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

TSGRP#6(99)633

Title: **Agreed CRs of category "B" (New feature) to TS 25.304**

Source: **TSG-RAN WG2**

Agenda item: **5.2.3**

Doc #	Status-	Spec	CR	Rev	Subject	Cat	Versio	Versio
R2-99k78	agreed	25.304	002	3	Specification of Cell reselection	B	3.0.0	3.1.0
R2-99k31	agreed	25.304	003	2	Integration of Cell Broadcast Service	B	3.0.0	3.1.0
R2-99k51	agreed	25.304	004	2	Measurement used as a quality	B	3.0.0	3.1.0
R2-99k63	agreed	25.304	008	3	Barred Cells and Access Control	B	3.0.0	3.1.0
R2-99k08	agreed	25.304	009		Introduction of network control of UE	B	3.0.0	3.1.0

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

***Document* (R2-99k78)**
e.g. for 3GPP use the format TP-99xxx
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25.304	CR	002r3	Current Version:	3.0.0

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

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

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

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

Source: TSG-RAN WG2 **Date:** 3 Dec 1999

Subject: Specification of Cell reselection procedures in Connected Mode

Work item:

Category: *(only one category shall be marked with an X)*			**Release:**	
F	Correction		Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature	X	Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change:
Introduction of procedures for cell reselection in connected mode.
TS title changed to: UE Procedures in idle mode and Procedures for Cell reselection in connected mode
The procedures are based on the corresponding procedures for idle mode. A new section 5.3 is introduced.

Clauses affected: Section 5

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

Other comments:


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3G TS 25.304 V3.0.0 (1999-10)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode

(3G TS 25.304 version 3.0.0)

5.3 Cell ~~Selection and~~ Reselection in Connected Mode

5.3.1 UTRA Radio Access Technology

5.3.1.1 General

This section specifies cell ~~selection and~~ reselection procedures in UTRAN connected mode.

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

Figure 1 shows the states and procedures in the cell ~~selection and~~ reselection process in connected mode.

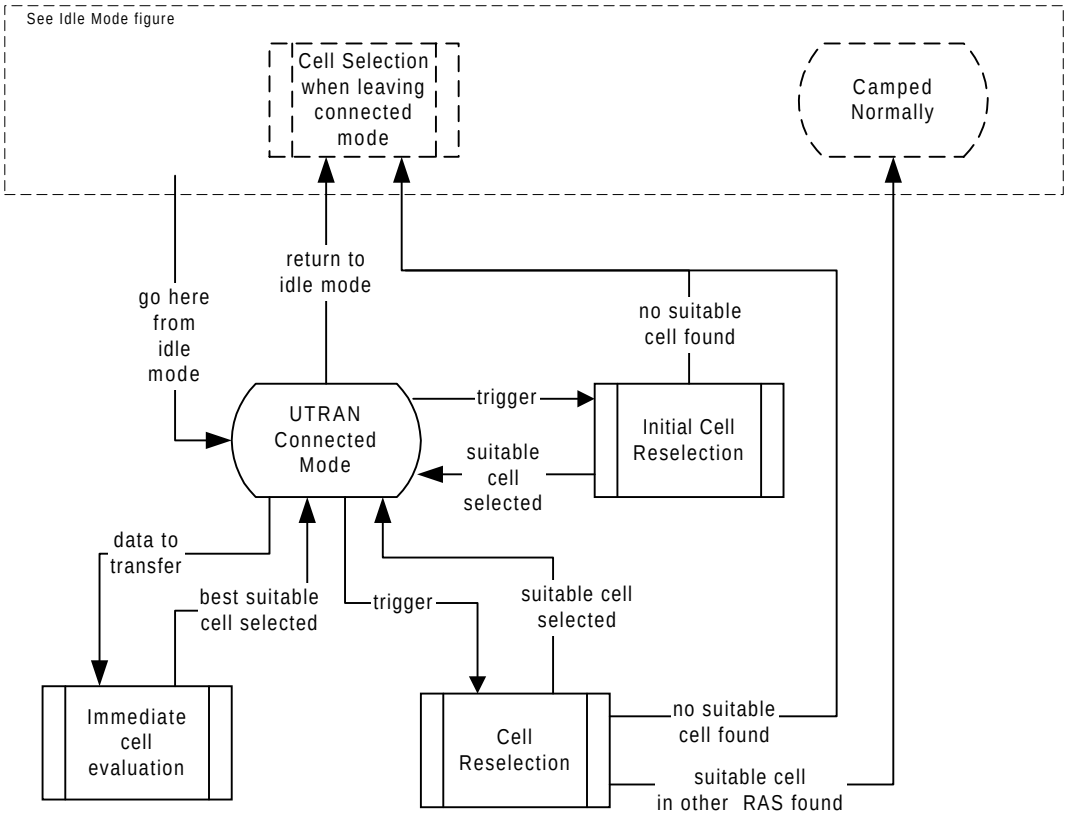

Figure 1. UTRAN Connected mode cell ~~selection and~~ reselection

Transition from idle mode to connected mode is described in section [5.2].

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

When a cell reselection is triggered, the UE shall evaluate the cell reselection criteria based on radio measurements, and if a better cell is found that cell is selected, procedure *Cell reselection (see 5.3.1.4)*. If the change of cell implies a change of radio access technology, the RRC connection is released, and the UE enters idle mode. If no suitable cell is found in the cell reselection procedure, the RRC connection is released, and the UE enters idle mode.

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

When an immediate cell reselection is triggered, the UE shall use the Initial ~~C~~*cell reselection* procedure (see 5.3.1.2) to

find a suitable cell. The cases where this may be triggered are specified in [25.331]. One example where this procedure is triggered is at radio link failure, where the UE may trigger an initial cell reselection in order to request re-establishment of the RRC connection. If the UE is unable to find a suitable cell, the UE shall release the RRC connection and enter idle mode.

5.3.1.2 Initial Cell Re-~~S~~selection Procedure

5.3.1.2.1 Description

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

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

1. The UE shall scan all RF channels of the UTRA band to find a suitable cell. The UE may optimise this search by using stored information of carrier frequencies and optionally also scrambling code information from previously received measurement control information elements.
2. After the UE has found one suitable cell for the selected PLMN, the UE shall create a candidate list consisting of this cell and its neighbouring UTRA cells, as received in measurement control information via the selected cell.
3. For each cell on the candidate list fulfilling all criteria for a suitable cell, see **Error! Reference source not found.**, except the cell selection criteria, calculate the cell selection value, S, and the quality value, Q, defined in 5.3.1.2.2.
4. Among the cells with S > 0 select the cell with the highest Q value.

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

~~5.3.1.1.2~~5.3.1.2.2 Criteria

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

$$S = Q - Q_{min} - P_{compensation}$$

~~S Cell Selection value, (dB)~~

~~Q Quality value. The quality of the received signal, (dB or dBm) [Note: Exact unit is FFS]~~

~~Qmin Minimum required quality level in the cell (read in system information and dependent on the quantity to measure), (dB or dBm).~~

~~Pcompensation max(UE_TXPWR_MAX_RACH – P_MAX, 0), (dB)~~

~~UE_TXPWR_MAX_RACH Maximum TX power level an UE may use when accessing the cell on RACH (read in system information), (dBm)~~

~~P_MAX Maximum RF output power of the UE, (dBm)~~

S	Cell Selection value, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measures Q (read in system information). Note 1.
Q	Quality value. The quality of the received signal, (CPICH Rx Ec/N0 or CPICH Rx SIR) (dB)
Q_{min}	Minimum required quality level in the cell (read in system information and dependent on the quantity to measure), (dB)
Pcompensation	max(UE_TXPWR_MAX_RACH – P_MAX, 0), (dB)
UE_TXPWR_MAX_RACH	Maximum TX power level an UE may use when accessing the cell on RACH

	(read in system information), (dBm)
P_MAX	Maximum RF output power of the UE, (dBm)

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may inpact the use of that measurement in this document)

The initial cell re-selection criterion is fulfilled if:

$$S > 0$$

5.3.1.3 Immediate Cell Evaluation Procedure

5.3.1.3.1 Description

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

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

The following steps shall be carried out when an immediate cell evaluation has been triggered:

1. The candidate list of potential cells consists of the cells for intra-frequency measurements in system information of the serving cell. However, if UE dedicated measurements control information has been assigned to the UE in the serving cell, the candidate list consists of the cells for intra-frequency measurements included in this UE dedicated measurement control information.
2. Calculate the Q value and the S value for each cell on the candidate list.
3. Select the neighbouring cell that fulfils the criteria in 5.3.1.3.2 best.

5.3.1.3.2 Criteria

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

$$S_n > 0$$

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

~~S_n Cell Selection value of the neighbouring cell, (dB)~~

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

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

~~$Qoffset_{s,n}$ Offset between the two cells considered in the evaluation (read in system information), (dB).~~

S_n	Cell Selection value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measures Q_n and Q_s (read in system information). Note 1.
Q_n	Quality of the neighbouring cell, (CPICH Rx Ec/N0 or CPICH Rx SIR), (dB)

Q_s	Quality of the serving cell, (CPICH Rx Ec/N0 or CPICH Rx SIR), (dB)
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB).

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may inpact the use of that measurement in this document)

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

5.3.1.4 Cell Reselection Procedure

5.3.1.4.1 Description

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

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

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

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

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

1. The candidate list of potential cells consists of the cells for intra- and inter-frequency and inter-radio access technology measurements in system information of the serving cell. However, if UE dedicated measurements control information has been assigned to the UE in the serving cell, the candidate list consists of the cells for intra- and inter-frequency and inter-radio access technology measurements included in this UE dedicated measurement control information.
2. Intra- and inter frequency cells : Calculate the Q value and the S value for each cell on the candidate list.
   Inter-radio-access-technology cells: When $Q_s \leq$ Qsearch, calculate the Q value of each cell on the candidate list.
3. Depending on which types of cells are on the candidate list (intra-frequency, inter-frequency and inter-radio-access technology), select the cell that fulfils the corresponding criteria best.

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

1) Intra-frequency neighbouring cells, see 5.3.1.4.2.
2) Inter-frequency neighbouring cells, see 5.3.1.4.3.
3) Inter-radio-access-technology neighbouring cells, see 5.3.1.4.4.

5.3.1.4.2 Intra-Frequency Cell Reselection Criteria

The criteria for a better intra-frequency cell are:

$$S_n > 0$$

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

~~S_n Cell Selection value of the neighbouring cell, (dB)~~

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

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

~~$Qoffset_{s,n}$ Offset between the two cells considered in the evaluation (read in system information), (dB)~~

~~$Qhyst_s$ Hysteresis value of the serving cell, (dB)~~

~~$Treselection_s$ Time-to-trigger criteria for cell reselection, (s) *[Note: Exact unit is FFS]*~~

S_n	Cell Selection value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measures Q_n and Q_s (read in system information). Note 1.
Q_n	Quality of the neighbouring cell, (CPICH Rx Ec/N0 or CPICH Rx SIR), (dB)
Q_s	Quality of the serving cell, (CPICH Rx Ec/N0 or CPICH Rx SIR), (dB)
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB)
$Qhyst_s$	Hysteresis value of the serving cell, (dB)
$Treselection_s$	Time-to-trigger criteria for cell reselection, (s) *[Note: Exact unit is FFS]*

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may inpact the use of that measurement in this document)

The UE shall reselect the new cell, if the cell reselection criteria are fulfilled during a time interval Treselection. The value of Treselection is broadcast in system information.

~~5.3.1.1.3~~5.3.1.4.3 Inter-Frequency Cell Reselection Criteria

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

~~5.3.1.1.4~~5.3.1.4.4 Inter Radio Access Technology Cell Reselection Criteria

The criteria for a better inter-radio-access-technology cell are:

$$Q_s < Qsearch_s$$

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

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

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

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

unit is FFS]

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

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

The UE shall select an inter-radio-access-technology cell that fulfils the criteria $Q_n > Qaccept_{s,n}$. If more than one cell fulfils the criteria, the UE shall select the cell with the highest quality Q.

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

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

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

5.3 Location Registration

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Nice, France, 13-15 December 1999

Document* *(R2-99k31)
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25.304	**CR**	**003r2**	Current Version:	3.0.0

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

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

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

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

Source: TSG RAN WG2 **Date:** 02.12.1999

Subject: Integration of Cell Broadcast Service (CBS)

Work item:

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

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

Reason for change: It is a R99 requirement to adapt the radio interface for CBS. This CR provides the description of the UE capability when UE is in IDLE mode.

Clauses affected:

Other specs affected:

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

Other comments:

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6.2 Cell Broadcast

A UE supporting Cell Broadcast Service (CBS) shall be capable to receive BMC messages in the Idle mode.

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***Document* (R2-99k51)**
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25.304	CR	004r2	Current Version:	3.0.0

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

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

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

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

Source: TSG-RAN WG2 **Date:** 1999-12-03

Subject: Measurement used as quality-estimate for cell selection and reselection

Work item:

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

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

Release:

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

Reason for change: There is a need to specify how the mobile chooses which measure should be used for the quality value in the criteria for cell selection and reselection.

Clauses affected: 5.2.2

Other specs affected:

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

Other comments:


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5.2.2 UTRA Radio access system

5.2.2.1 Cell Selection Procedures

5.2.2.1.1 Description

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

1) The cell is part of the selected PLMN.
2) The cell is not barred [details are FFS].
3) The cell is not part of a forbidden registration area [details are FFS].
4) The cell selection criteria are fulfilled (see below).
5) The SoLSA criteria are fulfilled [FFS].

Whenever a PLMN is selected, the UE shall attempt to find the most suitable cell of that PLMN according to the following steps.

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

   a) Initial Cell Selection

      This procedure requires no prior knowledge of which RF channels are UTRA carriers. The UE shall scan all RF channels in the UTRA band to find a suitable cell. On each carrier, the UE searches first for the scrambling code of the strongest cell, in order to find out which PLMNs are available. If the PLMN that NAS requested to search for is found, the search of the rest of carriers shall be stopped. After the UE has found one suitable cell for the selected PLMN, the UE shall create a candidate list consisting of this cell and its neighbouring cells, as received in measurement control information via the selected cell.

   b) Stored Information Cell Selection

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

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

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

   - Cell Barred [details are FFS]
   - Registration area
   - Cell selection parameters

3) For each cell on the candidate list not barred or forbidden, calculate the cell selection value, S, and the quality value, Q, defined below.

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

If no suitable cells are found and the stored information cell selection procedure was used in step 1, the Initial cell selection procedure is started and the steps are repeated. If the UE is unable to find any suitable cell using the Initial cell selection procedure, it attempts to camp on any acceptable cell and enters “limited service state”.

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

5.2.2.1.2 Criteria

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

$$S = Q - Qmin - Pcompensation$$

S	Cell Selection value, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measure Q (read in system information). Note 1.
Q	Quality value. The quality of the received signal, CPICH Rx E_C/N_0 or CPICH Rx SIR, (dB ~~or dBm~~) ~~[Note: Exact unit is FFS]~~. The measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
Qmin	Minimum required quality level in the cell (read in system information and dependent on the quantity to measure), (dB or dBm).
Pcompensation	max(UE_TXPWR_MAX_RACH – P_MAX, 0), (dB)
UE_TXPWR_MAX_RACH	Maximum TX power level an UE may use when accessing the cell on RACH (read in system information), (dBm)
P_MAX	Maximum RF output power of the UE, (dBm)

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may impact the use of that measurement in this document)

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

The cell selection criterion is fulfilled if:

$$S > 0$$

5.2.2.2 Immediate Cell Evaluation Procedure

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

5.2.2.2.1 Description

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

The purpose of the immediate cell evaluation is to quickly find the best cell.

Triggers of immediate cell evaluation are:

1) Prior to RACH transmission
2) $S \leq 0$
3) Downlink signalling failure [details are FFS]
4) Cell has become barred or forbidden [details are FFS]

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

1) The candidate list of potential cells to camp on consists of the cells for intra frequency measurements in system information of the serving UTRA cell.

2) Calculate the Q value for each cell on the candidate list.

3) Calculate the S value for the best cell.

4) Select the neighbouring cell if the criteria defined below are fulfilled.

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

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

5.2.2.2.2 Criteria

The UE shall perform cell reselection if the following criteria are fulfilled.

$$S_n > 0$$

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

S_n	Cell Selection value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measures Q_n and Q_s, (read in system information). Note 1.
Q_n	Quality of the neighbouring cell, CPICH Rx E_C/N_0 or CPICH Rx SIR, (dB ~~or dBm~~) ~~*[Note: Exact unit is FFS]*~~. The measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
Q_s	Quality of the serving cell, (dB ~~or dBm~~) ~~*[Note: Exact unit is FFS]*~~. The measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB).

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may impact the use of that measurement in this document)

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

If more than one neighbouring cell fulfils the criteria, the UE shall choose the cell where the difference between Q_n and (Q_s + Qoffset) is highest. If no neighbouring cell fulfils the criteria, the UE shall keep the serving cell if the immediate cell evaluation was triggered prior to a RACH transmission otherwise a new initial cell selection shall take place.

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

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

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

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

5.2.2.3 Camped Normally

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

- Monitor PICH and PCH of the cell as specified in section 8 according to information sent in system information
- Monitor relevant System Information blocks on BCCH as specified in section 6.1.
- Monitor immediate cell evaluation and cell reselection trigger criteria and trigger cell reselection when needed.

5.2.2.4 Cell Reselection Procedure

5.2.2.4.1 Description

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

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

1) The candidate list of potential cells to camp on consists of the cells for intra- and inter-frequency measurements and intra-radio access system measurements in system information of the serving cell.
2) Calculate the Q value for each cell and the S value for each current UTRA mode cell in the candidate list.
3) Depending on which type of cells are on the candidate list (intra-frequency, inter-frequency and inter radio access system), select the cell that fulfils the corresponding criteria best.

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

1) Intra-frequency neighbouring cells
2) Inter-frequency neighbouring cells
3) Inter-radio access system neighbouring cells

5.2.2.4.2 Intra-Frequency Cell Reselection Criteria

The criteria for a better intra-frequency cell are:

$$S_n > 0$$

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

S_n	Cell Selection value of the neighbouring cell, (dB)
Cell_selection_and_reselection_quality_measure	Choice of measurement (CPICH Rx Ec/N0 or CPICH Rx SIR) to use as quality measures Q_n and Q_s, (read in system information). Note 1.
Q_n	Quality of the neighbouring cell, CPICH Rx E_C/N_0 or CPICH Rx SIR, (dB ~~or dBm~~) ~~*[Note: Exact unit is FFS]*~~. The measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
Q_s	Quality of the serving cell, CPICH Rx E_C/N_0 or CPICH Rx SIR, (dB ~~or dBm~~). ~~*[Note: Exact unit is FFS]*~~The measurement to use for the quality value is set by the Cell_selection_and_reselection_quality_measure information element.
$Qoffset_{s,n}$	Offset between the two cells considered in the evaluation (read in system information), (dB)
Qhyst	Hysteresis value, (dB)

(Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may impact the use of that measurement in this document)

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

5.2.2.4.3 Inter-Frequency Cell Reselection Criteria

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

5.2.2.4.4 Inter Radio Access System Cell Reselection Criteria

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

Qaccept	Minimum quality required for a cell in the new system.
Qsearch	Below this limit in the serving UTRA cell, the UE shall take measurements of interradio access system and inter UTRA mode cells if such entries exist in the measurement control information elements.

The UE shall consider inter radio access system and inter UTRA mode cells with a quality Q > Qaccept, for reselection. The UE shall select the cell with the highest quality Q. Qaccept and Qsearch are included in the system information of the serving cell.

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

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

5.2.2.5 Connected Mode Cell Selection for Idle Mode

When returning to Idle Mode from Connected Mode, the UE shall select the best cell to camp on, according to the cell selection criteria. Candidate cells for this selection are the cell(s) used immediately before leaving connected mode. If UE fails to camp on any of the candidate cells, Stored Information Cell Selection shall be initiated.

5.2.2.6 ODMA probing sub-process

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

5.2.2.6.1 ODMA probing state machines

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

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

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

Full probing

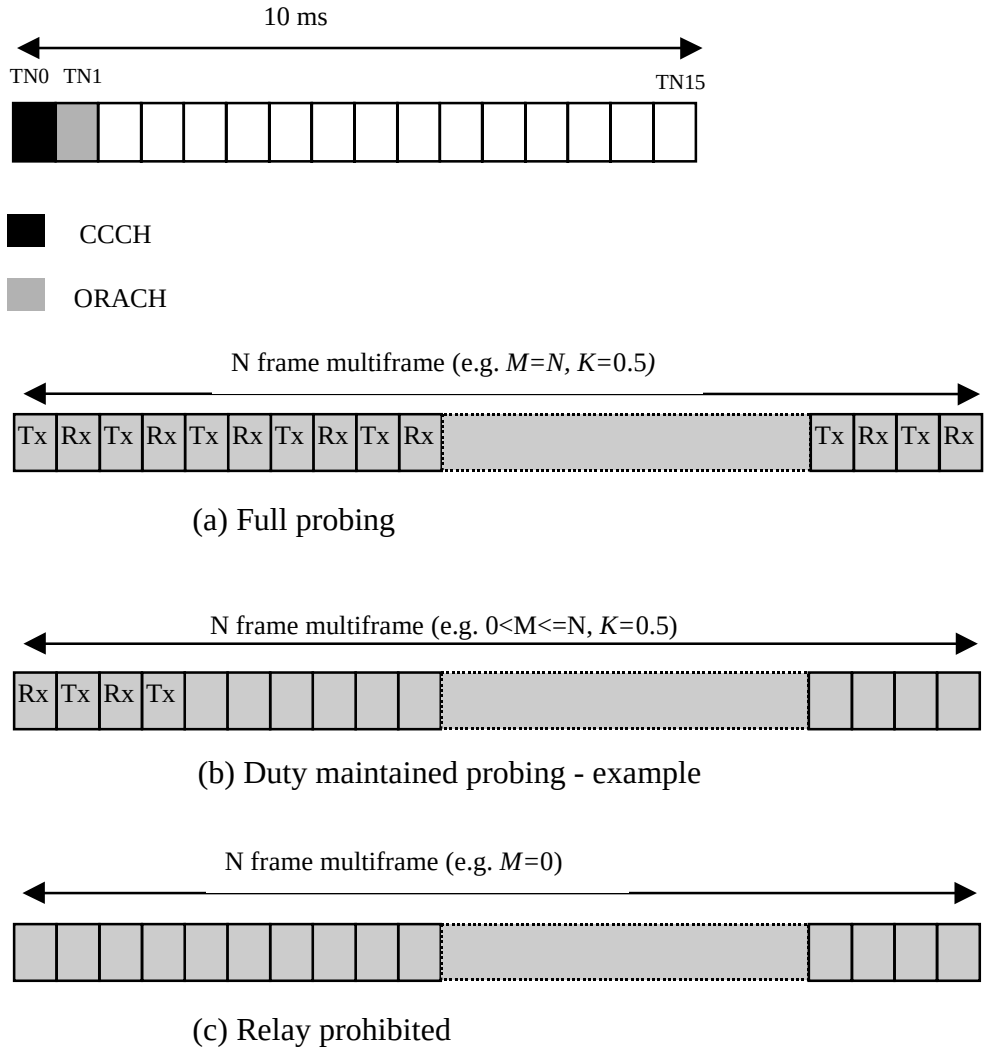
Full probing is the case where probing is allowed on every ORACH timeslot within a *N* multiframe. The UE_R will probe on the ORACH at a rate defined by the probing activity parameter *K*.

Duty Maintained probing

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

Relay Prohibited

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



The probing activity levels for given state machines are illustrated in Figure 3 for a system with an ORACH for M slots per N × 16 multiframe.

Figure 1: Probing state machines and mechanism

NOTE: The distribution of probing opportunities within a multiframe may not necessarily be consecutive and located at the beginning of a multiframe.

A practical illustration of these probing state machines within the ODMA system is shown in figure 4.

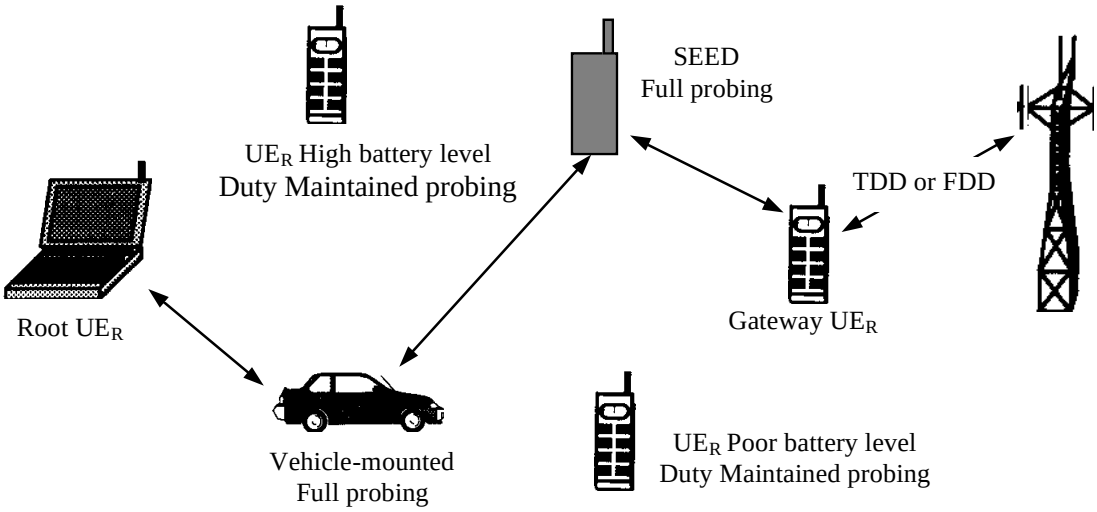


Figure 2: Illustration of probing process assignment

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

Cell_selection_and_reselection_quality_measure

The cell selection and reselection quality measure (CPICH Rx E_C/N_0 or CPICH Rx SIR) is decoded from system information broadcasts in the serving cell. [Note 1: The work in order to support the CPICH Rx SIR measurement is in progress in RAN WG4 and may inpact the use of that measurement in this document]

Qoffset$_{s,n}$

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

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

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

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

Qhyst

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

Treselection

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

Decoding range

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

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

OffsetExp

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

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

Qaccept

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

Qsearch

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

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

***Document* (R2-99k63)**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.304	CR	008r3	Current Version:	3.0.0

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

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

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

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

Source: TSG-RAN WG2 **Date:** 03 Dec 1999

Subject: Barred Cells and Access Control

Work item:

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

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

Reason for change: Nothing is currently defined for the Barred Cells and Access Control.

Clauses affected: 5.2.2.1.1, 5.2.4

Other specs affected:

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

Other comments:

help.doc

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

5.2.2 UTRA Radio access system

5.2.2.1 Cell Selection Procedures

5.2.2.1.1 Description

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

1) The cell is part of the selected PLMN.
2) The cell is not barred except for [details are FFS]:

   2a) emergency calls, and/or

   2b) operator only use, and/or

   2c) SoLSA exclusive access.
3) The cell is not part of a forbidden registration area [details are FFS].
4) The cell selection criteria are fulfilled (see below).
5) The SoLSA criteria are fulfilled [FFS].

Whenever a PLMN is selected, the UE shall attempt to find the most suitable cell of that PLMN according to the following steps.

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

   a) Initial Cell Selection

      This procedure requires no prior knowledge of which RF channels are UTRA carriers. The UE shall scan all RF channels in the UTRA band to find a suitable cell. On each carrier, the UE searches first for the scrambling code of the strongest cell, in order to find out which PLMNs are available. If the PLMN that NAS requested to search for is found, the search of the rest of carriers shall be stopped. After the UE has found one suitable cell for the selected PLMN, the UE shall create a candidate list consisting of this cell and its neighbouring cells, as received in measurement control information via the selected cell.

   b) Stored Information Cell Selection

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

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

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

   - Cell Barred [details are FFS]
   - Registration area
   - Cell selection parameters

3) For each cell on the candidate list not barred or forbidden, calculate the cell selection value, S, and the quality value, Q, defined below.
4) Among the cells with S > 0 choose the cell with the highest Q value to camp on.

If no suitable cells are found and the stored information cell selection procedure was used in step 1, the Initial cell

selection procedure is started and the steps are repeated. If the UE is unable to find any suitable cell using the Initial cell selection procedure, it attempts to camp on any acceptable cell and enters “limited service state”.

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

5.2.4 Barred Cells and Access Control

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

1. Cell not Barred,
2. Cell Barred for normal users - allows Operator access,
3. Cell Barred for normal users – allows Emergency access,
4. Cell Barred for normal users – allows SoLSA access.

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

[Access Control is FFS]

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***Document* (R2-99k08)**
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25.304	CR	009	Current Version:	3.0.0

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

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

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

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

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

Subject: Introduction of network control of UE measurement activities

Work item:

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

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

Release:

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

Reason for change:

- A network operator has the choice to allow UEs to perform fewer measurements when the quality conditions of the serving cell is sufficient. This has major impact on UE power consumption.

Clauses affected: Chapter 7

Other specs affected:

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

Other comments:

7. Idle mode measurements

7.1 Network control of UE measurement activities

7.1.1 Intra-frequency cell measurements

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

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

1. Parameter Qintrasearch is available for serving cell:

Q_s > Qintrasearch	UE need not perform Intra-frequency measurements
Q_s <= Qintrasearch	UE shall perform Intra-frequency measurements

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

7.1.2 Inter-frequency cell measurements

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

Depending on the presence of the parameters, and the quality of the serving cell, Q_s, the following 3 cases are possible :

1. Parameters Qintersearch and Qintersearchsize are available for serving cell :

Q_s > Qintersearch + Qintersearchsize	UE shall perform Inter-frequency measurements
Qintersearch < Q_s <= Qintersearch + Qintersearchsize	UE need not perform Inter-frequency measurements
Q_s <= Qintersearch	UE shall perform Inter-frequency measurements

2. Parameters Qintersearch is available for serving cell, Qintersearchadd is not available for serving cell :

Q_s > Qintersearch	UE need not perform Inter-frequency measurements
Q_s <= Qintersearch	UE shall perform Inter-frequency measurements

3. Parameters Qintersearch and Qintersearchsize are not available for serving cell :
   UE shall perform Inter-frequency measurements.

7.1.3 Inter-Radio Access Technology measurements

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

Q_s > Qsearch	UE need not perform Inter-RAT measurements

Q_s <= Qsearch	UE shall perform Inter-RAT measurements