TSG-RAN Meeting #27 **RP-050073**
Tokyo, Japan, 09-11 March 2005 **Agenda item 8.3.5**

Source: TSG-RAN WG2

Title: CRs to 25.304 on Cell Reselection (HCS and non-HCS)

Spec	CR	Rev	Phase	Subject	Cat	Version-Current	Version-New	Doc-2nd-Level	Workitem
25.304	128	1	Rel-5	Reselection procedures (1235)	F	5.7.0	5.8.0	R2-050734	TEI5
25.304	129	1	Rel-6	Reselection procedures (1235)	A	6.4.0	6.5.0	R2-050735	TEI5
25.304	130	1	Rel-5	RSCP Thresholds	F	5.7.0	5.8.0	R2-050738	TEI5
25.304	131	1	Rel-6	RSCP Thresholds	A	6.4.0	6.5.0	R2-050739	TEI5
25.304	132	2	Rel-6	High-mobility measurement rules	A	6.4.0	6.5.0	R2-050745	TEI5
25.304	138	1	Rel-5	High-mobility measurement rules	F	5.7.0	5.8.0	R2-050744	TEI5
25.304	135	1	Rel-5	Intra frequency measurement rules for HCS	F	5.7.0	5.8.0	R2-050742	TEI5
25.304	139	1	Rel-6	Intra frequency measurement rules for HCS	A	6.4.0	6.5.0	R2-050743	TEI5

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050663

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **128** ⌘**rev** **1** ⌘ Current version: **5.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Reselection procedures (1235)
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
Rel-4 (Release 4)
Rel-5 (Release 5)
Rel-6 (Release 6)
Rel-7 (Release 7)

Reason for change: ⌘

a) During the RAN2 Meeting #43 (Prague), document R2-041462 highlighted that TS 25.304 contradicts the measurement requirements in 25.133 for CELL_FACH.

b) The current mixing of reselection rules and measurement rules in different sections of the specification leads to unclarity. This has been highlighted several times in offline discussions between several companies although never specifically addressed in a contribution. Therefore, it would be beneficial to take the opportunity of a general correction to be able to clarify this issue.

Summary of change: ⌘

It is clarified that the power saving options are only valid for Idle, URA_PCH, CELL_PCH states (i.e. the specification is also aligned with 25.133).
It is also clarified thesemeasurement rules are also taken into account in the reselection procedures (e.g. Ssearchinter, is a threshold used for reselection in Idle, URA_PCH, CELL_PCH and CELL_FACH states)..

Impact Analysis:
UEs that do not behave according to the proposed CR will require modifications.
UEs that already behave according to the CR do not require modifications.
Implementation of this CR by a R99/Rel-4 UE, will not cause backwards compatibility issues.

Consequences if not approved: ⌘

a) Relaxing measurement requirements for CELL_FACH may result in the UE reselecting to a non-optimum cell and cause significant UL interference, and it may increase the possibility of entering OOS under fast-fading conditions. Furthermore, it was seen this would not allow any extra power saving option

	for the UE because the S-CCPCH must be continuously received. The specification will also remain not aligned to 25.133. b) Measurement rules and reselection criteria will remain mixed in the specification and therefore unclear, leading to uncertain UE behaviour.

Clauses affected:	⌘	5.2.6.1.1, 5.2.6.1.2, 5.2.6.1.4			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

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

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

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

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

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

  2. If Sx > $S_{intersearch}$, UE may choose to not perform inter-frequency measurements. ~~Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.~~
     If Sx <= $S_{intersearch}$, perform inter-frequency measurements.
     If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

  3. If Sx > $Ssearch_{RAT\ m}$, UE may choose to not perform measurements on cells of RAT "m". ~~Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.~~
     If Sx <= $Ssearch_{RAT\ m}$, perform measurements on cells of RAT "m".
     If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

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

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

1. For intra-frequency and inter-frequency threshold-based measurement rules

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

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

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

   ELSE

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

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

      ELSE

measure on all intra-frequency 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

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

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

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

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

IF the UE is not measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN

~~prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.~~

~~ELSE~~

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

~~prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.~~

ENDIF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$:
  - revert to measurements according to the threshold based measurement rules.

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

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

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

UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

ELSE

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

UE may choose to not measure neighbouring cells in RAT "m". ~~Inter-RAT measurements that may have been performed shall not be considered in the cell-reselectrion criteria.~~

ELSE

UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

ENDIF

ENDIF

If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

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

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

- IF the UE is not measuring all neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN

~~prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level..~~

~~ELSE~~

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

~~prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.~~

- END IF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$
  - revert to measure according to the threshold-based measurement rules.

5.2.6.1.3 Highest ranked cells with access restrictions

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

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

5.2.6.1.4 Cell Reselection Criteria

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

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

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

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

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

The cell-ranking criterion R is defined by:

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

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

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 $x >= 0$

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

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

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

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

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

Or

- if $HCS\_PRIO_n = HCS\_PRIO_s$ and
  - for serving FDD and neighbour FDD cells if the quality measure for cell selection and reselection is set to CPICH RSCP in the serving cell, and:

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

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

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

  - for all other serving and neighbour cells:

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

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

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

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

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

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

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

Where :

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

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

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

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

- all measured cells (see subclause 5.2.6.1.1).

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

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

   - all measured cells, that have the highest HCS_PRIO among those cells that fulfil the criterion H >= 0. ~~Note that this rule is not valid when UE high-mobility is detected (see subclause 5.2.6.1.2).~~

   - all measured cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0. ~~This case is also valid when it is indicated in system information that HCS is not used, that is when serving cell does not belong to a hierarchical cell structure.~~

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

- all measured cells.

If HCS is used in the serving cell and UE high-mobility has been detected, prioritise re-selection of intra-frequency, inter-frequency and RAT "m" neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on the same HCS priority level as the serving cell, and prioritise neighbouring cells having the same HCS priority as the serving cell before neighbouring cells having higher HCS priority level than the serving cell.

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

The offset $Qoffset1_{s,n}$ is used for $Qoffset_{s,n}$ to calculate R_n, the hysteresis $Qhyst1_s$ is used for $Qhyst_s$ to calculate R_s. For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,PCH}$ to calculate R_s, if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,FACH}$ to calculate R_s, if provided in SIB4 [see 4].

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

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

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH RSCP, the UE shall perform cell re-selection to that FDD cell.

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

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

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

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

5.2.6.1.5 Cell reselection parameters in system information broadcasts

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

$Qoffset1_{s,n}$

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

$Qoffset2_{s,n}$

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

$Qhyst1_s$

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

$Qhyst1_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst1_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst2_s$

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

$Qhyst2_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

$Qhyst2_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

HCS_PRIO_s, HCS_PRIO_n

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

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

$Qhcs_s$, $Qhcs_n$

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

Qqualmin

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

Qrxlevmin

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

$PENALTY\_TIME_n$

This specifies the time duration for which the $TEMPORARY\_OFFSET_n$ is applied for a neighbouring cell.

$TEMPORARY\_OFFSET1_n$

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

$TEMPORARY\_OFFSET2_n$

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

T_{CRmax}

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

N_{CR}

This specifies the maximum number of cell reselections.

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can revert to low-mobility measurements.

$Treselection_s$

This specifies the cell reselection timer value.

$Treselection_{s,PCH}$

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

$Treselection_{s,FACH}$

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

$Ssearch_{HCS}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the limit for Srxlev in the serving cell below which the UE shall initiate measurements of all neighbouring cells of the serving cell.

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

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

$S_{HCS,RATm}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the RAT specific threshold in the serving cell used in the inter-RAT measurement rules.

$S_{intrasearch}$

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

$S_{intersearch}$

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

$S_{limit,SearchRATm}$

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

5.2.6.2 GSM case

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

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050734

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **129** ⌘ **rev** **1** ⌘ Current version: **6.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Reselection procedures (1235)
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
Rel-4 (Release 4)
Rel-5 (Release 5)
Rel-6 (Release 6)
Rel-7 (Release 7)

Reason for change: ⌘

a) During the RAN2 Meeting #43 (Prague), document R2-041462 highlighted that TS 25.304 contradicts the measurement requirements in 25.133 for CELL_FACH.

b) The current mixing of reselection rules and measurement rules in different sections of the specification leads to unclarity. This has been highlighted several times in offline discussions between several companies although never specifically addressed in a contribution. Therefore, it would be beneficial to take the opportunity of a general correction to be able to clarify this issue.

Summary of change: ⌘

It is clarified that the power saving options are only valid for Idle, URA_PCH, CELL_PCH states (i.e. the specification is also aligned with 25.133).
It is also clarified thesemeasurement rules are also taken into account in the reselection procedures (e.g. Ssearchinter, is a threshold used for reselection in Idle, URA_PCH, CELL_PCH and CELL_FACH states)..

Impact Analysis:
UEs that do not behave according to the proposed CR will require modifications.
UEs that already behave according to the CR do not require modifications.
Implementation of this CR by a R99/Rel-4 UE, will not cause backwards compatibility issues.

Consequences if not approved: ⌘

a) Relaxing measurement requirements for CELL_FACH may result in the UE reselecting to a non-optimum cell and cause significant UL interference, and it may increase the possibility of entering OOS under fast-fading conditions. Furthermore, it was seen this would not allow any extra power saving option

	for the UE because the S-CCPCH must be continuously received. The specification will also remain not aligned to 25.133. b) Measurement rules and reselection criteria will remain mixed in the specification and therefore unclear, leading to uncertain UE behaviour.

Clauses affected:	⌘	5.2.6.1.1, 5.2.6.1.2, 5.2.6.1.4			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

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

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

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

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

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

2. If Sx > $S_{intersearch}$, UE may choose to not perform inter-frequency measurements. ~~Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.~~
   If Sx <= $S_{intersearch}$, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If Sx > $Ssearch_{RAT\ m}$, UE may choose to not perform measurements on cells of RAT "m". ~~Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.~~
   If Sx <= $Ssearch_{RAT\ m}$, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

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

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

use $HCS\ priority_1$ as the HCS priority broadcast in the system information and apply the following rule:

IF an MBMS PL is used THEN

- If the UE is in HCS low mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = $HCS\ priority_1$ + HCS_OFF_{mbms}.

- If the UE is in HCS high mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = $HCS\ priority_1$.

- for serving cell and neighbour cells not belonging to the MBMS PL, set the HCS priority = $HCS\ priority_{1.}$

IF an MBMS PL is not used THEN

For serving cell and all neighbour cells set HCS priority = $HCS\ priority_1$

Then apply this to the following:

1. For intra-frequency and inter-frequency threshold-based measurement rules

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

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

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

   ELSE

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

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

      ELSE

         measure on all intra-frequency 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

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

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

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

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

   IF the UE is not measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN

   ~~prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.~~

   ~~ELSE~~

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

   ~~prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.~~

   ENDIF

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

   - continue these measurements during time period $T_{CrmaxHyst}$
   - if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$:
      - revert to measurements according to the threshold based measurement rules.

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

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

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

UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

ELSE

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

UE may choose to not measure neighbouring cells in RAT "m". ~~Inter-RAT measurements that may have been performed shall not be considered in the cell reselectrion criteria.~~

ELSE

UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

ENDIF

ENDIF

If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

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

- If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall
- IF the UE is not measuring all neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN

~~- prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level..~~

~~ELSE~~

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

~~- prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.~~

- END IF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$
  - revert to measure according to the threshold-based measurement rules.

5.2.6.1.3 Highest ranked cells with access restrictions

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

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

5.2.6.1.4 Cell Reselection Criteria

[This subclause will need material on the MBMS offset, expected as part of the FLC changes.]

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

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

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

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

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

The cell-ranking criterion R is defined by:

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

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

where:

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

where:

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

$L_n = 0$ 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 $x >= 0$

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

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

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

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

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

Or

- if $HCS\_PRIO_n = HCS\_PRIO_s$ and
  - for serving FDD and neighbour FDD cells if the quality measure for cell selection and reselection is set to CPICH RSCP in the serving cell, and:

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

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

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

- for all other serving and neighbour cells:

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

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

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

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

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

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

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

Where :

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

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

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

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

- all measured cells (see subclause 5.2.6.1.1).

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

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

   - all measured cells, that have the highest HCS_PRIO among those cells that fulfil the criterion H >= 0. ~~Note that this rule is not valid when UE high-mobility is detected (see subclause 5.2.6.1.2).~~

   - all measured cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0. ~~This case is also valid when it is indicated in system information that HCS is not used, that is when serving cell does not belong to a hierarchical cell structure.~~

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

   - all measured cells.

If HCS is used in the serving cell and UE high-mobility has been detected, prioritise re-selection of intra-frequency, inter-frequency and RAT "m" neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on the same HCS priority level as the serving cell, and prioritise neighbouring cells having the same HCS priority as the serving cell before neighbouring cells having higher HCS priority level than the serving cell.

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

The offset $Qoffset1_{s,n}$ is used for $Qoffset_{s,n}$ to calculate R_n, the hysteresis $Qhyst1_s$ is used for $Qhyst_s$ to calculate R_s. For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,PCH}$ to calculate R_s, if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,FACH}$ to calculate R_s, if provided in SIB4 [see 4].

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

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

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH RSCP, the UE shall perform cell re-selection to that FDD cell.

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

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

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

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

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050738

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **130** ⌘ **rev** **1** ⌘ Current version: **5.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	RSCP thresholds
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*
Rel-7 *(Release 7)*

Reason for change:	⌘	A problem with the current reselection rules was highlighted in R2-042446 where the current thresholds for cell quality are only based on Ec/No measurements, as stated in section 5.2.6.1.1-25.304 - "use Squal for FDD cells and Srxlev for TDD for Sx and apply the following rules". The suitability of a neighbouring cell is still ensured by Squal and Srxlev levels.
Summary of change:	⌘	$S_{searchHCS}$ is used in the measurement rules when HCS is not used, such the UE will perform measurements if S_{rxlev} <= $S_{searchHCS}$. **Impact Analysis:** All UEs will require modifications. Optimal parameterisation of system information Ssearchinter and Ssearchrat parameters, for UEs that have implemented this CR may slightly degrade legacy UEs reselection performance. This is the reason why pre-Rel5 implementation was allowed and is inline with the *mirror* RSCP threshold addition already present in the GERAN specifications. **Implementation of this CR by a R99/Rel-4 UE, will not cause backwards compatibility issues.**
Consequences if not approved:	⌘	The UE may experience good downlink coverage and perform reselection to a cell. However, although the uplink coverage may satisfy the suitability criterion Srxlev, it may not be sufficient to provide adequate service. For example, currently there is no threshold that triggers the UE to measure GSM cells if the uplink coverage is suitable but does not ensure service.

Clauses affected:	⌘	5.2.6.1.1			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	A related proposal was already accepted in GERAN last year (with R99 solution).			

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

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

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

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

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

2. If Sx > $S_{intersearch}$, and Srxlev > $S_{searchHCS,}$ if $S_{searchHCS,}$ is signalled, UE may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $S_{intersearch}$, or Srxlev <= $S_{searchHCS,}$ if $S_{searchHCS,}$ is signalled, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If Sx > $Ssearch_{RAT\ m}$, and Srxlev > $S_{HCS,RATm,}$ if $S_{HCS,RATm,}$ is signalled, UE may choose to not perform measurements on cells of RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $Ssearch_{RAT\ m}$, or Srxlev <= $S_{HCS,RATm,}$ if $S_{HCS,RATm,}$ is signalled, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

********** next changed section **********

5.2.6.1.5 Cell reselection parameters in system information broadcasts

< snip >

$Ssearch_{HCS}$

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

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

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

$S_{HCS,RATm}$

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

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050739

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **131** ⌘**rev** **1** ⌘ Current version: **6.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	RSCP thresholds
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*
Rel-7 *(Release 7)*

Reason for change:	⌘	A problem with the current reselection rules was highlighted in R2-042446 where the current thresholds for cell quality are only based on Ec/No measurements, as stated in section 5.2.6.1.1-25.304 - "use Squal for FDD cells and Srxlev for TDD for Sx and apply the following rules". The suitability of a neighbouring cell is still ensured by Squal and Srxlev levels.
Summary of change:	⌘	$S_{searchHCS}$ is used in the measurement rules when HCS is not used, such the UE will perform measurements if S_{rxlev} <= $S_{searchHCS}$. **Impact Analysis:** All UEs will require modifications. Optimal parameterisation of system information Ssearchinter and Ssearchrat parameters, for UEs that have implemented this CR may slightly degrade legacy UEs reselection performance. This is the reason why pre-Rel5 implementation was allowed and is inline with the *mirror* RSCP threshold addition already present in the GERAN specifications. **Implementation of this CR by a R99/Rel-4 UE, will not cause backwards compatibility issues.**
Consequences if not approved:	⌘	The UE may experience good downlink coverage and perform reselection to a cell. However, although the uplink coverage may satisfy the suitability criterion Srxlev, it may not be sufficient to provide adequate service. For example, currently there is no threshold that triggers the UE to measure GSM cells if the uplink coverage is suitable but does not ensure service.

Clauses affected:	⌘	5.2.6.1.1			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	A related proposal was already accepted in GERAN last year (with R99 solution).			

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

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

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

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

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

2. If Sx > $S_{intersearch}$, and Srxlev > $S_{searchHCS,}$ if $S_{searchHCS,}$ is signalled, UE may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $S_{intersearch}$, or Srxlev <= $S_{searchHCS,}$ if $S_{searchHCS,}$ is signalled, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If Sx > $Ssearch_{RAT\ m}$, and Srxlev > $S_{HCS,RATm,}$ if $S_{HCS,RATm,}$ is signalled, UE may choose to not perform measurements on cells of RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $Ssearch_{RAT\ m}$, or Srxlev <= $S_{HCS,RATm,}$ if $S_{HCS,RATm,}$ is signalled, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

********** next changed section **********

5.2.6.1.5 Cell reselection parameters in system information broadcasts

< snip >

$Ssearch_{HCS}$

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

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

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

$S_{HCS,RATm}$

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

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050745

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **132** ⌘**rev** **2** ⌘ Current version: **6.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	HCS high-mobility measurement rules
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*
Rel-7 *(Release 7)*

Reason for change:	⌘	1. It was highlighted in R2-041433 and R2-041775 that the measurement rules for high-mobility can currently be interpreted in two different ways. Depending on implementation, some UEs may apply threshold based rules also in high-mobility whilst others will continuously perform measurements. It would be beneficial to clarify some of the threshold based rules, to guaranteed that a UE using these will perform the necessary minimum measurements depending on the quality of the cell – i.e. if the serving cell quality if low, the UE will always perform all measurements when in high-mobility. 2. There is an incorrect usage of terminology (i.e. “low-mobility” in the $T_{CRmaxHyst}$ definition).
Summary of change:	⌘	1. The HCS measurement rules are clarified to ensure UEs in high-mobility will measure all cells when the quality of the serving cell is below a certain threshold. The measurement rules for HCS were split into high/low mobility. 2. The terminology was corrected. **Impact Analysis:** UEs not implementing the CR will require modifications. This CR does not have impact to UTRAN implementations. **Implementation of this CR by a R99/Rel-4 UE will not cause compatibility issues**
Consequences if not approved:	⌘	A UE may not apply threshold based rules in HCS high-mobility and may not measure sufficient cells when the serving cell quality is low. This could lead to

	fast-moving UEs reselecting to non-suitable cells.

Clauses affected:	⌘	5.6.2.1.2			
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

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

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

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

IF an MBMS PL is used THEN

- If the UE is in HCS low mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS priority$_1$ + HCS_OFF$_{mbms}$.
- If the UE is in HCS high mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS priority$_1$.
- for serving cell and neighbour cells not belonging to the MBMS PL, set the HCS priority = HCS priority$_1$.

IF an MBMS PL is not used THEN

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

Then apply this to the following:

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

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

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

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

   ELSE

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

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

   ELSE

   measure on all intra-frequency 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

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

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

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

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

   ~~IF the UE is measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN~~

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

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

- prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

ELSE

- measure intra-frequency and inter-frequency neighbouring cells, which have equal or lower HCS priority than serving cell.
- prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.

ENDIF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$:
  - ~~revert to measurements according to the threshold based measurement rules~~exit high-mobility.

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

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

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

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

   UE shall measure on all inter-RATm cells. ~~Fast-moving UEs may also use this rule.~~

   ELSE

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

   UE may choose to not measure neighbouring cells in RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.

   ELSE

   UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell ~~unless measurement rules for fast-moving UEs are triggered~~

   ENDIF

   ENDIF

   If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. ~~Fast-moving UEs may also use this rule.~~

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

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

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

     - UE shall measure on all inter-RATm cells.

   ~~IF the UE is measuring neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN~~

- prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

- ELSE
  - measure the neighbouring cells in RAT "m", which have an equal or lower HCS priority than the serving cell
  - prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.
- ENDIF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$
  - ~~revert to measure according to the threshold based measurement rules~~exit high-mobility.

< snip >

5.2.6.1.5 Cell reselection parameters in system information broadcasts

< snip >

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can ~~revert~~ exit ~~to low~~high-mobility ~~measurements~~.

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050742

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **135** ⌘ **rev** **1** ⌘ Current version: **5.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Intra- and inter-frequency measurement rules for HCS
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
- ***F*** *(correction)*
- ***A*** *(corresponds to a correction in an earlier release)*
- ***B*** *(addition of feature),*
- ***C*** *(functional modification of feature)*
- ***D*** *(editorial modification)*

Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

Ph2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change: ⌘

CPICH Ec/No is a good measure of downlink quality and CPICH RSCP is a good measure of uplink quality. These measures are thus complementing each other and are both necessary to define the quality of a cell.

If HCS is used, both CPICH Ec/No thresholds and a CPICH RSCP thresholds are defined, but here the same threshold values are used both for inter and intra frequency cells. To avoid strong interference from RACH attempts towards a cell, which is not the best intra frequency cell available, the intra frequency thresholds are set to a high values if used. As a consequence the threshold functionality can't be used for inter frequency either.

Inter-RAT cell reselections should work for a release 99 UE when using HCS, and RAN4 has specified a test case for it in release 5.

Summary of change: ⌘

When HCS is used and Sintrasearch is not sent for the serving cell but SsearchHCS and Sintersearch (in FDD) are sent, the UE is mandated to meassure on:
- All intra-frequency neighbouring cells, and
- if (Srxlev > SsearchHCS) and (Sx > Sintersearch): all inter-frequency cells, which have higher HCS priority level than the serving cell, otherwise all inter-frequency cells.

The change is only for non-high-mobility.

		Impact Analysis: System information parameterisation optimised for UEs compliant to this CR will eliminate inter-frequency power saving options for legacy UEs. Since Sintrasearch is required to be set to a very high value if sent, power saving will only be performed for low priority inter-frequency cells. Hence, if there are no low priority cells there is no impact. **Implementation of this CR by a R99/Rel-4 UE will not cause any compatibility issues.**
Consequences if not approved:	⌘	The threshold functionality cannot be used for inter-frequency cell reselection (for neighbouring inter-frequency cells of equal HCS priority) without creating strong interference peaks and congestion for intra-frequency cells.

Clauses affected:	⌘	5.2.6.1.2			
		Y	**N**		
Other specs affected:	⌘	**X**		Other core specifications	⌘ CR 128rev1
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	Ranking rules are specified in CR128.			

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

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

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

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

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

2. If Sx > $S_{intersearch}$, UE may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $S_{intersearch}$, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If Sx > $Ssearch_{RAT\ m}$, UE may choose to not perform measurements on cells of RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $Ssearch_{RAT\ m}$, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

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

1. For intra-frequency and inter-frequency threshold-based measurement rules

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

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

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

   ELSE

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

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

      ELSE

         measure on all intra-frequency 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

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

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

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

   ENDIF

ENDIF

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

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

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

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

   IF the UE is measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN

   - prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

   ELSE

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

   - prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.

   ENDIF

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

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

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

     - revert to measurements according to the threshold based measurement rules.

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

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

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

   UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

   ELSE

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

   UE may choose to not measure neighbouring cells in RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselectrion criteria.

   ELSE

   UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

   ENDIF

   ENDIF

   If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

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

- If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall
- IF the UE is measuring neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN
  - prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level..
- ELSE
  - measure the neighbouring cells in RAT "m", which have an equal or lower HCS priority than the serving cell
  - prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.
- END IF

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

- continue these measurements during time period $T_{CrmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$
  - revert to measure according to the threshold-based measurement rules.

5.2.6.1.3 Highest ranked cells with access restrictions

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

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

5.2.6.1.4 Cell Reselection Criteria

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

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

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

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

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

The cell-ranking criterion R is defined by:

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

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

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 $x >= 0$

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

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

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

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

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

Or

- if $HCS\_PRIO_n = HCS\_PRIO_s$ and
  - for serving FDD and neighbour FDD cells if the quality measure for cell selection and reselection is set to CPICH RSCP in the serving cell, and:

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

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

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

  - for all other serving and neighbour cells:

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

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

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

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

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

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

for FDD cells: Srxlev > 0 AND Squal > 0

for TDD cells: Srxlev > 0

for GSM cells: Srxlev > 0

Where :

$Squal = Q_{qualmeas} - Qqualmin$

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

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

The UE shall perform ranking of all cells that fulfil the S criterion among

- all 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 5.2.6.1.2).
- all cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0. This case is also valid when it is indicated in system information that HCS is not used, that is when serving cell does not belong to a hierarchical cell structure.

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

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

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

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

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

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH RSCP, the UE shall perform cell re-selection to that FDD cell.

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

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

- the new cell is better ranked than the serving cell during a time interval Treselection. For UE in RRC connected mode states CELL_PCH or URA_PCH the interval $Treselection_{s,PCH}$ applies, if provided in SIB4 [see 4], while for UE in RRC connected mode state CELL_FACH the interval $Treselection_{s,FACH}$ applies, if provided in SIB4 [see 4]. For hierarchical cell structures when high mobility state has not been detected, if according to the HCS rules the serving cell is not ranked then all the ranked cells are considered to be better ranked than the serving cell.
- more than 1 second has elapsed since the UE camped on the current serving cell.

5.2.6.1.5 Cell reselection parameters in system information broadcasts

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

$Qoffset1_{s,n}$

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

$Qoffset2_{s,n}$

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

$Qhyst1_s$

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

$Qhyst1_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst1_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst2_s$

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

$Qhyst2_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

$Qhyst2_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

HCS_PRIO_s, HCS_PRIO_n

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

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

$Qhcs_s$, $Qhcs_n$

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

Qqualmin

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

Qrxlevmin

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

$PENALTY\_TIME_n$

This specifies the time duration for which the $TEMPORARY\_OFFSET_n$ is applied for a neighbouring cell.

$TEMPORARY\_OFFSET1_n$

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

$TEMPORARY\_OFFSET2_n$

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

T_{CRmax}

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

N_{CR}

This specifies the maximum number of cell reselections.

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can revert to low-mobility measurements.

$Treselection_s$

This specifies the cell reselection timer value.

$Treselection_{s,PCH}$

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

$Treselection_{s,FACH}$

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

$Ssearch_{HCS}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the limit for Srxlev in the serving cell below which the UE shall initiate measurements of all neighbouring cells of the serving cell.

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

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

$S_{HCS,RATm}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the RAT specific threshold in the serving cell used in the inter-RAT measurement rules.

$S_{intrasearch}$

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

$S_{intersearch}$

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

$S_{limit,SearchRATm}$

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

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050744

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **138** ⌘ **rev** **1** ⌘ Current version: **5.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	HCS high-mobility measurement rules
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
Rel-4 (Release 4)
Rel-5 (Release 5)
Rel-6 (Release 6)
Rel-7 (Release 7)

Reason for change:	⌘	1. It was highlighted in R2-041433 and R2-041775 that the measurement rules for high-mobility can currently be interpreted in two different ways. Depending on implementation, some UEs may apply threshold based rules also in high-mobility whilst others will continuously perform measurements. It would be beneficial to clarify some of the threshold based rules, to guaranteed that a UE using these will perform the necessary minimum measurements depending on the quality of the cell – i.e. if the serving cell quality if low, the UE will always perform all measurements when in high-mobility. 2. There is an incorrect usage of terminology (i.e. “low-mobility” in the $T_{CRmaxHyst}$ definition).
Summary of change:	⌘	1. The HCS measurement rules are clarified to ensure UEs in high-mobility will measure all cells when the quality of the serving cell is below a certain threshold. The measurement rules for HCS were split into high/low mobility. 2. The terminology was corrected. **Impact Analysis:** UEs not implementing the CR will require modifications. This CR does not have impact to UTRAN implementations. **Implementation of this CR by a R99/Rel-4 UE will not cause compatibility issues**
Consequences if not approved:	⌘	A UE may not apply threshold based rules in HCS high-mobility and may not measure sufficient cells when the serving cell quality is low. This could lead to

	fast-moving UEs reselecting to non-suitable cells.

Clauses affected:	⌘	5.6.2.1.2			
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

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

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

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

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

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

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

   ELSE

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

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

      ELSE

         measure on all intra-frequency 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

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

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

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

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

   ~~IF the UE is measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN~~

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

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

     - prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

     ELSE

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

     - prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.

   ENDIF

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

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

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

- ~~revert to measurements according to the threshold based measurement rules~~exit high-mobility.

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

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

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

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

      UE shall measure on all inter-RATm cells. ~~Fast-moving UEs may also use this rule.~~

   ELSE

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

         UE may choose to not measure neighbouring cells in RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.

      ELSE

         UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell ~~unless measurement rules for fast-moving UEs are triggered~~

      ENDIF

   ENDIF

   If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. ~~Fast-moving UEs may also use this rule.~~

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

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

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

     - UE shall measure on all inter-RATm cells.

   ~~IF the UE is measuring neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN~~

     - prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

   - ELSE

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

     - prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.

   - ENDIF

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

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

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

     - ~~revert to measure according to the threshold based measurement rules~~exit high-mobility.

< snip >

5.2.6.1.5 Cell reselection parameters in system information broadcasts

< snip >

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can ~~revert~~ exit ~~to low~~high-mobility ~~measurements~~.

3GPP TSG-RAN-WG2 Meeting #46
Phoenix, USA, 14-18 February 2005

Tdoc ⌘R2-050743

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.304** **CR** **139** ⌘ **rev** **1** ⌘ Current version: **6.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Intra- and inter-frequency measurement rules for HCS
Source:	⌘	RAN WG2
Work item code:	⌘	TEI5
Date:	⌘	Feb/2005
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*
Rel-7 *(Release 7)*

Reason for change: ⌘

CPICH Ec/No is a good measure of downlink quality and CPICH RSCP is a good measure of uplink quality. These measures are thus complementing each other and are both necessary to define the quality of a cell.

If HCS is used, both CPICH Ec/No thresholds and a CPICH RSCP thresholds are defined, but here the same threshold values are used both for inter and intra frequency cells. To avoid strong interference from RACH attempts towards a cell, which is not the best intra frequency cell available, the intra frequency thresholds are set to a high values if used. As a consequence the threshold functionality can't be used for inter frequency either.

Inter-RAT cell reselections should work for a release 99 UE when using HCS, and RAN4 has specified a test case for it in release 5.

Summary of change: ⌘

When HCS is used and Sintrasearch is not sent for the serving cell but SsearchHCS and Sintersearch (in FDD) are sent, the UE is mandated to meassure on:

- All intra-frequency neighbouring cells, and
- if (Srxlev > SsearchHCS) and (Sx > Sintersearch): all inter-frequency cells, which have higher HCS priority level than the serving cell, otherwise all inter-frequency cells.

The change is only for non-high-mobility.

		Impact Analysis: System information parameterisation optimised for UEs compliant to this CR will eliminate inter-frequency power saving options for legacy UEs. Since Sintrasearch is required to be set to a very high value if sent, power saving will only be performed for low priority inter-frequency cells. Hence, if there are no low priority cells there is no impact. **Implementation of this CR by a R99/Rel-4 UE will not cause any compatibility issues.**
Consequences if not approved:	⌘	The threshold functionality cannot be used for inter-frequency cell reselection (for neighbouring inter-frequency cells of equal HCS priority) without creating strong interference peaks and congestion for intra-frequency cells.

Clauses affected:	⌘	5.2.6.1.2			
		Y	**N**		
Other specs affected:	⌘	**X**		Other core specifications	⌘ CR 128rev1
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	Ranking rules are specified in CR128.			

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.6 Cell Reselection Evaluation Process

5.2.6.1 UTRA case

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

5.2.6.1.0 Use of MBMS PL

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

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

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

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

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

2. If Sx > $S_{intersearch}$ and MBMS PL has not been indicated, UE may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx > $S_{intersearch}$and MBMS PL has been indicated and the serving cell belongs to the MBMS PL, UE may choose to not perform inter-frequency measurements. Inter-frequency measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx > $S_{intersearch}$, MBMS PL has been indicated and the serving cell does not belong to the MBMS PL, UE shall at least perform inter-frequency measurements on the MBMS PL.
   If Sx <= $S_{intersearch}$, perform inter-frequency measurements.
   If $S_{intersearch}$, is not sent for serving cell, perform inter-frequency measurements.

3. If Sx > $Ssearch_{RAT\ m}$, UE may choose to not perform measurements on cells of RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.
   If Sx <= $Ssearch_{RAT\ m}$, perform measurements on cells of RAT "m".
   If $Ssearch_{RAT\ m}$, is not sent for serving cell, perform measurements on cells of RAT "m".

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

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

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

use HCS $priority_1$ as the HCS priority broadcast in the system information and apply the following rule:

IF an MBMS PL is used THEN

- If the UE is in HCS low mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS $priority_1$ + HCS_OFF_{mbms}.

- If the UE is in HCS high mobility state, for serving cell and neighbour cells belonging to the MBMS PL set the HCS priority = HCS $priority_1$.

- for serving cell and neighbour cells not belonging to the MBMS PL, set the HCS priority = HCS $priority_{1.}$

IF an MBMS PL is not used THEN

For serving cell and all neighbour cells set HCS priority = HCS $priority_1$

Then apply this to the following:

1. For intra-frequency and inter-frequency threshold-based measurement rules

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

   IF ($Srxlev_s$ <= $Ssearch_{HCS}$) or (if FDD and S_x <= $S_{intersearch}$) THEN

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

   ELSE

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

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

      ELSE

         measure on all intra-frequency 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

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

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

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

      ENDIF

   ENDIF

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

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

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

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

   IF the UE is measuring all cells according to the intra-frequency and inter-frequency threshold based measurement rules above THEN

   - prioritise reselection of intra-frequency and inter-frequency neighbouring cells having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.

   ELSE

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

   - prioritise re-selection of intra-frequency and inter-frequency neighbouring cells on lower HCS priority level than the serving cell before neighbouring cells on same HCS priority level.

ENDIF

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

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

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

- revert to measurements according to the threshold based measurement rules.

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

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

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

   UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

   ELSE

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

   UE may choose to not measure neighbouring cells in RAT "m". Inter-RAT measurements that may have been performed shall not be considered in the cell-reselection criteria.

   ELSE

   UE shall measure on all neighbouring cells in RAT "m", which have equal or higher HCS priority level than the serving cell unless measurement rules for fast-moving UEs are triggered

   ENDIF

   ENDIF

   If HCS is used and if $S_{HCS,RATm}$ is not sent for the serving cell, UE shall measure on all inter-RATm cells. Fast-moving UEs may also use this rule.

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

   - If the number of cell reselections during time period T_{CRmax} exceeds N_{CR}, high-mobility has been detected. In this high-mobility state, UE shall
   - IF the UE is measuring neighbouring cells of RAT "m" according to the inter-RAT threshold based measurement rules above THEN
     - prioritise re-selection of neighbouring cells in RAT "m" having lower HCS priority level than the serving cell before neighbouring cells having the same HCS priority level and prioritise neighbouring cells having the same HCS priority before neighbouring cells having higher HCS priority level.
   - ELSE
     - measure the neighbouring cells in RAT "m", which have an equal or lower HCS priority than the serving cell
     - prioritise re-selection of neighbouring cells in RAT "m" on lower HCS priority level than the serving cell before neighbouring cells in RAT "m" on same HCS priority level.
   - ENDIF

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

   - continue these measurements during time period $T_{CrmaxHyst}$
   - if the criteria for entering high mobility is not detected during time period $T_{CrmaxHyst}$
     - revert to measure according to the threshold-based measurement rules.

5.2.6.1.3 Highest ranked cells with access restrictions

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

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

5.2.6.1.4 Cell Reselection Criteria

[This subclause will need material on the MBMS offset, expected as part of the FLC changes.]

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

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

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

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

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

The cell-ranking criterion R is defined by:

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

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

where:

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

where:

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

$L_n = 0$ 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 $x >= 0$

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

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

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

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

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

Or

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

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

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

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

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

  - for all other serving and neighbour cells:

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

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

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

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

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

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

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

Where :

$Squal = Q_{qualmeas} – Qqualmin$

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

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

The UE shall perform ranking of all cells that fulfil the S criterion among

- all 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 5.2.6.1.2).

- all cells, not considering HCS priority levels, if no cell fulfil the criterion H >= 0. This case is also valid when it is indicated in system information that HCS is not used, that is when serving cell does not belong to a hierarchical cell structure.

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

The offset $Qoffset1_{s,n}$ is used for $Qoffset_{s,n}$ to calculate R_n, the hysteresis $Qhyst1_s$ is used for $Qhyst_s$ to calculate R_s. For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,PCH}$ to calculate R_s, if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Qhyst_s$ takes the value $Qhyst1_{s,FACH}$ to calculate R_s, if provided in SIB4 [see 4].

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

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

If an FDD cell is ranked as the best cell and the quality measure for cell selection and re-selection is set to CPICH RSCP, the UE shall perform cell re-selection to that FDD cell.

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

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

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

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

5.2.6.1.5 Cell reselection parameters in system information broadcasts

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

$Qoffset1_{s,n}$

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

$Qoffset2_{s,n}$

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

$Qhyst1_s$

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

$Qhyst1_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst1_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for TDD and GSM cells and for FDD cells in case the quality measure for cell selection and re-selection is set to CPICH RSCP. If this parameter is not provided in SIB4, $Qhyst1_s$ shall be used.

$Qhyst2_s$

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

$Qhyst2_{s,PCH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode states CELL_PCH and URA_PCH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

$Qhyst2_{s,FACH}$

This specifies the hysteresis value (Qhyst) to be used in RRC connected mode state CELL_FACH. It is used for FDD cells if the quality measure for cell selection and re-selection is set to CPICH Ec/No. If this parameter is not provided in SIB4, $Qhyst2_s$ shall be used.

HCS_PRIO_s, HCS_PRIO_n

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

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

HCS_OFF_{mbms}

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

$Qhcs_s$, $Qhcs_n$

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

Qoffmbms

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

Qqualmin

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

Qrxlevmin

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

$PENALTY\_TIME_n$

This specifies the time duration for which the $TEMPORARY\_OFFSET_n$ is applied for a neighbouring cell.

$TEMPORARY\_OFFSET1_n$

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

$TEMPORARY\_OFFSET2_n$

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

T_{CRmax}

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

N_{CR}

This specifies the maximum number of cell reselections.

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can revert to low-mobility measurements.

$Treselection_s$

This specifies the cell reselection timer value.

$Treselection_{s,PCH}$

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

$Treselection_{s,FACH}$

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

$Ssearch_{HCS}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the limit for Srxlev in the serving cell below which the UE shall initiate measurements of all neighbouring cells of the serving cell.

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

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

$S_{HCS,RATm}$

This threshold is used in the measurement rules for cell re-selection when HCS is used. It specifies the RAT specific threshold in the serving cell used in the inter-RAT measurement rules.

$S_{intrasearch}$

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

$S_{intersearch}$

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

$S_{limit,SearchRATm}$

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

5.2.6.2 GSM case

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