurrence of Paging Blocks. (For FDD, PBP = 1).
Paging Message Receiving Occasion	The frame where the UE receives actual paging message.
Paging occasion	FDD: The frame where the UE monitors the PICH.~~in FDD or~~ TDD: T~~t~~he paging block, which consists of several frames. ~~, for TDD. For Paging Blocks, t~~The value of Paging Occasion is equal to the first frame of the Paging Block.
~~**PICH Monitoring Occasion**~~	~~The time instance where the UE monitors PICH within Paging Occasion.~~
Radio Access Mode	Radio access m~~M~~ode of the cell, FDD or TDD.
Radio Access ~~System~~Technology	The type of ~~system~~technology used for radio access, for instance UTRA or GSM. ~~UMTS, GSM etc.~~
Registered PLMN (RPLMN)	This is the PLMN on which the UE has performed a location registration successfully.
Registration Area	A (NAS) registration area is an area in which the UE may roam without a need to perform location registration, which is a NAS procedure.
Selected PLMN	This is the PLMN that has been selected by the non-access stratum, either manually or automatically.
Suitable Cell	This is a cell on which an UE may camp. It ~~must~~ shall satisfy certain conditions, see 4.3~~.~~ ~~*[Note: These certain conditions are FFS.]*~~
Visited PLMN of home country	This is a PLMN, different from the home PLMN, where the MCC part of the PLMN identity is the same as the MCC of the IMSI.

3.2 Abbreviations

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

~~3.3Symbols~~

4. General description of Idle mode

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

4.1 Overview

When a multi-~~mode~~ RAT UE is switched on, it attempts to make contact with a public land mobile network (PLMN) using a certain radio access ~~system~~technology.

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

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

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

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

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

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

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

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

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

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 messages

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

The idle mode tasks can be subdivided into three processes:

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

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

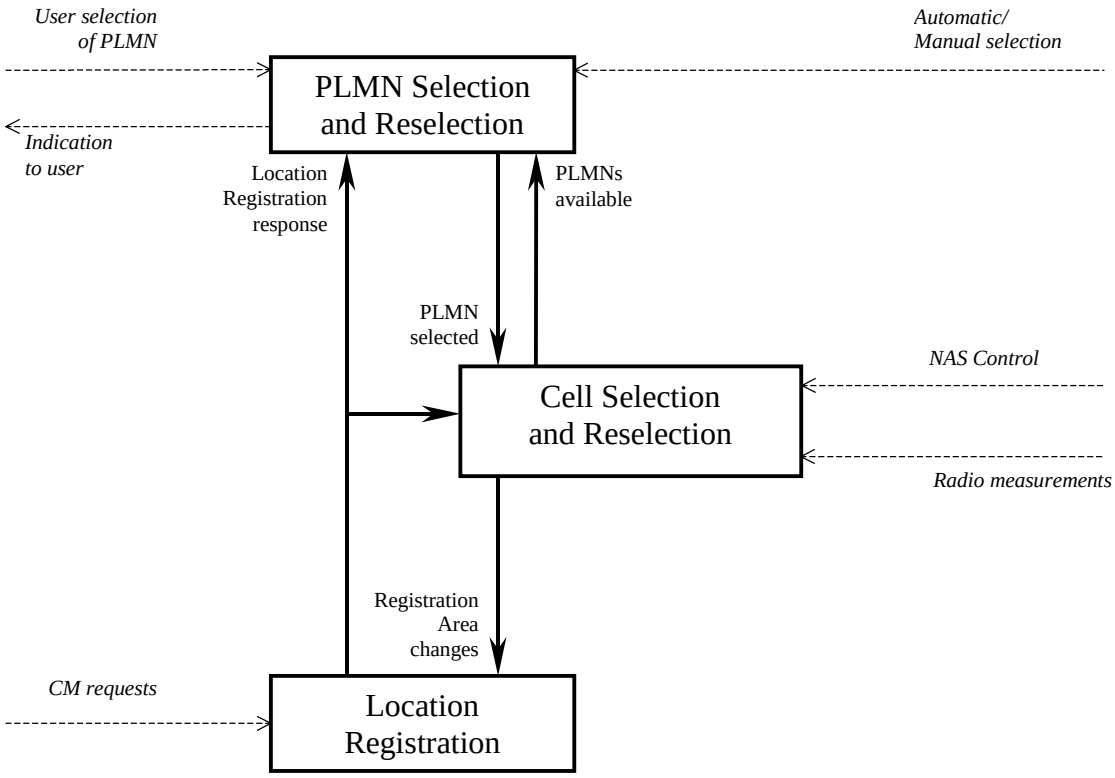

Figure 1. Overall Idle Mode process.

[Note: The ~~prioritization of radio access systems and the~~ impact of NAS defined service areas is FFS.]

4.2 Functional division between AS and NAS in Idle mode

Idle Mode Process	**UE Non-Access Stratum**	**UE Access Stratum**
PLMN Selection and Reselection	Maintain a list of PLMNs in priority order. Request AS to select a cell either belonging to the PLMN having the highest priority (in automatic mode) or belonging to the manually selected PLMN. In automatic mode, if a PLMN with higher priority is found, request AS to select a cell belonging to that	Report available PLMNs to NAS on request from NAS or autonomously.

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

Table 1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in idle mode. The non-access stratum part is specified in 3G TS 23.022: "Functions related to MS in idle mode and group receive mode" and the access stratum part in this document. ~~The primary purpose of this functional division is to serve as a basis for the work division between 3GPP TSG RAN WG2 and other groups.~~ Examples of different idle mode procedures are presented in chapter **Error! Reference source not found.**.

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

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

4.3 Service type in Idle mode

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

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

- Limited service (e~~E~~mergency calls)
- Normal service~~s~~ (for public use)
- Operator related services (for operators only)

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

acceptable cell:

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

~~• the cell may or may not belong to the allowable PLMN list stored on the USIM~~
~~• 1. the path loss between the UE and the radio site is below a threshold which is set by the operator~~The cell selection criteria are fulfilled, see 5.2.2.1.
~~• 2. t~~The cell is not reserved for operator use only

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.

1. The cell is part of the selected PLMN.
2. The cell is not barred [details are FFS].
3. The cell is not part of a forbidden registration area [details are FFS].
4. The cell selection criteria are fulfilled, see 5.2.2.1.
5. The SoLSA criteria are fulfilled [FFS].
6. The cell is not an operator-only cell, unless the UE has those access rights.

~~high priority suitable cell:~~

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

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

~~low priority suitable cell:~~

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

barred cell:

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

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

Whether or not the cell is barred, is ~~provided by the network on the BCCH~~indicated in the system information.

"operator –only" cell:

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

Whether or not the cell is reserved for operator use only, is indicated in the system information~~provided by the network on the BCCH~~.

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

Service level	A~~a~~cceptable cell	Suitable cell	~~High priority suitable cell~~	~~low priority suitable cell~~	B~~b~~arred cell	Operator-only cell
~~Emergency~~Limited service	Y	Y	~~Y~~	~~Y~~	Y	N
~~Standard~~Normal service	N	Y	~~Y~~	~~Y (backup)~~	N	N
Operator related services	N	Y	~~Y~~	~~Y~~	N	Y

Table 2. Summary of service levels provided by UTRAN.

5. Process descriptions

5.1 PLMN selection and reselection

In the UE, the access stratum shall report available PLMNs to the non-access stratum on request from the non-access stratum or autonomously.

The non-access part of the PLMN selection and reselection process is specified in 3G TS 23.022: “Functions related to MS in idle mode and group receive mode”.

5.2 Cell selection and reselection in idle mode

5.2.1 General

As stated in chapter 1, this document applies to UEs that support at least UTRA and possibly also other radio access technologies, for instance GSM. The following subsections specify the details for idle mode cell selection and reselection.

- The general part for all radio access technologies, currently UTRA and GSM, this subsection.
- UTRA radio access technologies, see subsection 5.2.2.
- GSM radio access technologies, see subsection 5.2.3.

As an example, consider a UE supporting both UTRA and GSM radio access technologies. It shall follow the specification in this subsection at all times, the specification in 5.2.2 while in UTRA and 5.2.3 while in GSM radio access ~~system~~technology (in addition to the GSM specifications).
~~This subsection gives an overall introduction to cell selection and reselection procedures in idle mode, independent of radio access system used.~~

~~Subsection describes further details of idle mode cell selection and reselection in UTRA.~~
~~Subsection describes further details of idle mode cell selection and reselection in GSM.~~

The UE shall select~~s the most~~a suitable cell and the radio access mode based on idle mode measurements and cell selection criteria. The non-access stratum can control the cell selection, for instance in terms of a list of forbidden registration area(s~~), a list of radio access technologies in priority order~~ and a list of NAS defined service area(s) in priority order. ~~In addition, NAS may also influence to the radio access system into which the cell should belong. For instance, NAS may create a list of radio access systems in priority order. *[FFS]*~~

When camped on a cell, the UE shall regularly search~~es~~ for a better cell according to the cell reselection criteria. If a ~~more suitable~~better cell is found, that cell is selected.

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

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

- Receive system information from the PLMN
  - Receive registration area information from the PLMN, e.g., location area and routing area, and,
  - Identify the NAS defined service area(s) to which the serving cell belongs
  - Receive ~~O~~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.

~~The following figure~~ Figure 2 shows the states and procedures in the cell selection and reselection process.

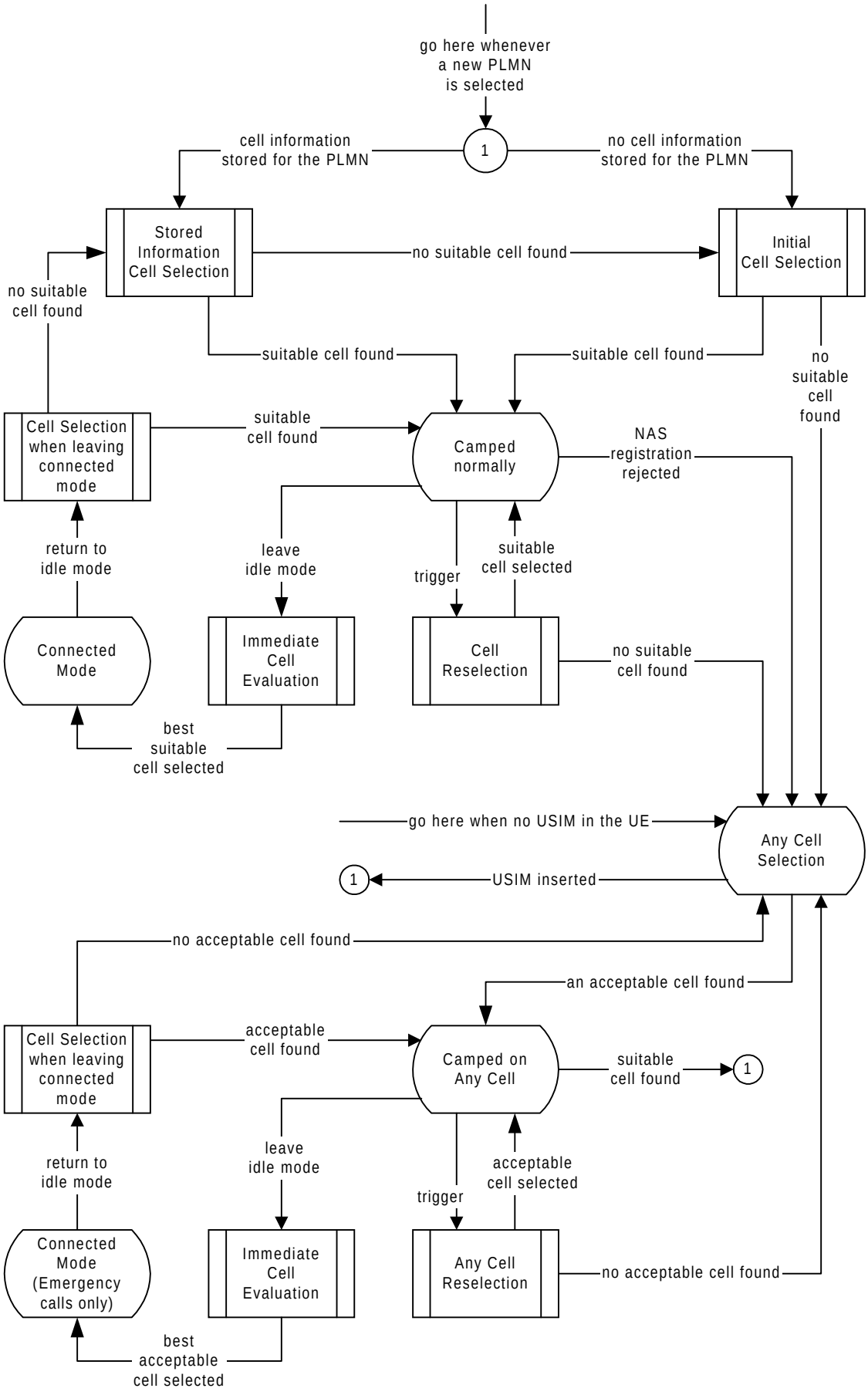

Figure 2. Idle Mode Cell Selection and Reselection. In any state, a new PLMN selection causes an exit to number 1.

Whenever a PLMN has been selected, the UE shall ~~start~~ attempt to find a suitable cell to camp on using one of the two procedures, *Initial cell selection* or *Stored information cell selection*. The *Initial cell selection* procedure requires no knowledge about the selected PLMN, but the *Stored information cell selection* procedure requires information about the selected PLMN previously stored. This information makes the search for a suitable cell faster. The non-access stratum may control the cell selection by for example, maintaining lists of forbidden registration areas~~, a list of radio access technologies in priority order~~ and a list of NAS defined service areas in priority order. ~~The RASRAT priority list contains all radio access technologies supported by the UE in priority order.~~

In the *Initial cell selection* procedure~~, the UE shall use the list of radio access technologies in priority order, if provided by the non-access stratum. The UE shall select the highest prioritised radio access systemtechnology according to the list. . If no suitable cell is found, the UE shall select the second highest prioritised radio access systemtechnology, and so on. If no list of prioritised radio access technologies is available (operator option, [FFS])~~, the UE shall select~~ion of~~ one radio access ~~system~~technology and search for a suitable cell. ~~is a UE implementation issue, for instance all supported radio access may havebased on equal prioritisationy.~~If no suitable cell is found, the UE shall select another radio access technology and search for a suitable cell, and so on. In the *Stored information cell selection* procedure, the UE may use stored information about the selected PLMN. The information may contain information from several radio access technologies.

When a suitable cell has been found, the UE shall perform necessary NAS registration procedures. When the UE has registered successfully (assuming a service that requires registration), the UE shall camp on the cell, state *Camped normally*. In this state, the UE shall monitor paging information, monitor system information and perform radio measurements. The measurements shall be used in evaluation of the cell selection, immediate cell evaluation (UTRA only) and reselection criteria. The network controls what the UE shall measure by sending measurement control information in the system information. The measurement control information may contain intra-frequency, inter-frequency and inter-radio-access ~~system~~ technology measurements.

When a cell reselection is triggered, the UE shall evaluate the cell reselection criteria based on radio measurements, and if a better cell is found that cell is selected, procedure *Cell reselection*. The change of cell may imply a change of radio access ~~system~~technology.

When UE leaves idle mode, state *Camped normally*, in order to enter connected mode, state *Connected mode*, the UE shall use the *Immediate cell evaluation* procedure (UTRA only) in order to select the best cell on the current frequency for the access attempt. This procedure allows the UE to reduce power consumption spent on radio measurements, still enabling the UE to select the best cell for access, thus minimising the interference in the system. If no suitable cell is found, the UE shall use the *Cell reselection* procedure. 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, state *Camped normally*. If no suitable cell is found, the *Stored information cell selection* procedure shall be used.

If no suitable cell is found, the UE shall attempt to find an acceptable cell of any PLMN, state *Any cell selection*. This state is also entered if a non-access stratum registration procedure is rejected, see 3G TS 23.022: “Functions related to MS in idle mode and group receive mode”, or if there is no USIM in the UE. If an acceptable cell is found, the UE shall camp on this cell and obtain limited service, state *Camped on any cell*. In this state, the UE shall behave as specified for state *Camped normally*, but typically with a different PLMN. Additionally, the UE shall regularly attempt to find a suitable cell using stored information, ~~and the RASRAT priority list. If no list of prioritised radio access technologies is available (operator option, [FFS]), the UE shall selection of radio access systemtechnology is a UE implementation issuebased on equal prioritisation. This includes~~ trying all radio access technologies that are supported by the UE. If a suitable cell is found, the PLMN is reselected which causes an exit to number 1.

When a cell reselection is triggered, the UE shall evaluate the cell reselection criteria based on radio measurements, and if a better cell is found that cell is selected, procedure *Any cell reselection*. The change of cell may imply a change of radio access ~~system~~technology.

When UE leaves idle mode, state *Camped on any cell*, in order to make an emergency call in connected mode, state *Connected mode (emergency calls only)*, the UE shall use the *Immediate cell evaluation* procedure (UTRA only) in order to select the best cell on the current frequency for the access attempt. If no suitable cell is found, the UE shall use the *Any cell reselection* procedure. 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, state *Camped on any cell*.

If no acceptable cell is found, the UE shall continue to search for an acceptable cell of any PLMN in state *Any cell selection*. ~~The UE may use stored information and the RASRAT priority list in order to find an acceptable cell. If no list of prioritised~~

~~radio access technologies is available (operator option, [FFS]), the UE shall selection of radio access systemtechnology is a UE implementation issuebased on equal prioritisation. This includes~~ trying all radio access technologies that are supported by the UE.

~~If the non-access stratum have provided a list of radio access systems [FFS], the UE shall select the highest prioritised radio access system according to the list. If no list of prioritised radio access systems is available (operator option, [FFS]), the selection of radio access system is a UE implementation issue and all supported radio access systems should have equal priority. If UE fails to find a cell of the selected PLMN in the highest prioritised radio access system, the UE shall select the second highest prioritised radio access system, and so on. If no cell belonging to the selected PLMN is found, a new PLMN may be selected, or, if no new PLMN selection is made, UE shall select a cell of any PLMN, where only limited service can be obtained (state Camped on Any Cell).~~

~~The cell selection can be performed either using information stored in the UE from previous network accesses (Stored Information Cell Selection), or by performing Initial Cell Selection.~~

~~While camped on a cell of the selected PLMN (state *Camped Normally*), measurements on neighbouring cells are performed regularly and evaluated in the Cell Reselection procedure. If a better cell is found (according to the cell reselection criteria), the UE shall select that cell. Depending on network parameter settings, cell reselection might lead to a change of radio access system. If no suitable cell is found, the Initial Cell Selection procedure is initiated.~~

~~When UE leaves idle mode in order to enter connected mode, the UE shall use the Immediate Cell Evaluation procedure in order to select the best cell among the cells on the same frequency for the access attempt. The Immediate Cell Evaluation procedure shall also be used in some other situations in idle mode, as described in section . If UE fails to select a new cell, Initial Cell Selection shall be initiated.~~

~~When UE returns from Connected Mode to idle mode, UE shall select one cell of the current radio access system to camp on (state Camped Normally). When camped on a cell, measurements on neighbouring cells are performed regularly and evaluated in the Cell Reselection procedure. Depending on network parameter settings, cell reselection might lead to a change of radio access system.~~

~~If UE fails to select any cell when returning from Connected Mode, Stored Information Cell Selection shall be initiated. If no suitable cell is found in any of the selected PLMNs and any of the radio access systems, or if there is no USIM in the UE, the UE shall select a cell belonging to any PLMN on which it may camp so that emergency calls can be made (procedure Any Cell Selection). This state is also entered if non-access stratum registration procedure (e.g., Location Registration) is rejected.~~

~~If an acceptable cell is found, the UE camps on this cell (state Camped on Any Cell). While camped on any cell, measurements on neighbouring cells are performed regularly and evaluated in the Any Cell Reselection procedure. If a better cell is found (according to the Cell Reselection criteria), the UE shall select that cell. If no suitable cell is found, the UE shall attempt to find another cell using the Any Cell Selection procedure.~~

~~While camped on any cell, UE shall also regularly search for any other radio access system that is supported by the UE, but not supported by the current PLMN (procedure Any System Reselection).~~

~~If, while camped on any cell, an emergency call origination is made, the UE shall use the Immediate Cell Evaluation procedure in order to select the best cell among the cells on the same frequency for the access attempt. This procedure allows the UE to reduce power consumption spent on neighbouring cell measurements in idle mode, still enabling the UE to select the optimal cell, from a radio interference point of view, for the access. The Immediate Cell Evaluation procedure shall also be used in some other situations, as described for UTRA. If UE fails to select a new cell, Any Cell Selection shall be initiated.~~

~~Note: Immediate Cell Evaluation is not defined as a separate cell selection and reselection procedure in GSM.~~

~~When UE returns from Connected Mode (Emergency calls only) to idle mode, UE shall select one cell of the current radio access system to camp on (state Camped on Any Cell). If UE fails to select any cell, Any Cell Selection procedure shall be initiated.~~

Note that the ~~‘~~PLMN selection and reselection~~’~~ process may select a new PLMN at any time in idle mode, which in Figure 2 ~~implies a new cell selection (1).~~causes an exit to number 1.

5.2.2 UTRA Radio access ~~system~~technology

5.2.2.1 Cell Selection Procedures

5.2.2.1.1 Description

~~The purpose of the cell selection procedure is to find the most suitable cell for the UE to camp on. A suitable cell must fulfil all the following requirements.~~

~~1.The cell is part of the selected PLMN.~~
~~2.The cell is not barred [details are FFS].~~
~~3.The cell is not part of a forbidden registration area [details are FFS].~~
~~4.The cell selection criteria are fulfilled (see below).~~
Whenever a PLMN is selected, the UE shall attempt to find ~~the most~~a suitable cell of that PLMN to camp on according to the following steps.

1. Create a candidate list of potential cells to camp on. Two searching procedures are possible ~~for searching the most suitable cell~~.

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 band to find a suitable cell. On each carrier, the UE searches first for the scrambling code of the strongest cell, in order to find out which PLMNs are available. If the ~~PLMN that NAS requested to search for~~selected PLMN is found, the search of the rest of carriers ~~shall~~ may be stopped. After the UE has found one suitable cell for the selected PLMN, the UE shall create a candidate list consisting of this cell and its neighbouring cells, as received in measurement control information via the selected cell.

b) Stored Information Cell Selection

This procedure requires stored information of carrier frequencies and ~~potentially~~ optionally also scrambling codes information from previously received measurement control information elements~~. The scrambling code information should not, however, be requirement to camp on the selected PLMN.~~. After the UE has found one suitable cell for a selected PLMN the UE shall create the candidate list consisting of this cell and its neighbouring cells, as received in measurement control information via the selected cell.

[Note: Setting the priorities of PLMN search and selection are FFS]

~~2.Read the following information from the system information of each cell of the candidate list.~~

~~• Cell Barred [details are FFS]~~

~~• Registration area~~

~~• Cell selection parameters~~

~~3.~~2. For each cell on the candidate list ~~not barred or forbidden,~~ fulfilling all criteria for a suitable cell, see 4.3, except the cell selection criteria, calculate the cell selection value, S, and the quality value, Q, defined ~~below~~ in 5.2.2.1.2.

~~4.~~3. Among the cells with S > 0 choose the cell with the highest Q value to camp on.

If no suitable cells are found and the stored information cell selection procedure was used in step 1, the Initial cell selection procedure ~~is~~ shall be started and the steps are repeated. If the UE is unable to find any suitable cell using the Initial cell selection procedure, it shall attempt~~s~~ to camp on any acceptable cell and enter~~s "limited service state".~~ the Camped on any cell state, where it can only obtain limited service.

[Note: In PLMN selection, automatic mode, this would normally result in a new PLMN selection.]

5.2.2.1.2 Criteria

The cell selection value, S, is defined as follows.

$$S = Q - Qmin - Pcompensation$$

S	Cell Selection value, (dB)
Q	Quality value. The quality of the received signal, (dB or dBm) [Note: Exact unit is FFS]
Qmin	Minimum required quality level in the cell (read in system information and dependent on the quantity to measure), (dB or 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)

~~The selection of values for network controlled parameters can be optimised by means of different methods. Examples of methods are described in 25.922.~~

The cell selection criterion is fulfilled if:

$$S > 0$$

5.2.2.2 Immediate Cell Evaluation Procedure

[Note: Conditions on the use of the immediate cell evaluation procedure are FFS. Specifically, the time needed to perform the procedure is to be considered.]

5.2.2.2.1 Description

The Immediate Cell Evaluation procedure is used by the UE to perform a quick evaluation of the quality of the ~~neighbouring~~ intra-frequency ~~UTRA~~ cells. Based on this information, the UE ~~selects~~ shall select the best cell among the cells on the same frequency, according to the criteria defined in the next section ~~**Error! Reference source not found.**~~.

The immediate cell evaluation shall be triggered prior to RACH transmission.
~~The purpose of the immediate cell evaluation is to quickly find the best cell.~~

~~Triggers of immediate cell evaluation are:~~

~~1)Prior to RACH transmission~~

~~2)S ≤ 0~~

~~3)Downlink signalling failure [details are FFS]~~

~~4)Cell has become barred or forbidden [details are FFS]~~

The following steps ~~are~~ shall be carried out when an immediate cell evaluation has been triggered.

1. The candidate list of potential cells to camp on consists of the cells in the current registration area listed for intra-frequency measurements in system information of the serving ~~UTRA~~ cell.
2. Calculate the Q value and the S value for each cell on the candidate list.

~~3.Calculate the S value for the best cell.~~

~~4.~~3. Select the neighbouring cell ~~if the criteria defined below are fulfilled~~that fulfils the criteria in 5.2.2.2.2 best.

~~5.If the criteria are not fulfilled, check the S value for the next best cell until the criteria defined below are fulfilled.~~

[Note: Whether the calculation of the Q value should require the immediate decoding (e.g. in case the UL load value is used for the calculation) of a set of neighbouring cell BCHs is FFS.]

5.2.2.2.2 Criteria

The UE shall ~~perform cell reselection~~select a new cell if the following criteria are fulfilled.

$$S_n > 0$$

$$Q_n > Q_s + Qoffset_{s,n}$$

S_n	Cell Selection value of the neighbouring cell, (dB)
Q_n	Quality of the neighbouring cell, (dB or dBm) *[Note: Exact unit is FFS]*
Q_s	Quality of the serving cell, (dB or dBm) *[Note: Exact unit is FFS]*
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB).

~~The selection of values for network controlled parameters can be optimised by means of different methods. Examples of methods are described in 25.922.~~

If more than one neighbouring cell fulfils the criteria, the UE shall choose the cell where the difference between Q_n and (Q_s + Qoffset) is highest. If no neighbouring cell fulfils the criteria, the UE shall keep the serving cell.

~~if the immediate cell evaluation was triggered prior to a RACH transmission otherwise a new initial cell selection shall take place.~~

~~If Immediate Cell Evaluation is triggered before entering connected mode, also the following criteria must be fulfilled when selecting a neighbouring cell:~~

~~1.If the reason for entering connected mode is to respond to a page, the UE shall not select a neighbouring cell that belongs to another CN domain registration area (e.g. Location Area) than the current cell.~~

~~2.If the reason for entering connected mode is a UE originating connection setup attempt, the UE shall not select a neighbouring cell that belongs to another CN registration area (e.g. Location Area) than the current cell.~~

~~3.If the reason for entering connected mode is a UE internal non-access stratum request to perform a CN registration (e.g. Location Registration), and a better neighbouring cell belonging to another CN registration area is found, the UE shall not select this cell for connected mode.~~

5.2.2.3 Camped Normally

When camped normally ~~on a UTRA cell~~, the UE shall perform the following tasks:

- Monitor PICH and PCH of the cell as specified in section 8 according to information sent in system information.
- Monitor relevant System Information ~~blocks on BCCH as specified in section 6.1~~.
- ~~Monitor immediate cell evaluation and cell reselection trigger criteria and trigger cell reselection when needed.~~Prior to RACH transmission, the UE shall perform an immediate cell evaluation, according to 5.2.2.2.

5.2.2.4 Cell Reselection Procedure

5.2.2.4.1 Description

The purpose of the cell reselection is to ~~regularly~~ look for ~~the best~~a better cell for the UE to camp on. The serving cell is changed when a better cell is found. The ~~criterion for a better cell is~~criteria for a better cell are different for intra/inter-frequency and inter-~~-~~radio-~~-~~access-~~-~~system cell reselections (see below).

The cell reselection procedure shall be triggered in the following cases.

1) Better cell is found
2) $S \leq 0$
3) Downlink signalling failure [details are FFS]
4) Cell has become barred or forbidden [details are FFS]

In case 2), 3) and 4) the parameters Qhyst and Treselection shall not be considered in the criteria.

The following steps are carried out when evaluating cells for cell reselection.

1. The candidate list of potential cells to camp on consists of the cells for intra- and inter-frequency measurements and intra-radio access ~~system~~technology measurements in system information of the serving cell.
2. Intra- and inter frequency cells : Calculate the Q value ~~for each cell~~ and the S value for each ~~current UTRA mode~~ cell ~~in~~ on the candidate list.
   Inter-radio-access ~~system~~technology cells : When $Q_s \leq$ Qsearch, calculate the Q value of each cell on the candidate list.
3. Depending on which ~~type of cells are~~type of cells is on the candidate list (intra-frequency, inter-frequency and inter-radio-~~-~~access ~~system~~technology), select the cell that fulfils the corresponding criteria best.

Better cells are prioritised in the following order when several cells fulfil their corresponding criteria:

1) Intra-frequency neighbouring cells, see 5.2.2.4.2.
2) Inter-frequency neighbouring cells, see 5.2.2.4.3.
3) Inter-radio-~~-~~access-~~ system~~technology neighbouring cells, see 5.2.2.4.4.

5.2.2.4.2 Intra-Frequency Cell Reselection Criteria

The criteria for a better intra-frequency cell are:

$$S_n > 0$$

$$Q_n > Q_s + Qoffset_{s,n} + Qhyst_s$$

S_n	Cell Selection value of the neighbouring cell, (dB)
Q_n	Quality of the neighbouring cell, (dB or dBm) *[Note: Exact unit is FFS]*
Q_s	Quality of the serving cell, (dB or dBm) *[Note: Exact unit is FFS]*
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB)
$Qhyst_s$	Hysteresis value of the serving cell, (dB)
$Treselection_s$	Time-to-trigger for cell reselection, (s) *[Note: Exact unit is FFS]*

~~The timer Treselection puts a time-to-trigger criteria for cell reselection. The timer shall be started when the cell reselection criteria is fulfilled. At timer expiry, t~~The UE shall reselect the new cell, if the cell reselection criteria are ~~still~~ fulfilled during a time interval Treselection. ~~The timer is reset if the cell reselection criteria are no longer fulfilled.~~ The value of ~~the~~ Treselection is ~~presented~~ broadcast in system information.

5.2.2.4.3 Inter-Frequency Cell Reselection Criteria

The inter-frequency cell reselection evaluation uses the same criteria as intra-frequency cell reselections.

5.2.2.4.4 Inter-Radio-Access- SystemTechnology Cell Reselection Criteria

~~Measurements on another radio access system and UTRA mode are not carried out unless the quality in the current UTRA mode is lower than a threshold, Qsearch. The quality of the target cell in the other radio access system and UTRA mode has to exceed a threshold, Qaccept, before a reselection takes place. The following quantities are defined for interradio access system cell reselection evaluations:~~The criteria for a better inter-radio-access-~~system~~technology cell are:

$$Q_s < Qsearch_s$$

$$Q_n > Qaccept_{s,n}$$

~~Qaccept Minimum quality required for a cell in the new system.~~

Q_s Quality of the serving cell, (dB or dBm) *[Note: Exact unit is FFS]*

Q_n Quality of the neighbouring cell, (dB or dBm) *[Note: Exact unit is FFS]*

$Qsearch_s$ Below this limit in the serving ~~UTRA~~ cell, the UE shall take measurements of inter-radio-access-~~system~~technology ~~and inter UTRA mode~~ cells if such entries exist in the measurement control information elements. (dB or dBm) *[Note: Exact unit is FFS]*

$Qaccept_{s,n}$ Minimum quality required for a cell in another radio access ~~system~~technology. (dB or dBm) *[Note: Exact unit is FFS]*

Measurements on another radio access ~~system~~technology are not carried out unless the quality of the serving cell is lower than a threshold, Qsearch.

The UE shall ~~consider~~ select an inter-radio-access-~~system~~technology ~~and inter UTRA mode~~ cell~~s~~ that fulfils the criteria ~~with a quality~~ $Q_n > Qaccept_{s,n}$~~, for reselection~~. If more than one cell fulfils the criteria, ~~T~~the UE shall select the cell with the highest quality Q.

Qaccept and Qsearch are included in the system information of the serving cell.

If ~~the present quality is below Qsearch but~~ no cells of the other ~~systems~~radio access technologies ~~reach the Qaccept quality~~fulfil the criteria, the UE shall stay on the current cell and continue to perform measurements as long as $Q_s \leq Qsearch_s$. ~~, the cell reselection should not be performed. However, the measurements shall still continue.~~

~~If cells belonging to different radio access systems~~technologies ~~fulfil their respective inter-radio access system~~technology ~~Ccell Sreselection criteria, the UE shall choose the radio access system~~technology ~~with the highest priority [FFS], according to the RASRAT priority list. If no list of prioritised radio access systems~~technologies ~~is available (operator option, [FFS]), the UE shall selection of radio access system~~technology ~~is a UE implementation issuebased on equal prioritisation.~~

~~5.2.2.4.4~~5.2.2.4.5 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 3G TR 25.922, "Radio Resource Management Strategies". Cell reselection parameters are broadcast in system information as follows:

$Qoffset_{s,n}$

The offset between the two cells considered in the evaluation ($Qoffset_{s,n}$ (dB)) can be conveyed in two different ways:

Alternative 1. Offsets can be included for each neighbouring cell in the intra-frequency neighbouring cell list, which is read

in system information of the serving cell.

Alternative 2. The offset can be broadcast in each cell, and the UE decodes it from system information broadcasts in the neighbouring cell. In the case, this offset is applied for all cell relations towards that neighbouring cell (i.e. for each value on the subscript s). Decoding is done only when the cell measurement exceeds the neighbour cell decoding range. The offset is broadcast together with an offset expiration timer, which indicates how long the offset value is valid.

[Note: Whether both 1 and 2 could be used or if only one of these alternatives is used is FFS]

$Qhyst_s$

The hysteresis value (Qhyst) is read in system information of the serving cell.

$Treselection_s$

The cell reselection timer value is read in system information of the serving cell.

Decoding range

The decoding range is read in system information of the serving cell.

[Note:This parameter is only applicable for Alternative 2, see above.]

OffsetExp

The offset expiration timer is read in system information of the neighbouring cell.

[Note:This parameter is only applicable for Alternative 2, see above.]

$Qaccept_{s,n}$

Minimum quality required for selecting a cell in other radio access ~~system~~technology. The value is read in system information of the serving cell.

$Qsearch_s$

Below this limit in the serving UTRA cell, the UE shall take measurements of inter-radio access ~~system~~technology cells. The value is read in system information of the serving cell.

5.2.2.5 ~~Connected Mode~~ Cell Selection ~~for Idle Mode~~when leaving connected mode

When returning to i~~I~~dle m~~M~~ode from c~~C~~onnected m~~M~~ode, the UE shall select ~~the best~~a suitable cell to camp on. ~~, according to the cell selection criteria.~~ Candidate cells for this selection are the cell(s) used immediately before leaving connected mode~~. If UE fails to camp on any of the candidate cells, Stored Information Cell Selection shall be initiated.~~. 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.

5.2.2.6 Any Cell Selection

In this state, the UE shall attempt to find an acceptable cell to camp on~~. The UE may use stored information and the RASRAT priority list in order to find an acceptable cell. If no list of prioritised radio access systemstechnologies is available (operator option, [FFS]), the UE shall selection of radio access systemtechnology is a UE implementation issuebased on equal prioritisation. This includes~~ trying all radio access ~~systems~~technologies that are supported by the UE.

If no acceptable cell is found, the UE shall continue to search for an acceptable cell in this state.

5.2.2.7 Camped on Any Cell

If an acceptable cell is found, the UE shall camp on this cell and obtain limited service, state Camped on any cell. In this state, the UE shall behave as specified for state Camped normally, but typically with a different PLMN. Additionally, the

UE shall regularly attempt to find a suitable cell ~~using stored information and the RASRAT priority list. If no list of prioritised radio access systemstechnologies is available (operator option, [FFS]), the UE shall selection of radio access systemtechnology is a UE implementation issue based on equal prioritisation. This includes~~ trying all radio access ~~systems~~technologies that are supported by the UE. If a suitable cell is found, this causes an exit to number 1 in Figure 2.

5.2.2.8 Any Cell Reselection

The Any cell reselection procedure is identical to the cell reselection procedure. However, the requirement of selecting a suitable cell is relaxed to selecting an acceptable cell.

~~5.2.2.6~~5.2.2.9 ODMA probing sub-process

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

~~5.2.2.6.1~~5.2.2.9.1 ODMA probing state machines

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

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

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

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

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

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

The probing activity levels for given state machines are illustrated in **Error! Reference source not found.** for a system with an ORACH for M slots per N × 16 multiframe.

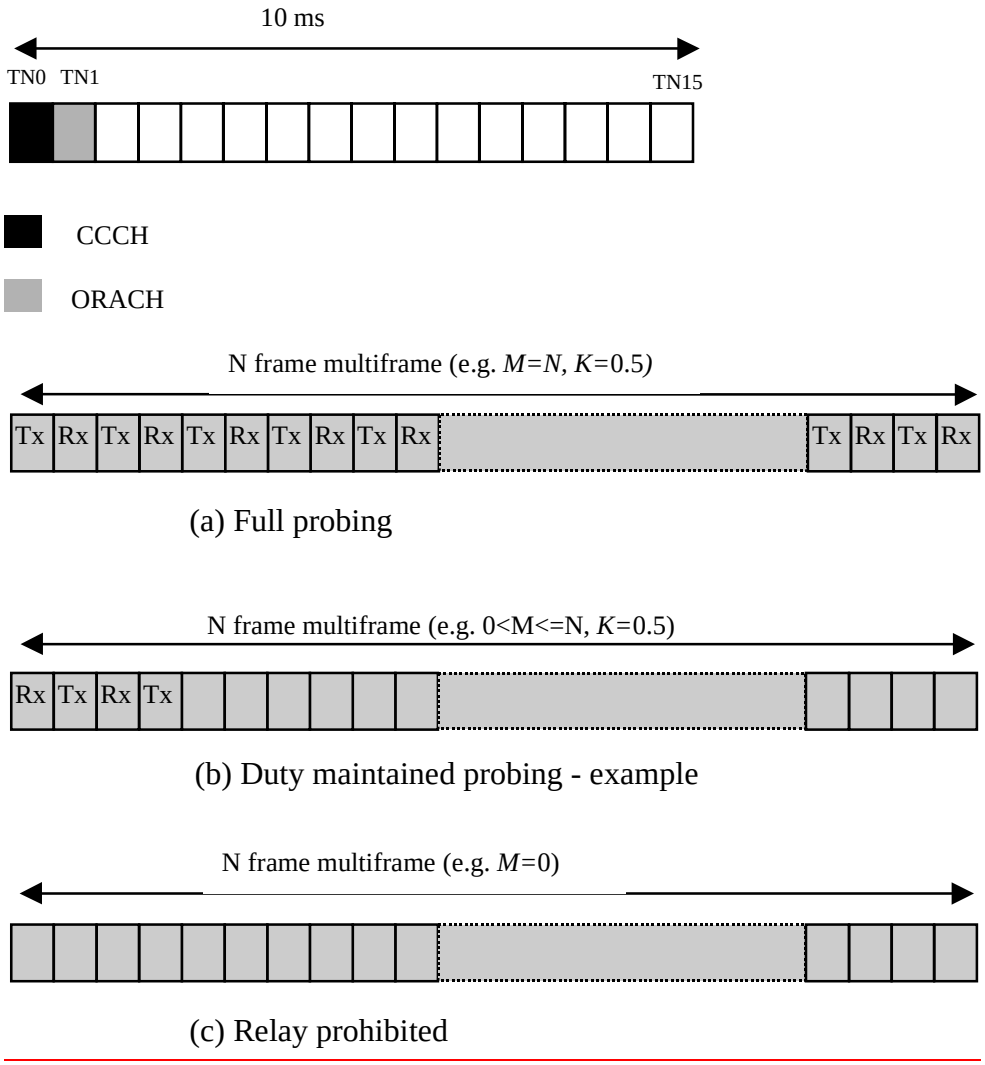

Figure 3. Probing state machines and mechanism.

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

A practical illustration of these probing state machines within the ODMA system is shown in Figure 4**Error! Reference source not found.**.

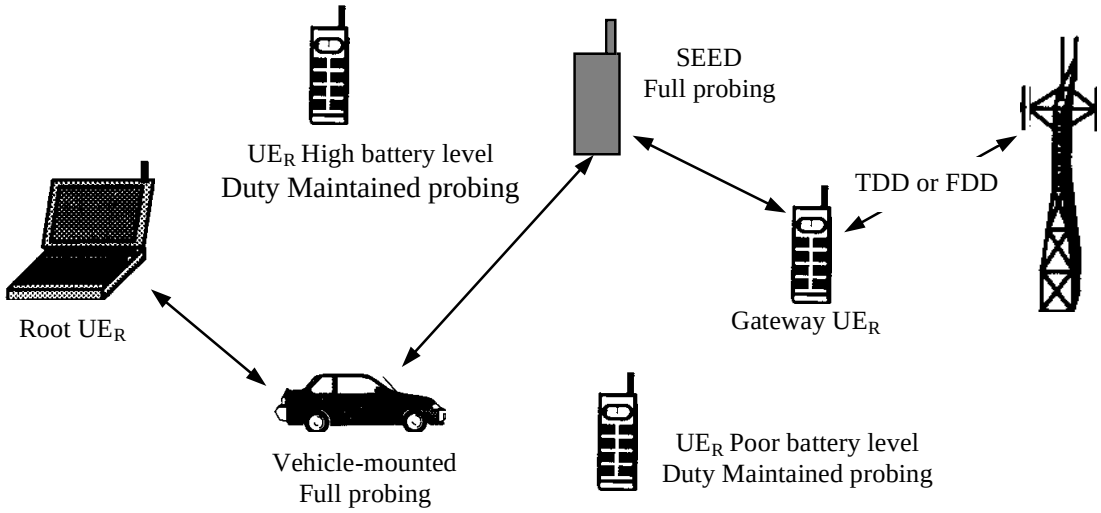

Figure 4. Illustration of probing process assignment.

~~5.2.2.7Cell 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 25.922. Cell reselection parameters are broadcast in system information as follows:~~

~~**Qoffset$_{s,n}$**~~

~~The offset between the two cells considered in the evaluation (Qoffset$_{s,n}$ (dB)) can be conveyed in two different ways:~~

~~Alternative 1. Offsets can be included for each neighbouring cell in the intra frequency neighbouring cell list, which is decoded from system information broadcasts in the serving cell.~~

~~Alternative 2. The offset can be broadcast in each cell, and the UE decodes it from system information broadcasts in the neighbouring cell. In the case, this offset is applied for all cell relations towards that neighbouring cell (i.e. for each value on the subscript s). Decoding is done only when the cell measurement exceeds the neighbour cell decoding range. The offset is broadcast together with an offset expiration timer, which indicates how long the offset value is valid.~~

~~*[Note: Whether both 1 and 2 could be used or if only one of these alternatives is used is FFS]*~~

~~**Qhyst**~~

~~The hysteresis value (Qhyst (dB)) is decoded from system information broadcasts in the serving cell.~~

~~**Treselection**~~

~~The cell reselection timer value is decoded from system information broadcasts in the serving cell.~~

~~**Decoding range**~~

~~The decoding range is decoded from system information broadcasts in the serving cell.~~

~~*[Note:This parameter is only applicable for Alternative 2, see above.]*~~

~~**OffsetExp**~~

~~The offset expiration timer decoded from system information broadcasts in the neighbouring cell.~~

~~*[Note:This parameter is only applicable for Alternative 2, see above.]*~~

~~**Qaccept**~~

~~Minimum quality required for selecting a cell in other radio acess system.~~

~~**Qsearch**~~

~~Below this limit in the serving UTRAcell, the UE shall take measurements of inter radio access system and inter UTRA mode cells.~~

5.2.3 GSM Radio access ~~system~~technology

5.2.3.1 Cell Selection Procedures

The ~~C~~cell selection procedures in GSM are~~is~~ specified in ~~[TS 03.22]~~GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".

5.2.3.2 Immediate Cell Evaluation Procedure

Immediate Cell Evaluation procedure is not applicable for GSM.

5.2.3.3 Cell Reselection Procedure

5.2.3.3.1 Description

The cell reselection procedure in GSM is specified in GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".
~~The purpose of the cell reselection is to regularly look for the best cell for the UE to camp on. The serving cell is changed when a better cell is found.~~
~~When cells belonging to different radio sccess systems fulfil their respective cell reselection criteria, GSM cells are preferred prior to cells belonging to other radio access systems.~~

5.2.3.3.2 ~~GSM~~ Cell Reselection ~~Procedure and~~ Criteria

The ~~C~~cell reselection ~~procedure and~~ criteria in GSM ~~are specified~~are specified in GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode"~~[TS 03.22]~~.

5.2.3.3.3 ~~Inter Radio Access System Cell Reselection Procedure~~Inter-Radio-Access-~~System~~Technology Cell Reselection Criteria

The criteria for a better UTRA cell are:

$$Q_s < Qsearch_s$$

$$Q_n > Qaccept_{s,n}$$

Q_s Quality of the serving cell, (dB or dBm) *[Note: Exact unit is FFS]*

Q_n Quality of the neighbouring cell, (dB or dBm) *[Note: Exact unit is FFS]*

$Qsearch_s$ Below this limit in the serving cell, the UE shall take measurements of UTRA cells if such entries exist in the measurement control information elements. (dB or dBm) *[Note: Exact unit is FFS]*

$Qaccept_{s,n}$ Minimum quality required for a UTRA cell. (dB or dBm) *[Note: Exact unit is FFS]*

Measurements on UTRA cells are not carried out unless the quality of the serving cell is lower than a threshold, Qsearch.

The UE shall select a UTRA cell that fulfils the criteria $Q_n > Qaccept_{s,n}$. If more than one cell fulfils the criteria, the UE shall select the cell with the highest quality Q.

Qaccept and Qsearch are included in the system information of the serving cell.

If no cells of the other ~~systems~~technologies fulfil the criteria, the UE shall stay on the current cell and continue to perform measurements as long as $Q_s < Qsearch_s$.

~~When camped on a GSM cell, measurements on cells of other radio access system are not carried out unless the quality in the GSM cell is lower than a threshold, Qsearch. The quality of the target non-GSM cell has to exceed a threshold, Qaccept, before a reselection takes place. The following quantities are defined for inter-radio access system cell reselection evaluations:~~

~~Qaccept — Minimum quality required for a cell in the new system.~~

~~Qsearch — Below this limit in the serving GSM cell, the UE shall take measurements of inter-radio access system cells if such entries exist in the measurement control information elements.~~

~~The UE shall consider non-GSM cells with a quality Q > Qaccept, for reselection. The UE shall select the cell with the highest quality Q. Qaccept and Qsearch are included in the system information of the serving GSM cell.~~

~~If the present quality is below Qsearch but no cells of other radio access systems reach the Qaccept quality, the cell reselection shall not be performed. However, the measurements shall still continue.~~

~~If cells belonging to different non-GSM radio access systems fulfil their respective inter-radio access system Cell Selection criteria, the UE shall choose the radio access system with the highest priority [FFS].~~

~~5.2.3.3.3~~5.2.3.3.4 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 3G TR 25.922, "Radio Resource Management Strategies". Inter-radio access ~~system~~technology cell reselection parameters are broadcast in GSM system information as follows:

$Qsearch_s$
When the Q value of the serving GSM cell is below this value, the UE shall perform measurements of UTRA cells.

$Qaccept_{s,n}$
Minimum quality of the UTRA cell required for selecting the UTRA cell.

5.2.3.4 ~~Connected Mode~~ Cell Selection ~~for Idle Mode~~when leaving connected mode

Cell selection when ~~returning from~~leaving connected mode ~~to idle mode~~ in GSM is specified in ~~[TS 03.22]~~GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".

5.2.3.5 Any Cell Selection

The any cell selection state in GSM is specified in GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".

5.2.3.6 Camped on Any Cell

The camped on any cell state in GSM is specified in GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".

5.2.3.7 Any Cell Reselection

The any cell reselection procedure in GSM is specified in GSM TS 03.22, "Functions related to Mobile Station in idle mode and group receive mode".

~~5.2.3.5Cell 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 25.922. Inter radio access system cell reselection parameters are broadcast in GSM system information as follows:~~

~~**Qaccept**~~
~~Minimum quality required for selecting a cell in other radio access system.~~

~~**Qsearch**~~
~~Below this limit in the serving GSM cell, the UE shall take measurements of inter radio access system and inter UTRA mode cells.~~

5.2.4 Barred Cells and Access Control

FFS

5.2.5 Regional Provision of Service

FFS

5.3 Location Registration

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

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

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

~~Prior to power off, the non-access stratum will deregister the UE, if necessary.~~
In the UE, the access stratum shall report registration area information to the non-access stratum.

The non-access part of the location registration process is specified in 3G TS 23.022: "Functions related to MS in idle mode and group receive mode".

~~7.~~

~~7.~~

~~7.~~6. Broadcast information receiving

6.1 Reception of System Information

The UE shall read the BCCH to acquire valid system information. For each acquisition, the UE will need different combinations of system information blocks broadcast on BCCH. Thus, the scheduling of the broadcast channel is done in such way that the UE knows exactly when the needed information can be found.

When any of the system information blocks are modified, the corresponding scheduling information is updated to reflect the changes in system information transmitted on BCCH. Further, a message is sent to all UEs on PCCH to indicate that a new master information block is available in the cell. Then the UE shall read the updated master information block on BCCH and if the changes are applicable for the UE, the modified system information block(s) are read as well.

6.2 Cell Broadcast

7. Idle mode measurements

8. Discontinuous Reception

The UE may use Discontinuous Reception (DRX) in idle mode in order to reduce ~~save~~ power consumption. When DRX is used the UE needs only to monitor ~~at~~ one Page~~ing~~ Indicator, PI, (see definition in 3G TS 25.211, "Physical channels and mapping of transport channels onto physical channels (FDD)"~~,~~ and 3G TS 25.221, "Physical channels and mapping of transport channels onto physical channels (TDD")).~~PICH Monitoring Occasion~~ in one ~~the~~ Paging Occasion per DRX cycle.

The DRX cycle length shall be 2^k * PBP frames, where k is an integer and PBP is the Paging Block Periodicity. PBP is only applicable for TDD. For FDD, PBP=1.

The UE may be attached to different CN domains with different DRX cycle lengths. In this case, the UE shall use the shortest of those DRX cycle lengths. The DRX cycle lengths to use for each CN domain are given in system information~~broadcast in UTRAN cells~~. An UE may also be assigned an individual DRX cycle length to use in idle mode by a CN.

The DRX cycle lengths to use for UTRAN connected mode is also given in system information. An UE may also be assigned an individual DRX cycle length to use by UTRAN.

The UE shall use the IMSI, the Cell System Frame Number (SFN), Np (number of pag~~ing~~e indicators~~PICH paging occasions~~ within a frame), Frame offset (For FDD, Frame offset = 0), PBP and the DRX cycle length to determine the Paging Occasions.

The Paging Occasions are ~~is~~ the frames where ~~number~~:

Cell SFN = {(IMSI mod M) 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 and~~.~~ M is a constant = 10 000 000 used to simplify the calculations ~~(FFS). M will depend on the coding used for IMSI. M must be significantly greater than the maximum possible DRX cycle length*Np.~~.

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

The Page~~ing~~ Indicator ~~PI~~ to use ~~PICH Monitoring Occasion~~ is calculated by using the following formula:

PI ~~PICH Monitoring Occasion~~ = DRX Index mod Np

where **DRX Index = {(IMSI mod M) div (DRX Cycle Length div PBP)}**

The number of Page~~in~~ Indicators per frame, Np = (18, 36,72, 144), is given in IE "Number of PI per frame", part of system information ~~The value of Np can be calculated by PICH repetition cycle(1,2,4,8)~~ in FDD mode ~~(Np = 144/PICH repetition cycle)~~. In TDD mode, Np is calculated by PICH repetition cycle and Burst Type (long or short midamble).

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

For FDD, see 3G TS 25.211, "Physical channels and mapping of transport channels onto physical channels (FDD)" 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, ~~T~~the Paging Message Receiving Occasion is calculated using the following formula:

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

The value N_{PICH} is the number of frames for PICH transmission ~~(For FDD, N_{PICH} = 0)~~. 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 ~~(for FDD, N_{PCH} = 1)~~.

3GPP TSG-RAN Meeting #6
Nice, France, 13-15 December 1999

Document* *(R2-99j00)
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.304	**CR**	**006**	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN#6	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** Nov. 29. 1999

Subject: Discontinuous reception

Work item:

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

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: This contribution proposes to remove “M” in the description in section 8 “Discontinuous reception” since it does not appear in the interface.

Clauses affected: 8

Other specs affected:

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

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

8 Discontinuous Reception

The UE may use Discontinuous Reception (DRX) in idle mode in order to save power consumption. When DRX is used the UE needs only to monitor at one PICH Monitoring Occasion in the Paging Occasion per DRX cycle.
The DRX cycle length shall be 2^k *PBP frames, where k is an integer and PBP is the Paging Block Periodicity.
The UE may be attached to different CN domains with different DRX cycle lengths. In this case, the UE shall use the shortest of those DRX cycle lengths. The DRX cycle lengths for each CN domain are broadcast in UTRAN cells. An UE may also be assigned an individual DRX cycle length by a CN.
The UE shall use the IMSI, the Cell System Frame Number, Np (number of PICH paging occasions within a frame), Frame offset (For FDD, Frame offset = 0), PBP and the DRX cycle length to determine the Paging Occasions.
The Paging Occasions is the frame number:

Cell SFN = {~~(~~IMSI ~~mod M)~~ 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.

~~M is a constant used to simplify the calculations (FFS). M will depend on the coding used for IMSI. M must be significantly greater than the maximum possible DRX cycle length*Np.~~
The actual Paging Indicator within Paging Occasion that the UE shall read is similarly determined based on IMSI.
The PICH Monitoring Occasion is calculated by using the following formula:

PICH Monitoring Occasion = DRX Index mod Np

where DRX Index = {~~(~~IMSI ~~mod M)~~ div (DRX cycle length div PBP)}

The value of Np can be calculated by PICH repetition cycle(1,2,4,8) in FDD mode (Np = 144/PICH repetition cycle). In TDD mode, Np is calculated by PICH repetition cycle and Burst Type(long or short midamble).
The Paging Message Receiving Occasion is calculated using the following formula:

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

The value N_{PICH} is the number of frames for PICH transmission (For FDD, N_{PICH} = 0). 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 (for FDD, N_{PCH} = 1).