TSG-RAN Meeting #8 *RP-000217*
Düsseldorf, Germany, 21 – 23 June 2000

Title: **Agreed CRs to TS 25.304**

Source: **TSG-RAN WG2**

Agenda item: **5.2.3**

Doc-1st-	Status-	Spec	CR	Rev	Subject	Cat	Version	Versio
R2-000766	agreed	25.304	025		Triggering of inter-system measurements for cell re-selection when HCS is used	F	3.2.0	3.3.0
R2-001272	agreed	25.304	026	5	Cell re-selection	F	3.2.0	3.3.0
R2-001149	agreed	25.304	027	4	Access Control	F	3.2.0	3.3.0
R2-000804	agreed	25.304	028		Downlink signalling failure	F	3.2.0	3.3.0
R2-000805	agreed	25.304	029		Cell-reselection parameter signalling	C	3.2.0	3.3.0
R2-000850	agreed	25.304	030		Cell Selection and Reselection	C	3.2.0	3.3.0
R2-000883	agreed	25.304	031	1	CN DRX cycle coefficient	F	3.2.0	3.3.0

3GPP RAN WG 2 Meeting #12
Seoul, Korea, 10 – 13 Apr. 2000

Document R2-000766

CHANGE REQUEST

25.304	CR	025	Current Version:	3.2.0

For submission to: TSG-RAN #8 — for approval [X] / for information [ ] — strategic [ ] / non-strategic [ ])

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 6th Apr. 2000

Subject: Triggering of inter-system measurements for cell re-selection when HCS is used

Work item:

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

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

Release:

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

Reason for change:

In the current specification, it is stated that If S_S <= $S_{SearchRATm}$, the UE shall measure on all RATm neighbouring cells. However, the correct rule should state that if S_S <= $S_{HCS,RATm}$, the UE shall measure on all RATm neighbouring cells.

Clauses affected: 5.2.2.4.3

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:

5.2.2.4.3 Measurements for cell re-selection when HCS is used

If hierarchical cell structures are used in the network, the following rules for intra- and inter-frequency measurements, depending on the quality of serving cell S_S, applies:

1. If $S_S > S_{intraserch}$ UE need not perform intra-frequency measurements.
2. If $S_S > S_{interserch}$, UE need not perform inter-frequency measurements
3. If $Ssearch_{HCS} < S_S <= S_{intraserch}$, UE shall measure on all intra-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.
4. If $Ssearch_{HCS} < S_S <= S_{interserch}$, UE shall measure on all inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.
5. If $S_S <= Ssearch_{HCS}$, UE shall measure on all intra- and inter-frequency neighbouring cells of the serving cell.
6. If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall measure intra- and inter-frequency neighbouring cells, which have equal or lower HCS priority than serving cell. Furthermore, UE shall prioritise re-selection of intra- and inter-frequency neighbouring cells on lower HCS priority level before neighbouring cells on same HCS priority level.

   When the number of cell reselections during time period T_{CRmax} no longer exceeds N_{CR}, UE shall continue these measurements during time period $T_{CrmaxHyst}$. Then, UE shall revert to measure all intra- and inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.

If hierarchical cell structures are used in the network, the following rules for inter-RAT measurements, depending on the quality of serving cell S_S, applies:

1. If $S_S > S_{SearchRATm}$, UE need not measure on RATm neighbouring cells.
2. If $S_{HCS,RATm} < S_S <= S_{Search,RATm}$, UE shall measure on RATm neighbouring cells according to the following rules:

   - If the number of cell reselections during time period T_{CRmax} does not exceed N_{CR}, the UE shall measure RATm neighbouring cells, which have an equal or higher HCS priority than the serving cell.
   - If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. . In this high-mobility state, UE shall measure RATm neighbouring cells, which have an equal or lower HCS priority than the serving cell. Furthermore, UE shall prioritise re-selection of RATm neighbouring cells on lower HCS priority level before RATm neighbouring cells on same HCS priority level.

     When the number of cell reselections during time interval T_{CRmax} no longer exceeds N_{CR}, UE shall continue these measurements during time period $T_{CrmaxHyst}$. Then, UE shall revert to measure all intra- and inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.

3. If $S_S <= S_{\sout{search}HCS,RATm}$, UE shall measure on all RATm neighbouring cells.

3GPP RAN WG2#12
Oahu, HI, USA, 22-26 May 2000

Document R2-001272
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	026r5	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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:** 2000-04-11

Subject: Cell re-selection

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:

RSCP introduced as a measure for cell re-selection according to reasoning shown in R2-000800.

Cell selection criteria S divided into Squal (based on Ec/N0) and Srxlev (RSCP). Squal>0 and Srxlev>0 required for a suitable cell.

Qmin renamed to Qqualmin
New parameter Qrxlevmin introduced in Srxlev criteria.

UE measurement rules aligned with Squal and Srxlev criteria and clarified with pseudo code.

Clarification of Cell selection and Immediate cell re-selection procedures.

Removal of Network control of UE measurement activities in chapter 7 since, this is already covered in section 5.2

Measurement quantity to be used at FDD to GSM cell re-selection clarified.

Note added on how to align parameter settings for UTRA to GSM and GSM to UTRA cell re-selection.

List of parameters sent on system information for GSM to UTRA cell re-selection removed.

The UE measurement rules in section 5.2.2.4.3 are corrected.

One new search threshold is also introduced since the addition of one extra S criterion changed the usage of the $S_{HCS,RATm}$ threshold.

The descriptions of threshold parameters are also corrected to correspond their current purposes.

Clauses affected:	5.2.1, 5.2.2, 5.2.3, 5.3, 7		
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:	The following documents has been merged and included in this CR. R2-000878 CR 022r1 to 25.304 on Editorial modification (NTT DoCoMo) R2-000879 CR 032 to 25.304 on Mapping function for cell (re)selection (Siemens) R2-000764 CR 023 to 25.304 on Removal of RSCP/ISCP measurement quantity (Nokia)		

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5.2 Cell selection and reselection in idle mode

5.2.1 General

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

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

As an example, consider a UE supporting both UTRA and GSM radio access technologies. It shall follow the specification in this subclause at all times, the specification in 5.2.2 while in UTRA and 5.2.3 while in GSM radio access technology (in addition to the GSM specifications).

Different types of measurements are used in different radio access technologies and modes for the cell selection and reselection. Whenever a direct comparison of these measurements is required, mapping functions will be applied that are defined in [4].The use of the mapping functions is defined in subclause 7.1. Measured values are marked with the index 'meas', whereas the index 'map' is used whenever mapping functions have been applied onto a measured value.

The UE shall select 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) and a list of NAS defined service area(s) in priority order.

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 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 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.

Figure 2 shows the states and procedures in the cell selection and reselection process.

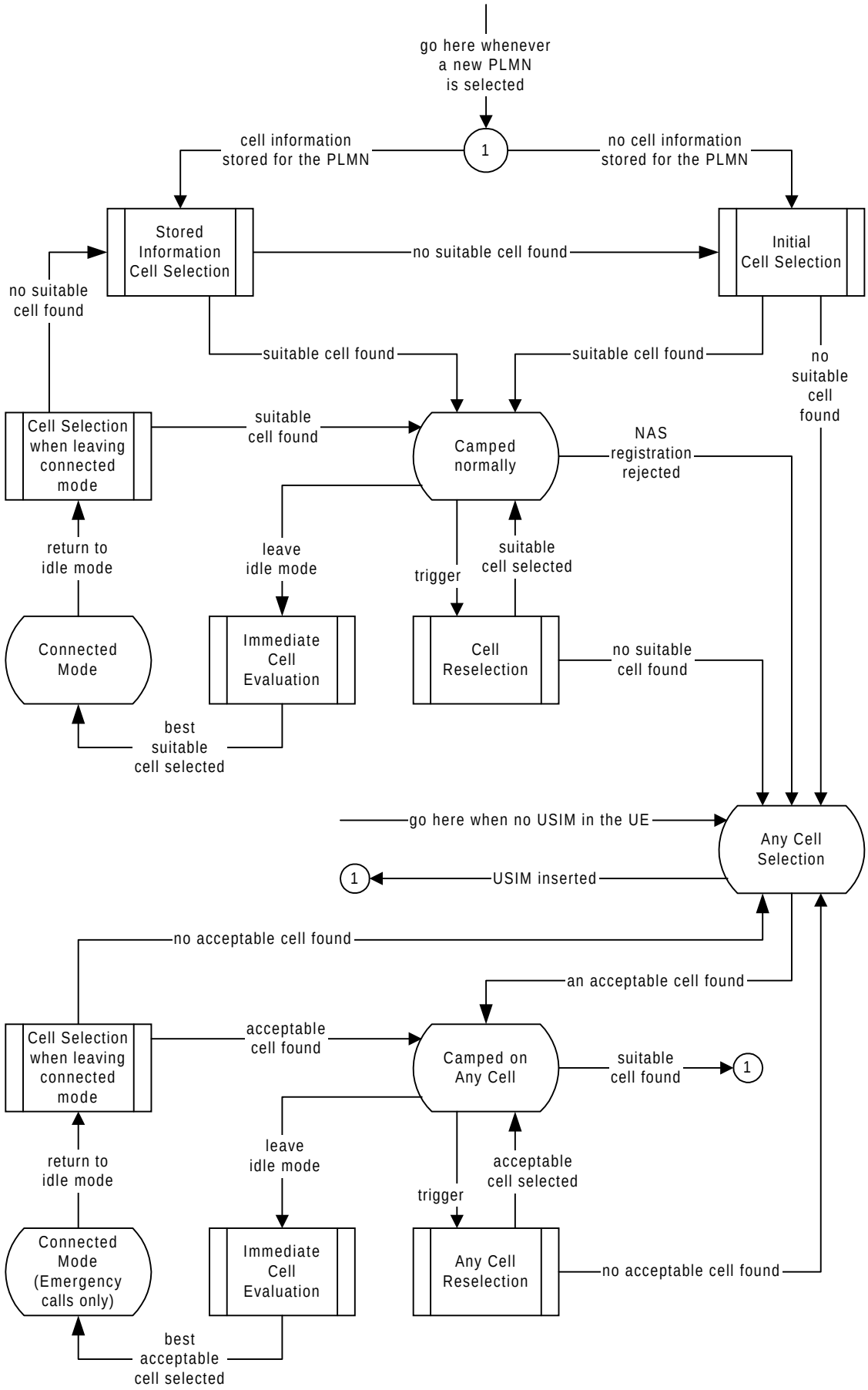


Figure 2: Idle Mode Cell Selection and Reselection
In any state, a new PLMN selection causes an exit to number 1

Whenever a PLMN has been selected, the UE shall 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 and a list of NAS defined service areas in priority order.

In the *Initial cell selection* procedure), the UE shall select one radio access technology and search for a suitable cell. 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- 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 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 [5], 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, 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 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*. trying all radio access technologies that are supported by the UE.

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

5.2.2 UTRA Radio access technology

5.2.2.1 Cell Selection Procedures

5.2.2.1.1 Description

Whenever a PLMN is selected, the UE shall attempt to find 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.

   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 strongest cell and reads its system information, in order to find out which PLMNs are available. If the selected PLMN is found, the search of the rest of carriers 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 optionally also information on cell parameters, e.g. scrambling codes, from previously received measurement control information elements. 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) For each cell on the candidate list, measure the quality value, $Q_{meas,LEV}$ (see 5.2.2.1.2).

~~2~~3) For each cell on the candidate list calculate the cell selection value, Squal and Srxlev~~S~~, ~~and the quality value, Q_{meas},~~ defined in subclause 5.2.2.1.2.

4) Rank the cells and select the best cell as follows;

- For FDD cells, select CPICH Rx Ec/N0 or RSCP used for evaluation of $Q_{meas,LEV}$ in the formula in section 5.2.2.2.2 based on Cell selection and reselection quality measure in system information.

- If mapping information is provided in system information, mapping function is used in the UE and uses the formula in section 5.2.2.2.2 for cell ranking rank. Select the best cell.

- If no mapping information is provided in system information, UE shall use Qmap = Qmeas_LEV in the formula in section 5.2.2.2.2 (=implicit mapping) and use it for cell ranking. Select the best cell.

~~3) Rank the cells with S>0 from the highest Q_{meas} value.~~

~~4~~5) Select the cell that fulfils the criteria in 5.2.2.2.2 best. Check if the selected cell ~~with the highest Q_{meas} value~~ fulfils all requirements for a suitable cell. If so, choose this cell to camp on. If this cell does not fulfil all requirements for a suitable cell, this cell and all cells on the same frequency shall be removed as candidates for cell selection (see also subclause 5.2.4), and step ~~4~~3 shall be repeated for the remaining cells.

If different radio access modes are involved in the procedure, specific mapping functions shall be applied. For each radio access mode, such a mapping function is defined and its parameters are broadcast in system information. The mapping function maps a certain range of measurement values Q_{meas_LEV} to a representing quality value Q_{map} that can have values between 0 and 99 (step size 1). These quality values Q_{map} can then be compared with each other and the cell with the highest Q_{map} value is chosen (among those cells with S>0).

If no suitable cell~~s~~ of selected PLMN ~~are~~ is found and the stored information cell selection procedure was used in step 1, the Initial cell selection procedure shall be started and the steps are repeated. If the UE is unable to find any suitable cell of selected PLMN using the Initial cell selection procedure, it shall attempt to camp on ~~any~~ highest ranked acceptable cell and enter 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~~criteria S are defined as follows.

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

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

~~$$S = Q - Qmin - Pcompensation$$~~

Squal	Cell Selection quality value, (dB) Not applicable for TDD cells or GSM cells.
Srxlev	Cell Selection RX level value (dB)
Cell_selection_and_reselection_quality_measure (FDD only)	Choice of measurement (CPICH Rx Ec/N0 or CPICH RSCP~~Rx SIR~~) to use as quality measure Q_{meas} (read in system information) ~~(see NOTE)~~
$Q_{qualmeas}$	Measured cell quality value. The quality of the received signal expressed in CPICH E_C/N_0 for FDD cells. Not applicable for TDD cells or GSM cells.
$Q_{~~mrxlev~~eas}$	Measured cell RX level ~~Quality~~ value. Th~~is~~e ~~is quality of the~~ received signal, ~~CPICH Rx E_c/N_0 or~~ CPICH ~~Rx SIR~~RSCP, (dB) for FDD cells, P-CCPCH RSCP for TDD cells (dBm). ~~In FDD, the measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.~~
Q_{meas_LEV}	Quality value. The quality value of the received signal expressed in CPICH E_C/N_0 or CPICH RSCP for FDD cells and P-CCPCH RSCP for TDD cells~~.~~
Qqualmin	Minimum required quality level in the cell ~~(read in system information and dependent on the quantity to measure)~~, (~~FDD:~~ dB~~, TDD: dBm~~). Not applicable for TDD cells or GSM cells.
Qrxlevmin	Minimum required RX level in the cell. (dBm)
Pcompensation	max(UE_TXPWR_MAX_RACH – P_MAX, 0)~~, (FDD: dB, TDD: dBm)~~
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)
~~NOTE:~~ ~~The work in order to support the CPICH Rx SIR measurement is in progress in TSG-RAN WG4 and may impact the use of that measurement in the present document.~~	

The cell selection criterion S is fulfilled if:

$$Squal > 0$$

$$Srxlev > 0$$

~~$$S > 0$$~~

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 intra-frequency cells. Based on this information, the UE shall select the best cell among the cells on the same frequency, according to the criteria defined in the next subclause.

The immediate cell evaluation shall be triggered prior to RACH transmission.

The following steps 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 cell.

2) For each cell on the candidate list, measure the quality value, $Q_{meas,LEV}$.

3) For each cell on the candidate list calculate the cell selection values, Squal and Srxlev defined in subclause 5.2.2.1.2.

4) Rank the cells and select the best cell as follows;

- For FDD cells, select CPICH Rx Ec/N0 or RSCP used for evaluation of $Q_{meas,LEV}$ in the formula in section 5.2.2.2.2 based on Cell_selection_and_reselection_quality_measure in system information.

- If mapping information is provided in system information, mapping function is used in the UE and uses the formula in section 5.2.2.2.2 for cell ranking rank. Select the best cell.

- If no mapping information is provided in system information, UE shall use Qmap = Qmeas_LEV in the formula in section 5.2.2.2.2 (=implicit mapping) and use it for cell ranking. Select the best cell..

~~2) Calculate the Q_{map} value and the S value for each cell on the candidate list.~~

5~~3~~) Select the neighbouring cell that fulfils the $Q_{map,n} > Q_{map,s} + Qoffset_{s,n}$ criteria in 5.2.2.2.2 best.
If the best cell does not fulfil all other requirements for a suitable cell, UE shall trigger cell re-selection (see also subclause 5.2.4).

NOTE: Whether the calculation of the Q_{map} 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 select a new cell if the following criteria are fulfilled.

$$Squal_n > 0$$

$$Srxlev_n > 0$$

$$Q_{map,n} > Q_{map,s} + Qoffset_{s,n}$$

$$S_n > 0$$

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

~~S_n~~	~~Cell Selection value of the neighbouring cell, (dB).~~
$Squal_n$	Cell Selection quality value of the neighbouring cell, (dB) Not applicable for TDD cells or GSM cells.
$Srxlev_n$	Cell Selection RX level value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure (FDD only)	Choice of measurement (CPICH Rx Ec/N0 or CPICH ~~Rx SIR~~RSCP) that is used to derive $Q_{map,n}$ and $Q_{map,s}$, (read in system information) ~~(see NOTE)~~.
Q_{meas_LEV}	Quality value. The quality value of the received signal expressed in CPICH E_C/N_0 or CPICH RSCP for FDD cells and P-CCPCH RSCP for TDD cells.
$Q_{map,n}$	Quality of the neighbouring cell, after mapping function is applied, derived from CPICH Rx E_C/N_0 or CPICH ~~Rx SIR~~RSCP ~~in~~ for FDD cells and from P-CCPCH RSCP ~~in~~ for TDD~~.~~ cells ~~In~~ 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.
$Q_{map,s}$	Quality of the serving cell, after mapping function is applied. ~~In~~ 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.
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information).
~~NOTE: The work in order to support the CPICH Rx SIR measurement is in progress in TSG-RAN WG4 and may impact the use of that measurement in the present document.~~	

The quality values $Q_{map,n}$ and $Q_{map,s}$ are determined by mapping functions. The parameters for these mapping functions are broadcast in system information. The mapping function maps a certain range of measurement values to a representing quality value. $Q_{map,n}$ and $Q_{map,s}$ can have values between 0 and 99 (step size 1).

If more than one neighbouring cell fulfils the criteria, the UE shall choose the cell where the difference between $Q_{map,n}$ and ($Q_{map,s}$ + Qoffset) is highest. If no neighbouring cell fulfils the criteria, the UE shall keep the serving cell.

5.2.2.3 Camped Normally

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

- monitor PICH and PCH of the cell as specified in clause 8 according to information sent in system information;
- monitor relevant System Information;
- 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 Triggers for cell re-selection

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

1) ~~better cell is found~~Time for cell re-selection evaluation;
2) Cell selection criterion S in 5.2.2.1.2 is not fulfilled~~≤ 0~~;
3) downlink signalling failure [details are FFS];
4) cell has become barred or forbidden.

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

5.2.2.4.2 Measurements for cell re-selection when HCS is not used

~~If hierarchical cell structures are not used in the network,~~ When serving cell does not belong to a hierarchical cell structure, UE shall follow these rules for intra- and inter-frequency measurements and inter-RAT measurements:~~rules for network control of UE measurement activities in subclause 7.1.~~

The UE shall use Squal for FDD cells and Srxlev for TDD and GSM cells as Sx in the following rules.

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

2. If Sx > $S_{intersearch}$, UE need not perform inter-frequency measurements
   If Sx <= $S_{intersearch}$, UE shall perform ~~intra~~inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, UE shall perform intra-frequency measurements.

3. If Sx > $Ssearch_{RAT\ nm}$, UE need not perform measurements on cells of RAT n
   If Sx <= $Ssearch_{RAT\ nm}$, UE shall perform measurements on cells of RAT n.
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, UE shall perform measurements on cells of RAT m.

5.2.2.4.3 Measurements for cell re-selection when HCS is used

~~If hierarchical cell structures are used in the network~~When serving cell belongs to a hierarchical cell structure, the UE shall follow~~ing~~ these rules for intra- and inter-frequency measurements:

~~, depending on the quality of serving cell S_S, apply:~~

1. Intra- and inter-frequency threshold-based measurement rules

The UE shall use Squal for FDD cells and Srxlev for TDD and GSM cells as Sx in the following rules.

~~IF ($Srxlev_S$ <= $Ssearch_{HCS}$) and ($Squal_S$ <= $S_{intersearch}$) THEN~~

~~<UE shall measure on all intra- and inter-frequency cells>~~

~~ELSE~~

IF ($Srxlev_S$ <= $Ssearch_{HCS}$) or ($S~~qual~~_{xs}$ <= $S_{intersearch}$) THEN

<UE shall measure on all intra- and inter-frequency cells~~, which have equal or lower HCS priority level than the serving cell~~>

ELSE

IF (S_x~~Squal$_S$~~ > $S_{intrasearch}$) THEN

<UE shall measure on all intra- and inter-frequency cells, which have higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered >

~~ENDIF~~ELSE

<UE shall measure on all intra- and inter-frequency cells, which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered >

ENDIF

ENDIF

~~ENDIF~~

~~1) If S_S > $S_{intrasearch}$, UE need not perform intra-frequency measurements.~~

~~2) If $S_S > S_{intersearch}$, UE need not perform inter-frequency measurements.~~

~~3) If $Ssearch_{HCS} < S_S <= S_{intrasearch}$, UE shall measure on all intra-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.~~

~~4) If $Ssearch_{HCS} < S_S <= S_{intersearch}$, UE shall measure on all inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.~~

~~5) If $S_S <= Ssearch_{HCS}$, UE shall measure on all intra- and inter-frequency neighbouring cells of the serving cell.~~

~~6)~~

2. Intra- and inter-frequency measurement rules for fast-moving UEs

If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall measure intra- and inter-frequency neighbouring cells, which have equal or lower HCS priority than serving cell. Furthermore, UE shall prioritise re-selection of intra- and inter-frequency neighbouring cells on lower HCS priority level before neighbouring cells on same HCS priority level.

When the number of cell reselections during time period T_{CRmax} no longer exceeds N_{CR}, UE shall continue these measurements during time period $T_{CrmaxHyst}$. Then, UE shall revert to measure according to the threshold based measurement rules.~~all intra- and inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.~~

~~If hierarchical cell structures are used in the network, the following rules for inter-RAT measurements, depending on the quality of serving cell S_S, apply:~~

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

The UE shall use Squal for FDD cells and Srxlev for TDD and GSM cells as Sx in the following rules.

~~IF ($Srxlev_S <= S_{HCS,RATm}$) and ($Squal_S <= S_{SearchRATm}$) THEN~~

~~<UE shall measure on all inter-RATm cells >~~

~~ELSE~~

IF ($Srxlev_S <= S_{HCS,RATm}$) or (S_x ~~$Squal_S$~~ <= $S_{SearchRATm}$) THEN

<UE shall measure on all inter-RATm cells~~, which have equal or lower HCS priority level than the serving cell >~~

ELSE

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

< UE need not measure inter-RATm neighbouring cells ~~UE shall measure on all inter-RATm cells, which have higher HCS priority level than the serving cell~~>

~~ENDIF~~ELSE

<UE shall measure on all inter-RATm cells, which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered >

ENDIF

ENDIF

~~ENDIF~~

~~1) If $S_S > S_{SearchRATm}$, UE need not measure on RATm neighbouring cells.~~

~~2) If $S_{HCS,RATm} < S_S <= S_{Search,RATm}$, UE shall measure on RATm neighbouring cells according to the following rules:~~

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

- ~~If the number of cell reselections during time period T_{CRmax} does not exceed N_{CR}, the UE shall measure RATm neighbouring cells, which have an equal or higher HCS priority than the serving cell.~~
- If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall measure RATm neighbouring cells, which have an equal or lower HCS priority than the serving cell. Furthermore, UE shall prioritise re-selection of RATm neighbouring cells on lower HCS priority level before RATm neighbouring cells on same HCS priority level.

  When the number of cell reselections during time interval T_{CRmax} no longer exceeds N_{CR}, UE shall continue these measurements during time period $T_{CrmaxHyst}$. Then, UE shall revert to measure according to the threshold-based measurement rules.~~all intra- and inter-frequency neighbouring cells, which have equal or higher HCS priority level than the serving cell.~~

~~3) If $S_S <= S_{search,RATm}$, UE shall measure on all RATm neighbouring cells.~~

5.2.2.4.4 Non-suitable cells ~~with S>0~~ (Squal > 0 or Srxlev > 0)

If the best cell according to cell reselection criteria specified in subclause 5.2.2.4.5~~4~~, does not fulfil all requirements for a suitable cell, that cell, together with all cells on that frequency shall be removed as candidate for cell re-selection (see also subclause 5.2.4).

5.2.2.4.5 Cell Reselection Criteria

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

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

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

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

The cell-ranking criterion R is defined by:

$$R_s = Q_{map,s} + Qhyst_s$$

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

where:

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

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

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

T_n is a timer implemented for each neighbouring cell. T_n shall be started from zero when following conditions becomes true:

$Q_{map,n} > Qhcs_n$ if $HCS\_PRIO_n <> HCS\_PRIO_s$

$Q_{map,n} > Q_{map,s} + Qoffset_{s,n}$ if $HCS\_PRIO_n = HCS\_PRIO_s$

T_n shall be stopped as soon as these conditions are no longer fulfilled.

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 criterion given above for starting timer T_n for the corresponding cell is no longer fulfilled with the parameters of the new serving cell.

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

S_n	Cell Selection value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure (FDD only)	Choice of measurement (CPICH Rx Ec/N0 or CPICH ~~Rx SIR~~RSCP) that is used to derive quality measures $Q_{map,n}$ and $Q_{map,s}$, (read in system information) ~~(see NOTE)~~.
$Q_{map,n}$	Quality of the neighbouring cell, after mapping function is applied, derived from CPICH Rx E_C/N_0 or CPICH ~~Rx SIR~~RSCP ~~in~~ for FDD cells, from P-CCPCH ~~in~~for TDD cells and from RXLEV ~~in~~for GSM cells. ~~In~~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.
$Q_{map,s}$	Quality of the serving cell, after mapping function is applied, derived from CPICH Rx E_C/N_0 or CPICH ~~Rx SIR~~RSCP ~~in~~for FDD cells, from P-CCPCH ~~in~~for TDD cells and from RXLEV ~~in~~ for GSM cells. For FDD cells, ~~T~~the measurement that is used to derive the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information).
$Qhyst_s$	Hysteresis value of the serving cell.
HCS_PRIO_s, HCS_PRIO_n	HCS priority level (0-7) for serving cell and neighbouring cells
$PENALTY\_TIME_n$	Duration for applying $TEMP\_OFFSET_n$ to H and R criteria (s)
$Qhcs_s$, $Qhcs_n$	Quality threshold level for applying prioritised hierarchical cell re-selection
$TEMP\_OFFSET_n$	Offset to H and R criteria for the duration of $PENALTY\_TIME_n$
T_{maxCR}	Duration for evaluating allowed amount of cell reselections (s).
N_{CR}	Maximum number of cell reselections
$T_{CrmaxHyst}$	Additional time period before UE reverts to low-mobility measurements (s)
$Treselection_s$	Time-to-trigger for cell reselection, (s)
~~NOTE: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may impact the use of that measurement in the present document.~~	

The quality values $Q_{map,n}$ and $Q_{map,s}$ are determined by mapping functions. The parameters for these mapping functions are broadcast in system information. The mapping function maps a certain range of measurement values to a representing quality value. $Q_{map,n}$ and $Q_{map,s}$ can have values between 0 and 99 (step size 1).

The UE shall perform a cell re-selection if a non-serving cell is evaluated to be better than the serving cell. The best cell is the cell with the highest R value and ~~S>0~~ (Squal > 0, Srxlev > 0) among

- those cells that have the highest HCS_PRIO among those cells that fulfil the criterion H >= 0. Note that this rule is not valid when UE high-mobility is detected (see subclause 5.2.2.4.3).

- all cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0. This case is also valid when ~~or~~ HCS is not applied, that is when serving cell does not belong to a hierarchical cell structure.

The UE shall reselect the new cell, if the cell reselection criteria are fulfilled during a time interval Treselection.

When serving cell is an FDD cell, and CPICH E_C/N_0 is used as cell selection and reselection quality measure for FDD cells, the UE shall perform the ranking and re-selection according to the procedure below and in the following order (FFS):

1. UE shall rank the FDD cells according to the R criteria above using the CPICH E_C/N_0 as measurement quantity. If a non-serving FDD cell is evaluated to be better than the serving FDD cell, the UE shall perform a cell re-selection to that cell.

2. If no non-serving FDD cell is evaluated to be better than the serving FDD cell, the UE shall rank TDD cells and/or Inter-RAT GSM cells according to the R criteria above. The UE shall re-select to a TDD or Inter-RAT GSM cell if the R_n value for the highest ranked TDD or Inter-RAT GSM cell exceeds the measured CPICH RSCP of the serving FDD cell and all FDD cells in the candidate list.

5.2.2.4.6 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 as follows:

$Qoffset_{s,n}$

The offset between the two cells considered in the evaluation ($Qoffset_{s,n}$) 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 1: 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.

HCS_PRIO_s, HCS_PRIO_n

HCS priority level (0-7) for serving cell and neighbouring cells are read in system information of serving cell.

$Qhcs_s$, $Qhcs_n$

Quality threshold levels for applying prioritised hierarchical cell re-selection are read in system information of serving cell.

Qqualmin

Minimum required quality level in the cell, (dB). Not applicable for TDD cells or GSM cells.

Qrxlevmin

Minimum required RX level in the cell. (dBm)

$PENALTY\_TIME_n$

Time duration for which the $TEMPORARY\_OFFSET_n$ is applied for a neighbouring cell is read in system information of serving cell.

$TEMPORARY\_OFFSET_n$

Applies an offset to the H and R criteria for a neighbouring cell for the duration of $PENALTY\_TIME_n$. The parameter is read in system information of serving cell.

T_{CRmax}

Duration for evaluating allowed amount of cell reselection(s) is read in system information of serving cell.

N_{CR}

Maximum number of cell reselections is read in system information of serving cell.

$T_{CRmaxHyst}$

Additional time period before UE reverts to low-mobility measurements is read in system information of 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 2: 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 3: This parameter is only applicable for Alternative 2, see above.

$Ssearch_{HCS}$

Below this limit in the serving cell, the UE shall initiate measurements of all neighbouring cells of the serving cell. The value is read in system information of the serving cell.

$Ssearch_{RAT\ 1}$ - $Ssearch_{RAT\ k}$

~~Below this RAT specific threshold in the serving UTRA cell, the UE shall initiate measurements of inter-radio access technology cells.~~ This RAT specific threshold in the serving cell is used in the inter-RAT measurement rules. The values are read in system information of the serving cell.

$S_{HCS,RATm}$

This RAT specific threshold in the serving cell is used in the inter-RAT measurement rules. The values are read in system information of the serving cell.

$S_{intrasearch}$

Threshold for intra frequency measurements (dB for FDD, dBm for TDD) and for the HCS measurement rules.

$S_{intersearch}$

Threshold for intra frequency measurements (dB for FDD, dBm for TDD) and for the HCS measurement rules.

$S_{limit,SearchRATm}$

Above this RAT specific threshold in the serving UTRA cell, the UE need not perform any inter-RATm measurements (dB for FDD, dBm for TDD)

Mapping Info

Mapping Info contains all the information that is necessary to define the mapping function that is used for mapping a certain range of measurement values to a representing quality value (0..99, step size 1).

5.2.3 GSM Radio access technology

5.2.3.1 Cell Selection Procedures

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

5.2.3.2 Immediate Cell Evaluation Procedure

Immediate Cell Evaluation procedure is not applicable for GSM.

5.2.3.3 Cell Reselection Procedure

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

~~5.2.3.3.1 Description~~

~~The cell reselection procedure in GSM is specified in [1].~~

~~5.2.3.3.2 Cell Reselection Criteria~~

~~The cell reselection criteria in GSM are specified in [1].~~

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

~~The criteria for a better UTRA cell are:~~

$$\frac{Q_s < Qsearch_s}{Q_n > Qaccept_{s,n}}$$

~~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 technologies fulfil the criteria, the UE shall stay on the current cell and continue to perform measurements as long as $Q_s < Qsearch_s$.~~

~~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 [6]. Inter radio access technology cell reselection parameters are broadcast in GSM system information as follows:~~

~~For support of GSM to UTRA cell reselection, the following parameters are sent in system information of a UTRA cell~~

~~**Qqualmin**~~

~~Minimum required quality level in the UTRA cell~~

~~**Qrxlevmin**~~

~~Minimum required RX level in the cell~~

~~**Qoffset**~~

~~The offset to be applied at cell reselection between serving GSM cell and neighbouring UTRA cell.~~

~~**PENALTY_TIME**~~

~~Time duration for which the TEMPORARY_OFFSET$_n$ is applied for UTRA cell~~

~~**TEMPORARY_OFFSET$_n$**~~

~~Applies a temporary offset at cell reselection from GSM to UTRA cell for the duration of PENALTY_TIME$_n$.~~

~~**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 Cell Selection when leaving connected mode

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

5.2.3.5 Any Cell Selection

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

5.2.3.6 Camped on Any Cell

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

5.2.3.7 Any Cell Reselection

The any cell reselection procedure in GSM is specified in [1].

5.3 Cell Reselection in Connected Mode

5.3.1 UTRA Radio Access Technology

5.3.1.1 General

This subclause specifies cell reselection procedures in UTRAN connected mode.

The UE shall select a suitable cell and radio access technology based on connected mode radio measurements and cell reselection criteria.

Figure 5 shows the states and procedures in the cell reselection process in connected mode.

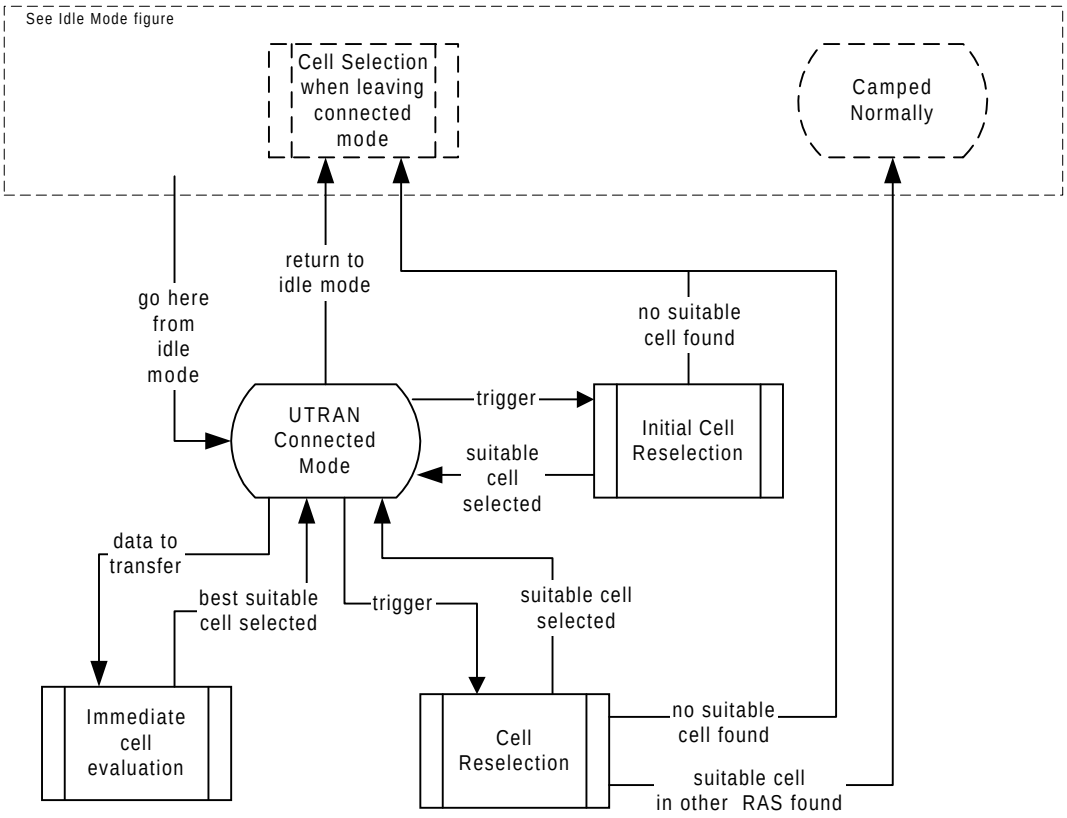


Figure 5: UTRAN Connected mode cell reselection

Transition from idle mode to connected mode is described in subclause 5.2.

For UTRAN connected mode, RRC connection mobility tasks are specified in [25.331]. In some states the UE shall perform cell reselection procedures.

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* (see subclause 5.3.1.4). If the change of cell implies a change of radio access technology, the RRC connection is released, and the UE enters idle mode. If no suitable cell is found in the cell reselection procedure, the RRC connection is released, and the UE enters idle mode.

When the UE has data to transmit, and there is no restriction for the UE to reselect cell (see [25.331]),.the UE shall use the *Immediate cell evaluation* procedure (see subclause 5.3.1.3) to select the best suitable cell prior to the access attempt, according to the immediate cell evaluation criteria. Constraints on the use of this procedure are specified in [25.331].

When an ~~immediate~~ Initial cell reselection is triggered, the UE shall use the Initial *cell reselection* procedure (see subclause 5.3.1.2) to find a suitable cell. The cases where this may be triggered are specified in [25.331]. One example

where this procedure is triggered is at radio link failure, where the UE may trigger an initial cell reselection in order to request re-establishment of the RRC connection. If the UE is unable to find a suitable cell, the UE shall release the RRC connection and enter idle mode.

5.3.1.2 Initial Cell Reselection Procedure

5.3.1.2.1 Description

Triggers for the Initial cell re-selection procedure are specified in [25.331].

When the Initial cell reselection procedure is triggered, the UE shall attempt to find a suitable cell belonging to the selected PLMN according to the following steps:

1) The UE shall scan all RF channels of the UTRA band to find a suitable cell. 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. ~~If UE, during the initial cell re-selection procedure, detects UTRA cell i, that fulfil the cell selection criteria S>0, but not all other requirements for a suitable cell, all cells on same frequency as cell i shall be removed as candidates for cell selection (see also subclause 5.2.4).~~

2) 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 UTRA cells, as received in measurement control information via the selected cell.

3) Rank the cells according to the cell reselection criteria (see 5.2.2.4.5), without considering the parameters Qhyst and Treselection.

4) Check if the highest ranked cell fulfils all requirements for a suitable cell. If so, select this cell. If this cell does not fulfil all requirements for a suitable cell, this cell and all cells on the same frequency shall be removed as candidates for cell selection (see also 5.2.4), and step 4 shall be repeated for the remaining cells.

~~3) For each cell on the candidate list fulfilling all criteria for a suitable cell, see subclause 5.2.2.1, except the cell selection criteria, calculate the cell selection value, S, and the quality value, Q_{meas}, defined in subclause 5.3.1.2.2.~~

~~4) Among the cells with S > 0 select the cell with the highest Q_{meas} value.~~

If different radio access modes are involved in the procedure, mapping functions shall be applied. For each radio access mode, such a mapping function is defined and its parameters are broadcast in system information. The mapping function maps a certain range of measurement values to a representing quality value Q_{map} that can have values between 0 and 99 (step size 1). These quality values Q_{map} can then be compared with each other and the cell with the highest Q_{map} value is chosen (among those cells with S criterion is fulfilled ~~> 0~~).

If the UE is unable to find any suitable cell, the UE shall release the RRC connection and enter idle mode.

5.3.1.2.2 Criteria

The criteria for initial cell reselection is specified in subclause 5.2.2.1.2.

5.3.1.3 Immediate Cell Evaluation Procedure

5.3.1.3.1 Description

The Immediate Cell Evaluation procedure is used by the UE to perform a quick evaluation of the quality of the intra-frequency cells. Based on this information, the UE shall select the best cell among the cells on the same frequency, according to the criteria defined in the next subclause.

The immediate cell evaluation procedure shall be triggered prior to RACH and CPCH (FFS) transmission, if not restrictions specified in [4] inhibits use of the procedure.

The immediate cell evaluation procedure in UTRA access technology Connected Mode is the same as used for idle mode, described in subclause 5.2.2.2, with the following differences:

1) The potential cells for selection at immediate cell evaluation in Connected Mode consists of the cells for intra-frequency measurements in system information of the serving cell. However, if UE dedicated measurements

control information has been assigned to the UE in the serving cell, the candidate list consists of the cells for intra- frequency measurements included in this UE dedicated measurement control information.

5.3.1.4 Cell Reselection Procedure

The cell reselection procedure in UTRA access technology Connected Mode is the same as used for idle mode, described in subclause 5.2.2.4.

7 Measurements for cell selection / reselection

7.1 Use of Mapping Functions

Different types of measurements are used in different radio access technologies and modes for the cell selection and reselection (CPICH Ec/N0 or CPICH ~~SIR~~ RSCP in UTRA FDD, P-CCPCH RSCP in UTRA TDD, RXLEV in GSM). Whenever a direct comparison of these measurements is required, mapping functions shall be applied.

Mapping functions are used for mapping a certain range of measurement values Q_{meas_LEV} (CPICH_EC/N0, CPICH_RSCP_LEV, P-CCPCH_RSCP_LEV, RXLEV) to a representing quality value Q_{map} (0..99, step size 1).

For each radio access technology and mode, one mapping function is defined. It may be defined over one or several consecutive intervals of the measurement values Q_{meas_LEV}.

The size of the consecutive intervals is sufficiently defined by their upper limit (given by parameter Upper_limit). In case of only one interval specified, the parameter Upper_limit is not needed and the interval is equivalent to the measurement range defined for that radio access technology. In case of more than one interval specified, the upper limit of the last interval defined is equivalent to the upper limit of the defined measurement range. The lower limit of an interval is equivalent to the upper limit of the interval before that interval. For the first interval, the lower limit is equivalent to the lower limit of the defined measurement range.

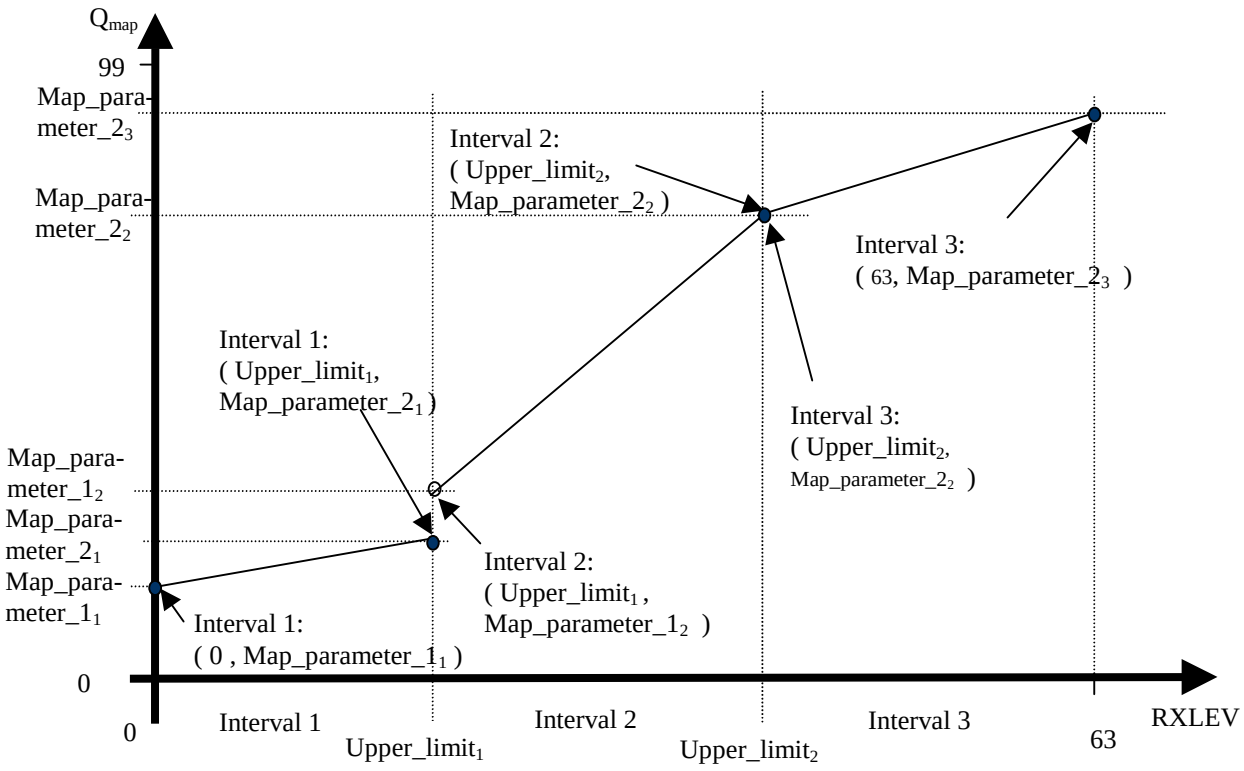
Within each interval, one function type is defined (given by parameter Function_type) and the according function is defined by two parameters Map_parameter_1 and Map_parameter_2. For release 99, only linear functions are specified: $Q_{map} = a * Q_{meas,LEV} + b$, ~~i~~If Q_{meas} is the measured value and Q_{map} is the representing quality value~~, the following relation is defined over a certain interval:~~

~~Function type:~~

~~linear: $Q_{map} = Map\_parameter\_1 * Q_{meas} + Map\_parameter\_2$.~~

Map_parameter_1 and Map_parameter_2 for an interval define the Q_{map} values that the $Q_{meas,LEV}$ values at the upper and the lower limit of this interval are mapped to, respectively. In other words, the linear function within one interval is defined by two tuples ($Q_{meas,LEV}$, Q_{map}) at the interval limits, so that the parameters a and b can be derived from this.

Accordingly, if the mapping function is steady between two consecutive intervals, Map_parameter_2 for the first interval has the same value as Map_parameter_1 for the following interval. This is illustrated in the following figure:



If no mapping functionality is needed (e.g. in FDD- or TDD-only networks), an implicit mapping is used: $Q_{map} = Q_{meas,LEV}$. This is specified as default case.

The parameters defined for each interval (Function_type, Map_parameter_1, Map_parameter_2 and Upper_limit)are broadcast in system information.

7.2 Network control of UE measurement activities

7.2.1 Intra-frequency cell measurements

The optional parameter Sintrasearch provides means for the network to control the UE Intra-frequency measurement activities in idle mode. The parameter is included in the system information of the serving cell.

Depending on the presence of the parameter, and the quality of the serving cell, S_s, the following 2 cases are possible.

1) Parameter Sintrasearch is available for serving cell:

S_s > Sintrasearch	UE need not perform Intra-frequency measurements
S_s <= Sintrasearch	UE shall perform Intra-frequency measurements

2) Parameter Sintrasearch is not available for serving cell:
UE shall perform Intra-frequency measurements.

7.2.2 Inter-frequency cell measurements

The optional parameters Sintersearch provide means for the network to control the UE Inter-frequency measurement activities in idle mode. The parameters is included in the system information of the serving cell.

Depending on the presence of the parameters, and the quality of the serving cell, S_s, the following cases are possible:

1) Parameter Sintersearch is available for serving cell:

S_s > Sintersearch	UE need not perform Inter-frequency measurements
S_s <= Sintersearch	UE shall perform Inter-frequency measurements

2) Parameter Sintersearch is not available for serving cell:
UE shall perform Inter-frequency measurements.

7.2.3 Inter-Radio Access Technology measurements

The parameter Ssearch provides means for the network to control the UE Inter-Radio Access Technology measurement activities in idle mode. The parameter is included in the system information of the serving cell.

S_s > Ssearch	UE need not perform Inter-RAT measurements
S_s <= Ssearch	UE shall perform Inter-RAT measurements

3GPP TSG RAN WG2#13
Ohahu, HI, USA, May 22-26, 2000

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e.g. for 3GPP use the format TP-99xxx
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GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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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:** 2000-05-23

Subject: Access Control

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: Text describing the Access Control mechanism when entering Connected mode is missing in 25.304 (stated as FFS). Text aligned with TS 25.331 is proposed. The present text on “barred cells” is updated in order to clarify the usage of this concept.

Clauses affected: 2, 5.2.4

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:


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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.

[1] GSM TS 03.22: "Functions related to Mobile Station in idle mode and group receive mode"

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

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

[4] 3G TS 25.331: "RRC Protocol Specification"

[5] 3G 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)"

[9] 3G TS 22.011: “Service accessibility”

***** Next modified section *****

5.2.4 ~~Barred~~ Cell ~~s and~~ Access Restrictions~~Control~~

There are two mechanisms which allow an operator to impose cell 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, see [TS 22.011], which are employed for this purpose.

5.2.4.1 ~~Barred cells~~Cell status and cell reservations

Cell status and cell reservations are indicated with the *Cell Access Restriction* Information Element in the System Information Message (cf. TS 25.331) by means of three Information Elements:

- Cell barred (IE type: “barred” or “not barred”),
- Cell Reserved for operator use (IE type: “reserved” or “not reserved”),
- Cell Reserved for SoLSA exclusive use (IE type: “reserved” or “not reserved”).

When cell status is indicated as “not barred”, “not reserved” for operator use, and “not reserved” for SoLSA,

- the UE may select/re-select this cell during the cell selection, immediate cell evaluation 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 SoLSA,

- UEs not supporting SoLSA (i.e. all UEs for Release ’99) shall behave as if cell status “barred” is indicated (see below).

When cell status is indicated as “reserved” for operator use,

- UEs assigned to an Access Class in the range 11 to 15 may select/re-select this cell if in the home PLMN.
- UEs assigned to an Access Class in the range 0 to 9 shall behave as if cell status “barred” is indicated (see below).

When cell status “barred” is indicated,

- the UE is not permitted to select/re-select this cell, except for emergency call, when no other acceptable cell can be found, and the cell is not barred for emergency call by means of the “Access Class 10 bit”, see Sec. 5.2.4.3.
- The UE shall ignore the “Cell Reserved for SoLSA exclusive use” IE.
- 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. For emergency call, the Intra-frequency cell re-selection indicator IE" shall be ignored, i.e. even if it is set to "not allowed" the UE may select another intra-frequency cell.

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

~~The barred case of cell status is used to bar completely a cell against access by all normal subscribers. This barred status is indicated in the information broadcast by the cell, in the Cell Access Restriction information element, which has 4 cases:~~

~~1. Cell not Barred,~~

~~2. Cell Barred for normal users – allows Operator access,~~

~~3. Cell Barred for normal users – allows Emergency access,~~

~~4. Cell Barred for normal users – allows SoLSA access.~~

~~Additionally, combinations of cases 2, 3, and 4 are allowed in one cell.~~

~~If UE, during the cell selection, immediate cell evaluation and cell re-selection procedures, detects UTRA cell i, that fulfil the cell selection criteria S>0, but not all other requirements for a suitable cell, all cells on same frequency as cell i shall be removed as candidates for cell selection. Specific actions performed by the UE are described for each procedure~~

~~UE shall regard that the cell barred condition of cell i is valid during time interval T_{barred}. T_{barred} is sent via system information of cell i.~~

~~NOTE: Access Control is FFS~~

~~FFS~~

5.2.4.2 Access Control

~~At subscription, one or more Access Classes are allocated to the subscriber and stored in the USIM, see [TS 22.011].~~ Information on cell access restrictions associated with the Access Classes is broadcast as system information, [TS 25.331].

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. Cell access restrictions associated with the Access Classes shall not apply when the initial access for entering Connected Mode is triggered by an Inter-RAT cell re-selection to UTRAN, and for a UE which already is in Connected Mode.

5.2.4.3 Emergency Call

Generally, emergency calls shall be allowed in all cells, independent of restrictions due to status indication and cell reservations.

A restriction on emergency calls, if needed, shall be indicated in the “Access class barred list” IE [25.331]. If the control bit which corresponds to "Access Class 10" is indicated as “barred”, emergency calls are not allowed in this cell.

CHANGE REQUEST

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25.304	CR	028	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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:** 2000-04-03

Subject: Downlink Signalling Failure

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: Downlink signalling failure, used as triggering criterion for cell selection, is undefined. Since benefit is small, it is proposed to remove it.

Clauses affected: 5.2.2.4.1, 5.3.1.4.1.

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:

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5.2.2.4.1 Description

The purpose of the cell reselection is to look for a better cell for the UE to camp on. The serving cell is changed when a better cell is found. The 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](see 5.2.2.4.5)~~
4. Cell has become barred or forbidden [details are FFS]

In case 2), and 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 technology measurements in system information of the serving cell.
2) Intra- and inter frequency cells: Calculate the Q value and the S value for each cell on the candidate list. Inter-radio access 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 is on the candidate list (intra-frequency, inter-frequency and inter-radio access 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 technology neighbouring cells, see 5.2.2.4.4.

***** Next modified section *****

5.3.1.4.1 Description

The purpose of the cell reselection is to look for a better cell for the UE to camp on. The serving cell is changed when a better cell is found.

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](see 5.3.1.4.5)~~
4) Cell has become barred or forbidden [details are FFS]

In case 2), and 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 consists of the cells for intra- and inter-frequency and inter-radio access technology measurements in system information of the serving cell. However, if UE dedicated measurements control information has been assigned to the UE in the serving cell, the candidate list consists of the cells for intra- and inter-frequency and inter-radio access technology measurements included in this UE dedicated measurement control information.
2. Intra- and inter frequency cells : Calculate the Q value and the S value for each cell on the candidate list. Inter-radio-access-technology cells: When $Q_s \leq$ Qsearch, calculate the Q value of each cell on the candidate list.

3. Depending on which types of cells are on the candidate list (intra-frequency, inter-frequency and inter-radio-access 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 5.3.1.4.2.

2) Inter-frequency neighbouring cells, see 5.3.1.4.3.

3) Inter-radio-access-technology neighbouring cells, see 5.3.1.4.4.

3GPP TSG RAN WG2#12
Seoul, Korea, 10-14 April, 2000

Document R2-000805
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	029	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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:** 2000-04-11

Subject: Cell re-selection parameter signalling

Work item:

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

F	Correction		**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	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

According to signalling alternative 1, UE reads Qoffset for each neighbouring cell in system information of serving cell. In signalling alternative 2, UE reads Qoffset parameter for a neighbouring cell in system information of that neighbouring cell. These are the motives for removing the signalling alternative 2.

1. The use of 2 alternatives for signalling Qoffset value is stated as FFS in TS 25.304.
2. The mechanism proposed according to Alt 2 (decoding range, expiration timer) is only used for the Qoffset parameter. There are other parameters 'of the same type' (Qmin, Maximum allowed UL TX power), that could have used signalling alternative 2, that now uses alternative 1 only.
3. For inter-frequency cells, it would not be a good solution to use alt 2. Frequent and repetitive decoding of SIBs of inter-frequency cells will considerably increase the risk of loosing page and delay cell re-selection.
4. From a network point of view: Qoffset value will normally be set to the same value for all cell-to-ncell intra-frequency relations. However, there might be a need at some specific cell-to-ncell relation to set another value. This is not supported by the Alternative 2 method.
5. Use of 2 alternative solutions requires a more complex UE design – UE has to support both.

Clauses affected: 5.2.2.4.6

Other specs affected:				
Other 3G core specifications	X	→ List of CRs:	25.331 CR xxx
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:

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5.2.2.4.6 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 as follows:

$Qoffset_{s,n}$

The offset between the two cells is read in system information of the serving cell.~~considered in the evaluation ($Qoffset_{s,n}$) 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.

HCS_PRIO_s, HCS_PRIO_n

HCS priority level (0-7) for serving cell and neighbouring cells are read in system information of serving cell

$Qhcs_s$, $Qhcs_n$

Quality threshold levels for applying prioritised hierarchical cell re-selection are read in system information of serving cell

$PENALTY\_TIME_n$

Time duration for which the $TEMPORARY\_OFFSET_n$ is applied for a neighbouring cell is read in system information of serving cell.

$TEMPORARY\_OFFSET_n$

Applies an offset to the H and R criteria for a neighbouring cell for the duration of $PENALTY\_TIME_n$. The parameter is read in system information of serving cell.

T_{CRmax}

Duration for evaluating allowed amount of cell reselection(s) is read in system information of serving cell.

N_{CR}

Maximum number of cell reselections is read in system information of serving cell.

$T_{CRmaxHyst}$

Additional time period before UE reverts to low-mobility measurements is read in system information of 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.~~

$Ssearch_{HCS}$

Below this limit in the serving cell, the UE shall initiate measurements of all neighbouring cells of the serving cell. The value is read in system information of the serving cell.

$Ssearch_{RAT\ 1}$ - $Ssearch_{RAT\ k}$

Below this RAT specific threshold in the serving UTRA cell, the UE shall initiate measurements of inter-radio access technology cells. The values are read in system information of the serving cell.

Mapping Info

Mapping Info contains all the information that is necessary to define the mapping function that is used for mapping a certain range of measurement values to a representing quality value (0..99, step size 1).

3GPP TSG RAN WG2 meeting #12
Seoul, Korea, 10 - 13 April 2000

***Document* R2-000850**
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or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.304	CR	030	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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:** 2000-4-10

Subject: Cell selection and Reselection

Work item:

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

F	Correction		**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	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Currently, when the UE selects the neighbouring cell, the increase of UL interference in barred serving cell is not acceptable for cell selection and re-selection. However there is a case that the increase of UL interference in the barred serving cell can be accepted such as in the cell maintenance phase. Therefore, in the cell restriction mechanism, the function to indicate whether UTRAN accepts the increased UL interference in barred cell or not is also proposed as IE" Intra-frequency cell re-selection indicator" in TS25.331. UE action is modified accordingly.

Clauses affected: 5.2.2.1.1, 5.2.4, 5.3.1.2.1

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:


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5.2.2.1.1 Description

Whenever a PLMN is selected, the UE shall attempt to find 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.

   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 strongest cell and reads its system information, in order to find out which PLMNs are available. If the selected PLMN is found, the search of the rest of carriers 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 optionally also information on cell parameters, e.g. scrambling codes, from previously received measurement control information elements. 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) For each cell on the candidate list calculate the cell selection value, S, and the quality value, Q_{meas}, defined in subclause 5.2.2.1.2.

3) Rank the cells with S>0 from the highest Q_{meas} value.

4) Check if the cell with the highest Q_{meas} value fulfils all requirements for a suitable cell. If so, choose this cell to camp on. If this cell does not fulfil all requirements for a suitable cell, this cell and all cells on the same frequency shall be removed as candidates for cell selection in case the barred cell does not accept intra-frequency cell selection and re-selection. On the other hand, in case the barred cell accepts intra-frequency cell selection and re-selection, only the barred cell shall be removed as candidates for cell selection (see also subclause 5.2.4), and step 3 shall be repeated.

If different radio access modes are involved in the procedure, mapping functions shall be applied. For each radio access mode, such a mapping function is defined and its parameters are broadcast in system information. The mapping function maps a certain range of measurement values Q_{meas} to a representing quality value Q_{map} that can have values between 0 and 99 (step size 1). These quality values Q_{map} can then be compared with each other and the cell with the highest Q_{map} value is chosen (among those cells with S>0).

If no suitable cells are found and the stored information cell selection procedure was used in step 1, the Initial cell selection procedure 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 to camp on any acceptable cell and enter 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.

5.2.4 Barred Cells and Access Control

The barred case of cell status is used to bar completely a cell against access by all normal subscribers. This barred status is indicated in the information broadcast by the cell, in the Cell Access Restriction information element, which has 4 cases:

1. Cell not Barred;

2. Cell Barred for normal users - allows Operator access;

3. Cell Barred for normal users – allows Emergency access;

4. Cell Barred for normal users – allows SoLSA access.

Additionally, combinations of cases 2, 3, and 4 are allowed in one cell.

If UE, during the cell selection, immediate cell evaluation and cell re-selection procedures, detects UTRA cell i, that fulfil the cell selection criteria S>0, but not all other requirements for a suitable cell, all cells on same frequency as cell i shall be removed as candidates for cell selection in case the barred cell does not accept intra-frequency cell selection and re-selection. On the other hand, in case the barred cell accepts intra-frequency cell selection and re-selection, only the barred cell shall be removed as candidates for cell selection. Specific actions performed by the UE are described for each procedure.

UE shall regard that the cell barred condition of cell i is valid during time interval T_{barred}. T_{barred} is sent via system information of cell i.

NOTE: Access Control is FFS

FFS

5.3.1.2 Initial Cell Reselection Procedure

5.3.1.2.1 Description

Triggers for the Initial cell re-selection procedure are specified in [25.331].

When the Initial cell reselection procedure is triggered, the UE shall attempt to find a suitable cell belonging to the selected PLMN according to the following steps:

1) The UE shall scan all RF channels of the UTRA band to find a suitable cell. 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. If UE, during the initial cell re-selection procedure, detects UTRA cell i, that fulfil the cell selection criteria S>0, but not all other requirements for a suitable cell, all cells on same frequency as cell i shall be removed as candidates for cell selection in case the barred cell does not accept intra-frequency cell selection and re-selection. On the other hand, in case the barred cell accepts intra-frequency cell selection and re-selection, only the barred cell shall be removed as candidates for cell selection (see also subclause 5.2.4).

2) 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 UTRA cells, as received in measurement control information via the selected cell.

3) For each cell on the candidate list fulfilling all criteria for a suitable cell, see subclause 5.2.2.1, except the cell selection criteria, calculate the cell selection value, S, and the quality value, Q_{meas}, defined in subclause 5.3.1.2.2.

4) Among the cells with S > 0 select the cell with the highest Q_{meas} value.

If different radio access modes are involved in the procedure, mapping functions shall be applied. For each radio access mode, such a mapping function is defined and its parameters are broadcast in system information. The mapping function maps a certain range of measurement values to a representing quality value Q_{map} that can have values between 0 and 99 (step size 1). These quality values Q_{map} can then be compared with each other and the cell with the highest Q_{map} value is chosen (among those cells with S>0).

If the UE is unable to find any suitable cell, the UE shall release the RRC connection and enter idle mode.

3GPP TSG RAN WG2 meeting #12
Seoul, Korea, 10 - 13 April 2000

***Document* R2-000883**
e.g. for 3GPP use the format TP-99xxx
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25.304	CR	031r1	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	for approval	X	Strategic		*(for SMG use only)*
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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:** 2000-4-10

Subject: CN DRX cycle coefficent

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: The CN domain specific DRX cycle length coefficient for PS domain is negotiated between UE and PS CN when the UE is attached. After the negotiation, the UE and UTRAN continue to use the CN domain specific DRX cycle length coefficient for PS CN domain which is stored both in UE and PS CN unless it is updated by NAS procedure. The UE shall not update the DRX cycle length coefficient for PS CN domain locally in order to page correctly. Therefore, the timings for updating “CN domain specific DRX cycle length coefficient” for both CNs are added.

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:

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8 Discontinuous Reception

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 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 each CN domain are given in system information.~~

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

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

The UE shall use the IMSI, the Cell System Frame Number (SFN), Np (number of page indicators within a frame), 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.

The value of the Paging Occasion (i.e. the SFN of the first frame of the Paging Block) is determined as follows:

Paging Occasion= {IMSI 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 (DRX cycle length div PBP)}

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) 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 a default number, IMSI = 0, in the formulas above.

For FDD, see [7] for details about the timing between a PICH frame and when the paging message is transmitted on the PCH in the associated S-CCPCH frame. In TDD mode, the Paging Message Receiving Occasion is calculated using the following formula:

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

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