

Source: T-Mobile, NTT DoCoMo, Vodafone, Qualcomm, Telecom Italia

Title: Correction to cell selection and reselection parameters to enable enhanced cell reselection

The following CRs are in RP-050128:

Spec	CR	Rev	Phase	Subject	Cat	Version-Current	Version-New	Doc-2nd-Level	Workitem
25.304	136	1	Rel-5	Correction to cell selection and reselection parameters to enable enhanced cell reselection	B	5.7.0	5.8.0		TEI5
25.304	137	1	Rel-6	Correction to cell selection and reselection parameters to enable enhanced cell reselection	A	6.4.0	6.5.0		TEI5
25.331	2537	1	Rel-5	Correction to cell selection and reselection parameters to enable enhanced cell reselection	B	5.b.0	5.c.0		TEI5
25.331	2538	1	Rel-6	Correction to cell selection and reselection parameters to enable enhanced cell reselection	A	6.4.0	6.5.0		TEI5

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Tdoc ~~RP-050128~~

CR-Form-v7.1
CHANGE REQUEST
⌘ 25.304 CR 136 ⌘ 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: ⌘	Correction to cell selection and reselection parameters to enable enhanced cell reselection		
Source: ⌘	T-Mobile, NTT DoCoMo, Vodafone, Qualcomm, Telecom Italia		
Work item code: ⌘	TEI5	Date: ⌘	5 th March, 2005
Category: ⌘	B	Release: ⌘	Rel-5
<i>Use one of the following categories:</i> 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 .		<i>Use one of the following releases:</i> 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: ⌘	R2-042292 originally highlighted the issue of the frequent inter-frequency/RAT cell reselection even for stable UE and proposed a way to increase the “timer” penalty without impacting fast moving UE. On the other hand, R2-050392 proposed to apply a speed dependent scaling factor to Treselection to improve mainly intra-frequency cell reselection in high mobility. Later it was decided to merge the two proposal in order to obtain different Treselection for the different neighbouring types (intra-freq/inter-freq/inter-RAT) and a speed Dependent Scaling that allows differentiation of these Treselection based on the UE mobility.
Summary of change: ⌘	<ol style="list-style-type: none"> 1. High mobility detection is introduced for non-HCS case in 5.2.6.1.1a 2. The three scaling factors for Treselection are introduced and utilised as follows: <ul style="list-style-type: none"> For intra-frequency cells: <ul style="list-style-type: none"> - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by Speed dependent Scaling Factor if sent on system information. For inter-frequency cells: <ul style="list-style-type: none"> - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-Frequency Scaling Factor if sent on system information - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-Frequency Scaling Factor if sent on system information. For inter-RAT cells:

	<ul style="list-style-type: none"> - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-RAT Scaling Factor if sent on system information. - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-RAT Scaling Factor if sent on system information.
Consequences if not approved:	⌘ Optimal Treselection value can not be applied to cell types (intra-frequency, inter-frequency and inter-RAT) and UE mobility, which may result in unwanted ping-pong or out of service. This, in turn, would negatively affect the QoS experienced by the subscribers. These unwanted consequences have been observed in existing commercial UMTS networks.

Clauses affected:	⌘ 5.2.6.1.1a, 5.2.6.1.4, 5.2.6.1.5																
Other specs Affected:	<table border="1"> <tr> <td></td> <td>Y</td> <td>N</td> <td></td> </tr> <tr> <td>⌘</td> <td>X</td> <td></td> <td>Other core specifications</td> </tr> <tr> <td></td> <td></td> <td>X</td> <td>Test specifications</td> </tr> <tr> <td></td> <td></td> <td>X</td> <td>O&M Specifications</td> </tr> </table> ⌘ 25.331		Y	N		⌘	X		Other core specifications			X	Test specifications			X	O&M Specifications
	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 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 S_x and apply the following rules.
 1. If $S_x > S_{\text{intrasearch}}$, UE may choose to not perform intra-frequency measurements.
If $S_x \leq S_{\text{intrasearch}}$, perform intra-frequency measurements.
If $S_{\text{intrasearch}}$ is not sent for serving cell, perform intra-frequency measurements.
 2. If $S_x > S_{\text{intersearch}}$, 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 $S_x \leq S_{\text{intersearch}}$, perform inter-frequency measurements.
If $S_{\text{intersearch}}$ is not sent for serving cell, perform inter-frequency measurements.
 3. If $S_x > S_{\text{search}_{\text{RAT } m}}$, 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 $S_x \leq S_{\text{search}_{\text{RAT } m}}$, perform measurements on cells of RAT "m".
If $S_{\text{search}_{\text{RAT } m}}$ is not sent for serving cell, perform measurements on cells of RAT "m".

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

5.2.6.1.1a High mobility state when HCS is not used

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

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

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

- continue in high-mobility state.
- if the criteria for entering high mobility is not detected during time period non-HCS- $T_{\text{CRmaxHyst}}$:
 - exit high-mobility.

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

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 S_x and apply the following rules.
IF ($S_{\text{rxlev}_s} \leq S_{\text{search}_{\text{HCS}}}$) or (if FDD and $S_x \leq S_{\text{intersearch}}$) THEN
measure on all intra-frequency and inter-frequency cells. Fast-moving UEs may also use this rule.

ELSE

IF ($S_x > S_{\text{intra search}}$) 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 $S_{\text{intra search}}$ or $S_{\text{search HCS}}$ or $S_{\text{inter search}}$ (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 $T_{\text{CRmaxHyst}}$
- if the criteria for entering high mobility is not detected during time period $T_{\text{CRmaxHyst}}$:
 - 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 S_{qual} for FDD cells and S_{rxlev} for TDD cells for S_x and apply the following rules.

IF ($S_{\text{rxlev}_s} \leq S_{\text{HCS,RATm}}$) or (if FDD and $S_{\text{qual}} \leq S_{\text{SearchRATm}}$) THEN

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

ELSE

IF ($S_x > S_{\text{limit,SearchRATm}}$) 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-RAT_m 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 $T_{CmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CmaxHyst}$
 - 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:

$$H_s = Q_{\text{meas},s} - Q_{\text{hcs}_s}$$

$$H_n = Q_{\text{meas},n} - Q_{\text{hcs}_n} - TO_n * L_n$$

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:

$$R_s = Q_{\text{meas},s} + Q_{\text{hyst}_s}$$

$$R_n = Q_{\text{meas},n} - Q_{\text{offset}_{s,n}} - TO_n * (1 - L_n)$$

where:

$$TO_n = \text{TEMP_OFFSET}_n * W(\text{PENALTY_TIME}_n - T_n)$$

$$L_n = 0 \quad \text{if } \text{HCS_PRIO}_n = \text{HCS_PRIO}_s$$

$$L_n = 1 \quad \text{if } \text{HCS_PRIO}_n <> \text{HCS_PRIO}_s$$

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

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

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 $\text{HCS_PRIO}_n <> \text{HCS_PRIO}_s$ and

$$Q_{\text{meas},n} > Q_{\text{hcs}_n}$$

Or

- if $\text{HCS_PRIO}_n = \text{HCS_PRIO}_s$ 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:

$$Q_{\text{meas},n} > Q_{\text{meas},s} + Q_{\text{offset}_{1,s,n}}$$

- 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:

$$Q_{\text{meas},n} > Q_{\text{meas},s} + Q_{\text{offset}_{2,s,n}}$$

- for all other serving and neighbour cells:

$$Q_{\text{meas},n} > Q_{\text{meas},s} + Q_{\text{offset}_{1,s,n}}$$

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 E_c/N_0 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:	$S_{rxlev} > 0$ AND $S_{qual} > 0$
for TDD cells:	$S_{rxlev} > 0$
for GSM cells:	$S_{rxlev} > 0$

Where :

$S_{qual} = Q_{qualmeas} - Q_{qualmin}$
$S_{rxlev} = Q_{rxlevmeas} - Q_{rxlevmin} - P_{compensation}$

S_{qual}	Cell Selection quality value (dB) Applicable only for FDD cells.
S_{rxlev}	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 E_c/N_0 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].
$Q_{qualmin}$	Minimum required quality level in the cell (dB). Applicable only for FDD cells.
$Q_{rxlevmin}$	Minimum required RX level in the cell (dBm)
$P_{compensation}$	$\max(UE_TXPWR_MAX_RACH - P_MAX, 0)$ (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 $H \geq 0$. 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 $H \geq 0$. 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 $Q_{offset1,s,n}$ is used for $Q_{offset,s,n}$ to calculate R_n , the hysteresis $Q_{hyst1,s}$ is used for $Q_{hyst,s}$ to calculate R_s . For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Q_{hyst,s}$ takes the value $Q_{hyst1,s,PCH}$ to calculate R_s , if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Q_{hyst,s}$ takes the value $Q_{hyst1,s,FACH}$ 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 $Q_{offset2,s,n}$ is used for $Q_{offset,s,n}$ to calculate R_n , the hysteresis $Q_{hyst2,s}$ is used for $Q_{hyst,s}$ to calculate R_s . For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Q_{hyst,s}$ takes the value $Q_{hyst2,s,PCH}$ to calculate R_s , if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Q_{hyst,s}$ takes the value $Q_{hyst2,s,FACH}$ 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 $T_{reselection}$. For UE in RRC connected mode states CELL_PCH or URA_PCH the interval $T_{reselection,s,PCH}$ applies, if provided in SIB4 [see 4], while for UE in RRC connected mode state CELL_FACH the interval $T_{reselection,s,FACH}$ applies, if provided in SIB4 [see 4]. For hierarchical cell structures when high mobility state has not been detected, if according to the HCS rules the serving cell is not ranked then all the ranked cells are considered to be better ranked than the serving cell.

Additionally the UE shall apply the following scaling rules to $T_{reselection_s}$ or $T_{reselection_{s,PCH}}$ or $T_{reselection_{s,FACH}}$:

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

- no scaling applied.

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

- multiply $T_{reselection_s}$ or $T_{reselection_{s,PCH}}$ or $T_{reselection_{s,FACH}}$ by the IE "Speed dependent ScalingFactor for $T_{reselection}$ " if sent on system information.

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

- multiply $T_{reselection_s}$ or $T_{reselection_{s,PCH}}$ or $T_{reselection_{s,FACH}}$ by the IE "Inter-Frequency ScalingFactor for $T_{reselection}$ " if sent on system information.

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

- multiply $T_{reselection_s}$ or $T_{reselection_{s,PCH}}$ or $T_{reselection_{s,FACH}}$ by both the IEs "Speed dependent ScalingFactor for $T_{reselection}$ " if sent on system information and "Inter-Frequency ScalingFactor for $T_{reselection}$ " if sent on system information.

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

- multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by the IE “Inter-RAT ScalingFactor for Treselection” if sent on system information.
 - For inter-RAT cells and high mobility state is detected:
 - multiply $Treselection_s$ or $Treselection_{s,PCH}$ or $Treselection_{s,FACH}$ by both the IEs “Speed dependent ScalingFactor for Treselection” if sent on system information and “Inter-RAT ScalingFactor for Treselection” if sent on system information.
- In case scaling is applied to $Treselection_s$ or $Treselection_{s,PCH}$, the UE shall round up the result after all scalings to the nearest second. In case scaling is applied to $Treselection_{s,FACH}$, the UE shall round up the result after all scalings to the nearest 0.2 seconds.
- more than 1 second has elapsed since the UE camped on the current serving cell.

5.2.6.1.5 Cell reselection parameters in system information broadcasts

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

Qoffset1_{s,n}

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

Qoffset2_{s,n}

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

Qhyst1_s

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

Qhyst1_{s,PCH}

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

Qhyst1_{s,FACH}

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

Qhyst2_s

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

Qhyst2_{s,PCH}

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

Qhyst2_{s,FACH}

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

HCS_PRIO_s, HCS_PRIO_n

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

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

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.

non-HCS T_{CRmax}

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

non-HCS N_{CR}

[This specifies the maximum number of cell reselections in case of non-HCS usage.](#)

non-HCS T_{CRmaxHyst}

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

Treselection_s

This specifies the cell reselection timer value.

Treselection_{s,PCH}

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

Treselection_{s,FACH}

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

$S_{search_{HCS}}$

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

$S_{search_{RAT1}} - S_{search_{RATk}}$

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".

Speed dependent ScalingFactor for Treselection

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

Inter-frequency ScalingFactor for Treselection

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

Inter-RAT ScalingFactor for Treselection

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

5.2.6.2 GSM case

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

3GPP TSG-RAN Meeting #27
Tokyo, Japan, 9th-11th March 2005

Tdoc ~~RP-050128~~

CR-Form-v7.1
CHANGE REQUEST
⌘ 25.304 CR 137 ⌘ 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: ⌘	Correction to cell selection and reselection parameters to enable enhanced cell reselection		
Source: ⌘	T-Mobile, NTT DoCoMo, Vodafone, Qualcomm, Telecom Italia		
Work item code: ⌘	TEI5	Date: ⌘	5 th March, 2005
Category: ⌘	A	Release: ⌘	Rel-6
	<i>Use one of the following categories:</i> 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 .		<i>Use one of the following releases:</i> 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: ⌘	R2-042292 originally highlighted the issue of the frequent inter-frequency/RAT cell reselection even for stable UE and proposed a way to increase the “timer” penalty without impacting fast moving UE. On the other hand, R2-050392 proposed to apply a speed dependent scaling factor to Treselection to improve mainly intra-frequency cell reselection in high mobility. Later it was decided to merge the two proposal in order to obtain different Treselection for the different neighbouring types (intra-freq/inter-freq/inter-RAT) and a speed Dependent Scaling that allows differentiation of these Treselection based on the UE mobility.
Summary of change: ⌘	1. High mobility detection is introduced for non-HCS case in 5.2.6.1.1a 2. The three scaling factors for Treselection are introduced and utilised as follows: For intra-frequency cells: - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by Speed dependent Scaling Factor if sent on system information. For inter-frequency cells: - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-Frequency Scaling Factor if sent on system information - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-Frequency Scaling Factor if sent on system information. For inter-RAT cells:

	<ul style="list-style-type: none"> - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-RAT Scaling Factor if sent on system information. - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-RAT Scaling Factor if sent on system information.
Consequences if not approved:	⌘ Optimal Treselection value can not be applied to cell types (intra-frequency, inter-frequency and inter-RAT) and UE mobility, which may result in unwanted ping-pong or out of service. This, in turn, would negatively affect the QoS experienced by the subscribers. These unwanted consequences have been observed in existing commercial UMTS networks.

Clauses affected:	⌘ 5.2.6.1.1a, 5.2.6.1.4, 5.2.6.1.5																
Other specs Affected:	<table border="1"> <tr> <td></td> <td>Y</td> <td>N</td> <td></td> </tr> <tr> <td>⌘</td> <td>X</td> <td></td> <td>Other core specifications</td> </tr> <tr> <td></td> <td></td> <td>X</td> <td>Test specifications</td> </tr> <tr> <td></td> <td></td> <td>X</td> <td>O&M Specifications</td> </tr> </table> ⌘ 25.331		Y	N		⌘	X		Other core specifications			X	Test specifications			X	O&M Specifications
	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 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 S_x and apply the following rules.
 1. If $S_x > S_{\text{intrasearch}}$, UE may choose to not perform intra-frequency measurements.
If $S_x \leq S_{\text{intrasearch}}$, perform intra-frequency measurements.
If $S_{\text{intrasearch}}$ is not sent for serving cell, perform intra-frequency measurements.
 2. If $S_x > S_{\text{intersearch}}$ 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 $S_x > S_{\text{intersearch}}$ 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 $S_x > S_{\text{intersearch}}$, 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 $S_x \leq S_{\text{intersearch}}$, perform inter-frequency measurements.
If $S_{\text{intersearch}}$ is not sent for serving cell, perform inter-frequency measurements.
 3. If $S_x > S_{\text{search}_{\text{RAT } m}}$, 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 $S_x \leq S_{\text{search}_{\text{RAT } m}}$, perform measurements on cells of RAT "m".
If $S_{\text{search}_{\text{RAT } m}}$ is not sent for serving cell, perform measurements on cells of RAT "m".

If HCS is not used and if $S_{\text{limit,Search}_{\text{RAT } m}}$ is sent for serving cell, UE shall ignore it.

5.2.6.1.1a High mobility state when HCS is not used

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

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

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

- continue in high-mobility state.
- if the criteria for entering high mobility is not detected during time period non-HCS- $T_{\text{CRmaxHyst}}$:
 - exit high-mobility.

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

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 priority₁ 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 priority₁ + 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 priority₁.
- for serving cell and neighbour cells not belonging to the MBMS PL, set the HCS priority = HCS priority₁.

IF an MBMS PL is not used THEN

For serving cell and all neighbour cells set HCS priority = HCS priority₁

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 S_x and apply the following rules.

IF (Srxlev_s ≤ S_{searchHCS}) 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

- 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 S_{qual} for FDD cells and S_{rxlev} for TDD cells for S_x and apply the following rules.

IF ($S_{rxlev_s} \leq S_{HCS,RATm}$) or (if FDD and $S_{qual} \leq S_{SearchRATm}$) 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 $T_{CmaxHyst}$
- if the criteria for entering high mobility is not detected during time period $T_{CmaxHyst}$
 - 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:

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

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

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:

$$R_s = Q_{meas,s} + Q_{hyst_s} + Q_{offmbms}$$

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

where:

the signalled value $Q_{offmbms}$ is only applied to those cells (serving or neighbouring) belonging to the MBMS PL

where:

$$TO_n = TEMP_OFFSET_n * W(PENALTY_TIME_n - T_n)$$

$$L_n = 0 \quad \text{if } HCS_PRIO_n = HCS_PRIO_s$$

$$L_n = 1 \quad \text{if } HCS_PRIO_n <> HCS_PRIO_s$$

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

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

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

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

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:

$$Q_{meas,n} > Q_{meas,s} + Q_{offset1,s,n}$$

- 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:

$$Q_{meas,n} > Q_{meas,s} + Q_{offset2,s,n}$$

- for all other serving and neighbour cells:

$$Q_{meas,n} > Q_{meas,s} + Q_{offset1,s,n}$$

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:	$S_{rxlev} > 0$ AND $S_{qual} > 0$
for TDD cells:	$S_{rxlev} > 0$
for GSM cells:	$S_{rxlev} > 0$

Where :

$S_{qual} = Q_{qualmeas} - Q_{qualmin}$
$S_{rxlev} = Q_{rxlevmeas} - Q_{rxlevmin} - P_{compensation}$

S_{qual}	Cell Selection quality value (dB) Applicable only for FDD cells.
S_{rxlev}	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 E_c/N_0 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].
$Q_{qualmin}$	Minimum required quality level in the cell (dB). Applicable only for FDD cells.
$Q_{rxlevmin}$	Minimum required RX level in the cell (dBm)
$P_{compensation}$	$\max(UE_TXPWR_MAX_RACH - P_MAX, 0)$ (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 $H \geq 0$. 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 $H \geq 0$. 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 $Q_{offset1_{s,n}}$ is used for $Q_{offset_{s,n}}$ to calculate R_n , the hysteresis Q_{hyst1_s} is used for Q_{hyst_s} to calculate R_s . For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis Q_{hyst_s} takes the value $Q_{hyst1_{s,PCH}}$ to calculate R_s , if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis Q_{hyst_s} takes the value $Q_{hyst1_{s,FACH}}$ 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 $Q_{\text{meas},n}$ and $Q_{\text{meas},s}$ and calculating the R values of the FDD cells. The offset $Q_{\text{offset}2_{s,n}}$ is used for $Q_{\text{offset},n}$ to calculate R_n , the hysteresis $Q_{\text{hyst}2_s}$ is used for $Q_{\text{hyst},s}$ to calculate R_s . For UE in RRC connected mode states CELL_PCH or URA_PCH the hysteresis $Q_{\text{hyst},s}$ takes the value $Q_{\text{hyst}2_{s,PCH}}$ to calculate R_s , if provided in SIB4 [see 4]. For UE in RRC connected mode state CELL_FACH the hysteresis $Q_{\text{hyst},s}$ takes the value $Q_{\text{hyst}2_{s,FACH}}$ to calculate R_s , if provided in SIB4 [see 4]. If the usage of HCS is indicated in system information, TEMP_OFFSET_{2n} 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 $T_{\text{reselection}}$. For UE in RRC connected mode states CELL_PCH or URA_PCH the interval $T_{\text{reselection}_{s,PCH}}$ applies, if provided in SIB4 [see 4], while for UE in RRC connected mode state CELL_FACH the interval $T_{\text{reselection}_{s,FACH}}$ applies, if provided in SIB4 [see 4]. For hierarchical cell structures when high mobility state has not been detected, if according to the HCS rules the serving cell is not ranked then all the ranked cells are considered to be better ranked than the serving cell.

Additionally the UE shall apply the following scaling rules to $T_{\text{reselection}_s}$ or $T_{\text{reselection}_{s,PCH}}$ or $T_{\text{reselection}_{s,FACH}}$:

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

- no scaling applied.

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

- multiply $T_{\text{reselection}_s}$ or $T_{\text{reselection}_{s,PCH}}$ or $T_{\text{reselection}_{s,FACH}}$ by the IE "Speed dependent ScalingFactor for Treselection" if sent on system information.

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

- multiply $T_{\text{reselection}_s}$ or $T_{\text{reselection}_{s,PCH}}$ or $T_{\text{reselection}_{s,FACH}}$ by the IE "Inter-Frequency ScalingFactor for Treselection" if sent on system information.

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

- multiply $T_{\text{reselection}_s}$ or $T_{\text{reselection}_{s,PCH}}$ or $T_{\text{reselection}_{s,FACH}}$ by both the IEs "Speed dependent ScalingFactor for Treselection" if sent on system information and "Inter-Frequency ScalingFactor for Treselection" if sent on system information.

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

- multiply $T_{\text{reselection}_s}$ or $T_{\text{reselection}_{s,PCH}}$ or $T_{\text{reselection}_{s,FACH}}$ by the IE "Inter-RAT ScalingFactor for Treselection" if sent on system information.

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

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

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

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

5.2.6.1.5 Cell reselection parameters in system information broadcasts

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

Qoffset1_{s,n}

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

Qoffset2_{s,n}

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

Qhyst1_s

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

Qhyst1_{s,PCH}

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

Qhyst1_{s,FACH}

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

Qhyst2_s

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

Qhyst2_{s,PCH}

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

Qhyst2_{s,FACH}

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

HCS_PRIO_s, HCS_PRIO_n

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

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

HCS_OFF_{mbms}

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

Qhcs_s, Qhcs_n

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

Qoffmbms

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

Qqualmin

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

Qrxlevmin

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

PENALTY_TIME_n

This specifies the time duration for which the TEMPORARY_OFFSET_n is applied for a neighbouring cell.

TEMPORARY_OFFSET1_n

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

TEMPORARY_OFFSET2_n

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

T_{CRmax}

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

N_{CR}

This specifies the maximum number of cell reselections.

T_{CRmaxHyst}

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

non-HCS T_{CRmax}

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

non-HCS N_{CR}

[This specifies the maximum number of cell reselections in case of non-HCS usage.](#)

non-HCS T_{CRmaxHyst}

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

Treselection_s

This specifies the cell reselection timer value.

Treselection_{s,PCH}

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

Treselection_{s,FACH}

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

Ssearch_{HCS}

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

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.

 $S_{\text{intrasearch}}$

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

 $S_{\text{intersearch}}$

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

 $S_{\text{limit,SearchRATm}}$

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

Speed dependent ScalingFactor for Treselection

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

Inter-frequency ScalingFactor for Treselection

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

Inter-RAT ScalingFactor for Treselection

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

5.2.6.2 GSM case

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

CHANGE REQUEST

25.331 CR 2537 rev 1 Current version: **5.b.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: Correction to cell selection and reselection parameters to enable enhanced cell reselection

Source: T-Mobile, NTT DoCoMo, Vodafone, Qualcomm, Telecom Italia

Work item code: TEI5

Date: 5th March, 2005

Category: **B**

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: R2-042292 originally highlighted the issue of the frequent inter-frequency/RAT cell reselection even for stable UE and proposed a way to increase the "timer" penalty without impacting fast moving UE. On the other hand, R2-050392 proposed to apply a speed dependent scaling factor to Treselection to improve mainly intra-frequency cell reselection in high mobility. Later it was decided to merge the two proposal in order to obtain different Treselection for the different neighbouring types (intra-freq/inter-freq/inter-RAT) and a speed Dependent Scaling that allows differentiation of these Treselection based on the UE mobility.

Summary of change:

1. Parameters for high mobility detections were introduced for non-HCS case.
2. The three scaling factors for Treselection are introduced and utilised as follows:
 - For intra-frequency cells:
 - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by Speed dependent Scaling Factor if sent on system information.
 - For inter-frequency cells:
 - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-Frequency Scaling Factor if sent on system information
 - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-Frequency Scaling Factor if sent on system information.
 - For inter-RAT cells:

- In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-RAT Scaling Factor if sent on system information.
- In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-RAT Scaling Factor if sent on system information.

Consequences if not approved: ⓘ Optimal Treselection value can not be applied to cell types (intra-frequency, inter-frequency and inter-RAT) and UE mobility, which may result in unwanted ping-pong or out of service. This, in turn, would negatively affect the QoS experienced by the subscribers. These unwanted consequences have been observed in existing commercial UMTS networks.

Clauses affected: ⓘ Section 10.3.2.3

	Y	N		
Other specs Affected:	ⓘ X		Other core specifications	ⓘ 25.304
		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.

10.3.2.3 Cell selection and re-selection info for SIB3/4

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Mapping Info	OP		Mapping info 10.3.2.5	This IE should not be sent.	
Cell selection and reselection quality measure	MP		Enumerated (CPICH Ec/N0, CPICH RSCP)	Choice of measurement (CPICH Ec/N0 or CPICH RSCP) to use as quality measure Q for FDD cells. This IE is also sent to the UE in SIB11/12. Both occurrences of the IE should be set to the same value.	
CHOICE <i>mode</i>	MP				
>FDD					
>>S _{intrasearch}	OP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{intersearch}	OP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{searchHCS}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>RAT List	OP	1 to <maxOtherRAT>			
>>>RAT identifier	MP		Enumerated (GSM, cdma2000)		
>>>S _{search,RAT}	MP		Integer (-32..20 by step of 2)	In case the value 20 is received the UE shall consider this IE as if it was absent according to [4] If a negative value is received the UE shall consider the value to be 0. [dB]	
>>>S _{HCS,RAT}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>S _{limit,SearchRAT}	MP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>Qqualmin	MP		Integer (-	Ec/N0, [dB]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			24..0)		
>>Qrxlevmin	MP		Integer (-115..-25 by step of 2)	RSCP, [dBm]	
>> Delta _{Qrxlevmin}	CV-Delta		Integer(-4..-2 by step of 2)	If present, the actual value of Qrxlevmin = Qrxlevmin + Delta _{Qrxlevmin}	REL-5
>TDD					
>>S _{intrasearch}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{intersearch}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{searchHCS}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>RAT List	OP	1 to <maxOtherRAT>			
>>>>RAT identifier	MP		Enumerated (GSM, cdma2000)		
>>>>S _{search,RAT}	MP		Integer (-105..91 by step of 2)	In case the value 91 is received the UE shall consider this IE as if it was absent according to [4] If a negative value is received the UE shall consider the value to be 0. [dB]	
>>>>S _{HCS,RAT}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>>S _{limit,SearchRAT}	MP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>Qrxlevmin	MP		Integer (-115..-25 by step of 2)	RSCP, [dBm]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>>Delta _{Qrxlevmin}	CV- <i>Delta</i>		Integer(-4..-2 by step of 2)	If present, the actual value of Qrxlevmin = Qrxlevmin + Delta _{Qrxlevmin}	REL-5
Qhyst1 _s	MP		Integer (0..40 by step of 2)	[4] [dB]	
Qhyst1 _{s,PCH}	CV- <i>SIB4</i>		Integer (0..40)	If present, it is used as Qhyst1 _s for UE in CELL_PCH or URA_PCH state [4] [dB]	REL-5
Qhyst1 _{s,FACH}	CV- <i>SIB4</i>		Integer (0..40)	If present, it is used as Qhyst1 _s for UE in CELL_FACH state [4] [dB]	REL-5
Qhyst2 _s	CV- <i>FDD- Quality- Measure</i>		Integer (0..40 by step of 2)	Default value is Qhyst1 _s [4] [dB]	
Qhyst2 _{s,PCH}	CV- <i>SIB4- FDD- Quality- Measure</i>		Integer (0..40)	If present, it is used as Qhyst2 _s for UE using CPICH Ec/No quality measure in CELL_PCH or URA_PCH state. Default value is Qhyst1 _{s,PCH} [4] [dB]	REL-5
Qhyst2 _{s,FACH}	CV- <i>SIB4- FDD- Quality- Measure</i>		Integer (0..40)	If present, it is used as Qhyst2 _s for UE using CPICH Ec/No quality measure in CELL_FACH state. Default value is Qhyst1 _{s,FACH} [4] [dB]	REL-5
Treselection _s	MP		Integer (0..31)	[s]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Treselection _{s,PCH}	CV-SIB4		Integer (0..31)	If present, it is used as Treselection _s for UE in CELL_PCH or URA_PCH state [4] [s]	REL-5
Treselection _{s,FACH}	CV-SIB4		Integer Real (0..6.2 by step of 0.2)	If present, it is used as Treselection _s for UE in CELL_FACH state [4] [s]	REL-5
Speed dependent ScalingFactor for Treselection	OP		Real (0..1 by step of 0.1)	This IE is used by the UE in high mobility state as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} [4].	REL-5
Inter-frequency ScalingFactor for Treselection	OP		Real (1..4.75 by step of 0.25)	If present, it is used by the UE as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} for inter-frequency cell reselection evaluation [4].	REL-5
Inter-RAT ScalingFactor for Treselection	OP		Real (1..4.75 by step of 0.25)	If present, it is used by the UE as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} for inter-RAT cell reselection evaluation [4].	REL-5
Non-HCS T_{CRmax}	MD		Enumerated (not used, 30, 60, 120, 180, 240)	[s] Default value is 'not used'.	REL-5
Non-HCS N_{CR}	CV-UE speed detector MD		Integer (1..16)	Default value = 8	REL-5
Non-HCS T_{CRmaxHyst}	CV-UE speed detector MP		Enumerated (not used, 10, 20, 30, 40, 50, 60, 70)	[s]	REL-5

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
HCS Serving cell Information	OP		HCS Serving cell information 10.3.7.12		
Maximum allowed UL TX power	MP		Maximum allowed UL TX power 10.3.6.39	[dBm] UE_TXPWR_MAX_RACH in [4].	

Condition	Explanation
<i>FDD-Quality-Measure</i>	The IE is not needed if the IE "Cell selection and reselection quality measure" has the value CPICH RSCP, otherwise the IE is mandatory and has a default value.
Delta	This IE is optional if the value of Qrxlevmin is below – 115dBm. It is not needed otherwise.
<i>SIB4</i>	This IE is optional if the IE "Cell selection and reselection info for SIB3/4" is included in SIB type 4. It is not needed otherwise.
<i>SIB4-FDD-Quality-Measure</i>	This IE is optional if the IE "Cell selection and reselection info for SIB3/4" is included in SIB type 4, and the IE "Cell selection and reselection quality measure" has the value CPICH Ec/N0. It is not needed otherwise.
<u>UE Speed detector_MD (non-HCS)</u>	<u>This IE is not needed if non-HCS T_{CRmax} equals 'not used', else it is mandatory default.</u>
<u>UE Speed detector_MP (non-HCS)</u>	<u>This IE is not needed if non-HCS T_{CRmax} equals 'not used', else it is mandatory present.</u>

***** ASN.1 MODIFICATIONS *****

```

SysInfoType3 ::= SEQUENCE {
  sib4indicator          BOOLEAN,
  -- UTRAN mobility IEs
  cellIdentity           CellIdentity,
  cellSelectReselectInfo CellSelectReselectInfoSIB-3-4,
  cellAccessRestriction CellAccessRestriction,
  -- Extension mechanism for non- release99 information
  v4b0NonCriticalExtensions SEQUENCE {
    sysInfoType3-v4b0ext      SysInfoType3-v4b0ext-IEs,
    v590NonCriticalExtension SEQUENCE {
      sysInfoType3-v590ext      SysInfoType3-v590ext,
      v5c0NonCriticalExtension SEQUENCE {
        sysInfoType3-v5c0ext SysInfoType3-v5c0ext-IEs,
        nonCriticalExtensions SEQUENCE {}
      }
    }
  }
}

```

```

SysInfoType3-v4b0ext-IEs ::= SEQUENCE {
  mapping-LCR          Mapping-LCR-r4
}

```

```

SysInfoType3-v590ext ::= SEQUENCE {
  cellSelectReselectInfo-v590ext CellSelectReselectInfo-v590ext
}

```

```

SysInfoType3-v5c0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoTreseselectionScaling-v5c0ext CellSelectReselectInfoTreseselectionScaling-
v5c0ext OPTIONAL
}

```

```

SysInfoType4 ::= SEQUENCE {
  -- UTRAN mobility IEs
  cellIdentity           CellIdentity,
  cellSelectReselectInfo CellSelectReselectInfoSIB-3-4,
  cellAccessRestriction CellAccessRestriction,
  -- Extension mechanism for non- release99 information
  v4b0NonCriticalExtensions SEQUENCE {
    sysInfoType4-v4b0ext      SysInfoType4-v4b0ext-IEs,
    v590NonCriticalExtension SEQUENCE {
      sysInfoType4-v590ext      SysInfoType4-v590ext,
      v5b0NonCriticalExtension SEQUENCE {
        sysInfoType4-v5b0ext      SysInfoType4-v5b0ext-IEs,
        v5c0NonCriticalExtension SEQUENCE {
          sysInfoType4-v5c0ext SysInfoType4-v5c0ext-IEs,
          nonCriticalExtensions SEQUENCE {}
        }
      }
    }
  }
}

```

```

SysInfoType4-v4b0ext-IEs ::= SEQUENCE {
  mapping-LCR          Mapping-LCR-r4
}

```

```

SysInfoType4-v590ext ::= SEQUENCE {
  cellSelectReselectInfo-v590ext CellSelectReselectInfo-v590ext
}

```

```

SysInfoType4-v5b0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoPCHFACH-v5b0ext CellSelectReselectInfoPCHFACH-v5b0ext
}

```

```

SysInfoType4-v5c0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoTreseselectionScaling-v5c0ext CellSelectReselectInfoTreseselectionScaling-
v5c0ext OPTIONAL
}

```

[...]


```

CellSelectReselectInfo-v590ext ::= SEQUENCE {
    deltaQrxlevmin          DeltaQrxlevmin          OPTIONAL,
    deltaQhcs               DeltaRSCP              OPTIONAL
}

```

```

CellSelectReselectInfoPCHFACH-v5b0ext ::= SEQUENCE {
    q-Hyst-1-S-PCH          Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-1-S-FACH         Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-2-S-PCH          Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-2-S-FACH         Q-Hyst-S-Fine          OPTIONAL,
    t-Reselection-S-PCH     T-Reselection-S       OPTIONAL,
    t-Reselection-S-FACH    T-Reselection-S-Fine  OPTIONAL
}

```

```

CellSelectReselectInfoTresselectionScaling-v5c0ext ::= SEQUENCE {
-- For speed detection, the same HCS parameters are utilised
non-HCS-t-CR-Max          T-CRMax                      OPTIONAL,
speedDependentScalingFactor SpeedDependentScalingFactor  OPTIONAL,
interFrequencyTresselectionScalingFactor TresselectionScalingFactor  OPTIONAL,
interRATTresselectionScalingFactor TresselectionScalingFactor  OPTIONAL
}

```

[...]

```

-- Actual value ScalingFactor = IE value * 0.1
SpeedDependentScalingFactor INTEGER(0..10)

```

```

-- Actual value ScalingFactor = IE value * 0.25
TresselectionScalingFactor INTEGER(4..19)

```

CHANGE REQUEST

25.331 CR 2538 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:	Correction to cell selection and reselection parameters to enable enhanced cell reselection		
Source:	T-Mobile, NTT DoCoMo, Vodafone, Qualcomm, Telecom Italia		
Work item code:	TEI5	Date:	5 th March, 2005
Category:	A	Release:	Rel-6
	<p>Use <u>one</u> of the following categories:</p> <p>F (correction)</p> <p>A (corresponds to a correction in an earlier release)</p> <p>B (addition of feature),</p> <p>C (functional modification of feature)</p> <p>D (editorial modification)</p> <p>Detailed explanations of the above categories can be found in 3GPP TR 21.900.</p>		<p>Use <u>one</u> of the following releases:</p> <p>Ph2 (GSM Phase 2)</p> <p>R96 (Release 1996)</p> <p>R97 (Release 1997)</p> <p>R98 (Release 1998)</p> <p>R99 (Release 1999)</p> <p>Rel-4 (Release 4)</p> <p>Rel-5 (Release 5)</p> <p>Rel-6 (Release 6)</p> <p>Rel-7 (Release 7)</p>

Reason for change: R2-042292 originally highlighted the issue of the frequent inter-frequency/RAT cell reselection even for stable UE and proposed a way to increase the "timer" penalty without impacting fast moving UE. On the other hand, R2-050392 proposed to apply a speed dependent scaling factor to Treselection to improve mainly intra-frequency cell reselection in high mobility. Later it was decided to merge the two proposal in order to obtain different Treselection for the different neighbouring types (intra-freq/inter-freq/inter-RAT) and a speed Dependent Scaling that allows differentiation of these Treselection based on the UE mobility.

Summary of change:

1. Parameters for high mobility detections were introduced for non-HCS case.
2. The three scaling factors for Treselection are introduced and utilised as follows:
 - For intra-frequency cells:
 - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by Speed dependent Scaling Factor if sent on system information.
 - For inter-frequency cells:
 - In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-Frequency Scaling Factor if sent on system information
 - In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-Frequency Scaling Factor if sent on system information.
 - For inter-RAT cells:

- In slow mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by the Inter-RAT Scaling Factor if sent on system information.
- In high mobility, multiply Treselections or Treselections,PCH or Treselections,FACH by both the Speed dependent Scaling Factor if sent on system information and Inter-RAT Scaling Factor if sent on system information.

Consequences if not approved:

⌘ Optimal Treselection value can not be applied to cell types (intra-frequency, inter-frequency and inter-RAT) and UE mobility, which may result in unwanted ping-pong or out of service. This, in turn, would negatively affect the QoS experienced by the subscribers. These unwanted consequences have been observed in existing commercial UMTS networks.

Clauses affected:

⌘ Section 10.3.2.3

Other specs Affected:

	Y	N		
⌘	X		Other core specifications	⌘ 25.304
		X	Test specifications	
		X	O&M Specifications	

Other comments:

⌘

How to create CRs using this form:

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- 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.

10.3.2.3 Cell selection and re-selection info for SIB3/4

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Mapping Info	OP		Mapping info 10.3.2.5	This IE should not be sent.	
Cell selection and reselection quality measure	MP		Enumerated (CPICH Ec/N0, CPICH RSCP)	Choice of measurement (CPICH Ec/N0 or CPICH RSCP) to use as quality measure Q for FDD cells. This IE is also sent to the UE in SIB11/12. Both occurrences of the IE should be set to the same value.	
CHOICE <i>mode</i>	MP				
>FDD					
>>S _{intrasearch}	OP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{intersearch}	OP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{searchHCS}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>RAT List	OP	1 to <maxOtherRAT>			
>>>RAT identifier	MP		Enumerated (GSM, cdma2000)		
>>>S _{search,RAT}	MP		Integer (-32..20 by step of 2)	In case the value 20 is received the UE shall consider this IE as if it was absent according to [4] If a negative value is received the UE shall consider the value to be 0. [dB]	
>>>S _{HCS,RAT}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>S _{limit,SearchRAT}	MP		Integer (-32..20 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>Qqualmin	MP		Integer (-	Ec/N0, [dB]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			24..0)		
>>Qrxlevmin	MP		Integer (-115..-25 by step of 2)	RSCP, [dBm]	
>> Delta _{Qrxlevmin}	CV-Delta		Integer(-4..-2 by step of 2)	If present, the actual value of Qrxlevmin = Qrxlevmin + Delta _{Qrxlevmin}	REL-5
>TDD					
>>S _{intrasearch}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{intersearch}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>S _{searchHCS}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>RAT List	OP	1 to <maxOtherRAT>			
>>>>RAT identifier	MP		Enumerated (GSM, cdma2000)		
>>>>S _{search,RAT}	MP		Integer (-105..91 by step of 2)	In case the value 91 is received the UE shall consider this IE as if it was absent according to [4] If a negative value is received the UE shall consider the value to be 0. [dB]	
>>>>S _{HCS,RAT}	OP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>>>S _{limit,SearchRAT}	MP		Integer (-105..91 by step of 2)	If a negative value is received the UE shall consider the value to be 0. [4] [dB]	
>>Qrxlevmin	MP		Integer (-115..-25 by step of 2)	RSCP, [dBm]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>>Delta _{Qrxlevmin}	CV- <i>Delta</i>		Integer(-4..-2 by step of 2)	If present, the actual value of Qrxlevmin = Qrxlevmin + Delta _{Qrxlevmin}	REL-5
Qhyst1 _s	MP		Integer (0..40 by step of 2)	[4] [dB]	
Qhyst1 _{s,PCH}	CV- <i>SIB4</i>		Integer (0..40)	If present, it is used as Qhyst1 _s for UE in CELL_PCH or URA_PCH state [4] [dB]	REL-5
Qhyst1 _{s,FACH}	CV- <i>SIB4</i>		Integer (0..40)	If present, it is used as Qhyst1 _s for UE in CELL_FACH state [4] [dB]	REL-5
Qhyst2 _s	CV- <i>FDD- Quality- Measure</i>		Integer (0..40 by step of 2)	Default value is Qhyst1 _s [4] [dB]	
Qhyst2 _{s,PCH}	CV- <i>SIB4- FDD- Quality- Measure</i>		Integer (0..40)	If present, it is used as Qhyst2 _s for UE using CPICH Ec/No quality measure in CELL_PCH or URA_PCH state. Default value is Qhyst1 _{s,PCH} [4] [dB]	REL-5
Qhyst2 _{s,FACH}	CV- <i>SIB4- FDD- Quality- Measure</i>		Integer (0..40)	If present, it is used as Qhyst2 _s for UE using CPICH Ec/No quality measure in CELL_FACH state. Default value is Qhyst1 _{s,FACH} [4] [dB]	REL-5
Treselection _s	MP		Integer (0..31)	[s]	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Treselection _{s,PCH}	CV-SIB4		Integer (0..31)	If present, it is used as Treselection _s for UE in CELL_PCH or URA_PCH state [4] [s]	REL-5
Treselection _{s,FACH}	CV-SIB4		Integer Real (0..6.2 by step of 0.2)	If present, it is used as Treselection _s for UE in CELL_FACH state [4] [s]	REL-5
Speed dependent ScalingFactor for Treselection	OP		Real (0..1 by step of 0.1)	This IE is used by the UE in high mobility state as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} [4].	REL-5
Inter-frequency ScalingFactor for Treselection	OP		Real (1..4.75 by step of 0.25)	If present, it is used by the UE as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} for inter-frequency cell reselection evaluation [4].	REL-5
Inter-RAT ScalingFactor for Treselection	OP		Real (1..4.75 by step of 0.25)	If present, it is used by the UE as scaling factor for Treselection_s or Treselection_{s,PCH} or Treselection_{s,FACH} for inter-RAT cell reselection evaluation [4].	REL-5
Non-HCS T_{CRmax}	MD		Enumerated (not used, 30, 60, 120, 180, 240)	[s] Default value is 'not used'.	REL-5
Non-HCS N_{CR}	CV-UE speed detector MD		Integer (1..16)	Default value = 8	REL-5
Non-HCS T_{CRmaxHyst}	CV-UE speed detector MP		Enumerated (not used, 10, 20, 30, 40, 50, 60, 70)	[s]	REL-5

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
HCS Serving cell Information	OP		HCS Serving cell information 10.3.7.12		
Maximum allowed UL TX power	MP		Maximum allowed UL TX power 10.3.6.39	[dBm] UE_TXPWR_MAX_RACH in [4].	

Condition	Explanation
<i>FDD-Quality-Measure</i>	The IE is not needed if the IE "Cell selection and reselection quality measure" has the value CPICH RSCP, otherwise the IE is mandatory and has a default value.
Delta	This IE is optional if the value of Qrxlevmin is below – 115dBm. It is not needed otherwise.
<i>SIB4</i>	This IE is optional if the IE "Cell selection and reselection info for SIB3/4" is included in SIB type 4. It is not needed otherwise.
<i>SIB4-FDD-Quality-Measure</i>	This IE is optional if the IE "Cell selection and reselection info for SIB3/4" is included in SIB type 4, and the IE "Cell selection and reselection quality measure" has the value CPICH Ec/N0. It is not needed otherwise.
<u>UE Speed detector_MD (non-HCS)</u>	<u>This IE is not needed if non-HCS T_{CRmax} equals 'not used', else it is mandatory default.</u>
<u>UE Speed detector_MP (non-HCS)</u>	<u>This IE is not needed if non-HCS T_{CRmax} equals 'not used', else it is mandatory present.</u>

***** ASN.1 MODIFICATIONS *****

```

SysInfoType3 ::= SEQUENCE {
  sib4indicator          BOOLEAN,
  -- UTRAN mobility IEs
  cellIdentity           CellIdentity,
  cellSelectReselectInfo CellSelectReselectInfoSIB-3-4,
  cellAccessRestriction CellAccessRestriction,
  -- Extension mechanism for non- release99 information
  v4b0NonCriticalExtensions SEQUENCE {
    sysInfoType3-v4b0ext      SysInfoType3-v4b0ext-IEs,
    v590NonCriticalExtension SEQUENCE {
      sysInfoType3-v590ext      SysInfoType3-v590ext,
      v5c0NonCriticalExtension SEQUENCE {
        sysInfoType3-v5c0ext      SysInfoType3-v5c0ext-IEs,
        nonCriticalExtensions SEQUENCE {}
      }
    }
  }
}

```

```

SysInfoType3-v4b0ext-IEs ::= SEQUENCE {
  mapping-LCR          Mapping-LCR-r4
}

```

```

SysInfoType3-v590ext ::= SEQUENCE {
  cellSelectReselectInfo-v590ext      CellSelectReselectInfo-v590ext
}

```

```

SysInfoType3-v5c0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoTresselectionScaling-v5c0ext      CellSelectReselectInfoTresselectionScaling-
v5c0ext OPTIONAL
}

```

```

SysInfoType4 ::= SEQUENCE {
  -- UTRAN mobility IEs
  cellIdentity           CellIdentity,
  cellSelectReselectInfo CellSelectReselectInfoSIB-3-4,
  cellAccessRestriction CellAccessRestriction,
  -- Extension mechanism for non- release99 information
  v4b0NonCriticalExtensions SEQUENCE {
    sysInfoType4-v4b0ext      SysInfoType4-v4b0ext-IEs,
    v590NonCriticalExtension SEQUENCE {
      sysInfoType4-v590ext      SysInfoType4-v590ext,
      v5b0NonCriticalExtension SEQUENCE {
        sysInfoType4-v5b0ext      SysInfoType4-v5b0ext-IEs,
        v5c0NonCriticalExtension SEQUENCE {
          sysInfoType4-v5c0ext      SysInfoType4-v5c0ext-IEs,
          nonCriticalExtensions SEQUENCE {}
        }
      }
    }
  }
}

```

```

SysInfoType4-v4b0ext-IEs ::= SEQUENCE {
  mapping-LCR          Mapping-LCR-r4
}

```

```

SysInfoType4-v590ext ::= SEQUENCE {
  cellSelectReselectInfo-v590ext      CellSelectReselectInfo-v590ext
}

```

```

SysInfoType4-v5b0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoPCHFACH-v5b0ext      CellSelectReselectInfoPCHFACH-v5b0ext
}

```

```

SysInfoType4-v5c0ext-IEs ::= SEQUENCE {
  cellSelectReselectInfoTresselectionScaling-v5c0ext      CellSelectReselectInfoTresselectionScaling-
v5c0ext OPTIONAL
}

```

[...]

```

CellSelectReselectInfo-v590ext ::= SEQUENCE {
    deltaQrxlevmin          DeltaQrxlevmin          OPTIONAL,
    deltaQhcs                DeltaRSCP                OPTIONAL
}

```

```

CellSelectReselectInfoPCHFACH-v5b0ext ::= SEQUENCE {
    q-Hyst-1-S-PCH          Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-1-S-FACH          Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-2-S-PCH          Q-Hyst-S-Fine          OPTIONAL,
    q-Hyst-2-S-FACH          Q-Hyst-S-Fine          OPTIONAL,
    t-Reselection-S-PCH      T-Reselection-S        OPTIONAL,
    t-Reselection-S-FACH      T-Reselection-S-Fine    OPTIONAL
}

```

```

CellSelectReselectInfoTresselectionScaling-v5c0ext ::= SEQUENCE {
-- For speed detection, the same HCS parameters are utilised
non-HCS-t-CR-Max          T-CRMax          OPTIONAL,
speedDependentScalingFactor SpeedDependentScalingFactor OPTIONAL,
interFrequencyTresselectionScalingFactor TresselectionScalingFactor OPTIONAL,
interRATTresselectionScalingFactor TresselectionScalingFactor OPTIONAL
}

```

[...]

```

-- Actual value ScalingFactor = IE value * 0.1
SpeedDependentScalingFactor INTEGER(0..10)

```

```

-- Actual value ScalingFactor = IE value * 0.25
TresselectionScalingFactor INTEGER(4..19)

```