**3GPP TSG- Meeting # *R4-2008657***

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** |  | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | RAN WG4 | | | | | | | | | |
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| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
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| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change 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](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | TBD and square bracket removal | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | All tentative values in square brackets are finalised except for values which are expected to be addressed by other release 15 CRs in RAN4#95  All TBD in specifications are addressed | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | TBD and square brakets remain in specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1.6.2, 3.1.6.3,4.2.2.5.6, 4.2.2.7, 4.2.2.9a, 4.6.2.2, 4.6.2.3,  4.6.2.5, 4.6.2.6, 4.6.2.7, 4.6.2.7.A, 4.7.2.1.3, 4.7.2.1.5, 4.7.2.2.5,  4.8.6, 4.8.7, 4.8.8, 5.3.4, 5.3.5, 5.5.3.1.2, 6.3.2.4, 6.4.2,  7.3.2, 7.7.1, 7.7.2, 7.7.3, 7.7.4, 7.7.5, 7.7.12, 7.7.14, 7.7.15, 7.7.16  7.8.2.12, 7.8.2.13, 7.12.2.7, 7.14.2, 7.19.2, 7.19.4, 7.19.5, 8.1.2  8.4.1, 8.5.2, 8.12.3, 8.13.2, 8.13.3, 8.14.2, 8.14.3, 8.17.2,8.17.3,  9.1.6A, 9.1.20.2, 9.1.21, 9.1.22, 9.1.23, 9.1.25, 9.1.26, 13.10 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*Change 1*

3.6.1.2 Applicability of requirements with CRS muting for category M1 UE capable of CRS muting

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting [31], the CRS is transmitted during the active time periods at the following frequency locations within the cell bandwidth:

- over the part of the cell bandwidth where the UE reception is configured, and

- 2 additional PRBs where each one is adjacent to the UE configured bandwidth for reception, and

- K number of PRBs within the center of the cell bandwidth indicated by the system information broadcast [2]

During the inactive periods (T2), CRS is transmitted over at least K number of PRBs within center of the cell bandwidth. The UE acquires the values of K from system information broadcast [2] and defined as in Table 3.6.1.2-1.

**Table 3.6.1.2-1: Number of PRBs (K) containing CRS within the center of cell BW**

|  |  |
| --- | --- |
| crs-IntfMitigNumPRBs [2] | K |
| ‘0’ | 6 PRBs |
| ‘1’ | 24 PRBs |

The UE active period (T1) comprises the time period during which UE is engaged in receiving or monitoring any downlink channel/signal. Otherwise, UE is considered to be in inactive period (T2).

The CRS is transmitted over the part of the cell bandwidth where the UE reception is configured during at least N1 number of subframes immediately before and N2 number of subframes immediately after the T1 time period, which are excluded for the inactive time periods T2. The values of the parameters T1, T2 and N1 are specified for relevant requirements in their corresponding sections.

For a UE that is not pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted in 1 subframe every 10 ms or 20 ms over full cell bandwidth if K=6 PRBs or 24 PRBs, respectively, and

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For a UE that is pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For measurements on intra-frequency neighbor cells, if *intraFreqNeighCellMeasCenterPRBs* [2] is enabled then the UE shall assume center 6 PRBs for measurements.

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], the requirements for UE category M1 in this specification shall be met

- if CRS is transmitted over the part of the cell bandwidth where the UE reception is configured in a subframe which is comprised in any non-zero length T1, N1, or N2.

- for UE not configured with DRX or eDRX\_CONN, the UE being considered to be always in the active period T1 and the requirements being non-DRX requirements are assumed for the UE.

- for UE configured with DRX or eDRX\_CONN, provided the active time periods T1 comprise the periods where the UE is not using DRX, while N1=1 and N2=0 subframe.

- For UE receiving PDSCH receptions, provided CRS are available in the concerned cell in all subframes which are comprised in the active time periods T1, with N1=1, and N2=1 subframe.

- For UE in RRC\_IDLE and RRC\_CONNECTED and receiving SIB1-BR, provided the active time periods T1 comprise all subframes with SIB1-BR, where N1=1 and N1=8 for UEs which are not capable of supporting CRS muting, and N2=1 subframe.

- For UE receiving random access MSG2 and MSG4, provided the active time period T1 comprises the time from the start of RAR window until MSG2 and MSG4 is received and DRX is configured, where N1=N2=1.

- for UE performing MPDCCH monitoring, provided CRS are available in the concerned cell in all MPDCCH subframes configured for the UE to monitor which are comprised in the active time periods T1, with N1=1 and N2=0 subframes before the MPDCCH subframes.

- for UE operating in HD-FDD mode, provided CRS are available in the concerned cell during UL gaps occurring during UL transmission as defined in TS 36.211 [16], with N1=N2=0 subframes before and after the UL gaps occurring during UL transmission which are comprised in the active time periods T1 within the UE measurement bandwidth;

- provided the UE is configured with measurement gap also for the serving cell measurements according to gap pattern ID # 0 or gap pattern ID # 1 defined in Table 8.1.2.1-1.

3.6.1.3 Applicability of requirements with CRS muting for category M2 UE capable of CRS muting

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting [31], the CRS is transmitted during the active time periods at the following frequency locations within the cell bandwidth:

- over the part of the cell bandwidth where the UE reception is configured, and

- K number of PRBs within the center of the cell bandwidth indicated by the system information broadcast [2], and

- when the UE is configured with downlink bandwidth of 1.4MHz, 2 additional PRBs where each one is adjacent to the UE configured bandwidth for reception.

During the inactive periods (T2), CRS is transmitted over at least K number of PRBs within center of the cell bandwidth. The UE acquires the values of K from system information broadcast [2] and defined as in Table 3.6.1.3-1.

**Table 3.6.1.3-1: Number of PRBs (K) containing CRS within the center of cell BW**

|  |  |
| --- | --- |
| crs-IntfMitigNumPRBs [2] | K |
| ‘0’ | 6 PRBs |
| ‘1’ | 24 PRBs |

The UE active period (T1) comprises the time period during which UE is engaged in receiving or monitoring any downlink channel/signal. Otherwise, UE is considered to be in inactive period (T2).

The CRS is transmitted over the part of the cell bandwidth where the UE reception is configured during at least N1 number of subframes immediately before and N2 number of subframes immediately after the T1 time period, which are excluded for the inactive time periods T2. The values of the parameters T1, T2 and N1 are specified for relevant requirements in their corresponding sections.

For a UE that is not pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted in 1 subframe every 10 ms or 20 ms over full cell bandwidth if K=6 PRBs or 24 PRBs, respectively, and

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For a UE that is pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For measurements on intra-frequency neighbor cells, if *intraFreqNeighCellMeasCenterPRBs* [2] is enabled then the UE shall assume center 6 PRBs for measurements.

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting and configured with downlink bandwidth of 1.4MHz and K = 6 in Table 3.6.1.3-1, or for a UE capable of supporting CRS muting and configured with downlink bandwidth of 5MHz and K = 24 in Table 3.6.1.3-1, or for a UE capable of supporting CRS muting and not configured with downlink bandwidth and K = 6 or 24 in Table 3.6.1.3-1, the requirements for UE category M2 in this specification shall be met

- if CRS is transmitted over the part of the cell bandwidth where the UE reception is configured in a subframe which is comprised in any non-zero length T1, N1, or N2.

- for UE not configured with DRX or eDRX\_CONN, the UE being considered to be always in the active period T1 and the requirements being non-DRX requirements are assumed for the UE.

- for UE configured with DRX or eDRX\_CONN, provided the active time periods T1 comprise the periods where the UE is not using DRX, while N1=1 and N2=0 subframe.

- For UE receiving PDSCH receptions, provided CRS are available in the concerned cell in all subframes which are comprised in the active time periods T1, with N1= 1, and N2=1 subframe.

- For UE in RRC\_IDLE and RRC\_CONNECTED and receiving SIB1-BR, provided the active time periods T1 comprise all subframes with SIB1-BR, where N1=1 and N1=8 for UEs which are not capable of supporting CRS muting, and N2=1 subframe.

- For UE receiving random access MSG2 and MSG4, provided the active time period T1 comprises the time from the start of RAR window until MSG2 and MSG4 is received and DRX is configured, where N1=N2=1.

- for UE performing MPDCCH monitoring, provided CRS are available in the concerned cell in all MPDCCH subframes configured for the UE to monitor which are comprised in the active time periods T1, with N1=1 and N2=0 subframes before the MPDCCH subframes.

- for UE operating in HD-FDD mode, provided CRS are available in the concerned cell during UL gaps occurring during UL transmission as defined in TS 36.211 [16], with N1=N2=0 subframes before and after the UL gaps occurring during UL transmission which are comprised in the active time periods T1 within the UE measurement bandwidth;

- provided the UE is configured with measurement gap also for the serving cell measurements according to gap pattern ID # 0 or gap pattern ID # 1 defined in Table 8.1.2.1-1.

*Change 2*

4.2.2.5.6 Measurements of NR cells

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT NR layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT NR layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT NR layers shall be the same as that defined below for lower priority RATs.

The requirements in this section apply for inter-RAT NR measurements. When the measurement rules indicate that inter-RAT NR cells are to be measured, the UE shall measure SS-RSRP and SS-RSRQ of detected NR cells in the neighbour frequency list at the minimum measurement rate specified in this section. The parameter NNR\_carrier is the total number of configured NR carriers in the neighbour frequency list. The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured NR cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

The UE shall be able to evaluate whether a newly detectable inter-RAT NR cell meets the reselection criteria defined in TS 36.304 [1] within (NNR\_carrier) \* TdetectNR when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this section shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT NR cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

Cells which have been detected shall be measured at least every (NNR\_carrier) \* TmeasureNR when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT NR cell has met reselection criterion defined in TS 36.304 [1] within (NNR\_carrier) \* TevaluateNR when Treselection = 0as specified in Table 4.2.2.5.6-1 provided that the reselection criteria is met by a margin of at least 5dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-RAT NR cell is satisfied with the reselection criteria which are defined in TS 36.304 [1], the UE shall evaluate this NR cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

**Table 4.2.2.5.6-1: Tdetect,NR, TmeasureNR, and Tevaluate,NR**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | | **Tdetect,NR [s] (number of DRX cycles)** | **Tmeasure,NR [s] (number of DRX cycles)** | **Tevaluate,NR**  **[s] (number of DRX cycles)** |
| **FR1** | **FR2Note1** |
| 0.32 | 1 | 8 | 11.52 x 1.5 x N1  (36 x 1.5 x N1) | 1.28 x 1.5 x N1  (4 x 1.5 x N1) | 5.12 x 1.5 x N1  (16 x 1.5 x N1) |
| 0.64 | 5 | 17.92 x N1  (28 x N1) | 1.28 x N1  (2 x N1) | 5.12 x N1  (8 x N1) |
| 1.28 | 4 | 32 x N1  (25 x N1) | 1.28 x N1  (1 x N1) | 6.4 x N1  (5 x N1) |
| 2.56 | 3 | 58.88 x N1  (23 x N1) | 2.56 x N1  (1 x N1) | 7.68 x N1  (3 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. | | | | | |

4.2.2.6 Evaluation of cell re-selection criteria

The UE shall evaluate the intra-frequency, inter-frequency and inter-RAT cell reselection criteria defined in [1] at least every DRX cycle. When a non zero value of Treselection is used, the UE shall only perform reselection on an evaluation which occurs simultaneously to, or later than the expiry of the Treselection timer.

For UE configured with eDRX\_IDLE cycle, the cell reselection criteria shall be evaluated within at least every DRX cycle within the PTW.

4.2.2.7 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA + 50 ms.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For E-UTRAN to UTRA cell re-selection the interruption time must not exceed TSI-UTRA + 50 ms. For E-UTRAN to GSM cell re-selection the interruption time must not exceed TBCCH + 50 ms.

TSI-EUTRA is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for a E-UTRAN cell.

TSI-UTRA is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in [7] for a UTRAN cell.

TBCCH is the maximum time allowed to read BCCH data from a GSM cell defined in [8].

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

At cell re-selection to HRPD, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable of starting to monitor downlink channels for paging reception of the target HRPD cell. For HRPD cell re-selection the interruption time must not exceed TSI-HRPD + 50 ms.

TSI-HRPD is the time required for receiving all the relevant system information data according to the reception procedure and the upper layer (Layer 3) procedure delay of system information blocks defined in [11] in for HRPD cell.

At cell re-selection to cdma2000 1X, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable of starting to monitor downlink channels for paging reception of the target cdma2000 1X cell. For cdma2000 1X cell re-selection the interruption time must not exceed TSI-cdma2000\_1X + 50 ms.

TSI-cdma2000\_1X is the time required for receiving all the relevant system information data according to the reception procedure and the upper layer (Layer 3) procedure delay of system information blocks defined in [15] for cdma2000 1X cell.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

4.2.2.8 void

4.2.2.9 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, 3 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 3 TDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 3 FDD UTRA carriers, and

- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers, and

- Depending on UE capability, 3 cdma2000 1x carriers, and

- Depending on UE capability, 3 HRPD carriers.

- Depending on UE capability, 8 NR inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements and any of the above inter-RAT measurements excluding NR measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 8 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 cells), cdma2000 1x and HRPD layers.

In addition to the requirements defined above, the UE which supports E-UTRA measurements and any of the above inter-RAT measurements including NR measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 10 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

4.2.2.9a UE measurement capability (Increased UE carrier monitoring)

UE which support Increased UE carrier monitoring E-UTRA according to the capabilities in [2,31] shall be capable of monitoring at least

- Depending on UE capability, 8 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 8 TDD E-UTRA inter-frequency carriers

UE which support increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall additionally be capable of monitoring at least

- Depending on UE capability, 6 FDD UTRA carriers, and

- Depending on UE capability, 7 TDD UTRA carriers, and

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state and supporting Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall be capable of monitoring a total of at least 13 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 cells), cdma2000 1x and HRPD layers.

In addition to the requirements defined above, the UE which indicates support for Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31], and also supports standalone NR, shall be capable of monitoring a total of at least 15 carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

The requirements in this section apply for UE regardless of their capability to support eDRX\_IDLE.

*Change 3*

4.6.2.1A Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in normal coverage when configured with WUS

The UE which supports *wakeUpSignal* [2] shall meet the requirement defined for the DRX cycle length of N\*DRX\_cycle in Section 4.6.2.1, provided the following conditions are met:

- WUS has been configured in the serving NB-IoT cell using *WUS-Config-NB-r15* [2], and

- The serving cell measurement relaxation is signalled as ***n*** by the network using *numDRX-CycleRelaxed-r15*, and

- Serving cell S criteria is met with at least 2 dB margin.

- the relaxed monitoring criteria for neighbour cells in TS 36.304 [1] clause 5.2.4.12.1 is fulfilled, and

, where the relaxation factor N is given by Table 4.6.2.1A-1. Otherwise the requirements defined for the configured DRX cycle length in Section 4.6.2.1 shall apply.

The UE shall further meet the requirements in section 4.6.2.1 during time period T0 after following occasions:

- after the end of reception of latest paging message, or

- from the moment UE has switched from RRC\_CONNECTED state to RRC\_IDLE state.

T0 = N\*DRX cycle if the UE is not configured with eDRX\_IDLE cycle where the value of N specified in Table 4.6.2.1A-1;

T0 = one eDRX IDLE cycle if the UE is configured with eDRX\_IDLE cycle;

**Table 4.6.2.1A-1: The relaxation factor N for a UE not configured with eDRX IDLE cycle**

|  |  |
| --- | --- |
| **DRX cycle length [s]** | **Value** |
| 1.28 | Min(***n*** , 8) |
| 2.56 | Min(***n*** , 4) |
| 5.12 | Min(***n*** , 2) |
| 10.24 | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | |

**Table 4.6.2.1A-2: The relaxation factor N for a UE configured with eDRX IDLE cycle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Value** | | | |
| **5.12 ≤ PTW length [s] < 7.68** | **7.68 ≤ PTW length [s] < 12.8** | **12.8 ≤ PTW length [s] < 23.04** | **23.04 ≤ PTW length [s]** |
| 1.28 | 1 | Min(***n*** , 2) | Min(***n*** , 4) | Min(***n*** , 8) |
| 2.56 | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) |
| 5.12 | N/A | N/A | 1 | Min(***n*** , 2) |
| 10.24 | N/A | N/A | N/A | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | | | | |

4.6.2.2 Measurements of intra-frequency NB-IoT cells for UE category NB1 in normal coverage

The UE shall be able to identify new intra-frequency cells and perform NRSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,NB\_Intra\_NCwhen Treselection= 0. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

The UE shall measure NRSRP at least every Tmeasure,NB\_Intra\_NC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter NRSRP measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Intra-NC/2

The UE shall not consider an NB-IoT neighbour cell in cell reselection if it is indicated as not allowed in the measurement control system information of the serving NB-IoT cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,NB\_intra-NC when Treselection = 0, provided that the cell is at least XdB better ranked, where ‘X’ is specified in Table 4.6.2.4-3. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and non-serving NB-IoT intra-frequency cells.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra\_NC are specified in Table 4.6.2.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra -NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra-NC are specified in Table 4.6.2.2-2, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra\_NC when multiple PTWs are used.

**Table 4.6.2.2-1 : Tdetect,NB\_Intra\_NB-IoT-NC, Tmeasure,NB\_Intra\_NB-IoT-NC and Tevaluate, NB\_intra\_NB-IoT-NC**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NB\_Intra\_NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_NB\_NC [s] (number of DRX cycles)** | **Tevaluate,NB\_intra\_NB\_NC**  **[s] (number of DRX cycles)** |
| 1.28 | 51 (40) | 1.28 (1) | 6.5 (5) |
| 2.56 | 51 (20) | 2.56 (1) | 7.68 (3) |
| 5.12 | 102 (20) | 5.12 (1) | 10.24 (2) |
| 10.24 | 102 (10) | 10.24 (1) | 20.48 (2) |

**Table 4.6.2.2-2: Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate,NB\_intra\_NC for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 2.56s periods)** | **Tdetect,NB\_Intra\_NB-IoT-NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_NC [s] (number of DRX cycles)** | **Tevaluate,NB\_intra\_NC**  **[s] (number of DRX cycles)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥ 5.12 (2) | (20) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥ 7.68 (3) | 2.56 (1) | 5.12 (2) |
| 5.12 | ≥ 12.8 (5) | 5.12 (1) | 10.24 (2) |
| 10.24 | ≥ 23.04] (9) | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s intra-frequency measurement is not required to meet Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate,NB\_intra\_NC as defined in Table 4.6.2.2-1 and Table 4.6.2.2-2.

4.6.2.3 Measurement and evaluation of serving NB-IoT cell for UE category NB1 in enhanced coverage

The UE shall measure the NRSRP and NRSRQ level of the serving NB-IoT cell and evaluate the cell selection criterion S defined in [1] for the serving NB-IoT cell at least every DRX cycle.

The UE shall filter the NRSRP and NRSRQ measurements of the serving NB-IoT cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.3-1 in Nserv\_NB\_EC consecutive DRX cycles that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities. If the UE is configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.3-2 in Nserv\_NB-IoT-EC consecutive DRX cycles within a single PTW that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T= 80 s if the UE is not configured with eDRX\_IDLE cycle, and T=MAX(80 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle.

**Table 4.6.2.3-1: Nserv\_NB\_EC**

|  |  |
| --- | --- |
| **DRX cycle length [s]** | **Nserv\_NB-IoT-EC [number of DRX cycles]** |
| 1.28 | 4 |
| 2.56 | 4 |
| 5.12 | 4 |
| 10.24 | 4 |

**Table 4.6.2.3-2: Nserv\_NB\_ECfor UE configured with eDRX\_IDLE cycle**

|  |  |  |  |
| --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 2.56s periods)** | **Nserv\_NB\_EC [number of DRX cycles]** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥ 7.68 (3) | 4 |
| 2.56 | ≥ 12.8 (5) | 4 |
| 5.12 | ≥ 23.04 (9) | 4 |
| 10.24 | ≥ 43.52 (17) | 4 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

*Change 4*

4.6.2.5 Measurements of inter-frequency NB cells for UE category NB1 in normal coverage

The UE shall be able to identify new inter-frequency cells and perform NRSRP measurements of identified inter-frequency cells if carrier frequency information is provided by the serving NB-IoT cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev ≤ SnonIntraSearchP then the UE shall search for and measure inter-frequency layers in preparation for possible reselection.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Pcarrier \* Tdetect,NB\_Inter\_NC, and able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Nfreq\_NB-IoT \* Tdetect,NB\_Inter\_NC if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving NB-IoT cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5dB for reselections.An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NB-IoT\_SCH\_RP and SCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall filter NRSRP measurements of each measured inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure, Inter\_NB-IoT\_NC/2.

If an inter-frequency cell has been already detected but that has not been reselected to the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Pcarrier \* Tevaluate,NB\_Inter\_NC. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and inter-frequency cells.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6.2.5-1 for the UE in normal coverage. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6.2.5-2 for the UE in normal coverage, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC when multiple PTWs are used.

**Table 4.6.2.5-1 : Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate,NB\_Inter\_NC**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NB\_Inter\_ NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Inter\_ NC [s] (number of DRX cycles)** | **Tevaluate,NB\_Inter\_ NC**  **[s] (number of DRX cycles)** |
| 1.28 | 51 (40) | 1.28 (1) | 6.5 (5) |
| 2.56 | 51 (20) | 2.56 (1) | 7.68 (3) |
| 5.12 | [02 (20) | 5.12 (1) | 10.24 (2) |
| 10.24 | 102 (10) | 10.24 [1) | 20.48 (2) |

**Table 4.6.2.5-2: Tdetect,NB\_Inter\_ NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_ NC for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | | **DRX cycle length [s]** | | **PTW length [s] (number of 2.56s periods)** | | **Tdetect,NB\_Inter\_NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Inter\_NC [s] (number of DRX cycles)** | **Tevaluate,NB\_inter\_ NC**  **[s] (number of DRX cycles)** | |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | | 1.28 | | ≥5.12 (2) | | (20) | | 1.28 (1) | 2.56 (2) |
| 2.56 | | ≥7.68 (3) | | 2.56 (1) | 5.12 (2) |
| 5.12 | | ≥12.8 (5) | | 5.12 (1) | 10.24 (2) |
| 10.24 | | ≥23.04 (9) | | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s inter-frequency measurement is not required to meet Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC as defined in Table 4.6.2.5-1 and Table 4.6.2.5-2.

4.6.2.6 Measurements of inter-frequency NB-IoT cells for UE category NB1 in enhanced coverage

The UE shall be able to identify new inter-frequency cells and perform NRSRP measurements of identified inter-frequency cells if carrier frequency information is provided by the serving NB-IoT cell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Pcarrier \* Tdetect,NB\_Inter\_EC. An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

The UE shall filter NRSRP measurements of each measured inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Inter\_NB-IoT\_EC/2.

If an inter-frequency cell has been already detected but that has not been reselected to the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Pcarrier \* Tevaluate,NB\_Inter\_EC. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and inter-frequency NB-IoT cells.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For a UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC are specified in Table 4.6.2.6-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC are specified in Table 4.6.2.6-2 for the UE in enhanced coverage, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC when multiple PTWs are used.

**Table 4.6.2.6-1 : Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate,NB\_Inter\_EC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2** | **DRX cycle length [s]** | **Tdetect,NB\_Inter\_ EC [s] (number of DRX cycles)** | **Tmeasure,NB\_Inter\_ EC [s] (number of DRX cycles)** | **Tevaluate,NB\_Inter\_ EC**  **[s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 1.28 | 532 (415) | 1.28 (1) | 12.8 (10) |
| 2.56 | 532 (208) | 2.56 (1) | 15.36 (6) |
| 5.12 | 1063 (208) | 5.12 (1) | 20.48 (4) |
| 10.24 | 1063 (104) | 10.24 (1) | 30.72 (3) |
| **Q2≥-6** | 1.28 | 58 (45) | 1.28 (1) | 12.8 (10) |
| 2.56 | 59 (23) | 2.56 (1) | 15.36 (6) |
| 5.12 | 113 (22) | 5.12 (1) | 20.48 (4) |
| 10.24 | 113 (11) | 10.24 (1) | 30.72 (3) |

**Table 4.6.2.6-2: Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | | **DRX cycle length [s]** | | **PTW length [s]** **(number of 2.56s periods)** | | **Tdetect,NB\_Inter\_EC [s] (number of DRX cycles)** | | **Tmeasure,NB\_Inter\_EC [s] (number of DRX cycles)** | | **Tevaluate,NB\_interEC**  **[s] (number of DRX cycles)** | |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | | 1.28 | | ≥15.36 (6) | | ([406]) | | 1.28 (1) | | 12.8 (10) | |
| 2.56 | | ≥17.92 (7) | | 2.56 (1) | | 15.36 (6) | |
| 5.12 | | ≥23.04 (9) | | 5.12 (1) | | 20.48 (4]) | |
| 10.24 | | ≥33.28 (13) | | 10.24 (1) | | 30.72 (3) | |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | | | | | | | |

**Table 4.6.2.6-3: Conditions on NSCH Ês/Iot of identified and of the neighbour cell**

|  |  |  |
| --- | --- | --- |
| **NSCH Ês/Iot of already identified cell including serving cell: Q1** | **Neighbouring cell NSCH Ês/Iot: Q2** | **Cell Reselection Margin**  **‘Y’** |
| -15≤Q1<-6 | -15≤ Q2 < -6 | 9.3 |
| -15≤Q1<-6 | Q2-6 | 9.3 |
| Q1 -6 | Q2-6 | 5 |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s inter-frequency measurement is not required to meet Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC as defined in Table 4.6.2.6-1 and Table 4.6.2.6-2.

4.6.2.7 Maximum interruption in paging reception in normal coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving NB-IoT cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NB1-NC + 100 ms.

4.6.2.7A Maximum interruption in paging reception in enhanced coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving NB-IoT cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NB1-EC + 100 ms.

*Change 5*

4.7.2.1.3 Measurements of inter-frequency cells for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 7 dB for reselections based on ranking or 7 dB for RSRP reselections based on absolute priorities or 5 dB for RSRQ reselections based on absolute priorities. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_NC . If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure RSRP or RSRQ at least every Tmeasure,EUTRAN\_Inter\_NC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter\_NC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Tevaluate,E-UTRAN\_Inter\_NC, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 7]B for reselections based on ranking or 7dB for RSRP reselections based on absolute priorities or 5dB for RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-2. Additionally, the requirements in Table 4.7.2.1.3-2 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC when multiple PTWs are used.

**Table 4.7.2.1.3-1 : Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_Inter\_NC**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX cycles)** | **Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_Inter\_NC**  **[s] (number of DRX cycles)** |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

**Table 4.7.2.1.3-2: Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_inter\_NC for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX cycles)** | **Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_inter\_NC**  **[s] (number of DRX cycles)** |
| 5.12 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | Note 3 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | Note 3 (2) |
| 1.28 | ≥1.28 (1) | 1.28 (1) | Note 3 (2) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | Note 3 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34]. | | | | | |

For higher priority cells, a UE may optionally use a shorter value forTmeasure,EUTRAN\_Inter\_NC,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE's inter-frequency measurement is not required to meet Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_inter\_NC as defined in Table 4.7.2.1.3-1 and Table 4.7.2.1.3-2.

4.7.2.1.4 Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage

The UE category M1 in normal coverage shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA inter-frequency carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

4.7.2.1.5 Maximum interruption in paging reception for Category M1 UEs in normal coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA-M1-NC + 50 ms.

TSI-EUTRA-M1-NC is the time required for receiving all the relevant system information data, which include MIB and relavant SIB, according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for an E-UTRAN cell.

These requirements assume normal coverage radio conditions and do not take into account cell re-selection failure.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

*Change 6*

4.7.2.2.5 Maximum interruption in paging reception for Category M1 UEs in extended coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA-M1-EC + 50 ms.

TSI-EUTRA-M1-EC is the time required for receiving all the relevant system information data, which include MIB and relavant SIB, according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for an E-UTRAN cell.

These requirements assume extended coverage radio conditions and do not take into account cell re-selection failure.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

*Change 7*

4.8.6 Intra-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_EC\_ECID provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID intra-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.

For UE not configured with eDRX\_IDLE cycle, Tidentify\_intra\_EC\_ECID is as shown in Table 4.8.6-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_intra\_EC\_ECID is as shown in Table 4.8.6-2.

**Table 4.8.6-1: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement**

|  |  |  |  |
| --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2** | **DRX cycle length [s]** | **Tdetect,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 1.28 | 532 (415) | 1.28 (1) |
| 2.56 | 532 (208) | 2.56 (1) |
| 5.12 | 1063 (208) | 5.12 (1) |
| 10.24 | 1063 (104) | 10.24 (1) |
| **Q2≥-6** | 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

**Table 4.8.6-2: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2** | **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 2.56s periods)** | **Tdetect,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥15.36 (6) | (406) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| **Q2≥-6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥15.36 (6) | (20) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_EC\_ECID as shown in Table 4.8.6-1. For UE configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_EC\_ECID as shown in Table 4.8.6-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified intra-frequency cell, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_EC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.1. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.3.

4.8.6.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.1 and 9.1.22.3.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

4.8.7 Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for normal coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable inter frequency cell according to the following expression provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state:

Tidentify\_inter\_NC\_ECID= Nfreq\_NB\_ECID•Tidentify\_inter\_NC\_perCC\_ECID

Where Nfreq\_NB\_ECID is the total number of inter frequency carriers UE measures provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID intra-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.

For UE not configured with eDRX\_IDLE cycle, Tidentify\_inter\_NC\_perCC\_ECID is as shown in Table 4.8.7-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_inter\_NC\_perCC\_ECID is as shown in Table 4.8.7-2.

**Table 4.8.7-1: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NB\_Inter\_NC\_perCC\_ECID [s] (number of DRX cycles)** | **Tmeasure\_Intra\_NC\_ECID [s] (number of DRX cycles)** |
| 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

**Table 4.8.7-2: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 2.56s periods)** | **Tdetect,NB\_Intra\_NC\_ECID [s] (number of DRX cycles)** | **Tmeasure\_Intra\_NC\_ECID [s] (number of DRX cycles)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥15.36 (6) | (20) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | |

An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle,the measurement period for inter frequency measurements is Tmeasure\_inter\_NC\_ECID as shown in Table 4.8.7-1. For UE configured with eDRX\_IDLE cycle,the measurement period for inter frequency measurements is Tmeasure\_inter\_NC\_ECID as shown in Table 4.8.7-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified inter-frequency cell per inter-frequency for at least 1 inter-frequency carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_NC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.5. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.7.

4.8.7.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.5 and 9.1.22.7.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

4.8.8 Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable inter frequency cell according to the following expression provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state:

Tidentify\_inter\_EC= Nfreq\_NB\_ECID•Tidentify\_inter\_EC\_perCC\_ECID

Where Nfreq\_NB\_ECID is the total number of inter frequency carriers UE measuresprovided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID intra-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.Tidentify\_inter\_EC\_perCC\_ECID is shown in Table 4.8.8-1

For UE not configured with eDRX\_IDLE cycle, Tidentify\_inter\_EC\_perCC\_ECID is as shown in Table 4.8.8-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_inter\_EC\_perCC\_ECID is as shown in Table 4.8.8-1.

**Table 4.8.8-1: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement**

|  |  |  |  |
| --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2** | **DRX cycle length [s]** | **Tdetect,NB\_Intra\_ EC\_perCC\_ECID [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 1.28 | 532 (415) | 1.28 (1) |
| 2.56 | 532 (208) | 2.56 (1) |
| 5.12 | 1063 (208) | 5.12 (1) |
| 10.24 | 1063 (104) | 10.24 (1) |
| **Q2≥-6** | 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

**Table 4.8.8-2: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2** | **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 2.56s periods)** | **Tdetect,NB\_Intra\_ EC\_perCC\_ECID [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥15.36 (6) | (406) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| **Q2≥-6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 1.28 | ≥15.36 (6) | (20) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle, the measurement period for inter frequency measurements is Tmeasure\_inter\_EC\_ECID as shown in Table 4.8.8-1. For UE configured with eDRX\_IDLE cycle, the measurement period for inter frequency measurements is Tmeasure\_inter\_EC\_ECID as shown in Table 4.8.8-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified inter-frequency cell per inter-frequency for at least 1 inter-frequency carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_EC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.5. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.7.

*Change 8*

5.3.4 E-UTRAN - NR FR1 Handover

5.3.4.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR1 is to transfer a connection between the UE and E-UTRAN to NR in FR1. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

5.3.4.2 Handover delay

When the UE receives a RRC message implying inter-RAT handover to the UE shall be ready to start the transmission of the uplink PRACH channel in NR within Dhandover seconds from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterruption

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay which is 50 ms.

Tinterruption: it is the time between end of the last TTI containing the RRC command on the PDSCH in E-UTRAN and the time the UE starts transmission of the PRACH in NR, excluding TRRC\_procedure\_delay. Tinterruption is defined in clause 5.3.4.3.

5.3.4.3 Interruption time

When inter-RAT handover to NR is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Trs + Tprocessing + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown cell and target cell Es/Iot ≥ -2 dB, then Tsearch = 3▪Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 20 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

Trs is the SMTC period of the taget NR cell if the UE has been provided with an SMTC configuration for the target cell prior to, or in the handover command, otherwise Trs is the taget cell SSB transmission period, if such is provided. If the UE is not provided with an SMTC configuration or SSB transmission period, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If UE is provided with both SMTC configuration and SSB transmission period the requirement shall be based on SMTC periodicity.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 8.1.2.4.20, 8.1.2.4.22, 8.1.2.4.22 and 8.1.2.4.20.

5.3.5 E-UTRAN - NR FR2 Handover

5.3.5.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR2 is to transfer a connection between the UE and E-UTRAN to NR in FR2. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

5.3.5.2 Handover delay

When the UE receives a RRC message implying inter-RAT handover to the UE shall be ready to start the transmission of the uplink PRACH channel in NR within Dhandover seconds from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterruption

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay which is 50 ms.

Tinterruption: it is the time between end of the last TTI containing the RRC command on the PDSCH in E-UTRAN and the time the UE starts transmission of the PRACH in NR, excluding TRRC\_procedure\_delay. Tinterruption is defined in clause 5.3.5.3.

5.3.5.3 Interruption time

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Trs + Tprocessing + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is unknown and the target cell Es/Iot ≥ -2 dB, then Tsearch = 24 ▪Trs periodicity. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 40 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

Trs is the SMTC period of the taget NR cell if the UE has been provided with an SMTC configuration for the target cell prior to, or in the handover command, otherwise Trs is the taget cell SSB transmission period, if such is provided. If the UE is not provided with an SMTC configuration or SSB transmission period, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If UE is provided with both SMTC configuration and SSB transmission period the requirement shall be based on SMTC periodicity.

Relevant cell identification requirements are described in clause 8.1.2.4.20, 8.1.2.4.22, 8.1.2.4.22 and 8.1.2.4.20.

In FR2, the target cell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3 of TS 38.133 [29],

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3 of TS 38.133 [29].

otherwise it is unknown.

*Change 9*

5.5.3.1.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH.

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* and *mib-RepetitionStatus* [2] are included in the handover command then the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* or *mib-RepetitionStatus* [2] is not included in the handover command then the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TMIB + TIU + 20 ms

Where:

- Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Otherwise, Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.3.1 for intra-frequency handover for a UE configured with CEModeB or Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.3.5 for inter-frequency handover for a UE configured with CEModeB. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- TMIB is the time required for acquiring the MIB information of the target cell.

- TIU is the time required to complete the transmission of PRACH in the target cell. The actual value of TIU shall depend upon the uncertainity in acquiring the first available PRACH occasion based on the PRACH configuration used in the target cell and the PRACH coverage enhancement level used by the UE for sending the random access preamble to the target cell.

- In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement for a time duration equal or longer than the time duration required for the cell identification. Otherwise, it is unknown. For intra-frequency handover the time duration required for the cell identification is specified in relevant intra-frequency cell identification requirements as described in Clause 8.13.3.1 for CEModeB. For inter-frequency handover the time duration required for the cell identification is specified in relevant inter-frequency cell identification requirements as described in Clause 8.13.3.5 for CEModeB.

*Change 10*

6.3.2.4 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within Tconnection\_release\_redirect\_NR.

The time delay (Tconnection\_release\_redirect\_UTRA FDD) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR) shall be less than:

Tconnection\_release\_redirect\_NR = TRRC\_procedure\_delay + Tidentify-NR + TSI-NR + TRACH

The target NR cell shall be considered detectable when for each relevant SSB:

- SSB\_RP and SSB Ês/Iot according to Annex B.2.5 of TS 38.133 [50] for a corresponding NR Band.

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCConnectionRelease*” as defined in clause 6.2.2 of TS 36.331 [2].

Tidentify-NR: It is the time to identify the target NR cell and depends on the frequency range (FR) of the target NR cell. It is defined in table 6.3.2.4-1. Tidentify-NR = TPSS/SSS-sync + Tmeas, whereTPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

TSI-NR: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

TRACH: It is the delay caused due to the random access procedure when sending random access to the target NR cell. This delay depends on the PRACH configuration defined in TS 38.211 [42] Table 6.3.3.2-2 or Table 6.3.3.2-3 for FR1 and in Table 6.3.3.2-4 for FR2.

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this section is applied with Trs = 20 ms assuming the SSB transmission periodicity is not larger than 20 ms,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

**Table 6.3.2.4-1: Time to identify target NR cell for RRC connection release with redirection to NR**

|  |  |
| --- | --- |
| **Frequency range (FR) of target NR cell** | **Tidentify-NR** |
| FR1 | MAX (680 ms, 11 x Trs) |
| FR2 | MAX (880 ms, 88 x Trs) |

6.4 CSG Proximity Indication for E-UTRAN and UTRAN

6.4.1 Introduction

The requirements defined in this section are applicable to a UE supporting and configured with CSG proximity indication and are valid when a UE is entering the proximity of one or more CSG member cell(s) or leaving the proximity of all CSG member cell(s) on a UTRA or E-UTRA frequency as specified in [2].

The detection of CSG proximity is based on a UE autonomous search function.

6.4.2 Requirements

The UE shall initiate transmission of the ProximityIndication message with “entering” according to [2] within 6 minutes after entering the proximity of one or more CSG member cell(s) on a UTRA or E-UTRA frequency.

The UE shall initiate transmission of the ProximityIndication message with “leaving” according to [2] within 6 minutes after leaving the proximity of all CSG member cell(s) on a UTRA or E-UTRA frequency.

There is no need for statistical testing of this requirement.

NOTE: Entering the proximity of one or more CSG member cell(s) means that the UE is near a cell whose CSG ID is in the UE’s CSG whitelist (as determined based on autonomous search procedures). Leaving the proximity of one or more CSG member cell(s) means that the UE is no longer near any cell whose CSG ID is in the UE’s CSG whitelist.

*Change 11*

7.3 Timing Advance

7.3.1 Introduction

The timing advance is initiated from E-UTRAN with MAC message that implies and adjustment of the timing advance, see TS 36.321 [17] clause 5.2.

7.3.2 Requirements

7.3.2.1 Timing Advance adjustment delay

When *ShortTTI-r15* is not configured and *ShortProcessingTime=FALSE*, the UE shall adjust the timing of its uplink transmission timing at sub-frame *n*+6 for a timing advance command received in sub-frame *n*.

When *ShortTTI-r15* is configured or *ShortProcessingTime=TRUE* and the TA command is received at subframe /slot/ subslot *n*, the timing advance adjustment delay is shown in Table 7.3.2.1-1. The UE shall adjust the uplink timing at the first subframe boundary following the time shown in Table 7.3.2.1-1.

The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

**Table 7.3.2.1-1: Timing advance adjustment delay requirement for sTTI and for *ShortProcessingTime=TRUE [2]***

|  |  |  |  |
| --- | --- | --- | --- |
| **TTI duration** | **Processing time** | **Requirement to update timing** | **Units** |
| *ShortTTI-*r15not configured Note 1 | *ShortProcessingTime=TRUE* | n+5 | Subframe |
| *dl-STTI-Length-r15*=slot Note 1 | N/A | n+8 | Slot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus4set1 | n+16 | Subslot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus6set1 or  *proc-Timeline-r15*= nplus6set2 | n+18 | Subslot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus8set2 | n+20 | Subslot |
| Note 1: If the PDSCH HARQ processing time is modified by RRC signalling during an ongoing connection, the requirement to update timing is not defined from the time when the RRC command is received by the UE until the UE has applied the updated PDSCH HARQ processing time | | | |

*Change 12*

7.7 SCell Activation and Deactivation Delay for E-UTRA Carrier Aggregation

7.7.1 Introduction

This section defines requirements for the delay within which the UE shall be able to activate a deactivated or dormant SCell, deactivate an activated or dormant SCell, or hibernate a deactivated or activated SCell in E-UTRA carrier aggregation. The requirements are applicable to an E-UTRA carrier aggregation capable UE which has been configured with up to six downlink SCells.

This section also defines requirements for the delay within which the UE shall be able to directly activate or directly hibernate a SCell in E-UTRA carrier aggregation. The requirements for dormant SCell are applicable for up to 4 SCell(s).

If multiple downlink SCells are activated or deactivated in the same MAC control element as defined in [17], the requirements shall apply to each of the SCells in the MAC control element.

For UE configured with one or more FeMBMS/Unicast-mixed SCells, the requirements in Section 7.7 apply also when one or more FeMBMS/Unicast-mixed SCells are activated or deactivated.

7.7.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Nact\_known provided the following conditions are met for the SCell:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SCell being activated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being activated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2 where

Nact\_known =24;

Nact\_known =23 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_known =22 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise upon receiving the SCell activation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Nact\_unknown provided the SCell can be successfully detected on the first attempt where

Nact\_unknown =34;

Nact\_unknown =33 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_unknown =32 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15 configured;

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the activated SCell on the next available uplink reporting resource after receiving the reference signal.

The SCell activation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell activation procedure.

If there are no uplink resources for reporting the valid CSI in subframe *n*+Nact\_known or *n*+Nact\_unknown or uplink transmission is interrupted due to SRS carrier based switching then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell activation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.4.2 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

7.7.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

Upon receiving SCell deactivation command or upon expiry of the *sCellDeactivationTimer* in subframe *n*, the UE shall accomplish the deactivation actions specified in [17] for the SCell being deactivated no later than in subframe *n+*Ndeact where

Ndeact =8

Ndeact=7 if the deactivation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Ndeact =6 if the deactivation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

The SCell deactivation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell deactivation procedure.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

7.7.4 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

While activating a SCell if the UE does not receive any command to activate, deactivate, configure or deconfigure any other SCell during the SCell activation delay then the UE shall meet the SCell activation delay requirements specified in section 7.7.2.

While activating a SCell if any other SCell is activated, deactivated, configured or deconfigured by the UE then the UE shall meet the SCell activation delay requirements (Tactivate\_total) according to the following expression:



Where:

Tactivate\_total is the total time to activate a SCell and is expressed in subframes.

Tactivate\_basic is the SCell activation delay specified in section 7.7.2;

Ki (0 ≤ Ki ≤ 3) is the number of times the other ith SCell is activated, deactivated, configured or deconfigured while the SCell is being activated.

N (2≤N≤6) is the maximum number of SCells supported by the UE.

While activating an SCell:

- The interruption on the PCell and/or on the activated SCell due to the SCell activation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

if:

- the PCell and/or the activated SCell being interrupted and the SCell being activated belong to E-UTRA TDD, or

- the activated SCell being interrupted and the SCell being activated belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD.

- Otherwise, the interruption on PCell and/or on the activated SCell due to the SCell activation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell and SCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell and SCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for an SCell.

7.7.5 SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

The UE shall deactivate a SCell and meet the SCell deactivation delay requirements specified in section 7.7.3 regardless of whether any other SCell is activated, deactivated, configured or deconfigured or not by the UE during the SCell deactivation delay.

While deactivating a SCell:

- The interruption on the PCell and/or on the activated SCell due to the SCell deactivation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

if:

- the PCell and/or the activated SCell being interrupted and the SCell being deactivated belong to E-UTRA TDD or

- the activated SCell being interrupted and the SCell being deactivated belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD.

- Otherwise, the interruption on PCell and/or the activated SCell due to the SCell deactivation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell and SCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell and SCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

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7.7.12 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells under Frame Structure 3

While activating a SCell, if any other SCell is activated, deactivated, configured or deconfigured by the UE, the UE shall meet the SCell activation delay requirements (Tactivate\_total\_FS3) according to the following expression:



where

Tactivate\_total\_FS3 is the total time to activate a SCell and is expressed in subframes,

Tactivate\_basic\_FS3\_ is the SCell activation delay for the SCell, as specified in section 7.7.10,

TDMTC\_periodicity is the periodicity of the DMTC [2],

Ki (0 ≤ Ki ≤ 3) is the number of times the other ith SCell is activated, deactivated, configured or deconfigured while the SCell is being activated,

N (2≤N≤4) is the maximum number of SCells supported by the UE.

While activating a SCell:

- When PCell belongs to E-UTRA FCC, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

- When the PCell belongs to E-UTRA TDD, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall send CSI with CQI index = 0 (out of range) if the UE has available uplink resources to report for the SCell being activated.

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7.7.14 SCell Activation Delay Requirement for Dormant SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one downlink SCell in dormant state. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

The delay within which the UE shall be able to activate the dormant SCell depends upon the specified conditions.

Upon receiving SCell activation command in subframe *n*, the UE shall be ready to receive the downlink grant and apply actions related to the activation command as specified in TS 36.321 [17] for the SCell being activated no later than in subframe *n*+Nact\_dormant provided the following conditions are met for the SCell:

- UE has been periodically sending a valid CQI report for the dormant SCell being activated before the reception of the SCell activation command:

- the SCell being activated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- MBSFN subframes are not configured in the PCell

- SCell being activated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2 where

when PCell belongs to E-UTRAN FDD,

Nact\_dormant = 8;

Nact\_dormant = 7 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_dormant = 6 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

and when the PCell belongs to E-UTRAN TDD,

Nact\_dormant = 11;

Nact\_dormant = 10 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_dormant = 9 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise, upon receiving the SCell activation command for a dormant SCell, the SCell activation delay requirement as specified by subclause 7.7.2 shall apply to the dormant SCell being activated.

The SCell activation delay specified in this section can be extended with each SRS carrier-based switching to any carrier occuring during the SCell activation procedure.

Scell activation delay and interruption requirements are defined assuming that MBSFN subframe(s) are not configured. Additional delay may be expected if MBSFN subframe(s) are configured.

In addition to the CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 36.321 [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+5* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+4* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+5* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

7.7.15 SCell Hibernation Delay Requirement for Activated SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one activated downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

Upon receiving SCell hibernation command or upon expiry of the *sCellHibernationTimer* in subframe *n*, the UE shall accomplish the hibernation actions specified in TS 36.321 [17] for the SCell being hibernated no later than in subframe *n+*Nhibernate where

Nhibernate =8Nhibernate =7 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate =6 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

The PCell interruption upon receiving the hibernation command specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

7.7.16 SCell Hibernation Delay Requirement for Deactivated SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

The delay within which the UE shall be able to hibernate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell hibernation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in TS 36.321 [17] for the SCell being in the dormant state no later than in subframe *n*+Nhibernate\_known provided the following conditions are met for the SCell:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell hibernation command:

- the UE has sent a valid measurement report for the SCell being hibernated and

- the SCell being hibernated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being hibernated also remains detectable during the SCell hibernation delay according to the cell identification conditions specified in section 8.3.3.2 where

Nhibernate\_known =24;

Nhibernate\_known =23 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate\_known =22 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise upon receiving the SCell hibernation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the hibernation command as specified in TS 36.321 [17] for the SCell being in the dormant state no later than in subframe *n*+ Nhibernate\_unknown provided the SCell can be successfully detected on the first attempt where

Nhibernate\_unknown =34;

Nhibernate\_unknown =33 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate\_unknown =32 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15 configured;

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the dormant SCell on the next available uplink reporting resource after receiving the reference signal.

The SCell hibernation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell activation procedure.

If there are no uplink resources for reporting the valid CSI in subframe *n*+ Nhibernate\_known or *n*+ Nhibernate\_unknown or uplink transmission is interrupted due to SRS carrier based switching then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in TS 36.213 [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell hibernation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of TS 36.213 [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the hibernation command specified in TS 36.321 [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

Starting from the subframe specified in section 4.3 of TS 36.213 [3] and until the UE has completed the SCell hibernation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

*Change 15*

7.8.2.12 Interruptions during RSSI measurements on multiple SCCs under Frame Structure 3

If the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, and if one SCell is deactivated,

- the UE is allowed due to RSSI measurements on the SCC with deactivated SCell:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCell is 640 ms or longer,

- an interruption on any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellis 640 ms or longer.

- no interruption is allowed if both of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellare below 640 ms.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers and if two, three, four, five, or six SCells are deactivated,

- the UE is allowed due to RSSI measurements on the SCCs with deactivated SCells:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when:

any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer, or

RSSI windows with the length of *measDuration* [2] for at least some of the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are not within 20 ms;

- an interruption on an activated SCell with up to 0.5% probability of missed ACK/NACK when:

any of the configured *rmtc-Period* [2] and the configured and the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer, or

RSSI windows with the length of *measDuration* [2] for at least some of the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are not within 20 ms.

- no interruption is allowed if both of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellare below 640 ms and RSSI windows with the length of *measDuration* [2] for all the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are within 20 ms.

Each allowed interruption shall not exceed:

- 1 subframe on the PCell, and

- 5 subframes on the activated SCell.

7.8.2.13 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

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7.12.2.7 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC, PSCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PCC, PSCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

*Change 17*

7.14.2 PSCell Addition Delay Requirement

The requirements in this section shall apply for the UE configured with only PCell.

Upon receiving PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell no later than in subframe *n*+ Tconfig\_ PSCell:

Where:

Tconfig\_PSCell = 20ms + Tactivation\_time + 50ms + TPCell\_ DU + TPSCell\_ DU

Tactivation\_time is the PSCell activation delay. If the PSCell is known, then Tactivation\_time is 20ms. If the PSCell is unknown, then Tactivation\_time is 30ms provided the PSCell can be successfully detected on the first attempt.

TPCell\_ DU is the delay uncertainty due to PCell PRACH preamble transmission. TPCell\_ DU is up to 20ms if PSCell activation is interrupted by a PCell PRACH preamble transmission, otherwise it is 0.

TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TPSCell\_ DU is up to 30ms.

PSCell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the PSCell configuration command:

- the UE has sent a valid measurement report for the PSCell being configured and

- the PSCell being configured remains detectable according to the cell identification conditions specified in section 8.8,

- PSCell being configured also remains detectable during the PSCell configuration delay according to the cell identification conditions specified in section 8.8.

otherwise it is unknown.The PCell interruption specified in section 7.12 is allowed only during the RRC reconfiguration procedure [2].

The PSCell addition delay specified in this section can be extended if SRS carrier based switching occurs during the PSCell addition procedure.

*Change 18*

7.19.2 Requirements for FD-FDD and TDD CE mode A

The requirements defined in this subclause 7.19.2 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_Cat M1 and Qin\_Cat M1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-1.

The threshold Qin\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-1.

**Table 7.19.2-1 M-PDCCH transmission parameters for out-of-sync and in-sync for UE category M1 with CE mode A**

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Out-of-sync** | **In-sync** |
| DCI format | 6-1A | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax Note1 | Rmax /2 Note1 |
| Aggregation level (ECCE) | L’max Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1.  NOTE 2: L’max and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level two levels below L’max, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

In addition to the requirements defined above, UE configured with *rlm-ReportConfig* has to

- Estimate the downlink radio link quality and compare it to the thresholds Q E1\_out\_CatM1 and Q E2\_in\_CatM1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-2.

The threshold QE2\_in\_CatM1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at QE1\_out\_CatM1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-2.

**Table 7.19.2-2 M-PDCCH transmission parameters for event E1 and event E2 for UE category M1 with CE mode A**

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Event E1** | **Event E2** |
| DCI format | 6-1A | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax/2 Note1 | Rmax/8 Note1 |
| Aggregation level (ECCE) | L’max-1Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax ≥ 2 to trigger Event E1 and Rmax ≥ 8 to trigger Event E2.  NOTE 2: L’max-1 and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max-1 is 16, 8 and 4, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level one level below L’max-1, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

7.19.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_CatM1 period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send an out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_CatM1 period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send an in-sync indication for the PCell to the higher layers within TEvaluate\_Qin\_CatM1 evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, rmax\*G).

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

TEvaluate\_Qout\_CatM1 = 5\**rmax*\**G* ms and TEvaluate\_Qin\_CatM1 = 5\**rmax*\**G* ms, provided the below conditions are met, where *rmax*\**G* is MPDCCH monitoring cycle length and parameters *rmax* and *G* are as specified in [3]:

*rmax*\**G* ≥ 80 ms, and

*G*>1, and

UE is not receiving PDSCH,

otherwise TEvaluate\_Qout\_CatM1 = 400 ms and TEvaluate\_Qin\_CatM1 = 200 ms.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last Qout\_CatM1 evaluation period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last Qin\_CatM1 period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within Qin\_CatM1 evaluation period. A L3 filter shall be applied to the event E2 indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

**Table 7.19.2.1-1: Reportable values of *excessRep-MPDCCH***

|  |  |
| --- | --- |
| **Parameter: excessRep-MPDCCH-r14** | **Value** |
| ‘excessRep1’ | 2 Note1 |
| ‘excessRep2’ | 4 Note1 |
| NOTE 1: excessRep-MPDCCH-r14 is the factor by which UE recommends eNB to scale down Rmax (as per the formula Rmax / excessRep-MPDCCH-r14), where Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331. | |

7.19.2.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.2.2-1 will be used.

When eDRX\_CONN cycle is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.2.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

**Table 7.19.2.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for FD-FDD and TDD UE category M1**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles)** |
| ≤ 0.01 | Non-DRX requirements in clause 7.19.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (20) |
| 0.04 < DRX cycle ≤ 0. 64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

**Table 7.19.2.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for FD-FDD and TDD UE category M1**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles)** |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.2.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

7.19.2.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell.

7.19.3 Requirements for HD-FDD with CE mode A

The requirements defined in this subclause 7.19.3 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

7.19.3.1 Minimum requirement when no DRX is used

The HD-FDD category M1 with CE mode A UE shall meet all applicable requirements specified in clause 7.19.2.1 under the following conditions

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

7.19.3.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for HD-FDD category M1 with CE mode A UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.3.2-1 will be used.

When eDRX\_CONN cycle is used for HD-FDD category M1 with CE mode A UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.3.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

**Table 7.19.3.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for HD-FDD UE category M1 with CE mode A**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles)** |
| ≤ 0.01 | Non-DRX requirements in clause 7.19.3.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (40) |
| 0.04 < DRX cycle ≤ 0. 16 | Note (20) |
| 0. 16 < DRX cycle ≤ 0.64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| Note: Evaluation period length in time depends on the length of the DRX cycle in use | | |

**Table 7.19.3.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for HD-FDD UE category M1 with CE mode A**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles)** |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.3.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

7.19.3.3 Minimum requirement at transitions

The minimum requirements at transitions defined in clause 7.19.2.3 also apply for this section under the following conditions:

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

7.19.4 Requirements for FD-FDD and TDD with CE mode B

The requirements defined in this subclause 7.19.4 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_Cat M1 and Qin\_Cat M1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-1.

The threshold Qin\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-1.

**Table 7.19.4-1 M-PDCCH transmission parameters for out-of-sync and in-sync for UE category M1 with CE mode B**

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Out-of-sync** | **In-sync** |
| DCI format | 6-1B | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | RmaxNote1 | Rmax/2Note1 |
| Aggregation level (ECCE) | L’max Note2 | L’max-2 Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1.  NOTE 2: L’max and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation levels two levels below L’max, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

In addition, a UE configured with *rlm-ReportConfig* has to meet the following requirements

- Estimate the downlink radio link quality and compare it to the thresholds Q E1\_out\_CatM1 and Q E2\_in\_CatM1.

The threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-2.

The threshold QE2\_in\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-2.

**Table 7.19.4-2 M-PDCCH transmission parameters for event E1 and event E2 for UE category M1 with CE mode B**

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Event E1** | **Event E2** |
| DCI format | 6-1B | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax/2 Note1 | Rmax/8 Note1 |
| Aggregation level (ECCE) | L’max-1Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax ≥2 to trigger Event E1 and Rmax ≥ 8 to trigger Event E2.  NOTE 2: L’max-1 and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max-1 is 16, 8 and 4, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level one levels below L’max-1, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

7.19.4.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_CatM1 period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send an out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_CatM1 period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send an in-sync indication for the PCell to the higher layers within TEvaluate\_Qin\_CatM1 evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, rmax\*G).

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

TEvaluate\_Qout\_CatM1 = 5\**rmax*\**G* ms and TEvaluate\_Qin\_CatM1 = 5\**rmax*\**G* ms, provided the below conditions are met, where *rmax*\**G* is MPDCCH monitoring cycle length and parameters *rmax* and *G* are as specified in [3]:

*rmax*\**G* ≥ 800 ms, and

*G*>1, and

UE is not receiving PDSCH,

otherwise TEvaluate\_Qout\_CatM1 = 4000 ms and TEvaluate\_Qin\_CatM1 = 2000 m

The requirements defined in clause 7.19.4.1 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last Qout\_CatM1 evaluation period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within Qout\_CatM1 evaluation period A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last Qin\_CatM1 evaluation period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within Qin\_CatM1 evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

**Table 7.19.4.1-1: Reportable values of *excessRep-MPDCCH***

|  |  |
| --- | --- |
| **Parameter: excessRep-MPDCCH-r14** | **Value** |
| ‘excessRep1’ | 2 Note1 |
| ‘excessRep2’ | 4 Note1 |
| NOTE 1: excessRep-MPDCCH-r14 is the factor by which UE recommends eNB to scale down Rmax (as per the formula Rmax / excessRep-MPDCCH-r14), where Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331. | |

7.19.4.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.4.2-1 will be used.

When eDRX\_CONN cycle is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.4.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

**Table 7.19.4.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for FD-FDD and TDD UE category M1**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles)** |
| ≤ 0.16 | Non-DRX requirements in clause 7.19.4.1 are applicable. |
| 0.160 < DRX cycle ≤ 0.320 | Note (20) |
| 0.320 < DRX cycle ≤ 0. 64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

**Table 7.19.4.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for FD-FDD and TDD UE category M1**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles)** |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.4.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

7.19.4.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell.

7.19.5 Requirements for HD-FDD with CE mode B

The requirements defined in this subclause 7.19.5 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

7.19.5.1 Minimum requirement when no DRX is used

The HD-FDD category M1 with CE mode B UE shall meet all applicable requirements specified in clause 7.19.4.1 under the following conditions

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

7.19.5.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for HD-FDD category M1 with CE mode B UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.5.2-1 will be used.

When eDRX\_CONN cycle is used for HD-FDD category M1 with CE mode B UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.5.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

**Table 7.19.5.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for HD-FDD UE category M1 with CE mode B**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles)** |
| ≤ 0.08 | Non-DRX requirements in clause 7.19.5.1 are applicable. |
| 0.08< DRX cycle ≤0.160 | Note (40) |
| 0.160 < DRX cycle ≤ 0.320 | Note (20) |
| 0.320 < DRX cycle ≤ 0.64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

**Table 7.19.5.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for HD-FDD UE category M1 with CE mode B**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles)** |
| 2.56 < DRX cycle ≤ 10.24 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | |

The requirements defined in clause 7.19.5.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

*Chanage 20*

8.1.2 Requirements

8.1.2.1 UE measurement capability

If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE does not support perServingCellMeasurementGap-r14 or is not configured with per serving cell measurement gaps, in order for the requirements in the following subsections to apply the E-UTRAN must provide a single measurement gap pattern with constant gap duration for concurrent monitoring of all frequency layers and RATs. If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per serving cell measurement gaps, in order for the requirements in the following subsections to apply the E-UTRAN must provide gap pattern(s) on at least each serving component carrier (per-CC) where the UE has indicated in the *perCC-ListGapIndication* IE that gaps are required. No gap pattern is required to be provided on the serving component carrier where UE has indicated in the the *perCC-ListGapIndication* IE that gaps are not required. The requirements apply if the gap on each serving cell is at least that which the UE has indicated with gapIndication in the *perCC-ListGapIndication* IE, and if the gapOffset, MGRP and MGL are the same for each serving component carrier. During the measurement gaps the UE:

During the measurement gaps the UE:

- shall not transmit any data

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell and any SCell.

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell, PSCell, and SCell.

If the UE supporting dual connectivity is configured with PSCell, during the total interruption time as shown in Figure 8.1.2.1-1, the UE shall not transmit and receive any data in SCG.

In addition, for UE supporting E-UTRA-NR dual connectivity, if MG timing advance of 0.5ms is applied, the UE:

- shall not transmit any data

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell and any SCell.

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell, PSCell, and SCell.

in subframes fully or partially overlapping with the measurement gaps on E-UTRAN serving cells. The total interruption time on E-UTRAN serving cells is (MGL+1) subframes.

When MG timing advance of 0.5 ms is not applied, in the uplink subframe occurring immediately after the measurement gap,

- if the following conditions are met then it is up to UE implementation whether or not the UE can transmit data:

- all the serving cells belong to E-UTRAN TDD;

- the measurement objects do not include any NR carrier frequency;

- if the subframe occurring immediately before the measurement gap is an uplink subframe.

- Otherwise the UE shall not transmit any data.

When MG timing advance of 0.5 ms is applied, in the uplink subframe occurring immediately after the subframe partially overlapped with measurement gap,

- it is up to UE implementation whether or not the UE can transmit data

In determining the above UE behaviour in the uplink subframe occurring immediately after the measurement gap or after the subframe partially overlapped with measurement gap,the UE shall treat a special subframe as an uplink subframe if the special subframe occurs immediately before the measurement gap.

Inter-frequency and inter-RAT measurement requirements within this clause rely on the UE being configured with one measurement gap pattern unless the UE has signaled that it is capable according to the capability interFreqNeedForGaps or interRATNeedForGaps of conducting such measurements without gaps and without interruption. UEs shall only support those measurement gap patterns listed in Table 8.1.2.1-1 and table 8.1.2.1.-2 that are relevant to its measurement capabilities. UEs supporting network controlled small gap and which have signaled that they are capable of measurements without gap but requiring NCSG, can be configured with a network controlled small gap pattern in table 8.1.2.1.3-1 on all component carrier(s) to perform inter-frequency and inter-RAT measurement.

ProSe capable UE is allowed to perform ProSe transmissions during the measurement gaps that are not used for measurements if the requirements specified in section 8 for inter-frequency and inter-RAT measurements are fulfilled.

For UE supporting NR – E-UTRA dual connectivity and configured with LTE PSCell, all gap patterns #0~11 in Table 8.1.2.1-1 can be configured by the NR PCell for measurement of NR carrier only, and gap pattern#0, 1, 2, 3, 4, 6, 7, 8, 10 can be configured by the NR PCell for measurement of E-UTRA carrier with the applicability as specified in Table 8.1.2.1-1.

**Table 8.1.2.1-1: Gap Pattern Configurations supported by the UE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gap Pattern Id** | **MeasurementGap Length (MGL, ms)** | **Measurement Gap Repetition Period**  **(MGRP, ms)** | **Minimum available time for inter-frequency and inter-RAT measurements during 480ms period**  **(Tinter1, ms)** | **Measurement Purpose** |
| 0 | 6 | 40 | 60 | Inter-Frequency E-UTRAN FDD and TDD, UTRAN FDD, GERAN, LCR TDD, HRPD, CDMA2000 1x, inter-RAT NR |
| 1 | 6 | 80 | 30 | Inter-Frequency E-UTRAN FDD and TDD, UTRAN FDD, GERAN, LCR TDD, HRPD, CDMA2000 1x, inter-RAT NR |
| 2 | 3 | 40 | 24NOTE 1,2 | Inter-Frequency E-UTRAN FDD and TDD for cells with time difference as specified below.  inter-RAT NR |
| 3 | 3 | 80 | 12NOTE 1,2 | Inter-Frequency E-UTRAN FDD and TDD for cells with time difference according as specified below.  inter-RAT NR |
| 4 | 6 | 20 | 120 Note 1 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 5 | 6 | 160 | Note 3 | inter-RAT NR |
| 6 | 4 | 20 | 72 Note 1, 5, 7 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 7 | 4 | 40 | 36 Note 1, 5, 8 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 8 | 4 | 80 | 18Note 1, 5, 9 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 9 | 4 | 160 | Note 3 | inter-RAT NR |
| 10 | 3 | 20 | 48 Note 1, 5 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 11 | 3 | 160 | Note 3 | inter-RAT NR |
| NOTE 1: When determing UE requirements using Tinter1 for GP2, 3, 4, 6, 7, 8, 10, Tinter1 = 60 for GP2, GP4, GP6, GP7, GP10 and Tinter1 = 30 for GP3 and GP8 shall be used.  NOTE 2: Void.  NOTE 3: This gap pattern can be used only for measurement of NR carriers, and Tinter is not applicable.  NOTE 4: Void  NOTE 5: Void.  NOTE 6: This gap pattern is supported by UEs which are configured to perform both E-UTRA inter-frequency measurement and inter-RAT NR measurement or supported by UEs configured to perform inter-RAT NR measurement only.  NOTE 7: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 48ms corresponding to the first 3ms of the 4ms gap  NOTE 8: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 24ms corresponding to the first 3ms of the 4ms gap  NOTE 9: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 12ms corresponding to the first 3ms of the 4ms gap | | | | |

**Table 8.1.2.1-2: Gap Pattern Configurations for UE supporting low density burst gap pattens**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Gap Pattern Id** | **MeasurementGap Length (MGL, ms)** | **Measurement Gap Repetition Period**  **(MGRP, ms)** | **Number of gaps per burst** | **Burst repetition period Tburst** | **Measurement Purpose** |
| nonUniform1 | 6 | 40 | 13 | 1.28s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform2 | 6 | 40 | 13 | 2.56s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform3 | 6 | 40 | 13 | 5.12s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform4 | 6 | 40 | 13 | 10.24s | Inter-Frequency E-UTRAN FDD and TDD |
| NOTE 1: When determing UE requirements nonUniform1, nonUniform2, nonUniform3 or nonUniform4, 60ms shall be assumed as the minimum available time for inter-frequency and inter-RAT measurements during each burst..  NOTE 2: The Gap patterns nonUniform1, nonUniform2, nonUniform3 and nonUniform4 cannot be be combined with IncMon reduced performance group | | | | | |

NOTE 1: When inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern 0 can be used. For defining the inter-frequency and inter-RAT requirements Tinter1=30ms shall be assumed.

NOTE 2: A measurement gap starts at the end of the latest subframe occurring immediately before the measurement gap among MCG serving cells subframes. If the measurement objects include at least one NR carrier frequency, the measurement gap starts at time TMG ms if configured advanced to the end of the latest DL E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells.

NOTE 2a: In EN-DC mode, the measurement gap starts at time TMG ms if configured advanced to the end of the latest E-UTRA DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

NOTE 2b: In NE-DC mode,

- if per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest NR DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE has NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest NR DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR1.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE doesn’t have NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest DL E-UTRA subframe occurring immediately before the configured measurement gap among SCG serving cells subframes.

TMG is the MG timing advance value provided in mgta according to TS 36.331 [2].

NOTE 3: MGL is the time from start of tuning to end of retuning, which is aligned between MCG and SCG.

NOTE 4: For GP0 and GP1 The total interruption time on SCG is 6 subframes for synchronous dual connectivity, and the total interruption time on SCG is 7 subframes for asyncrhonous dual connectivity. As shown in Figure 8.1.2.1-1, MCG subframes from *i+*1 to *i+*6 are included in total interruption time together with SCG subframes from *j+*1 to *j+*6 for synchronous dual connectivity and *j+*1 to *j+*7for asyncrhonous dual connectivity.

NOTE 5: For GP0 and GP1 and asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b), subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+8 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 6: For GP2 and GP3 the total interruption time on SCG is 3 subframes for synchronous dual connectivity, and the total interruption time on SCG is 4 subframes for asyncrhonous dual connectivity. The total interrupt is applied in same spirit as shown in Figure 8.1.2.1-1. I.e. For MCG subframes from *i+*1 to *i+*3 are included in total interruption time together with SCG subframes from *j+*1 to *j+*3 for synchronous dual connectivity and *j+*1 to *j+*4for asyncrhonous dual connectivity.

NOTE 7: For GP2 and GP3 and asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b) with measurement gap length 3, subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+5 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 8: nonUniform1 – nonUniform4 gap patterns are shown in figure 8.1.2.1-2. A burst repetition period Tburst is consisted of T1 and T2. During T1, UE performs measurement during the gap. During T2, UE suspends measurement gap. Both UE and eNB can assume there is no gap during T2. T1 equals to number of gaps per burst in Table 8.1.2.1-2. Tburst is configured by the higher layers.For nonUniform1 – nonUniform4 the total interruption time on SCG is same as for GP0 and GP1 for both synchronous and asynchronous dual connectivity as shown in Figure 8.1.2.1-1. For asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b), subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+8 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 9: When UE is in NE-DC, the total interruption time on SCG is MGL subframes for synchronous NE-DC, and the total interruption time on SCG is (MGL+1) subframes for asyncrhonous NE-DC. Subframe occurring immediately before the measurement gap for SCG is the latest subframe in SCG which is before and fully non-overlapped with the measurement gap, similarly, subframe occurring immediately after the measurement gap for SCG is the earliest subframe in SCG which is after and fully non-overlapped with the measurement gap.

****

**Figure 8.1.2.1-1: Measurement GAP and total interruption time on MCG and SCG**

****

**Figure 8.1.2.1-2: Non-uniform gap pattern**

A UE that is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps shall follow requirements as if Gap Pattern Id #0 had been used and the minimum available time Tinter1 of 60 ms shall be assumed for the corresponding requirements.

A UE configured with gap pattern Id 2, 3 or 10, shall be able to detect a target cell if the sub frame #0 or #5 of the target cell begins no earlier than 500uS from the start of the measurement gap and if the sub frame #0 or #5 of the target cell ends no later than 500uS before the end of the measurement gap in case of FDD, and no later than [750]us before the end of measurement gap in case of TDD.

A UE configured with gap pattern Id 6, 7 or 8 shall be able to detect a target cell if the sub frame #0 or #5 of the target cell begins no earlier than 500uS from the start of the measurement gap and if the sub frame #0 or #5 of the target cell ends no later than 1500uS before the end of the measurement gap in case of FDD, and no later than 1750us before the end of measurement gap in case of TDD.

If the UE supporting E-UTRA carrier aggregation when configured with up to six SCCs is performing measurements on cells on PCC, inter-frequency measurements, or inter-RAT measurements, and interruption occurs on PCell or any activated SCell or both due to measurements performed on cells on an SCC with a deactivated SCell according to section 8.3, then the UE shall meet the requirements specified for each measurement in Section 8 and Section 9.

If the UE supporting E-UTRA dual connectivity when configured with a PSCell is performing measurements on cells on PCC, inter-frequency measurements, or inter-RAT measurements, then the UE shall meet the requirements specified for each measurement in Section 8 and Section 9.

A UE which indicate support for Increased UE carrier monitoring E-UTRA according to the capabilities in [2, 31] and which is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps, shall be able to monitor maximum number of layers as defined in 8.1.2.1.1.1a, and apply the *MeasScaleFactor* [2] defining the relaxation to the requirements for the configured carriers according to section 8.1.2.1.1a.

A UE configured via LPP [24] to perform RSTD measurements requiring measurement gaps and provided with the OTDOA assistance data, which is comprising at least one PRS configuration with >6 consecutive downlink positioning subframes defined in TS 36.211 [16] in at least one cell, can be configured for performing the RSTD measurements with the following measurement gap patterns and shall not be used outside the corresponding RSTD measurement period:

- measurement gap pattern with Id 0 specified in Table 8.1.2.1-1, or

- an applicable measurement gap pattern specified in Table 8.1.2.1-3, provided the following conditions are met:

- the UE is Cat M1 or Cat M2 UE, and

- the applicability conditions are met for the UE.

**Table 8.1.2.1-3: Additional Measurement Gap Pattern Configurations supported by the UE**

|  |  |  |  |
| --- | --- | --- | --- |
| **Gap Pattern Id** | **Measurement Gap Length**  **(MGL, ms)** | **Measurement Gap Repetition Period**  **(MGRP, ms)** | **Applicability** |
| rstd0 | 10 | 80 | NOTE 1, 2 |
| rstd1 | 10 | 160 |
| rstd2 | 10 | 320 |
| rstd3 | 10 | 640 |
| rstd4 | 10 | 1280 |
| rstd5 | 14 | 160 | NOTE 1, 2 |
| rstd6 | 14 | 320 |
| rstd7 | 14 | 640 |
| rstd8 | 14 | 1280 |
| rstd9 | 24 | 320 | NOTE 1, 2 |
| rstd10 | 24 | 640 |
| rstd11 | 24 | 1280 |
| rstd12 | 32 | 320 | NOTE 1, 2 |
| rstd13 | 32 | 640 |
| rstd14 | 32 | 1280 |
| rstd15 | 54 | 640 | NOTE 2 |
| rstd16 | 54 | 1280 |
| rstd17 | 64 | 640 | NOTE 2 |
| rstd18 | 64 | 1280 |
| rstd19 | 80 | 640 | NOTE 3 |
| rstd20 | 80 | 1280 |
| NOTE 1: For FDD, (MGL-2) shall not be larger than the required minimum number of available measurement subframes specified in Section 9 in the corresponding RSTD measurement accuracy requirements.  NOTE 2: For TDD, the number of DL subframes within the available measurement time of the measurement gap shall not be larger than the required minimum number of available measurement subframes specified in Section 9 in the corresponding RSTD measurement accuracy requirements.  NOTE 3: At least one cell in the OTDOA assistance data is configured with multiple PRS configurations | | | |

If the UE is configured with any of the measurement gap patterns specified in Table 8.1.2.1-3 for performing RSTD measurements, using of any other measurement gap pattern configured to the UE is suspended during the RSTD measurement period.

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8.2 Capabilities for Support of Event Triggering and Reporting Criteria

8.2.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 8.2.2, the UE shall meet the performance requirements defined in clause 9.

The UE can be requested to make measurements under different measurement identities defined in TS 36.331 [2]. Each measurement identity corresponds to either event based reporting, periodic reporting, logged measurement reporting [2] or no reporting. In case of event based reporting, each measurement identity is associated with an event. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of logged measurement reporting, a measurement identity is associated with one logged measurement reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event, periodic, logged measurement and no reporting criteria the UE may be requested to track in parallel.

8.2.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event based reporting), or one periodic reporting criterion (in case of periodic reporting), or one logged measurement reporting criterion (in case of logged measurement reporting), or one no reporting criterion (in case of no reporting). For event based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 8.2.2-1.

The UE shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, and inter-RAT per supported RAT(i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- 26 reporting criteria in total if the UE is not configured with any SCell or PSCell carrier frequency,

- 35 reporting criteria in total if the UE is configured with one SCell carrier frequency,

- 44 reporting criteria in total if the UE is configured with two SCell carrier frequencies,

- 53 reporting criteria in total if the UE is configured with three SCell carrier frequencies,

- 62 reporting criteria in total if the UE is configured with four SCell carrier frequencies,

- 71 reporting criteria in total if the UE is configured with five SCell carrier frequencies,- 80 reporting criteria in total if the UE is configured with six SCell carrier frequencies,

- 35 reporting criteria in total if the UE is configured with one PSCell carrier frequency, and

- 44 reporting criteria in total if the UE is configured with one PSCell carrier frequency and one SCell carrier frequency.

Editor’s note: the total reporting criteria are to be verified when the UE capabilities related to frame structure 3 are decided.

A UE supporting increased number of carriers to monitor beyond 3 carriers shall be able to support up to 20 reporting criteria for inter-frequency measurement category according to table 8.2.2-1. Additionally such UE shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, and inter-RAT per supported RAT, the UE need not support more than the total number of reporting criteria as follows:

- 39 reporting criteria in total if the UE is not configured with any SCell carrier frequency,

- 48 reporting criteria in total if the UE is configured with one SCell carrier frequency,

- 57 reporting criteria in total if the UE is configured with two SCell carrier frequencies,

- 48 reporting criteria in total if the UE is configured with one PSCell carrier frequency,

- 57 reporting criteria in total if the UE is configured with one PSCell carrier frequency and one SCell carrier frequencies,

- 66 reporting criteria in total if the UE is configured with three SCell carrier frequencies, and

- 75 reporting criteria in total if the UE is configured with four SCell carrier frequencies.

- 84 reporting criteria in total if the UE is configured with five SCell carrier frequencies

- 93 reporting criteria in total if the UE is configured with six SCell carrier frequencies

Editor’s note: the total reporting criteria are to be verified when the UE capabilities related to frame structure 3 are decided.

The UE capable of supporting EN-DC operation with NR PSCell and one or more NR carrier frequencies in total shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, inter-RAT per supported RAT, and NR cells on serving and non-serving carrier frequencies (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the number of reporting criteria, excluding reporting criteria specified in TS 38.133 [50] that are applicable for the UE configured with EN-DC operation, as follows:

- [36] reporting criteria if the UE is not configured with any SCell or PSCell carrier frequency or NR SCell or NR PSCell,

- [36] reporting criteria if the UE is not configured with any SCell or NR SCell but configured with one NR PSCell carrier frequency.

The UE capable of supporting and configured with NE-DC operation with PSCell and NR PCell and one or more NR carrier frequencies in total shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells and E-UTRA inter-frequency cells, inter-RAT per supported RAT, and NR cells on serving and non-serving carrier frequencies (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the number of reporting criteria, excluding reporting criteria specified in TS 38.133 [50] that are applicable for the UE configured with NE-DC operation, as follows:

- [TBD] reporting criteria if the UE is not configured with any SCell or NR SCell.

Editor’s note: the above list is to be updated for the agreed CA combinations with NR PSCell.

**Table 8.2.2-1: Requirements for reporting criteria per measurement category**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measurement category** | **Ecat** | **Note** | |
| Intra-frequency Note 1, 5, 6 | 10 | Events for any one or a combination of intra-frequency RSRP, RSRQ, and RS-SINRNote4 for E-UTRA intra-frequency cells | |
| Intra-frequency UE Rx-Tx time difference Note 5 | 2 | Intra-frequency UE Rx-Tx time difference measurements reported to E-UTRAN via RRC and to positioning server via LPP. Applies for UE supporting both LPP and UE Rx-Tx time difference measurement. | |
| Intra-frequency RSTD Note 2, 5, 6 | 1 | Intra-frequency RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 cell measurements for the intra-frequency | |
| Intra-frequency RSRP and RSRQ measurements for E-CID Note 5, 6 | 1 | Intra-frequency RSRP and RSRQ measurements for E-CID reported to E-SMLC via LPP [24]. One report capable of at least in total 9 intra-frequency RSRP and RSRQ measurements. Applicable to UE capable of reporting RSRP and RSRQ to E-SMLC via LPP. | |
| Intra-frequency RSSI and channel occupancy measurements under operation with frame structure 3 | 1 | One report capable of one UE RSSI and channel occupancy measurement s per serving carrier frequency. Applicable for UE capable of performing and reporting UE RSSI and channel occupancy under operation with frame structure 3. | |
| Inter-frequency Note 5, 6 | 10 / 28 | Events for any one or a combination of inter-frequency RSRP, RSRQ, and RS-SINRNote4 for E-UTRA inter-frequency cells (see note 3) | |
| Inter-frequency RSTD Note 2, 5, 6 | 1 | Inter-frequency RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 cell measurements for at least one inter-frequency. Only applicable as specified in Section 8.1.2.6. | |
| Inter-frequency RSSI and channel occupancy measurements under operation with frame structure 3 | 1 | One report capable of one UE RSSI and channel occupancy measurement s for an inter-frequency. Applicable for UE capable of performing and reporting UE RSSI and channel occupancy under operation with frame structure 3. | |
| Inter-RAT (GSM, cdma2000 1 x RTT and HRPD) Note 5 | 5 | Only applicable for UE with this (inter-RAT) capability. This requirement (**Ecat** = 5) is per supported RAT. | |
| Inter-RAT (UTRAN FDD, UTRAN TDD)Note 5 | 5 or 11 | Only applicable for UE with this (inter-RAT) capability. This requirement (**Ecat** = 5 or 11) is per supported RAT. For UE which indicate support for Increased UE carrier monitoring UTRA **Ecat** = 11. | |
| Inter-RAT NR carrier frequency Note 5 | 10 | Events for NR cells on all inter-RAT NR carrier frequencies for UE capable of EN-DC operation. Only applicable for UE with this capability and measurements on any of the NR carrier frequencies other than the carrier frequency of the NR PSCell or NR SCell. | |
| MBSFN measurements for MDT | 1 | MBSFN measurement reporting for UE supporting MBSFN measurements (MBSFN RSRP, MBSFN RSRQ, and MCH BLER) for MDT [2]; 1 report capable of minimum 1 MBSFN RSRP measurement [4], 1 MBSFN RSRQ measurement [4], and 1 MCH BLER measurement [4]. | |
| Note 1: When the UE is configured with SCell, PSCell, PCell or NR PSCell carrier frequency, Ecat for Intra-frequency is applied per serving frequency.  Note 2: When the UE is configured with one SCell carrier frequency, the UE shall be capable of supporting at least 2 reporting criteria for all RSTD measurements configured to be performed on PCell carrier frequency, SCell carrier frequency and inter-frequency carrier. When the UE is configured with two SCell carrier frequencies, the UE shall be capable of supporting at least 3 reporting criteria for all RSTD measurements configured to be performed on PCell carrier frequency, the two SCell carrier frequencies and inter-frequency carrier. These requirements apply when there is a single on-going LPP OTDOA location session.  Note 3: Support of Ecat of 28 for Measurement category Inter-frequency is applied for a UE supporting increased number of carriers to monitor beyond 3.  Note 4: For UEs supporting RS-SINR measurements  Note 5: Applicable for UE configured with EN-DC operation mode.  Note 6: Applicable for UE configured with NE-DC operation mode. | | | |

*Change 20*

8.1.2.1.1b.1 Maximum allowed layers for multiple monitoring for UE in NSA operation

The UE configured with NR PSCell shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 6 FDD E-UTRA inter-frequency carriers configured by PCell, and

- Depending on UE capability, 6 TDD E-UTRA inter-frequency carriers configured by PCell, and

- Depending on UE capability, 7 NR inter-RAT carriers excluding NR serving carrier(s) configured by PCell, and

- Depending on UE capability, 7 NR inter-frequency carriers configured by NR PSCell [50].

- Depending on UE capability, 3 FDD UTRA carriers, and

- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and

- Depending on UE capability, 1 FDD E-UTRA inter-frequency carrier for RSTD measurements configured via LPP [24], and

- Depending on UE capability, 1 TDD E-UTRA inter-frequency carrier for RSTD measurements configured via LPP [24].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers) and NR layers.

The UE shall be capable of monitoring a total of at least 7 effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by PCell and NR inter-frequency carriers configured by NR PSCell.

When PCell and NR PSCell configure the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or

- different deriveSSB-IndexFromCell indications or

- different SMTC configurations.

NOTE 1: The EN-DC capable UE configured with NR PSCell shall fulfil the requirements defined in only one of Section 8.2.1.1b.1 and Section 9.1.3.2 of TS 38.133 [50].

8.1.2.1.1c Monitoring of multiple layers using gaps (NE-DC)

The requirements in this section are applicable for UE capable of and configured with the NE-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN carriers as configured by PSCell, inter-RAT E-UTRAN carriers as configured by NR PCell, and inter-frequency NR carriers as configured by NR PCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (NR SS-RSRP, NR SS-RSRQ, NR SS-SINR, SFTD, RSRP, RSRQ, and RS-SINR measurements, etc.) of detected cells on all the layers.

For UE configured with the NE-DC operation, the effective total number of frequencies excluding the frequencies of the NR PCell, NR SCells, PSCell, and SCells being monitored is Nfreq, NE-DC, which is defined as:

Nfreq, NE-DC = Nfreq, NE-DC, NR + Nfreq, NE-DC, E-UTRA,

where

Nfreq, NE-DC, NR is the number of NR inter-frequency carriers being monitored as configured by NR PCell.

Nfreq, NE-DC, E-UTRA ≤ Nfreq, NE-DC, E-UTRA, inter-RAT + Nfreq, NE-DC, E-UTRA, inter-freq

where

Nfreq, NE-DC, E-UTRA, inter-RAT is the number of E-UTRA inter-RAT carriers (FDD and TDD) excluding E-UTRA serving carrier(s) being monitored as configured by PSCell [15] or via LPP [22],

Nfreq, NE-DC, E-UTRA, inter-freq is the number of E-UTRA inter-frequency carriers (FDD and TDD) being monitored as configured by NR PCell or via LPP [22].

8.1.2.1.1c.1 NE-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NE-DC operation, the UE shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 7 NR inter-frequency carriers configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA TDD inter-RAT carriers excluding E-UTRA serving carriers configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA FDD inter-RAT carriers excluding E-UTRA serving carriers configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by PSCell, and

- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by PSCell, and

- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [57], and

- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [57].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, and E-UTRA TDD layers. The UE shall be capable of monitoring a total of at least 6 effective E-UTRA carrier frequency layers, excluding E-UTRA serving carrier(s), comprising of any above defined combination of E-UTRA inter-RAT carriers excluding E-UTRA serving carrier(s) configured by NR PCell and E-UTRA inter-frequency carriers configured by PSCell.

8.1.2.1.2 Network controlled small gap

A UE may reconfigure the receiver bandwidth, carrier frequency or turn on/off one of the RF chains when performing measurements on PCell, activated SCell/PSCell, deactivated SCell and/or unused RF chain. This may cause interruptions on PCell or activated SCell(s) or both that are specified in Section 7.8.

If the UE requires network controlled small gap (NCSG) to prevent the interruption and UE is not configured with asynchrouns DC,

- When UE is not configured with measurement gap, the E-UTRAN can explicitly provide a single NCSG pattern with constant repetition period per UE.

- When UE is configured with Gap Pattern ID #0 on some of, but not all, serving carriers including PCC and SCC(s), a single NCSG pattern with NCSG Pattern ID #0 in Table 8.1.2.1.2-1 can be implicitly configured on the serving carrier(s), where measurement gap is not configured.

Note: As shown in Figure 8.1.2.1.2-1, subframes of serving carrier 1 from i+1 to i+6 are used as measurement gap. The NCSG can be implicitly configured on other serving carrier subframes from j+1 to j+6, where no measurement gap is configured.

****

**Figure 8.1.2.1.2-1: Measurement GAP and NCSG**

- When UE is configured with Gap Pattern ID #1 on some of, but not all, serving carriers including PCC and SCC(s), a single NCSG pattern with NCSG Pattern ID #1 in Table 8.1.2.1.2-1 can be implicitly configured on the serving carrier(s), where measurement gap is not configured.

- When UE measurement gap is configured on all serving carriers including PCC and SCC(s), NCSG should not be configured.

If the UE requires NCSG to prevent the interruption and the UE supporting asynchronous DC is configured with PSCell which is asynchnous with PCell,

- When there is no measurement gap configured among MCG and SCG cell subframes, the E-UTRAN can explicitly provide a single NCSG pattern with constant repetition period per serving carrier.

- When Gap Pattern ID #0 is configured for UE on MCG (or SCG) and no measurement gap is configured on SCG (or MCG), a single NCSG pattern with NCSG Pattern ID #2 can be implicitly configured on SCG (or MCG).

Note: As shown in Figure 8.1.2.1.2-2, one serving carrier subframes from i+1 to i+6 are used as measurement gap. The NCSG can be implicitly configured on other serving carrier subframes from j+1 to j+7, where no measurement gap is configured.

- When Gap Pattern ID #1 is configured for UE on MCG (or SCG) and no measurement gap is configured on SCG (or MCG), a single NCSG pattern with NCSG Pattern ID #3 can be implicitly configured on SCG (or MCG).

UEs shall only support those NCSG patterns listed in Table 8.1.2.1.2-1 that are relevant to its measurement capabilities.

****

**Figure 8.1.2.1.2-2: Measurement GAP and NCSG for dual connectivity**

**Table 8.1.2.1.2-1: NCSG Configurations supported by the UE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NCSG Pattern Id** | **Visible interruption length before measurement (VIL1, ms)** | **Measurement Length during which there is no gap (ML, ms)** | **Visible interruption length after measurement (VIL2, ms)** | **Visible interruption Repetition Period**  **(VIRP, ms)** | **Purpose** |
| 0 | 1 | 4 | DL: 1  UL: 2 | 40 | Interruption control according to requirements in sections x,y,x |
| 1 | 1 | 4 | DL: 1  UL: 2 | 80 | Interruption control according to requirements in sections x,y,x |
| 2 | 2 | 3 | 2 | 40 | Interruption control according to requirements in sections x,y,x |
| 3 | 2 | 3 | 2 | 80 | Interruption control according to requirements in sections x,y,x |

During the VIL1 and VIL2, the UE is not expected to transmit and receive any data. During ML, the UE is expected to transmit and receive data on the corresponding serving carrier.

A UE that is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps, but needs interruption, and is configured with the network controlled small gap for such measurement (NCSG Pattern Id #0-3) shall follow requirements as if Gap Pattern Id #0 or Gap Pattern Id #1 had been used and shall not make any autonomous interruption outside the visual interruption of the configured network controlled small gap for the measurement., and the minimum available time Tinter1 of 60 ms and 30 ms shall be assumed for the corresponding requirement for visible interruption repetition period (VIRP) of 40 ms and 80 ms, respectively.

8.1.2.2 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency cells and perform RSRP, RSRQ, and RS-SINR measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

8.1.2.2.1 E-UTRAN FDD intra frequency measurements

8.1.2.2.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_FDD, intra is 800 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated, including nonUniform1 – nonUniform4 gaps, the UE shall be capable of performing measurements for at least Ymeasurement intra cells , where Ymeasurement intra is defined in the following equation. If the UE has identified more than Ymeasurement intra cells, the UE shall perform measurements of at least 8 identified intra- frequency cells but the reporting rate of RSRP, RSRQ, and RS-SINR measurements of cells from UE physical layer to higher layers may be decreased.

cells

where

Xbasic measurement FDD = 8 (cells),

TMeasurement\_Period, Intra = 200 ms is the measurement period for intra frequency RSRP, RSRQ, and RS-SINR measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.1.1.1 Measurement Reporting Requirements

8.1.2.2.1.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.1.1.1.3.

8.1.2.2.1.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra defined in Clause 8.1.2.2.1.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1A. When *highSpeedEnhancedMeasFlag* is configured the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1B.

**Table 8.1.2.2.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tidentify\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

**Table 8.1.2.2.1.2-1A: Requirement to identify a newly detectable FDD intra-frequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

**Table 8.1.2.2.1.2-1B: Requirement to identify a newly detectable FDD intrafrequency cell for UE configured with *highSpeedEnhancedMeasFlag***

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tidentify\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle≤1.28 | Note2(10) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-2. When eDRX\_CONN is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-3. When *highSpeedEnhancedMeasFlag* is configured in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-4. The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra.

**Table 8.1.2.2.1.2-2: Requirement to measure FDD intrafrequency cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

**Table 8.1.2.2.1.2-3: Requirement to measure FDD intra-frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

**Table 8.1.2.2.1.2-4: Requirement to measure FDD intrafrequency cells for UE configured with *highSpeedEnhancedMeasFlag***

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (4) |
| 0.08<DRX-cycle≤1.28 | Note2 (3) |
| 1.28<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.1.2.1 Measurement Reporting Requirements

8.1.2.2.1.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.1.2.1.3.

8.1.2.2.1.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra defined in Clause 8.1.2.2.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.2 E-UTRAN TDD intra frequency measurements

8.1.2.2.2.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_TDD, intra is 800 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement intra cells , where Ymeasurement intra is defined in the following equation. If the UE has identified more than Ymeasurement intra cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP, RSRQ, and RS-SINR measurements of cells from UE physical layer to higher layers may be decreased.

cells

where

Xbasic measurement TDD = 8 (cells),

TMeasurement\_Period Intra = 200 ms is the measurement period for intra frequency RSRP, RSRQ, and RS-SINR measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.2.1.1 Measurement Reporting Requirements

8.1.2.2.2.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.2.1.1.3.

8.1.2.2.2.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra defined in Clause 8.1.2.2.2.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.2.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.2.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1. When eDRX\_CONN is in use, the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1A. When *highSpeedEnhancedMeasFlag* is configured the UE shall be able to identify a new detectable TDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1B.

**Table 8.1.2.2.2.2-1: Requirement to identify a newly detectable TDD intrafrequency cell**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tidentify\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

**Table 8.1.2.2.2.2-1A: Requirement to identify a newly detectable TDD intra-frequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

**Table 8.1.2.2.2.2-1B: Requirement to identify a newly detectable TDD intrafrequency cell for UE configured with *highSpeedEnhancedMeasFlag***

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tidentify\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle≤1.28 | Note2(10) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Clause 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

When DRX is in use in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-2. When eDRX\_CONN is in use in the RRC\_CONNECTED state, the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-3. When *highSpeedEnhancedMeasFlag* is configured in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-4. The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra.

**Table 8.1.2.2.2.2-2: Requirement to measure TDD intra frequency cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

**Table 8.1.2.2.2.2-3: Requirement to measure TDD intra-frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

**Table 8.1.2.2.2.2-4: Requirement to measure TDD intrafrequency cells for UE configured with *highSpeedEnhancedMeasFlag***

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (4) |
| 0.08<DRX-cycle≤1.28 | Note2 (3) |
| 1.28<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.2.2.1 Measurement Reporting Requirements

8.1.2.2.2.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.2.2.1.3.

8.1.2.2.2.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra defined in Clause 8.1.2.2.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.3 E-UTRAN FDD intra frequency measurements with autonomous gaps

8.1.2.2.3.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, intra = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,.intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall transmit at least 60 ACK/NACKs on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.2.3.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.2.4 E-UTRAN TDD intra frequency measurements with autonomous gaps

8.1.2.2.4.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, intra = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.2.4.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

**Table 8.1.2.2.4.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, intra.**

|  |  |
| --- | --- |
| **UL/DL configuration** | **Minimum number of transmitted ACK/NACKs** |
| 0 (Note 1) | 18 |
| 1 | 35 |
| 2 | 43 |
| 3 | 36 |
| 4 | 39 |
| 5 | 42 |
| 6 | 30 |
| Note 1: When a UE is configured with EIMTA-*MainConfigServCell* via RRC signalling [2] only this requirement shall apply. | |

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.2.4.1-1 on PCell or each of the activated SCell(s).

8.1.2.2.4.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.2.5 E-UTRAN FDD intra-frequency measurements on carrier with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform intra-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of unicast reception from FeMBMS/Unicast mixed cell and capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the intra-frequency to be measured.

The UE shall meet the requirements in Section 8.1.2.2.1, when performing intra-frequency measurements on a carrier with at least one FeMBMS/Unicast mixed cell. The minimum number of cells that the UE shall be able to measure on includes also FeMBMS/Unicast mixed cells.

8.1.2.3 E-UTRAN inter frequency measurements

The UE shall be able to identify new inter-frequency cells and perform RSRP, RSRQ, and RS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

8.1.2.3.1 E-UTRAN FDD – FDD inter frequency measurements

8.1.2.3.1.1 E-UTRAN FDD – FDD inter frequency measurements when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

(normal performance) and

(reduced performance)

Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Nfreq,n Nfreq,r Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expressions:



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

(normal performance) and

(reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.1 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.1.2.3.1.1-1.

**Table 8.1.2.3.1.1-1:** M**easurement period and measurement bandwidth**

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance)** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance)** | **Measurement bandwidth [RB]** |
| 0 | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 6 |
| 1 (Note 1) | 240 x Kn x Nfreq,n | 240 x Kr x Nfreq,r | 50 |
| 2 (Note 2) | Tburst x Nfreq | N/A | 6 |
| 3 (Note 3) | ½∙Tburst x Nfreq | N/A | 50 |
| Note 1: This configuration is optional  Note 2: This configuration is for when nonUniform1 – nonUniform4 are configured  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.1.2.3.1.1-1.

For category 1bis UE, when measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period given by table 8.1.2.3.1.1-2.

**Table 8.1.2.3.1.1-2:** M**easurement period and measurement bandwidth (category 1bis UE)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance)** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance)** | **Measurement bandwidth [RB]** |
| 0 | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r | 6 |
| 1 (Note) | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 50 |
| Note: This configuration is optional | | | |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.1.2.3.1.1-2.

8.1.2.3.1.1.1 Measurement Reporting Requirements

8.1.2.3.1.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.1.1.1.3.

8.1.2.3.1.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH . The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify -inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.1.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.1.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.1.2.3.1.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.1.2 E-UTRAN FDD – FDD inter frequency measurements when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1, and when eDRX\_CONN is in use, Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1B.

**Table 8.1.2.3.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_inter (s) (DRX cycles), normal performance** | | **Tidentify\_inter (s) (DRX cycles), reduced performance** | |
| **Gap period = 40 ms, 20ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n  (20\*Kn\*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r  (20\*Kr\*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,nl (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32< DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.3.1.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter (s) (eDRX\_CONN cycles), normal performance** | | **Tidentify\_inter (s) (eDRX\_CONN cycles), reduced performance** | |
| **Gap period = 40 ms, 20ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

**Table 8.1.2.3.1.2-1B: Requirement to identify a newly detectable FDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tidentify\_inter  (DRX\_cycles)** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.16< DRX-cycle<2.56 | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) |
| Note: Time depends upon the DRX cycle in use | | | | |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.1.2-4.

**Table 8.1.2.3.1.2-2: Requirement to measure FDD interfrequency cells**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal performance)** | **Tmeasure\_inter (s) (DRX cycles) (reduced performance)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.1.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

**Table 8.1.2.3.1.2-4: Requirement to measure FDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tmeasure\_inter  (DRX cycles)** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| DRX-cycle ≤2.56 | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) |
| Note: Time depends on the DRX cycles in use | | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-6.

**Table 8.1.2.3.1.2-5: Requirement to measure FDD interfrequency cells (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal performance)** | **Tmeasure\_inter (s) (DRX cycles) (reduced performance)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.1.2-6: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.1.2.1 Measurement Reporting Requirements

8.1.2.3.1.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.1.2.1.3.

8.1.2.3.1.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.1.2.3.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter defined in clause 8.1.2.3.1.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter defined in clause 8.1.2.3.1.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.2 E-UTRAN TDD – TDD inter frequency measurements

8.1.2.3.2.1 E-UTRAN TDD – TDD inter frequency measurements when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied, ,

- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied, ,.

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

Nfreq is defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied,



- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied,



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied,

(normal performance) and

(reduced performance)

- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied,

(normal performance) and

(reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.2 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1. Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1.

For UE other than category 1bis UE , a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period (TMeasurement\_Period\_TDD\_Inter) given by table 8.1.2.3.2.1-1:

**Table 8.1.2.3.2.1-1: TMeasurement\_Period\_TDD\_Inter for different configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Configuration** | | **Measurement bandwidth [RB]** | **Number of UL/DL sub-frames per half frame (5 ms)** | | **DwPTS** | | **TMeasurement\_Period\_TDD\_Inter [ms] (normal performance)** | **TMeasurement\_Period\_TDD\_Inter [ms] (reduced performance)** |
|  |  | DL | UL | Normal CP | Extended CP |  |  |
| 0 | | 6 | 2 | 2 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 1 (Note 1) | | 50 | 2 | 2 |  |  | 240 x Kn x Nfreq,n | 240 x Kr x Nfreq,r |
| 2 | | 6 | 1 | 3 |  |  | 720 x Kn x Nfreq,n | 720 x Kr x Nfreq,r |
| 3 (Note 1) | | 50 | 1 | 3 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 4 | | 6 | 2 | 2 |  |  | Tburst x Nfreq | Tburst x Nfreq |
| 5 (Note 3) | | 50 | 2 | 2 |  |  | ½ x Tburst x Nfreq | ½ x Tburst x Nfreq |
| 6 | | 6 | 1 | 3 |  |  | 3/2∙Tburst x Nfreq | 3/2 x Tburst x Nfreq |
| 7 (Note 3) | | 50 | 1 | 3 |  |  | Tburst x Nfreq | Tburst x Nfreq |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16]  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | | | | | | |

The UE shall be capable of performing RSRP, RSRQ, RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period TMeasurement\_Period\_TDD\_Inter.

For category 1bis UE, when measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period (TMeasurement\_Period\_TDD\_Inter) given by table 8.1.2.3.2.1-2:

**Table 8.1.2.3.2.1-2: TMeasurement\_Period\_TDD\_Inter for different configurations (category 1bis UE)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Configuration** | | **Measurement bandwidth [RB]** | **Number of UL/DL sub-frames per half frame (5 ms)** | | **DwPTS** | | **TMeasurement\_Period\_TDD\_Inter [ms] (normal performance)** | **TMeasurement\_Period\_TDD\_Inter [ms] (reduced performance)** |
|  |  | DL | UL | Normal CP | Extended CP |  |  |
| 0 | | 6 | 2 | 2 |  |  | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r |
| 1 (Note 1) | | 50 | 2 | 2 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 2 | | 6 | 1 | 3 |  |  | 1440 x Kn x Nfreq,n | 1440 x Kr x Nfreq,r |
| 3 (Note 1) | | 50 | 1 | 3 |  |  | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16] | | | | | | | |  |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period TMeasurement\_Period\_TDD\_Inter given by table 8.1.2.3.2.1-2.

8.1.2.3.2.1.1 Measurement Reporting Requirements

8.1.2.3.2.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.2.1.1.3.

8.1.2.3.2.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.2.1.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_TDD\_Inter defined in clause 8.1.2.3.2.1 provided the timing to that cell has not changed more than ± 50 Ts while measurementgap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.2.2 E-UTRAN TDD – TDD inter frequency measurements when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN TDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1, and when eDRX\_CONN is in use Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1B.

**Table 8.1.2.3.2.2-1: Requirement to identify a newly detectable TDD interfrequency cell**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_inter (s) (DRX cycles) (normal performance)** | | **Tidentify\_inter (s) (DRX cycles) (reduced performance)** | |
| **Gap period = 40 ms, 20ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,n (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32<DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.3.2.2-1A: Requirement to identify a newly detectable TDD inter-frequency cell when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter (s) (eDRX\_CONN cycles) (normal performance)** | | **Tidentify\_inter (s) (eDRX\_CONN cycles) (reduced performance)** | |
| **Gap period = 40 ms, 20ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

**Table 8.1.2.3.2.2-1B: Requirement to identify a newly detectable TDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tidentify\_inter  (DRX cycles)** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.16< DRX-cycle<2.56 | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) |
| Note: Time depends upon the DRX cycle in use | | | | |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter  is as defined in Table 8.1.2.3.2.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.2.2-4.

**Table 8.1.2.3.2.2-2: Requirement to measure TDD interfrequency cells**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal requirement)** | **Tmeasure\_inter (s) (DRX cycles) (reduced requirement)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.128 | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (5\*Kn\*Nfreq,n) | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (5\*Kr\*Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.2.2-3: Requirement to measure TDD inter-frequency cells when eDRX\_CONN cycle is used**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal requirement)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced requirement)** |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

**Table 8.1.2.3.2.2-4: Requirement to measure TDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tmeasure\_inter  (DRX cycles)** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| DRX-cycle ≤2.56 | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) |
| Note: Time depends upon the DRX cycle in use | | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.2.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter  is as defined in Table 8.1.2.3.2.2-6.

**Table 8.1.2.3.2.2-5: Requirement to measure TDD interfrequency cells (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal requirement)** | **Tmeasure\_inter (s) (DRX cycles) (reduced requirement)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.128 | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (10\*Kn\*Nfreq,n) | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (10\*Kr\*Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.2.2-6: Requirement to measure TDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal requirement)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced requirement)** |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.2.2.1 Measurement Reporting Requirements

8.1.2.3.2.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.2.2.1.3.

8.1.2.3.2.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clause 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter defined in Clause 8.1.2.3.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter in clause 8.1.2.3.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter in clause 8.1.2.3.2.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.3 E-UTRAN TDD – FDD inter frequency measurements

8.1.2.3.3.1 E-UTRAN TDD – FDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.1.2.3.1.1 also apply for this section.

8.1.2.3.3.2 E-UTRAN TDD – FDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.1.2 shall also apply for this section.

8.1.2.3.4 E-UTRAN FDD – TDD inter frequency measurements

8.1.2.3.4.1 E-UTRAN FDD – TDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.1.2.3.2.1 also apply for this section.

8.1.2.3.4.2 E-UTRAN FDD – TDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.2.2 shall also apply for this section.

8.1.2.3.5 E-UTRAN FDD-FDD inter frequency measurements with autonomous gaps

8.1.2.3.5.1 Identification of a new CGI of E-UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall transmit at least 60 ACK/NACKs on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.3.5.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.3.6 E-UTRAN TDD-FDD inter frequency measurements using autonomous gaps

The requirements in this clause shall apply to UE supporting FDD and TDD.

8.1.2.3.6.1 Identification of a new CGI of E-UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.3.6.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

**Table 8.1.2.3.6.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, inter.**

|  |  |
| --- | --- |
| **TDD UL/DL configuration for serving cell** | **Minimum number of transmitted ACK/NACKs** |
| 0 (Note 1) | 18 |
| 1 | 30 |
| Note 1: When a UE is configured with *EIMTA-MainConfigServCell* via RRC signalling [2] only this requirement shall apply.  Note 2: The requirement for other TDD UL/DL configuration is not specified. | |

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.3.6.1-1 on PCell or each of the activated SCell(s).

8.1.2.3.6.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.3.7 E-UTRAN TDD-TDD inter frequency measurements with autonomous gaps

8.1.2.3.7.1 Identification of a new CGI of E-UTRA TDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.3.7.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

**Table 8.1.2.3.7.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, inter.**

|  |  |
| --- | --- |
| **TDD UL/DL configuration for serving cell** | **Minimum number of transmitted ACK/NACKs** |
| 0 (Note 1) | 18 |
| 1 | 30 |
| Note 1: When a UE is configured with *EIMTA-MainConfigServCell* via RRC signalling [2] only this requirement shall apply cell.  Note 2: The requirement for other TDD UL/DL configuration is not specified. | |

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.3.7.1-1 on PCell or each of the activated SCell(s).

8.1.2.3.7.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.3.8 E-UTRAN FDD-TDD inter frequency measurements using autonomous gaps

The requirements in this clause shall apply to UE supporting FDD and TDD.

8.1.2.3.8.1 Identification of a new CGI of E-UTRA TDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall have more than 60 ACK/NACKs transmitted on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.3.8.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.3.9 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform inter-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of receiving unicast from the FeMBMS/Unicast mixed cell and are capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the inter-frequency to be measured.

The minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

8.1.2.3.9.1 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/unicast mixed cells when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

 (normal performance) and

 (reduced performance)

Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Nfreq,n Nfreq,r Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expressions:



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

 (normal performance) and

 (reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.9 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1. For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.1.2.3.9.1-1.

**Table 8.1.2.3.9.1-1:** M**easurement period and measurement bandwidth**

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance)** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance)** | **Measurement bandwidth [RB]** |
| 0 | 720 x Kn x Nfreq,n | 720 x Kr x Nfreq,r | 6 |
| 1 (Note 1) | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 50 |
| 2 (Note 2) | 1.5∙Tburst x Nfreq | 1.5∙Tburst x Nfreq | 6 |
| 3 (Note 3) | Tburst x Nfreq | Tburst x Nfreq | 50 |
| Note 1: This configuration is optional  Note 2: This configuration is for when nonUniform1 – nonUniform4 are configured  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.1.2.3.9.1-1.

For category 1bis UE, when measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period given by table 8.1.2.3.9.1-2.

**Table 8.1.2.3.9.1-2:** M**easurement period and measurement bandwidth (category 1bis UE)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance)** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance)** | **Measurement bandwidth [RB]** |
| 0 | 1440 x Kn x Nfreq,n | 1440 x Kr x Nfreq,r | 6 |
| 1 (Note) | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r | 50 |
| Note: This configuration is optional | | | |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.1.2.3.9.1-2.

8.1.2.3.9.1.1 Measurement Reporting Requirements

8.1.2.3.9.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.9.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.9.1.1.3.

8.1.2.3.9.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH . The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify -inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.9.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.9.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.1.2.3.9.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.9.2 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1, and when eDRX\_CONN is in use, Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1B.

**Table 8.1.2.3.9.2-1: Requirement to identify a newly detectable FDD interfrequency cell**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_inter (s) (DRX cycles), normal performance** | | **Tidentify\_inter (s) (DRX cycles), reduced performance** | |
| Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n  (20\*Kn\*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r  (20\*Kr\*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,nl (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32< DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.3.9.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter (s) (eDRX\_CONN cycles), normal performance** | | **Tidentify\_inter (s) (eDRX\_CONN cycles), reduced performance** | |
| **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

**Table 8.1.2.3.9.2-1B: Requirement to identify a newly detectable FDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tidentify\_inter** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.16< DRX-cycle<2.56 | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.9.2-4.

**Table 8.1.2.3.9.2-2: Requirement to measure FDD interfrequency cells**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal performance)** | **Tmeasure\_inter (s) (DRX cycles) (reduced performance)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.128 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.128<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.9.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

**Table 8.1.2.3.9.2-4: Requirement to measure FDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX\_CONN cycle length (s)** | **Tmeasure\_inter** | | | |
| **Tburst = 1280 ms** | **Tburst = 2560 ms** | **Tburst = 5120 ms** | **Tburst = 10240 ms** |
| DRX-cycle ≤2.56 | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-6.

**Table 8.1.2.3.9.2-5: Requirement to measure FDD interfrequency cells (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles) (normal performance)** | **Tmeasure\_inter (s) (DRX cycles) (reduced performance)** |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 1.28 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 1.28<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.1.2.3.9.2-6: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.9.2.1 Measurement Reporting Requirements

8.1.2.3.9.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.9.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.9.2.1.3.

8.1.2.3.9.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.1.2.3.9.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter defined in clause 8.1.2.3.9.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter defined in clause 8.1.2.3.9.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.10 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform inter-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of receiving unicast from the FeMBMS/Unicast mixed cell and are capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the FDD inter-frequency to be measured.

8.1.2.3.10.1 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when no DRX is used

The requirements in clause 8.1.2.3.9.1 also apply for this section, where the minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

8.1.2.3.10.2 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when DRX is used

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.9.2 shall also apply for this section, where the minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

8.1.2.4 Inter RAT measurements

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

8.1.2.4.1 E-UTRAN FDD – UTRAN FDD measurements

8.1.2.4.1.1 E-UTRAN FDD – UTRAN FDD measurements when no DRX is used

8.1.2.4.1.1.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

8.1.2.4.1.1.1a Enhanced UTRA FDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_FDD:

 (normal performance)

and

 (reduced performance)

A cell shall be considered detectable when:

- CPICH Ec/Io > -15 dB,

- SCH\_Ec/Io > -15 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

8.1.2.4.1.1.2 UE UTRA FDD CPICH measurement capability

When measurement gaps are scheduled for UTRA FDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.2 with measurement period given by

 (normal performance),

and

 (reduced performance)

The UE shall be capable of performing UTRA FDD CPICH measurements for Xbasic measurementUTRA\_FDD inter-frequency cells per FDD frequency and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_FDD.

Xbasic measurement UTRA\_FDD = 6

TMeasurement\_Period UTRA\_FDD = 480 ms. The period used for calculating the measurement period Tmeasurement\_UTRA\_FDD for UTRA FDD CPICH measurements.

Tbasic\_identify\_UTRA\_FDD  = 300 ms. This is the time period used in the inter RAT equation in clause 8.1.2.4.1.1.1 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_FDD  = 60 ms. This is the time period used in the inter RAT equation in clause 8.1.2.4.1.1.1a where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_measurement\_UTRA\_FDD = 50 ms. This is the time period used in the equation for defining the measurement period for inter RAT CPICH measurements.

Nfreq, n, Nfreq,r ,Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

8.1.2.4.1.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.1.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in Clause 8.1.2.4.1.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.1.2.4.1.1.1a for the enhanced requirementsWhen L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.1.2.4.1.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.1.2.4.1.1.1a for the enhanced requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.1.2.4.1.1.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.1.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.1.1.4.

8.1.2.4.1.2 E-UTRAN FDD – UTRAN FDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_FDD. When DRX is used, Tidentify,UTRA\_FDD is as defined in table 8.1.2.4.1.2-1, and when eDRX\_CONN is used, Tidentify,UTRA\_FDD is as defined in table 8.1.2.4.1.2-1A.

**Table 8.1.2.4.1.2-1: Requirement to identify a newly detectable UTRA FDD cell**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_UTRA\_FDD (s) (DRX cycles) normal requirement** | | | **Tidentify\_UTRA\_FDD (s) (DRX cycles) reduced requirement** | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | | Gap period = 80 ms |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable |
| 0.064 | 2.56\*Kn\* Nfreq,n (40\* Nffreq,n) | 4.8\* Kn\* Nfreq,n (75\* Kn\* Nfreq,n) | | 2.56\*Kr\* Nfreq,r (40\* Kr\* Nffreq,r) | 4.8\* Kr\* Nfreq,r(75\* Kr\* Nfreq,r) |
| 0.08 | 3.2\* Kn\* Nfreq,n (40\* Kn\* Nfreq,n) | 4.8\* Kn\* Nfreq,n (60\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,r (40\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (60\* Kr\* Nfreq,r) |
| 0.128 | 3.2\* Kn\* Nfreq,n (25\* Kn\* Nfreq) | 4.8\* Kn\* Nfreq,n (37.5\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,n (25\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (37.5\* Kr\* Nfreq,r) |
| 0.16 | 3.2\* Kn\* Nfreq,n (20\* Kn\* Nfreq,n) | 4.8\* Kn\* Nfreq,n (30\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,n (20\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (30\* Kr\* Nfreq,r) |
| 0.16<DRX-cycle≤2.56 | Note (20\* Kn\* Nfreq,n) | Note  (20\* Kn\* Nfreq,n) | | Note (20\* Kr\* Nfreq,r) | Note  (20\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | | |

**Table 8.1.2.4.1.2-1A: Requirement to identify a newly detectable UTRA FDD cell when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement** | | **Tidentify\_UTRA\_FDD (s) (eDRX\_CONN cycles) reduced requirement** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20\* Kn\* Nfreq,n) | Note (20\* Kn\* Nfreq,n) | Note (20\* Kr\* Nfreq,r) | Note (20\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is used, the UE shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 3 UTRA FDD carriers and the UE physical layer shall be capable of reporting RSCP and Ec/Io measurements to higher layers within the measurement period Tmeasure\_ UTRA\_FDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 6 UTRA FDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-2, and when eDRX\_CONN cycle is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-3.

**Table 8.1.2.4.1.2-2: Requirement to measure UTRA FDD cells**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_ UTRA\_FDD (s) (DRX cycles) normal requirement** | | **Tmeasure\_ UTRA\_FDD (s) (DRX cycles) normal requirement** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable |
| 0.064 | 0.48\*Kn\* Nfreq,n (7.5\* Kn\* Nfreq,n) | 0.8\* Kn\* Nfreq,n  (12.5\* Kn\* Nfreq,n) | 0.48\* Kr\* Nfreq,r (7.5\* Kr\* Nfreq,r) | 0.8\* Kr\* Nfreq,r  (12.5\* Kr\* Nfreq,r) |
| 0.08 | 0.48\* Kn\* Nfreq,n  (6\* Kn\* Nfreq,n) | 0. 8\* Kn\* Nfreq,n (10\* Nfreq,n) | 0.48\* Kr\* Nfreq,r  (6\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (10\* Kr\* Nfreq,r) |
| 0.128 | 0.64\* Kn\* Nfreq,n  (5\* Kn\* Nfreq,n) | 0. 8\* Kn\* Nfreq,n (6.25\* Nfreq,n) | 0.64\* Kr\* Nfreq,r  (5\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (6.25\* Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (5\* Kn\* Nfreq,n) | Note (5\* Kn\* Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.4.1.2-3: Requirement to measure UTRA FDD cells when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_ UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement** | | **Tmeasure\_ UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kn\* Nfreq,n) | Note (5\* Kn\* Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

8.1.2.4.1.2.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.1.2.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify,UTRA\_FDD defined in Clause 8.1.2.4.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.1.2.4.1.2and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.1.2.4.1.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.1.2.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.1.2.2.

8.1.2.4.2 E-UTRAN TDD – UTRAN FDD measurements

The requirements in clause 8.1.2.4.1 also apply for this section.

8.1.2.4.2.1 E-UTRAN TDD – UTRAN FDD measurements when no DRX is used

8.1.2.4.2.2 E-UTRAN TDD – UTRAN FDD measurements when DRX is used

8.1.2.4.3 E-UTRAN TDD – UTRAN TDD measurements

8.1.2.4.3.1 E-UTRAN TDD – UTRAN TDD measurements when no DRX is used

8.1.2.4.3.1.1 Identification of a new UTRA TDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

8.1.2.4.3.1.1a Enhanced UTRA TDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_TDD:

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when:

- P-CCPCH\_Ec/Io > -6 dB,

- DwPCH\_Ec/Io > -1 dB

When L3 filtering is used an additional delay can be expected.

8.1.2.4.3.1.2 UE UTRA TDD P-CCPCH RSCP measurement capability

When measurement gaps are scheduled for UTRA TDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.3 with measurement period given by

 (normal performance)

 (reduced performance)

The UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements for Xbasic measurementUTRA\_TDD inter-frequency cells per TDD frequency of the monitored set, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_TDD.

Xbasic measurementUTRA\_TDD = 6

TMeasurement\_Period UTRA\_TDD = 480 ms is the period used for calculating the measurement period Tmeasurement\_UTRA\_TDD for UTRA TDD P-CCPCH RSCP measurements.

Tbasic\_identify\_UTRA\_TDD = 800 ms is the time period used in the inter RAT equation in clause 8.1.2.4.3.1.1 where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_TDD  = 80 ms is the time period used in the inter RAT equation in clause 8.1.2.4.3.1.1a where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_measurement\_UTRA\_TDD = 50 ms is the time period used in the equation for defining the measurement period for inter RAT P-CCPCH RSCP measurements.

Nfreq,n, Nfreq,r, Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

8.1.2.4.3.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.3.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.1.2.4.3.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_TDD defined in Clause 8.1.2.4.3.1.1a for the enhanced requirements. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.1.2.4.3.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.1.2.4.3.1.2 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.3.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.3.1.4.

8.1.2.4.3.2 E-UTRAN TDD – UTRAN TDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_TDD. When DRX is used, Tidentify,UTRA\_TDD is as defined in table 8.1.2.4.3.2-1, and when eDRX\_CONN is used, Tidentify,UTRA\_TDD is as defined in table 8.1.2.4.3.2-1A.

**Table 8.1.2.4.3.2-1: Requirement to identify a newly detectable UTRA TDD cell**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_UTRA\_TDD (s) (DRX cycles) (normal requirement)** | | **Tidentify\_UTRA\_TDD (s) (DRX cycles) (reduced requirement)** | |
| **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.32 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.32<DRX-cycle≤0.512 | Note (20\*Kn\* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note (20\*Kr\* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| 0.512<DRX-cycle≤2.56 | Note (20\*Kn \* Nfreq,n) | Note  (20\*Kn \* Nfreq,n) | Note (20\*Kr \* Nfreq,r) | Note  (20\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.4.3.2-1A: Requirement to identify a newly detectable UTRA TDD cell when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_UTRA\_TDD (s) (eDRX\_CONN cycles) (normal requirement)** | | **Tidentify\_UTRA\_TDD (s) (eDRX\_CONN cycles) (reduced requirement)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (20\*Kn \* Nfreq,n) | Note (20\*Kn \* Nfreq,n) | Note (20\*Kr \* Nfreq,r) | Note (20\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 3 UTRA TDD carriers and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period Tmeasure\_UTRA\_TDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 7 UTRA TDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.1.2.4.3.2-2, and when eDRX\_CONN is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.1.2.4.3.2-3.

**Table 8.1.2.4.3.2-2: Requirement to measure UTRA TDD cells**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_UTRA\_TDD (s) (DRX cycles) (normal requirement)** | | **Tmeasure\_UTRA\_TDD (s) (DRX cycles) (reduced requirement)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.064 | 0.48\*Kn\*Nfreq,n (7.5\*Kn \*Nfreq,n) | 0.8\*Kn \*Nfreq,n  (12.5\*Kn \*Nfreq,n) | 0.48\* Kr\* Nfreq,r (7.5\* Kr\* Nfreq,r) | 0.8\* Kr\* Nfreq,r  (12.5\* Kr\* Nfreq,r) |
| 0.08 | 0.48\*Kn \*Nfreq,n (6\*Kn \*Nfreq,n) | 0. 8\*Kn \*Nfreq,n (10\*Kn \*Nfreq,n) | 0.48\* Kr\* Nfreq,r  (6\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (10\* Kr\* Nfreq,r) |
| 0.128 | 0.64\*Kn \*Nfreq,n (5\*Kn \*Nfreq,n) | 0. 8\*Kn \*Nfreq,n (6.25\*Kn \*Nfreq,n) | 0.64\* Kr\* Nfreq,r  (5\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (6.25\* Nfreq,r) |
| 0. 128<DRX-cycle≤2.56 | Note (5\*Kn \*Nfreq,n) | Note (5\*Kn \*Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.4.3.2-3: Requirement to measure UTRA TDD cells when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_UTRA\_TDD (s) (eDRX\_CONN cycles) (normal requirement)** | | **Tmeasure\_UTRA\_TDD (s) (eDRX\_CONN cycles) (reduced requirement)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn \*Nfreq,n) | Note (5\*Kn \*Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

8.1.2.4.3.2.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.3.2.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.1.2.4.3.2When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.1.2.4.3.2and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.1.2.4.3.2 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.3.2.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.3.2.2.

8.1.2.4.4 E-UTRAN FDD – UTRAN TDD measurements

The requirements in clause 8.1.2.4.3 also apply for this section.

8.1.2.4.5 E-UTRAN FDD – GSM measurements

8.1.2.4.5.1 E-UTRAN FDD – GSM measurements when no DRX is used

The requirements in this clause apply only to UE supporting E-UTRAN FDD and GSM.

Measurements on GSM cells can be requested with BSIC verified.

In RRC\_CONNECTED state when a supported measurement gap pattern sequence according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells.

8.1.2.4.5.1.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per measurement gap. In RRC\_CONNECTED state the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is Kn\*Nfreq,n \*480 ms. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

The UE shall meet the measurement accuracy requirements stated for RXLEV in [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

8.1.2.4.5.1.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells. The UE shall trigger the initial BSIC identification within the available measurement gap pattern sequence. The requirements for BSIC re-confirmation can be found in clause 8.1.2.4.5.1.2.1.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern. The requirements for BSIC re-confirmation can be found in clause 8.1.2.4.5.1.2.2.

If the network requests measurements on a GSM cell the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.1.2.4.5.1 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 8\*Tre-confirm,GSM seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified". If a measurement gap pattern sequence is deactivated by the network after BSIC has been identified or verified, the UE shall consider the BSIC as non-verified.

Tidentify,GSM indicates the maximum time allowed for the UE to decode the unknown BSIC of the GSM cell in one GSM BCCH carrier in the initial BSIC identification procedure.

Tre-confirm,GSM indicates the maximum time allowed for the re-confirmation of the BSIC of one GSM cell in the BSIC re-confirmation procedure.

The UE shall be able to decode a BSIC within a measurement gap when the time difference between the middle of the received GSM synchronisation burst at the UE and the middle of the effective measurement gap is within the limits specified in table 8.1.2.4.5.1.2-1.

**Table 8.1.2.4.5.1.2-1: The gap length and maximum time difference for BSIC verification**

|  |  |
| --- | --- |
| **Gap length**  **[ms]** | **Maximum time difference [μs]** |
| 6 | ± 2350 µs |

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in [9].

8.1.2.4.5.1.2.1 Initial BSIC identification

This measurement shall be based on the measurement gaps used for Initial BSIC identification as described in clause 8.1.2.4.5.1.2.

The UE shall continuously attempt to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall immediately continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within Tidentify,GSM ms, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall continue to try to perform BSIC identification of the next GSM BCCH carrier in signal strength order. The GSM BCCH carrier for which the BSIC identification failed shall not be re-considered for BSIC identification until BSIC identification attempts have been made for all the rest of the 8 strongest GSM BCCH carriers in the monitored set with unknown BSIC.

Tidentify,GSM values are given for a set of reference gap patterns in table 8.1.2.4.5.1.2.1-1. The requirements in the table represent the time required to guarantee at least two attempts to decode the BSIC for one GSM BCCH carrier. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tidentify,GSM shall be based on the 80ms gap configuration.

**Table 8.1.2.4.5.1.2.1-1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ceil(Nfreq,n \* Kn –Mgsm)** | **Tidentify,gsm(ms)** | | **Treconfirm,gsm(ms)** | |
| **40ms gap configuration (ID 0)** | **80ms gap configuration (ID 1)** | **40ms gap configuration (ID 0)** | **80ms gap configuration (ID 1)** |
| 0 | 2160 | 5280 | 1920 | 5040 |
| 1 | 5280 | 21760 | 5040 | 17280 |
| 2 | 5280 | 31680 | 5040 | 29280 |
| 3 | 19440 | No requirement | 13320 | No requirement |
| 4 | 31680 | No requirement | 29280 | No requirement |
| 5 | 31680 | No requirement | 29280 | No requirement |

8.1.2.4.5.1.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For each measurement gap used for GSM BSIC reconfirmation as described in clause 8.1.2.4.5.1.2, the UE shall attempt to decode the BSIC falling within the measurement gap according to table 8.1.2.4.5.1.2.1-1. If more than one BSIC can be decoded within the same measurement gap, priority shall be given to the least recently decoded BSIC. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tre-confirm,GSM shall be based on the 80ms gap configuration.

If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within Tre-confirm,GSM seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.1.2.4.5.1.2.1.

8.1.2.4.5.1.2a Enhanced BSIC verification

In addition to the BSIC verification requirements in clause 8.1.2.4.5.1.2, when the UE receives the GSM cell at levels down to 10 dB + the reference sensitivity level or reference interference levels as specified in [9] the BSIC identification requirement in table 8.1.2.4.5.1.2a-1 applies. The BSIC verification requirements in table 8.1.2.4.5.1.2a-1 shall apply when no DRX is used or when DRX cycle length ≤ 40 ms.

**Table 8.1.2.4.5.1.2a-1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ceil(Nfreq,n \* Kn –Mgsm)** | **Tenhanced\_identify,gsm(ms)** | | **Tenhanced\_reconfirm,gsm(ms)** | |
| **40ms gap configuration (ID 0)** | **40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements** | **40ms gap configuration (ID 0)** | **40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements** |
| 0 | 1320 | 2160 | 1080 | 1920 |

8.1.2.4.5.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.5.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.1.2.4.5.1).

The event triggered measurement reporting delay for a GSM cell with verified BSIC , measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.1.2.4.5.1. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.5.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.5.1.4.

8.1.2.4.5.2 E-UTRAN FDD – GSM measurements when DRX is used

The requirements in this clause apply only to UE supporting E-UTRAN FDD and GSM.

Measurements on GSM cells can be requested with BSIC verified.

In RRC\_CONNECTED state when a supported measurement gap pattern sequence according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells. During DRX or eDRX\_CONN periods the UE may use other periods of time outside the specified measurement gap patterns. The UE is not required to make measurements of GSM cells during DRX or eDRX\_CONN periods if a measurement gap pattern has not been configured, unless the UE supports capability of conducting such measurements without gaps.

8.1.2.4.5.2.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per DRX or eDRX\_CONN cycle. When DRX is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.1.2.4.5.2.1-1. When eDRX\_CONN is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.1.2.4.5.2.1-2. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

**Table 8.1.2.4.5.2.1-1: GSM measurement period for large DRX**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure,GSM (s) (DRX cycles)** |
| ≤0.064 | Non DRX Requirements are applicable |
| 0.064<DRX-cycle≤ 0.08 | Note (6\*Kn\*Nfreq,n) |
| 0.08<DRX-cycle≤ 2.56 | Note (5\*Kn\*Nfreq,n) |
| Note: Time depends upon the DRX cycle in use | |

**Table 8.1.2.4.5.2.1-2: GSM measurement period for large DRX when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure,GSM (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The UE shall meet the measurement accuracy requirements stated for RXLEV in [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

8.1.2.4.5.2.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern

If the network requests measurements on a GSM cell, the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.1.2.4.5.2.1 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 30 seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified".

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in [9].

8.1.2.4.5.2.2.1 Initial BSIC identification

This measurement shall be made on GSM cells that are requested with BSIC verified.

For DRX cycle length ≤ 40 ms, the initial GSM BSIC identification requirements corresponding to the non DRX requirements as specified in clause 8.1.2.4.5.1.2.1 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, the UE shall make at least one attempt every Kn\*Nfreq,n \*30s to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within Kn\*Nfreq,n \*60 s, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

8.1.2.4.5.2.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For DRX cycle length ≤ 40 ms, the GSM BSIC re-conformation requirements corresponding to the non DRX requirements as specified in clause 8.1.2.4.5.1.2.2 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, at least every Kn\*Nfreq,n \*30 seconds, the UE shall attempt to decode the BSIC of each identified GSM cell.If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within Kn\*Nfreq,n \*60 seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.1.2.4.5.2.2.1. The parameters Nfreq,n and kn are defined in clause 8.1.2.1.1.

8.1.2.4.5.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.5.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.1.2.4.5.2.1).

The event triggered measurement reporting delay for a GSM cell with verified BSIC , measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.1.2.4.5.2.1. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.5.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.5.2.4.

8.1.2.4.6 E-UTRAN TDD – GSM measurements

The requirements in clause 8.1.2.4.5 also apply for this section.

8.1.2.4.7 E-UTRAN FDD – UTRAN FDD measurements for SON

8.1.2.4.7.1 Identification of a new UTRA FDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

8.1.2.4.7.1.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:

 (normal performance)

and

(reduced performance)

Tbasic\_identify\_UTRA\_FDD  = 300 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD ms, the UE may stop searching UTRA cells for SON.

8.1.2.4.7.1.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_FDD. When DRX is used, Tidentify, UTRA\_FDD is as defined in table 8.1.2.4.7.1.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_FDD is as defined in table 8.1.2.4.7.1.2-2.

**Table 8.1.2.4.7.1.2-1: Requirement to identify a new UTRA FDD cell for SON**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify, UTRA\_FDD (s) (DRX cycles) (normal requirement)** | | **Tidentify, UTRA\_FDD (s) (DRX cycles) (reduced requirement)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.7.1.1are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1 are applicable |
| 0.04<DRX cycle≤0.08 | Note (45\*Kn\* Nfreq,n) | Note (95\*Kn \* Nfreq,n) | Note (45\*Kr\* Nfreq,r) | Note (95\*Kr \* Nfreq,r) |
| 0.128 | 3.84\*Kn \* Nfreq,n (30\*Kn \* Nfreq,n) | 8.0\*Kn \* Nfreq,n (62.5\*Kn \* Nfreq,n) | 3.84\*Kr \* Nfreq,r (30\*Kr \* Nfreq,r) | 8.0\*Kr \* Nfreq,r (62.5\*Kr \* Nfreq,r) |
| 0.16 | 4.0\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.0\*Kn \* Nfreq,n (50\*Kn \* Nfreq,n) | 4.0\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.0\*Kr \* Nfreq,r (50\*Kr \* Nfreq,r) |
| 0.256 | 6.4\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.96\*Kn \* Nfreq,n (35\*Kn \* Nfreq,n) | 6.4\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.96\*Kr \* Nfreq,r (35\*Kr \* Nfreq,r) |
| 0.32 | 8\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.96\*Kn \* Nfreq,n (28\*Kn \* Nfreq,n) | 8\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.96\*Kr \* Nfreq,r (28\*Kr \* Nfreq,r) |
| 0.32<DRX cycle≤2.56 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |  |  |

**Table 8.1.2.4.7.1.2-2: Requirement to identify a new UTRA FDD cell for SON when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify, UTRA\_FDD (s) (eDRX\_CONN cycles) (normal requirement)** | | **Tidentify, UTRA\_FDD (s) (eDRX\_CONN cycles) (reduced requirement)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD seconds, the UE may stop searching UTRA cells for SON; when DRX is used Tidentify, UTRA\_FDD is defined in table 8.1.2.4.7.1.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_FDD is defined in table 8.1.2.4.7.1.2-2.

8.1.2.4.7.1.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in clause 8.1.2.4.7.1.1 and in clause 8.1.2.4.7.1.2 for non DRX and DRX or eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.8 E-UTRAN TDD – UTRAN FDD measurements for SON

The requirements in clause 8.1.2.4.7 also apply for this section.

8.1.2.4.9 E-UTRAN FDD – cdma2000 1xRTT measurements

UE shall perform cdma2000 1xRTT measurements according to the procedure defined in [15] on the cdma2000 1xRTT neighbor cells indicated by the serving eNode B. If measurement gaps are required, the UE shall perform cdma2000 1xRTT measurements only during the measurement gaps configured by the serving eNode B.

8.1.2.4.9.1A E-UTRAN FDD – cdma2000 1xRTT measurements when no DRX is used

When measurement gaps are scheduled for CDMA2000 1xRTT inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CDMA2000 1xRTT Pilot Strength measurements to higher layers with measurement accuracy as specified in Clause 9.5, corresponding to a 90% measurement success rate, with measurement period given by



where Tbasic\_measurement\_CDMA2000\_1x = 100 ms and the measurement gap specific scale factor Sgap is based on the measurement gap pattern in use as defined in Table 8.1.2.4.9.1-1. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Sgap shall be based to the Gap Pattern Id 1.

**Table 8.1.2.4.9.1-1: Gap Pattern Specific Scale Factor**

|  |  |
| --- | --- |
| **Gap Pattern Id** | **Sgap** |
| 0 | 32/3 |
| 1 | 64/3 |

8.1.2.4.9.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

The measurement reporting delay of each periodic report is defined as the time between the end of the last measurement period and the moment when the UE starts to transmit the measurement report over the Uu interface. This delay shall be less than T71m defined in [15] for each periodic report. This measurement reporting delay excludes a delay which is caused by the unavailability of the uplink resources for the UE to send the measurement report.

8.1.2.4.10 E-UTRAN TDD – cdma2000 1xRTT measurements

The requirements in clause 8.1.2.4.9 also apply for this section.

8.1.2.4.11 E-UTRAN FDD – HRPD measurements

UE shall perform HRPD measurements according to the procedure defined in [11] on the HRPD neighbor cells indicated by the serving eNode B. If measurement gaps are required, the UE shall perform HRPD measurements only during the measurement gaps configured by the serving eNode B.

8.1.2.4.12 E-UTRAN TDD – HRPD measurements

The requirements in clause 8.1.2.4.11 also apply for this section.

8.1.2.4.13 E-UTRAN TDD – UTRAN TDD measurements for SON

8.1.2.4.13.1 Identification of a new UTRA TDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA TDD cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

8.1.2.4.13.1.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:

 (normal performance)

and

 (reduced performance)

Tbasic\_identify\_UTRA\_TDD  = 800 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD ms, the UE may stop searching UTRA TDD cells for SON.

8.1.2.4.13.1.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_TDD. When DRX is used, Tidentify, UTRA\_TDD is as defined in table 8.1.2.4.13.1.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_TDD is as defined in table 8.1.2.4.13.1.2-2.

**Table 8.1.2.4.13.1.2-1: Requirement to identify a new UTRA TDD cell for SON**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify, UTRA\_TDD (s) (DRX cycles)** | | **Tidentify, UTRA\_TDD (s) (DRX cycles)** | **Tidentify, UTRA\_TDD (s) (DRX cycles)** |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.16<DRX cycle≤0.256 | Note (25\*Kn\* Nfreq,n) | Note (50\*Kn \* Nfreq,n) | Note (25\*Kr\* Nfreq,r) | Note (50\*Kr \* Nfreq,r) |
| 0.256<DRX cycle≤0.32 | Note (25\*Kn \* Nfreq,n) | Note (45\*Kn \* Nfreq,n) | Note (25\*Kr \* Nfreq,r) | Note (45\*Kr \* Nfreq,r) |
| 0.32<DRX cycle≤2.56 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

**Table 8.1.2.4.13.1.2-2: Requirement to identify a new UTRA TDD cell for SON when eDRX\_CONN cycle is used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify, UTRA\_TDD (s) (eDRX\_CONN cycles)** | | **Tidentify, UTRA\_TDD (s) (eDRX\_CONN cycles)** | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD seconds, the UE may stop searching UTRA TDD cells for SON; when DRX is used Tidentify, UTRA\_TDD is defined in table 8.1.2.4.13.1.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_TDD is defined in table 8.1.2.4.13.1.2-2.

8.1.2.4.13.1.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in clause 8.1.2.4.13.1.1 and in clause 8.1.2.4.13.1.2 for non DRX and DRX and eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.14 E-UTRAN FDD – UTRAN TDD measurements for SON

The requirements in clause 8.1.2.4.13 also apply for this section.

8.1.2.4.15 E-UTRAN FDD – cdma2000 1xRTT measurements for SON ANR

8.1.2.4.15.1 Identification of a new cdma2000 1xRTT cell for SON ANR

No explicit neighbour list is provided to the UE for identifying a cdma2000 1xRTT cell for SON ANR. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON ANR.

8.1.2.4.15.1.1 Requirement when no DRX is used

When measurement gaps are scheduled for CDMA2000 1xRTT inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CDMA2000 1xRTT Pilot Strength measurements to higher layers with measurement accuracy as specified in Clause 9.5, corresponding to a 90% measurement success rate, with measurement period given by



where Tbasic\_measurement\_CDMA2000\_1x = 100 ms and the measurement gap specific scale factor Sgap is based on the measurement gap pattern in use as defined in Table 8.1.2.4.15.1.1-1. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Sgap shall be based to the Gap Pattern Id 1.

**Table 8.1.2.4.15.1.1-1: Gap Pattern Specific Scale Factor**

|  |  |
| --- | --- |
| **Gap Pattern Id** | **Sgap** |
| 0 | 32/3 |
| 1 | 64/3 |

If the UE is unable to identify the CDMA2000 1xRTT cell for SON ANR, the UE may stop searching CDMA2000 1xRTT cells for SON ANR. The time after which the UE may stop searching is up to UE implementation.

8.1.2.4.15.1.2 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON ANR as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON ANR until the UE starts to transmit its physical cell identity over the Uu interface. This delay shall be less than T71m defined in [15]. This measurement reporting delay excludes a delay which is caused by the unavailability of the uplink resources for the UE to send the measurement report.

8.1.2.4.16 E-UTRAN TDD – cdma2000 1xRTT measurements for SON ANR

The requirements in clause 8.1.2.4.15 also apply for this section.

8.1.2.4.17 E-UTRAN FDD-UTRAN FDD measurements with autonomous gaps

The requirements in this clause apply only to UE supporting E-UTRA FDD and UTRA FDD.

8.1.2.4.17.1 Identification of a new CGI of UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of UTRA FDD cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for decoding SFN and receiving UTRAN MIB and SIB3 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, the UE shall be able to identify a new CGI of UTRA FDD cell within:

Tidentify\_CGI, UTRAN FDD = 630 + 40\*SIB3\_REP ms

where SIB3\_REP is the repetition period at which the UTRAN cell schedules SIB3 blocks in units of frames specified in TS 25.331 [7] , provided that the UTRAN cell has been already identified by the UE.

This requirement is applicable for UTRA FDD target cell configurations where the information required to make the SI report can be determined from the MIB and SIB3 alone, and MIB and SIB3 are not segmented into multiple TTIs. Additionally, for the requirement to be applicable, the reception conditions shall be such that the system frame number of the target UTRA FDD cell, the MIB and SIB3 can each be successfully decoded in no more than four attempts.

According to the reception conditions:

A cell shall be considered identifiable following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.The system frame number, the MIB and SIB3 of the target cell shall be considered decodable provided the BCH demodulation requirements are met according to [29].

The requirement for identifying a new CGI of an UTRA FDD cell within Tidentify\_CGI, UTRAN FDD is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.1.2.4.17.1 provided the following condition is met:

- all MIB/SIB3/SCH specified in Section 8.1.2.4.17.1 are available for CGI reading at the UE in the measured cell.

Otherwise the time to acquire the new CGI of the UTRA FDD cell may be extended.

8.1.2.4.17.2 CGI Reporting Delay

The CGI reporting delay occurs due to the delay uncertainty when inserting the CGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the CGI reporting may be delayed until the next DRX cycle. In case eDRX is used, the CGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.4.18 E-UTRAN TDD-UTRAN FDD measurements with autonomous gaps

The requirements in this clause apply only to UE supporting E-UTRA TDD and UTRA FDD.

8.1.2.4.18.1 Identification of a new CGI of UTRA FDD cell with autonomous gaps

The requirements in clause 8.1.2.4.17.1 also apply for this section.

8.1.2.4.18.2 CGI Reporting Delay

The requirements in clause 8.1.2.4.17.2 also apply for this section.

8.1.2.4.19 E-UTRAN FDD – WLAN measurements

8.1.2.4.19.1 Introduction

The requirements in this section shall apply for a UE capable of E-UTRA FDD and LTE-WLAN Aggregation [2].

8.1.2.4.19.2 Requirements

8.1.2.4.19.2.1 E-UTRAN FDD – WLAN measurements when no DRX is used

In the RRC\_CONNECTED state when no DRX is used the measurement period for WLAN RSSI shall be TWLAN\_RSSI as defined in table 8.1.2.4.19.2.1-1.

The value of TWLAN\_RSSI depends upon whether the WLAN RSSI measurement is performed on the serving access point (AP) or on a neighbour AP and in case of the neighbour AP whether the neighbour AP is known or unknown to the UE:

- Measurement of known single neighbor AP is time-sensitive and is performed on the AP for which information about the operating channel is known to the UE; and

- - Measurement of unknown neighbor AP is not time-sensitive and is performed on the AP for which information about the operating channel is not known to the UE.

The UE shall be capable of performing WLAN RSSI measurements for certain minimum number of APs during TWLAN\_RSSI as defined in table 8.1.2.4.19.2.1-1 provided that the beacon frame of the measured AP is available at the UE at least once every 102.4 ms. The UE physical layer shall be capable of reporting WLAN RSSI measurements to higher layers with the measurement period of TWLAN\_RSSI.

**Table 8.1.2.4.19.2.1-1: WLAN RSSI measurement period**

|  |  |  |
| --- | --- | --- |
| **WLAN RSSI measurement configuration** | | **TWLAN\_RSSI [seconds]** |
| **Type of Measurement** | **Minimum number of APs measured during TWLAN\_RSSI** |
| Measurement of serving AP | 1 | 0.5 |
| Measurement of known neighbor AP on a single channel | 1 | 5 |
| Measurement of multiple unknown neighbor APs | 3 | 30 |

The WLAN RSSI measurement accuracy for all measured access points shall be fulfilled according to the accuracy as specified in the sub-clause 9.7.1.

8.1.2.4.19.2.2 E-UTRAN FDD – WLAN measurements when DRX is used

In the RRC\_CONNECTED state when DRX is used the measurement period for WLAN RSSI shall be TRSSI\_DRX as defined in table 8.1.2.4.19.2.2-1.

The value of TWLAN\_RSSI\_DRX depends upon whether the WLAN RSSI measurement is performed on the serving access point (AP) or on a neighbour AP and in case of the neighbour AP whether the neighbour AP is known or unknown to the UE:

- Measurement of known single neighbor AP is time-sensitive and is performed on the AP for which information about the operating channel is known to the UE; and

- Measurement of unknown neighbor AP is not time-sensitive and is performed on the AP for which information about the operating channel is not known to the UE

The UE shall be capable of performing WLAN RSSI measurements for certain minimum number of APs during TWLAN\_RSSI\_DRX as defined in table 8.1.2.4.19.2.2-1 provided that the beacon frame of the measured AP is available at the UE at least once every 102.4 ms. The UE physical layer shall be capable of reporting WLAN RSSI measurements to higher layers with the measurement period of TWLAN\_RSSI\_DRX.

**Table 8.1.2.4.19.2.2-1: Requirement to measure WLAN RSSI in DRX**

|  |  |  |  |
| --- | --- | --- | --- |
| **WLAN RSSI measurement configuration** | | **DRX cycle length (s)** | **TWLAN\_RSSI\_DRX (s)** |
| **Type of Measurement** | **Minimum number of APs measured during TWLAN\_RSSI** |
| Measurement of serving AP | 1 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (0.5, 5\*LDRX) |
| Measurement of one known neighbor AP on a single channel | 1 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (5, 25\*LDRX) |
| 0.320 < DRX-cycle ≤ 2.56 | MAX (5, 20\*LDRX) |
| Measurement of 3 unknown neighbor APs | 3 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (30, 150\*LDRX) |
| 0.320 < DRX-cycle ≤ 2.56 | MAX (30, 120\*LDRX) |
| Note 1: LDRX is the length of DRX cycle in second(s) | | | |

The WLAN RSSI measurement accuracy for all measured access points shall be fulfilled according to the accuracy as specified in the sub-clause 9.7.1.

8.1.2.4.19.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.7.1.

8.1.2.4.19.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.7.1.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TWLAN\_RSSI when no DRX is used as defined in section 8.1.2.4.19.2.1 and TWLAN\_RSSI\_DRX when DRX is used as defined in section 8.1.2.4.19.2.2. When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching,an additional delay can be expected.

8.1.2.4.19.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.7.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.19.2.3.

8.1.2.4.20 E-UTRAN TDD – WLAN measurements

The requirements in this section shall apply for a UE capable of E-UTRA TDD and LTE-WLAN Aggregation [2].

The requirements in clause 8.1.2.4.19 also apply for this section.

8.1.2.4.21 E-UTRAN FDD – NR measurements

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC.

The UE shall be able to identify new inter-RAT E-UTRAN FDD − NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

8.1.2.4.21.1 E-UTRAN FDD – NR measurements

8.1.2.4.21.1.1 Identification of a new NR cell

When measurement gaps are scheduled, the UE shall be able to identify a new detectable cell within Tidentify\_irat\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise, UE shall be able to identify a new detectable inter-RAT cell within Tidentify\_irat\_with\_index. The UE shall be able to identify a new detectable inter-RAT SS block of an already detected cell within Tidentify\_irat\_without\_index.

Tidentify\_irat\_without\_index = (TPSS/SSS\_sync\_irat + T SSB\_measurement\_period\_irat) ms

Tidentify\_irat\_with\_index = (TPSS/SSS\_sync\_irat + T SSB\_measurement\_period\_irat + TSSB\_time\_index\_irat) ms

Where:

TPSS/SSS\_sync\_irat: it is the time period used in PSS/SSS detection given in table 8.1.2.4.21.1.1-1 and table 8.1.2.4.21.1.1-2.

TSSB\_time\_index\_irat: it is the time period used to acquire the index of the SSB being measured given in table 8.1.2.4.21.1.1-3 and table 8.1.2.4.21.1.1-4.

TSSB\_measurement\_period\_irat: equal to a measurement period of SSB based measurement given in table 8.1.2.4.21.1.1-5 and table 8.1.2.4.21.1.1-6.

Mpss/sss\_sync\_irat: For a UE supporting FR2 power class 1, Mpss/sss\_sync\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_irat = 40 samples.

MSSB\_index\_irat: For a UE supporting FR2 power class 1, MSSB\_index\_irat = 40 samples. For a UE supporting FR2 power class 2 (vehicle mounted), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 3 (handheld), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_irat = 24 samples.

Mmeas\_period\_irat: For a UE supporting FR2 power class 1, Mmeas\_period\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_irat = 40 samples.

Nfreq is defined in clause 8.1.2.1.1

For per-FR measurement gap capable UE, when serving cells are in E-UTRA and measurement objects are only in FR2,

- UE can perform such measurements without gap, and

- UE fulfils the requirements for FR2 measurement objects based on effective MGRP = 20 ms.

**Table 8.1.2.4.21.1.1-1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_irat** |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 8.1.2.4.21.1.1-2: Time period for PSS/SSS detection (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_irat** |
| No DRX | Max(600ms, Mpss/sss\_sync\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mpss/sss\_sync\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 8.1.2.4.21.1.1-3: Time period for time index detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_irat** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 3 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 8.1.2.4.21.1.1-4: Time period for time index detection (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_irat** |
| No DRX | Max(200ms, MSSB\_index\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | MSSB\_index\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

In the requirements, an NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in Section 9.11.1 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section 9.11.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section 9.11.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50].

When measurement gaps are scheduled for NR measurements the UE physical layer shall be capable of reporting NR SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clause 9.11, with measurement period as shown in table 8.1.2.4.21.1.1-5 and 8.1.2.4.21.1.1-6:

**Table 8.1.2.4.21.1.1-5: Measurement period for inter-RAT measurements (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_measurement\_period\_irat** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 8.1.2.4.21.1.1-6: Measurement period for inter-RAT measurements (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_measurement\_period\_irat** |
| No DRX | Max(400ms, Mmeas\_period\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mmeas\_period\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

The UE shall be capable of performing NR SS-RSRP, SS-RSRQ and SS-SINR for up to 7 NR carrier frequencies.

For each RAT E-UTRAN FDD-NR layer on FR1 or FR2, the UE shall be capable of monitoring at least 4 cells.

For each RAT E-UTRAN FDD-NR layer on FR1, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer.

For each RAT E-UTRAN FDD-NR layer on FR2, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer. The UE shall be capable of monitoring at least one SSB per cell.

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause 9.11.1. The NR SS-RSRQ measurement accuracy for all measured NR cells shall be as specified in clause 9.11.2. The NR SS-SINR measurement accuracy for all measured NR cells shall be as specified in clause 9.11.3.

8.1.2.4.21.1.2 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.21.1.3 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_irat\_without\_index or Tidentify\_irat\_with\_index defined in Clause 8.1.2.4.21.1.1 for the minimum requirements.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_irat\_without\_index. or Tidentify\_irat\_with\_index defined in clause 8.1.2.4.21.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_irat defined in clause 8.1.2.4.21.1.1 provided the timing to that cell has not changed more than ±3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.21.1.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.21.1.3.

8.1.2.4.21.2 Void

8.1.2.4.22 E-UTRAN TDD – NR measurements

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC.

The requirements in clause 8.1.2.4.21 also apply for this section.

8.1.2.4.23 Void

8.1.2.4.24 Void

8.1.2.4.25 E-UTRAN FDD – NR SFTD Measurements

8.1.2.4.25.1 Introduction

This clause contains requirements for a UE supporting E-UTRAN FDD – NR dual connectivity and is applicable in RRC\_CONNECTED state and conditioned on that no NR PSCell is configured. The UE shall perform inter-RAT SFTD measurement and report SFTD result with/without SS-RSRP after the network requests with *reportSFTD-Meas* set to neighbour cells. The overall delay includes RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] and SFTD measurement reporting delay in clause 8.1.2.4.25.3.

8.1.2.4.25.2 SFTD Measurement delay

The requirements on SFTD measurement delay defined in this section are applicable under the side condition SCH Ês/Iot ≥ -3 dB for the NR cell. Depending on configuration, the SFTD measurement may be carried out with or without the support of configured measurement gaps. In the current release, indication on whether to carry out the SFTD measurement with or without measurement gaps is implicit and depending on whether measurement gaps are configured.

The UE shall be able to detect, identify and measure SFTD of up to 3 of the strongest NR cells on the carrier frequency provided in the SFTD measurement configuration. Further depending on the SFTD measurement configuration, the UE shall additionally report SS-RSRP for the one or more NR cells. The UE may or may not be configured with *cellsForWhichToReportSFTD*. The UE does not expect *cellsForWhichToReportSFTD* to change during an ongoing SFTD measurement.

When no measurement gaps are provided, the UE shall be capable of finding the NR cell regardless of its SSB position in the SMTC period. The SFTD measurement shall be conducted with sustained connection to the E-UTRA PCell and activated SCell(s), however, the UE may be allowed to cause a certain amount of interruptions for reconfiguration of the radio receiver, as specified in clause 7.35.

When measurement gaps are provided, the UE shall be capable of finding the NR cell under the additional condition that the SSB at least occasionally falls within the measurement gap.

When no MCG DRX is used, the UE shall be capable of determining SFTD within a physical layer measurement period of Tmeasure\_SFTD1 as follows:

- For SFTD measurements without measurement gaps, and without additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = 14 SMTC periods

- For NR carrier in FR2: Tmeasure\_SFTD1 = 112 SMTC periods

- For SFTD measurements in measurement gaps, and without additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = Nfreq × 8 × Max(MGRP, SMTC period)

- For NR carrier in FR2: Tmeasure\_SFTD1 = Nfreq × 64 × Max(MGRP, SMTC period)

- For SFTD measurements without measurement gaps, and with additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = 19 SMTC periods

- For NR carrier in FR2: Tmeasure\_SFTD1 = 152 SMTC periods

- For SFTD measurements in measurement gaps, and with additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = Nfreq × 13 × Max(MGRP, SMTC period)

- For NR carrier in FR2: Tmeasure\_SFTD1 = Nfreq × 104 × Max(MGRP, SMTC period)

where Nfreq is the number of carriers monitored in measurement gaps.

When MCG DRX is used, the same Tmeasure\_SFTD1 as for non-DRX applies, but the reporting delay depends on the DRX cycle length in use.

In case an NR PSCell is added, the UE shall terminate the inter-RAT SFTD measurement.

In case PCell is changed due to handover, the UE shall terminate the inter-RAT SFTD measurement.

The measurement accuracy for the SFTD measurement shall fulfill the requirement in clause 9.1.27. The measurement accuracy for additionally reported NR SS-RSRP shall fulfil the requirement in clause 9.11.1.

8.1.2.4.25.3 SFTD Measurement reporting delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier-based switching, an additional delay can be expected.

The SFTD measurement reporting delay shall be less than Tmeasure\_SFTD1 defined in clause 8.1.2.4.25.2.

8.1.2.4.26 E-UTRAN TDD – NR SFTD Measurements

8.1.2.4.26.1 Introduction

This clause contains requirements for a UE supporting E-UTRAN TDD – NR dual connectivity and is applicable in RRC\_CONNECTED state and conditioned on that no NR PSCell is configured.

When no measurement gap is provided, the UE is not required to perform SFTD measurement during the UL subframes of an E-UTRAN serving cell which is on the same TDD band with the NR target cell.

When no measurement gap is provided, the UE is not required to perform SFTD measurement during the UL subframes of a TDD E-UTRAN serving cell which is on the different band with the NR target cell when UE doesn’t support *simultaneousRxTxInterBandENDC* in this band combination.

The requirements in clause 8.1.2.4.25 also apply for this section.

8.1.2.5 E-UTRAN OTDOA Intra-Frequency RSTD Measurements

All intra-frequency RSTD measurement requirements specified in Sections 8.1.2.5.1 and 8.1.2.5.2 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

When using CRS, in addition to PRS, is enabled in the OTDOA assistance data, it is up to UE implementation whether to use or not the CRS for RSTD measurements, but in either case the RSTD measurements reported by the UE shall meet the requirements specified in this section.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.1.2.5.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.1.2.5.1-1):

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.1-1, where each PRS positioning occasion comprises of  (1≤≤6) consecutive downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

**Table 8.1.2.5.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.1.2.5.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.1.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.



**Figure 8.1.2.5.1-1. Illustration of the RSTD reporting time requirement in an FDD system.**

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.1.2.5.1.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.5.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.2-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

**Table 8.1.2.5.2-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1 and one inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.1.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.1.2.5.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.5.2-2.

**Table 8.1.2.5.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.5.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.5.3 E-UTRAN FDD Intra-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.1.2.5.3-1):

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.3-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

**Table 8.1.2.5.3-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.1.2.5.3-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.

****

**Figure 8.1.2.5.3-1. Illustration of the RSTD reporting time requirement in an FDD system.**

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.1.2.5.3.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.5.4 E-UTRAN TDD Intra-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.4-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

**Table 8.1.2.5.4-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1 and one inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.1.2.5.4) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.5.4-2.

**Table 8.1.2.5.4-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.5.4.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.5 Void

8.1.2.6.6 Void

8.1.2.6.7 Void

8.1.2.6.8 Void

8.1.2.6 E-UTRAN Inter-Frequency OTDOA Measurements

All inter-frequency RSTD measurement requirements specified in Sections 8.1.2.6.1-8.1.2.6.4 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Clause 8.1.2.1 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.1.2.6.1-8.1.2.6.4 shall apply without DRX as well as for any DRX or eDRX\_CONN cycles specified in TS 36.331 [2].

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.1.2.6 provided the following condition is met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements at the UE in the measured and reference cells.

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

When using CRS, in addition to PRS, is enabled in the OTDOA assistance data, it is up to UE implementation whether to use or not the CRS for RSTD measurements, but in either case the RSTD measurements reported by the UE shall meet the requirements specified in this section.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.1.2.6.1 E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.1.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.2 E-UTRAN TDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.2-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.2-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band,

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.2-2.

**Table 8.1.2.6.2-2: TDD uplink-downlink subframe configurations applicable for TDD-FDD inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.6.2.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.3 E-UTRAN TDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.3-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The inter-frequency requirements in this clause (8.1.2.6.3) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.3-2.

**Table 8.1.2.6.3-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.3.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.4 E-UTRAN FDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.4-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.4-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.4) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.4-2.

**Table 8.1.2.6.4-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

8.1.2.6.4.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.5 E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.5-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.5-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.5.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.6 E-UTRAN TDD-FDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.6-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.6-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band,

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.6) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.6-2.

**Table 8.1.2.6.6-2: TDD uplink-downlink subframe configurations applicable for TDD-FDD inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.6.6.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.7 E-UTRAN TDD-TDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.7-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.7-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 6] |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The inter-frequency requirements in this clause (8.1.2.6.7) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.7-2.

**Table 8.1.2.6.7-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.7.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.6.8 E-UTRAN FDD-TDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.8-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.8-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.8) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.8-2.

**Table 8.1.2.6.8-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note 2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

*Change 21*

8.4 OTDOA RSTD Measurements for E-UTRAN carrier aggregation

8.4.1 Introduction

This clause contains RSTD measurement requirements on UE capabilities for support of E-UTRA carrier aggregation. Requirements in this clause are applicable to all carrier aggregation capable UE which have been configured with one or two downlink Scell(s). Non-configured frequencies may be measured with measurement gaps according to the requirements in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies. Requirements in this clause are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

For UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], RSTD requirements in Section 8.4 shall apply also with different TDD UL/DL subframe configurations and/or different special subframe configurations used in CCs of different bands, under the following additional conditions:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements in the measured and reference cells; and

- UE is not simultaneously scheduled in UL and DL on the different CCs.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.4 provided the following condition is met:

all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements at the UE in the measured and reference cells.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS, with N1=0 and N2=0 subframes before and after the indicated PRS subframes respectively, during all positioning occasions within the RSTD measurement period.

8.4.2 Measurements on the primary component carrier

The RSTD measurements on cells belonging to the primary component carrier shall meet all applicable requirements (FDD or TDD) specified in clause 8.1.2.5, i.e., E-UTRAN intra-frequency RSTD measurement period applies.

The RSTD measurement accuracy for all the measurements on the primary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

If the PCell is changed, regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the primary component carrier, then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the primary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.5,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

corresponds to the E-UTRAN intra-frequency RSTD measurement period as specified in clause 8.1.2.5.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.4.3 Measurements on a secondary component carrier

The RSTD measurements when all cells are on a configured secondary component carrier shall meet all applicable requirements (FDD or TDD) specified in clause 8.1.2.5, i.e., E-UTRAN intra-frequency RSTD measurement period applies, regardless of whether the Scell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17].

The RSTD measurement accuracy for all the measurements on the secondary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when making RSTD measurements on cells belonging to SCC with deactivated SCell. This may cause interruptions (packet drops) to a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell.

If the PCell is changed, regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the secondary component carrier, then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the secondary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.5,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN intra-frequency RSTD measurement period as specified in clause 8.1.2.5.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.4.4 Measurements on both primary component carrier and a secondary component carrier

The RSTD measurements of cells on both primary component carrier and a configured secondary component carrier shall meet all applicable requirements (FDD-FDD, TDD-TDD, TDD-FDD or FDD-TDD inter-Frequency OTDOA) specified in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies regardless of whether the SCell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17], with the following exceptions

- the number of PRS positioning occasions is as specified in Table 8.4.4-1 shall apply, and

- TDD uplink-downlink subframes configurations as specified in Clause 8.1.2.5.2, Table 8.1.2.5.2-2 shall apply.

**Table 8.4.4-1: Number of PRS positioning occasions within measurement period**

|  |  |
| --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** |
| 160 ms | 32 |
| >160 ms | 16 |

The RSTD measurement accuracy for all the measurements on both primary component carrier and the secondary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure its receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when performing RSTD measurements on cells belonging to at least SCC with deactivated SCell. This may cause interruptions (packet drops) on a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell.

If the PCell is changed regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to both the primary component carrier and the secondary component carrier then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the primary and secondary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.6,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN inter-frequency RSTD measurement period as specified in clause 8.1.2.6 with the exception that the number of PRS positioning occasions is as specified in Table 8.4.4-1.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.4.5 Measurements on different secondary component carriers

The RSTD measurements of cells on a configured secondary component carrier and another configured secondary component carrier shall meet all applicable requirements (FDD-FDD, TDD-TDD, TDD-FDD or FDD-TDD inter-Frequency OTDOA) specified in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies regardless of whether the SCell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17], with the following exceptions

- the number of PRS positioning occasions is as specified in Table 8.4.4-1 shall apply, and

- TDD uplink-downlink subframes configurations as specified in Clause 8.1.2.5.2, Table 8.1.2.5.2-2 shall apply.

**Table 8.4.4-1: Number of PRS positioning occasions within measurement period**

|  |  |
| --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** |
| 160 ms | 32 |
| >160 ms | 16 |

The RSTD measurement accuracy for all the measurements on the secondary component carriers shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure its receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when performing RSTD measurements on cells belonging to at least SCC with deactivated SCell. This may cause interruptions (packet drops) on a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell. No interruption to the SCells shall be allowed during the PRS positioning occasion on the SCells.

If the PCell is changed regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the secondary component carriers then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the secondary component carriers. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.6,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN inter-frequency RSTD measurement period as specified in clause 8.1.2.6 with the exception that the number of PRS positioning occasions is as specified in Table 8.4.4-1.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.5 Measurements for UE category 0

8.5.1 Introduction

The UE category 0 applicability of the requirements in subclause 8.5 is defined in Section 3.6.1.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are specified for E-UTRA intra frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

8.5.2 Requirements

8.5.2.1 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency cells and perform RSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

8.5.2.1.1 E-UTRAN FDD intra frequency measurements

8.5.2.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_FDD\_UE cat 0, intra is 1000 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause 9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_ UE cat 0 Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 400 ms. When no measurement gaps are activated, the low complexity UE shall be capable of performing RSRPand RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 400 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement intra\_UE cat 0 cells , where Ymeasurement intra\_ UE cat 0 is defined in the following equation. If the UE has identified more than Ymeasurement intra\_UE cat 0 cells, the UE shall perform measurements of at least 8 identified intra- frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.



cells where

Xbasic measurement FDD\_UE cat 0 = 8 (cells)

TMeasurement\_Period\_UE cat 0, Intra = 400 ms. The measurement period for Intra frequency RSRP and RSRQ measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.1.1.1 Measurement Reporting Requirements

8.5.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.1.1.1.3.

8.5.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat 0 defined in Clause 8.5.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat 0, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.5.2.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.1.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.1.2-1A.

**Table 8.5.2.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tidentify\_intra\_UE cat 0 (s) (DRX cycles)** |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

**Table 8.5.2.1.1.2-1A: Requirement to identify a newly detectable FDD intra-frequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat 0 (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause  9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat 0. When DRX is used, Tmeasure\_intra\_UE cat 0 is as defined in table 8.5.2.1.1.2-2, when eDRX\_CONN is used, Tmeasure\_intra\_UE cat 0 is as defined in table 8.5.2.1.1.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat 0.

**Table 8.5.2.1.1.2-2: Requirement to measure FDD intrafrequency cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat 0 (s) (DRX cycles)** |
| ≤0.08 | 0.4 (Note1) |
| 0.08<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

**Table 8.5.2.1.1.2-3: Requirement to measure FDD intra-frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat 0 (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.

For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.1.2.1 Measurement Reporting Requirements

8.5.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.1.2.1.3.

8.5.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat 0 defined in Clause 8.5.2.1.1.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat 0 provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

*Change 22*

8.12.3 Requirements for CSI-RS based discovery signal measurements for E-UTRA carrier aggregation

8.12.3.1 Introduction

The requirements in Section 8.12.3 shall apply for CSI-RS based discovery signal measurements comprising CSI-RSRP measurements [4].

8.12.3.2 Measurements of a secondary component carrier

A Secondary component carrier may be activated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived or deactivated.

8.12.3.3 Measurements of a secondary component carrier with active SCell

When the SCell is activated, measurement performance requirements for the frequency are those given in Section 8.11.3.1. If common DRX is in use, then the requirements for that secondary component carrier are given by the DRX requirements in Section 8.11.3.1.1.2, otherwise the non DRX requirements are applicable. The applicable measurement accuracy requirements are in Section 9.1.19.

8.12.3.4 Measurements of a secondary component carrier with deactivated SCell

This section defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

8.12.3.4.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FS3 TP on a secondary component carrier within the cell identification time Tidentify\_SCC\_TP\_FS3, where the identification of a TP shall include cell identification and a single measurement on the TP within the measurement period Tmeasure\_SCC\_FS3\_CSI-RS.

Tidentify\_SCC\_TP\_FS3 = Tidentify\_SCC\_FS3 + Tmeasure\_SCC\_FS3\_CSI-RS,

where:

Tidentify\_SCC\_FS3 is the time period for cell identification in Section 8.12.2.4.1,

Tmeasure\_SCC\_FS3\_CSI-RS is the time period for TP measurement in Table 8.12.3.4.1-1,

M is the number of configured discovery signal occasions which are not available for the measurements at the UE during Tmeasure\_SCC\_FS3\_CSI-RS due to the absence of the necessary radio signals from the cell.

During Tidentify\_SCC\_TP\_FS3 over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

**Table 8.12.3.4.1-1: Measurement requirements for a TP on SCC with deactivated SCell under operation with frame structure 3**

|  |  |  |  |
| --- | --- | --- | --- |
| **SCH Ês/Iot** | **CSI-RS measurement bandwidth [RB] Note2** | **CSI-RS Ês/Iot** | **Tmeasure\_SCC\_FS3\_CSI-RS [ms]** |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤ CSI-RS Ês/Iot | (5+M) \* k1\*k2\* *measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \* k1\*k2\* *measCycleSCell* |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CSI-RS Ês/Iot | (1+M) \* k1\*k2\* *measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \* k1\*k2\* *measCycleSCell* |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CSI-RS for TP measurement does not exceed 60\*k1\*k2\* *measCycleSCell.* | | | |

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_TP\_FS3:

- CSI-RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is accordin g to Table 8.12.2.4.1-1.

The UE shall be capable of performing RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_SCC\_FS3\_CSI-RS.

The measurement accuracy for all measured TPs shall be as specified in Section 9.1.19.

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on one SCC with deactivated SCell. This may cause interruptions on PCell that are specified in Section 7.8.

8.12.3.4.1.1 Measurement Reporting Requirements

8.12.3.4.1.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.3.4.1.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.12.3.4.1.1.3.

8.12.3.4.1.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_TP\_FS3 defined in Section 8.12.3.4.1. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_SCC\_TP\_FS3 defined in Section 8.12.3.4.1 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

8.12.3.4.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use the UE shall be able to identify a new detectable FS3 TP on a secondary component carrier within Tidentify\_SCC\_TP\_FS3\_DRX, according to the parameter *measCycleSCell*, where the identification of a TP shall include cell identification and a single measurement on the TP within the measurement period Tmeasure\_SCC\_FS3\_CSI-RS\_DRX.

Tidentify\_SCC\_TP\_FS3\_DRX = Tidentify\_SCC\_FS3\_DRX + Tmeasure\_SCC\_FS3\_CSI-RS\_DRX,

where:

Tidentify\_SCC\_FS3\_DRX is the time period for cell identification in Section 8.12.2.4.2,

Tmeasure\_SCC\_FS3\_CSI-RS\_DRX is the time period for TP measurement in Table 8.12.3.4.2-1,

M is the number of configured discovery signal occasions during ON DURATION and which are not available during Tmeasure\_SCC\_FS3\_CSI-RS\_DRX for the measurements at the UE due to the absence of the necessary radio signals from the cell.

During Tidentify\_SCC\_TP\_FS3\_DRX over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

**Table 8.12.3.4.2-1: Measurement requirements for a TP on SCC with deactivated SCell under operation with frame structure 3**

|  |  |  |  |
| --- | --- | --- | --- |
| **SCH Ês/Iot** | **CSI-RS measurement bandwidth [RB] Note2** | **CSI-RS Ês/Iot** | **Tmeasure\_SCC\_FS3\_CSI-RS\_DRX [ms]** |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤ CSI-RS Ês/Iot | (5+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CSI-RS Ês/Iot | (1+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CSI-RS\_DRX for TP measurement does not exceed 60\*k1\*k2\*Max{*measCycleSCell*, DRX cycle length}*.* | | | |

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_TP\_FS3\_DRX:

- CSI-RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.12.2.4.2-1.

The UE shall be capable of performing CSI-RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_SCC\_FS3\_CSI-RS\_DRX.

The measurement accuracy for all measured TPs shall be as specified in Section 9.1.19.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of TPs on one SCC with deactivated SCell. This may cause interruptions (packet drops) to a PCell. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.12.3.4.2.1 Measurement Reporting Requirements

8.12.3.4.2.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.3.4.2.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.12.3.4.2.1.3.

8.12.3.4.2.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_TP\_FS3\_DRX defined in Section 8.12.3.4.2. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_SCC\_TP\_FS3\_DRX defined in Section 8.12.3.4.2 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

8.13 Measurements for UE Category M1

8.13.1 Introduction

The UE category M1 applicability of the requirements in subclause 8.13 is defined in Section 3.6.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are specified for E-UTRA intra frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in TS 36.214 [4], the measurement model is defined in TS 36.302 [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

The UE shall meet the requirements in Section 8.13, provided:

- the UE does not require measurement gaps for the corresponding measurements, or

- the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern Id 0 or 1 and is not configured with any measurement gap pattern from Table 8.1.2.1-3.

If the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern from Table 8.1.2.1-3, the UE is not required to perform any RRM measurements that requires gaps during the RSTD measurement period and the requirement in Section 8.13 shall not apply during the RSTD measurement period.

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

8.13.2 Requirements for UE category M1 with CE mode A

The UE category M1 applicability of the requirements in subclause 8.13.2 is defined in Section 3.6. The requirements defined in clause 8.13.2 apply provided the following conditions are met:

- UE is configured with measurement gap pattern ID#0 or ID#1 defined in Table 8.1.2.1-1.

Alternatively, the UE shall meet the requirements in subclause 8.13.2 defined for gap pattern ID#0 without using any measurement gaps provided:

- UE indicates it does not need gaps with the capability intraFreq-CE-NeedForGaps-r13 [2, TS 36.331] for the frequency band of the serving cell, or

- UE is not configured with any reporting configuration that requires measurement on any intra-frequency neighbour cell.

8.13.2.1 E-UTRAN intra frequency measurements by UE category M1 with CE mode A

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

8.13.2.1.1 E-UTRAN FDD intra frequency measurements

8.13.2.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD intra frequency cell according to requirements in Table 8.13.2.1.1.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.1.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.2.1.1.1-1: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| 0 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |

Kintra\_M1\_NC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.1.1.1-2 when *highSpeedMeasGapCE-ModeA* [2]is not configured, and in Table 8.13.2.1.1.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_NC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

**Table 8.13.2.1.1.1-2: Value of parameter X for CEModeA**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

**Table 8.13.2.1.1.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA***

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

**Table 8.13.2.1.1.1-3: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell with MPDCCH scaling**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.2.1.1.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurement of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

8.13.2.1.1.1.1 Measurement Reporting Requirements

8.13.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.1.1.1.3.

8.13.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_NC defined in Clause 8.13.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.1.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.1.2-1A.

**Table 8.13.2.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.1.2-1A: Requirement to identify a newly detectable FDD intrafrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14-1 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.1.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.1.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

**Table 8.13.2.1.1.2-2: Requirement to measure FDD intrafrequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.128 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (\*Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.1.2-3: Requirement to measure FDD intrafrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.1.2.1 Measurement Reporting Requirements

8.13.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.1.2.1.3.

8.13.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat M1 defined in Clause 8.13.2.1.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC  defined in clause 8.13.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.2 E-UTRAN intra frequency measurements for HD-FDD

8.13.2.1.2.1 E-UTRAN intra frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.1.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE over Tidentify\_intra\_UE cat M1;

- at least one downlink subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell over Tmeasure\_intra\_UE cat M1.

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.1.2.2 E-UTRAN intra frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use the UE shall be able to identify a new detectable HD-FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC  as shown in table 8.13.2.1.2.2-1.

When eDRX\_CONN is in use, the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.2.2-1A.

**Table 8.13.2.1.2.2-1: Requirement to identify a newly detectable HD-FDD intrafrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC (32 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | ≤0.08 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (32 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.2.2-1A: Requirement to identify a newly detectable HD-FDD intrafrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.2.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.2.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

**Table 8.13.2.1.2.2-2: Requirement to measure HD-FDD intrafrequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.08 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.08≤DRX-cycle≤0.16 | Note 2 (7 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.16 | 0.96 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| DRX-cycle=0.16 | 1.12 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (7 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.2.2-3: Requirement to measure HD-FDD intrafrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.2.2.1 Measurement Reporting Requirements

8.13.2.1.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2, and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.2.2.1.3.

8.13.2.1.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_NC defined in Clause 8.13.2.1.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.3 E-UTRAN TDD intra frequency measurements

8.13.2.1.3.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use, the UE shall be able to identify and measure a new detectable TDD intra frequency cell according to requirements in Table 8.13.2.1.3.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.1.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.2.1.3.1-1: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| 0 | 1.44 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC seconds | 480 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |

Kintra\_M1\_NC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.1.3.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.1.3.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_NC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

**Table 8.13.2.1.3.1-2: Value of parameter X for CEModeA**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

**Table 8.13.2.1.3.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA***

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

**Table 8.13.2.1.3.1-3: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell with MPDCCH scaling**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.2.1.3.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQmeasurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

8.13.2.1.3.1.1 Measurement Reporting Requirements

8.13.2.1.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.3.1.1.3.

8.13.2.1.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_NC defined in Clause 8.13.2.1.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.3.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_ UE catM1 as shown in table 8.13.2.1.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.3.2-1A.

**Table 8.13.2.1.3.2-1: Requirement to identify a newly detectable TDD intrafrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.3.2-1A: Requirement to identify a newly detectable TDD intrafrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.3.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.3.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

**Table 8.13.2.1.3.2-2: Requirement to measure TDD intra frequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.128 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.96 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.1.3.2-3: Requirement to measure TDD intra frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.3.2.1 Measurement Reporting Requirements

8.13.2.1.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.3.2.1.3.

8.13.2.1.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_NC defined in Clause 8.13.2.1.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.2 Void

8.13.2.3 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M1 UE in CEModeA

All intra-frequency RSTD measurement requirements specified in Sections 8.13.2.3 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2]. All the measurement requirements specified in Sections 8.13.2.3 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M1 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.13.2.3.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+TMIB ms,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24],

is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.20.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Editor’s note: Requirements have assumed that prsOccGroupLength is not configured in the measurement period.

**Table 8.13.2.3.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.13.2.3.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.20.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

****

**Figure 8.13.2.3.1-1: Illustration of the RSTD reporting time requirement in an FDD system.**

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.2.3.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.3.1.

8.13.2.3.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

 is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24],

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.20.

, ,  and , are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.2.3.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.20.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.13.2.3.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.2.3.2-2.

**Table 8.13.2.3.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.2.3.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.3.2.

8.13.2.3.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.3.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.20 are available for RSTD measurements in the measured and reference cells.

8.13.2.3.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.13.2.3.3.

8.13.2.4 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M1 UE in CEModeA

All inter-frequency RSTD measurement requirements specified in Sections 8.13.2.4 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.13.2.4 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.21.17 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.13.2.4 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.13.2.4.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.2.4.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.17.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.2.4.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.17.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.2.4.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.4.1.

8.13.2.4.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.2.4.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.17.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.2.4.2-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f21 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.17.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.13.2.4.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.2.4.2-2.

**Table 8.13.2.4.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.2.4.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.4.2.

8.13.2.4.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.4.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.17 are available for RSTD measurements in the measured and reference cells.

8.13.2.4.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period as defined in Clause 8.13.2.4.3.

8.13.2.5 E-UTRAN E-CID Measurements Requirements for UE category M1 with CE mode A

8.13.2.5.1 Intra-frequency FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.1.1 Introduction

The requirements in section 8.13.2.5.1 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.1.2 Measurement Requirements

The requirements in section 8.13.2.1.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.1.3.

8.13.2.5.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.5.2 Intra-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.2.1 Introduction

The requirements in section 8.13.2.5.2 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.2.2 Measurement Requirements

The requirements in section 8.13.2.1.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.2.3.

8.13.2.5.2.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.5.3 Intra-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.3.1 Introduction

The requirements in section 8.13.2.5.3 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.3.2 Measurement Requirements

The requirements in section 8.13.2.1.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.3.3.

8.13.2.5.3.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.5.4 Inter-frequency FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.4.1 Introduction

The requirements in section 8.13.2.5.4 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.4.2 Measurement Requirements

The requirements in section 8.13.2.6.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.4.3.

8.13.2.5.4.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.5.5 Inter-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.5.1 Introduction

The requirements in section 8.13.2.5.5 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.5.2 Measurement Requirements

The requirements in section 8.13.2.6.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.5.3.

8.13.2.5.5.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.5.6 Inter-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.6.1 Introduction

The requirements in section 8.13.2.5.6 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.6.2 Measurement Requirements

The requirements in section 8.13.2.6.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.6.3.

8.13.2.5.6.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.5.7 E-UTRAN FDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.13.2.5.7-1.

**Table 8.13.2.5.7-1: FDD UE Rx-Tx time difference measurement requirement when DRX is used**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_FDD\_UE\_Rx\_Tx1 (s) (DRX cycles)** |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_FDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_FDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_FDD\_UE\_Rx\_Tx1) + K\*TPCcell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.21.19.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwiwidth in the serving cell during the UE Rx-Tx time difference measurement period.

8.13.2.5.7.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.7.

8.13.2.5.8 E-UTRAN TDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.13.2.5.8-1.

**Table 8.13.2.5.8-1: TDD UE Rx-Tx time difference measurement requirement when DRX is used**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_TDD\_UE\_Rx\_Tx1 (s) (DRX cycles)** |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_TDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_TDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_TDD\_UE\_Rx\_Tx1) + K\*TPCell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.21.19.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwiwidth in the serving cell during the UE Rx-Tx time difference measurement period.

8.13.2.5.8.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.8.

8.13.2.5.9 E-UTRAN HD-FDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands.

The requirements defined in clause 8.13.2.5.7 also apply for this section except the measurement reporting requirements provided the following conditions are met:

- At least one downlink and one uplink subframes per radio frame are available for the UE Rx-Tx time difference measurement in the measured cell.

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE;

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.5.9.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.19.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.9.

8.13.2.6 E-UTRAN inter frequency measurements by UE category M1 with CE mode A

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. During the RRC\_CONNECTED state the UE shall continuously measure identified inter frequency cells and additionally search for and identify new inter frequency cells.

8.13.2.6.1 E-UTRAN FDD - FDD inter frequency measurements

8.13.2.6.1.1 E-UTRAN FDD - FDD inter frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD inter-frequency cell according to requirements in Table 8.13.2.6.1.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.6.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.2.6.1.1-1: Requirement on cell identification delay and measurement delay for FDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1\_NC)** | **Measurement delay (Tmeasure\_inter\_UE cat M1\_NC\_NC)** |
| 0 | 1.44 \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480 \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kinter\_M1\_NC seconds | 960 \* Kinter\_M1\_NC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.6.1.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.6.1.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

**Table 8.13.2.6.1.1-2: Value of parameter X for CEModeA**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

**Table 8.13.2.6.1.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA***

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

**Table 8.13.2.6.1.1-3: Requirement on cell identification delay and measurement delay for FDD interfrequency cell with MPDCCH scaling**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1)** | **Measurement delay (Tmeasure\_inter\_UE cat M1)** |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.22.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_inter\_UE cat M1\_NC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for inter frequency measurements is according to Table 8.13.2.6.1.1-1. When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 2 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.13.2.6.1.1-1.

8.13.2.6.1.1.1 Measurement Reporting Requirements

8.13.2.6.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.1.1.1.3.

8.13.2.6.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_NC defined in Clause 8.13.2.6.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_NC, Inter provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.1.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.1.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.1.2-1A.

**Table 8.13.2.6.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.1.2-1A: Requirement to identify a newly detectable FDD interfrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.1.2-3.

**Table 8.13.2.6.1.2-2: Requirement to measure FDD interfrequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.128 | 0.48 \* Kinter\_M1 cat M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.960 \* Kinter\_M1 cat M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.1.2-3: Requirement to measure FDD interfrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.9 and 9.1.21.10.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.1.2.1 Measurement Reporting Requirements

8.13.2.6.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.1.2.1.3.

8.13.2.6.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter, UE cat M1\_NC defined in Clause 8.13.2.6.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.2 E-UTRAN inter-frequency measurements for HD-FDD

8.13.2.6.2.1 E-UTRAN inter-frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.6.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an inter-frequency cell to be identified by the UE is available at the UE over Tidentify\_inter\_UE cat M1\_NC;

- at least one downlink subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell over Tmeasure\_inter\_UE cat M1\_NC.

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.6.2.2 E-UTRAN inter frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.2.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.2.2-1A.

**Table 8.13.2.6.2.2-1: Requirement to identify a newly detectable HD-FDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (32 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | ≤0.08 | 2.88 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note1) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (32 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(25 \* Kinter\_M \*  KRSTD\_M1\_NC 1) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.2.2-1A: Requirement to identify a newly detectable HD-FDD interfrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.2.2-3.

**Table 8.13.2.6.2.2-2: Requirement to measure HD-FDD interfrequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.08 | 0.48 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.08≤DRX-cycle≤0.16 | Note 2 (7 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2(5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.16 | 0.96 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| DRX-cycle=0.16 | 1.12 \* Kinter\_M1 \*  KRSTD\_M1\_NC (7 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2(5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.2.2-3: Requirement to measure HD-FDD interfrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.10 and 9.1.21.11.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.2.2.1 Measurement Reporting Requirements

8.13.2.6.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.2.2.1.3.

8.13.2.6.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_NC defined in Clause 8.13.2.6.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.3 E-UTRAN TDD inter frequency measurements

8.13.2.6.3.1 E-UTRAN inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable TDD inter frequency cell according to requirements in Table 8.13.2.6.3.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.6.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.2.6.3.1-1: Requirement on cell identification delay and measurement delay for TDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1\_NC)** | **Measurement delay (Tmeasure\_inter\_UE cat M1\_NC)** |
| 0 | 1.44\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.6.3.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.6.3.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

**Table 8.13.2.6.3.1-2: Value of parameter X for CEModeA**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

**Table 8.13.2.6.3.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA***

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

**Table 8.13.2.6.3.1-3: Requirement on cell identification delay and measurement delay for TDD interfrequency cell with MPDCCH scaling**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1)** | **Measurement delay (Tmeasure\_inter\_UE cat M1)** |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC  ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC  ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14 with measurement period (Tmeasure\_inter\_UE cat M1\_NC) given by table 8.13.2.6.3.1-1:

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC.

8.13.2.6.3.1.1 Measurement Reporting Requirements

8.13.2.6.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.3.1.1.3.

8.13.2.6.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_NC defined in Clause 8.13.2.6.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.3.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_ UE catM1 as shown in table 8.13.2.6.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.3.2-1A.

**Table 8.13.2.6.3.2-1: Requirement to identify a newly detectable TDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | ≤0.04 | 1.44\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2\* Kinter\_M1 \*  KRSTD\_M1\_NC (25\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20\* Kinter\_M 1 \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2\* Kinter\_M1 \*  KRSTD\_M1\_NC (25\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.3.2-1A: Requirement to identify a newly detectable TDD interfrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.3.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC  is as defined in Table 8.13.2.6.3.2-3.

**Table 8.13.2.6.3.2-2: Requirement to measure TDD inter frequency cells**

|  |  |  |
| --- | --- | --- |
| **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles)** |
| 0 | <0.128 | 0.48\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.96\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

**Table 8.13.2.6.3.2-3: Requirement to measure TDD inter frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.9 and 9.1.21.10.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.3.2.1 Measurement Reporting Requirements

8.13.2.6.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.3.2.1.3.

8.13.2.6.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_NC defined in Clause 8.13.2.6.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.7 Maximum allowed layers for multiple monitoring for UE category M1 with CE mode A

The UE UE category M1 configured with CE mode A shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

8.13.3 Requirements for UE category M1 with CE mode B

The UE category M1 applicability of the requirements in subclause 8.13.3 is defined in Section 3.6. The requirements defined in clause 8.13.3 apply provided the following conditions are met:

- UE is configured with measurement gap pattern ID#0 or ID#1 defined in Table 8.1.2.1-1.

Alternatively, the UE shall meet the requirements in subclause 8.13.3 defined for gap pattern ID#0 without using any measurement gaps provided:

- UE indicates it does not need gaps with the capability intraFreq-CE-NeedForGaps-r13 [2, TS36.331] for the frequency band of the serving cell, or

- UE is not configured with any reporting configuration that requires measurement on any intra-frequency neighbour cell.

8.13.3.1 E-UTRAN intra frequency measurements by UE category M1 with CE mode B

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

8.13.3.1.1 E-UTRAN FDD intra frequency measurements

8.13.3.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD intra frequency cell according to requirements in Table 8.13.3.1.1.1-1 provided that additional conditions table 8.13.3.1.1.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.1.1.1-4 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.3.1.1.1-1: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| Q2≥-6 | 0 | 21.8\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 22.6\* Kintra\_M1\_EC\*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |

**Table 8.13.3.1.1.1-2: Void**

Kintra\_M1\_EC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.1.1.1-3.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_EC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

**Table 8.13.3.1.1.1-3: Value of parameter X for CEModeB**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

**Table 8.13.3.1.1.1-4: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1\_EC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.3.1.1.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

8.13.3.1.1.1.1 Measurement Reporting Requirements

8.13.3.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3,9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.1.1.1.3.

8.13.3.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_EC defined in Clause 8.13.3.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_EC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.1.2-1 provided that additional conditions Table 8.13.3.1.1.2-1 is met.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.1.2-1B.

**Table 8.13.3.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.1.1.2-1A: Void**

**Table 8.13.3.1.1.2-1B: Requirement to identify a newly detectable FDD intrafrequency cell when eDRX\_CONN is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.1.2-2 provided that additional conditions table 8.13.3.1.1.2-2 is met. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.1.2-4. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

**Table 8.13.3.1.1.2-2: Requirement to measure FDD intrafrequency cells**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | 0 | ≤0.16 | 0.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.1.1.2-3: Void**

**Table 8.13.3.1.1.2-4: Requirement to measure FDD intrafrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.1.2.1 Measurement Reporting Requirements

8.13.3.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.1.2.1.3.

8.13.3.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat M1\_EC defined in Clause 8.13.3.1.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.2 E-UTRAN intra frequency measurements for HD-FDD

8.13.3.1.2.1 E-UTRAN intra frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.1.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 and downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE over Tidentify\_intra\_UE cat M1\_EC;

- at least two consecutive downlink subframe per radio frame of measured cell is available at the UE for RSRP measurements assuming measured cell is identified cell over Tmeasure\_intra\_UE cat M1\_EC.

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-4

8.13.3.1.2.2 E-UTRAN intra frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use the UE shall be able to identify a new detectable HD-FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.2.2-1 provided that additional conditions table 8.13.3.1.2.2-1 is met.

When eDRX\_CONN is in use, the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.2.2-1B.

**Table 8.13.3.1.2.2-1: Requirement to identify a newly detectable HD-FDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (24 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.1.2.2-1A: Void**

**Table 8.13.3.1.2.2-1B: Requirement to identify a newly detectable HD-FDD intrafrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-4 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.2.2-2 provided that additional conditions Table 8.13.3.1.2.2-2 is met. When eDRX\_CONN cycle is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.2.2-4. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

**Table 8.13.3.1.2.2-2: Requirement to measure HD-FDD intrafrequency cells**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | 0 | <0.128 | 0.8 \* Kintra \_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.128≤DRX-cycle≤0.16 | Note2 (7 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.1.2.2-3: Void**

**Table 8.13.3.1.2.2-4: Requirement to measure HD-FDD intrafrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | NOTE (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.2.2.1 Measurement Reporting Requirements

8.13.3.1.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.2.2.1.3.

8.13.3.1.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_EC defined in Clause 8.13.3.1.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.3 E-UTRAN TDD intra frequency measurements

8.13.3.1.3.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable TDD intra frequency cell according to requirements in Table 8.13.3.1.3.1-1provided that additional conditions Table 8.13.3.1.3.1-2 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.1.3.1-4 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.3.1.3.1-1: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1) for neighbouring cell SCH Ês/Iot (Q): -15≤ Q2 < -6** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC Note1  1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC Note2 |
| 1 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  3200 \* Kintra\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC S | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC S | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  3200 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0. | | | |

Kintra\_M1\_EC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.1.3.1-3.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_EC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

**Table 8.13.3.1.3.1-2: Void**

**Table 8.13.3.1.3.1-3: Value of parameter X for CEModeB**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

**Table 8.13.3.1.3.1-4: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 3200) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 3200) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0. | | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of **Tmeasure\_intra\_UE cat M1\_EC**. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.3.1.3.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

8.13.3.1.3.1.1 Measurement Reporting Requirements

8.13.3.1.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.3.1.1.3.

8.13.3.1.3.1.1.3 Event Triggered Reporting

Reported RSRP measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_EC defined in Clause 8.13.3.1.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.3.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_ UE cat M1\_EC as shown in table 8.13.3.1.3.2-1 provided that additional conditions table 8.13.3.1.3.2-1 is met.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.3.2-1B.

**Table 8.13.3.1.3.2-1: Requirement to identify a newly detectable TDD intrafrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.1.3.2-1A: Void**

**Table 8.13.3.1.3.2-1B: Requirement to identify a newly detectable TDD intrafrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as shown in table 8.13.3.1.3.2-2 provided that additional conditions Table 8.13.3.1.3.2-2 is met. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_EC is as shown in table 8.13.3.1.3.2-4. The UE shall be capable of performing RSRP and RSRQ measurement for 6 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

**Table 8.13.3.1.3.2-2: Requirement to measure TDD intra frequency cells**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **TDD Uplink-downlink**  **configuration** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | Other than 0 | 0 | ≤0.16 | 0.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 0 | 0 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.64 | 3.2 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use.  Note 2: Time depends upon the DRX cycle in use. | | | | |

**Table 8.13.3.1.3.2-3: Void**

**Table 8.13.3.1.3.2-4: Requirement to measure TDD intra frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.3.2.1 Measurement Reporting Requirements

8.13.3.1.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.3.2.1.3.

8.13.3.1.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_EC defined in Clause 8.13.3.1.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.4 E-UTRAN FDD intra frequency measurements with autonomous gaps for UE category M1 with CE mode B

The requirements defined in this subclause 8.13.3.1.4 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BRare supported in the target cell to be detected.

8.13.3.1.4.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BRmessage according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_Cat M1, intra is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

- For UE not supporting cross-TTI MIB/SIB-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

- For UE supporting cross-TTI MIB/SIB1-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 3200 ms provided that the target E-UTRA cell does not change the MIB payload information except the system frame number across MIB TTI and does not change the SIB1-BR information across SIB1-BR TTI. Otherwise Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_Cat M1,.intra is applicable when no DRX is used as well as when any of DRX and eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified in Table 8.13.3.1.4.1-1.

**Table 8.13.3.1.4.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_Cat M1, intra.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target cell** | | | |
| Ês/Iot [dB] | PBCH repetition | SIB1-BR repetition level | SIB1-BR TBS |
| ≥ -15 | Configured as specified in TS 36.211 [16] | 16 | 208 |

8.13.3.1.4.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.5 E-UTRAN intra frequency measurements with autonomous gaps for HD-FDD UE category M1 with CE mode B

The requirements in this section are applicable for the UE which supports half duplex FDD operation on one or more supported frequency bands [2].

The requirements defined in this subclause 8.13.3.1.5 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.13.3.1.5.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

The CGI requirements defined in clause 8.13.3.1.4.1 also apply for this section.

8.13.3.1.5.2 ECGI Reporting Delay

The ECGI reporting delay defined in clause 8.13.3.1.5.2 also apply for this section

8.13.3.1.6 E-UTRAN TDD intra frequency measurements with autonomous gaps for UE category M1 with CE mode B

The requirements defined in this subclause 8.13.3.1.6 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.13.3.1.6.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BR messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_Cat M1, intra is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

- For UE not supporting cross-TTI MIB/SIB-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

- For UE supporting cross-TTI MIB/SIB1-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 3200 ms, provided that the target E-UTRA cell does not change the MIB payload information except the system frame number across MIB TTI and does not change the SIB1-BR information across SIB1-BR TTI. Otherwise Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_Cat M1, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified Table 8.13.3.1.6.1-2.

**Table 8.13.3.1.6.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_Cat M1, intra.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target cell** | | | |
| Ês/Iot [dB] | PBCH repetition level | SIB1-BR repetition level | SIB1-BR TBS |
| ≥ -15 | Configured with repetition, as specified in TS 36.211 [16] | 16 | 208 |

8.13.3.1.6.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.2 Void

8.13.3.3 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M1 UE in CEModeB

All intra-frequency RSTD measurement requirements specified in Sections 8.13.3.3 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All the measurement requirements specified in Sections 8.13.3.3 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M1 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.13.3.3.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.3.3.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.3.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.21.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.3.3.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.13.3.3.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.21.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.



**Figure 8.13.3.3.1-1: Illustration of the RSTD reporting time requirement in an FDD system.**

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.3.3.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.3.1.

8.13.3.3.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.3.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.21.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.3.3.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f1 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.21.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.13.3.3.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.3.3.2-2.

**Table 8.13.3.3.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.3.3.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.3.2.

8.13.3.3.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.3.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.21 are available for RSTD measurements in the measured and reference cells.

8.13.3.3.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.13.3.3.3.

8.13.3.4 E-UTRAN E-CID Measurements Requirements for UE category M1 with CE mode B

8.13.3.4.1 Intra-frequency E-CID FDD RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.1.1 Introduction

The requirements in section 8.13.3.4.1 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.1.2 Measurement Requirements

The requirements in section 8.13.3.1.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.1.3.

8.13.3.4.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.4.2 Intra-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.2.1 Introduction

The requirements in section 8.13.3.4.2 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.2.2 Measurement Requirements

The requirements in section 8.13.3.4.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.2.3.

8.13.3.4.2.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.4.3 Intra-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.3.1 Introduction

The requirements in section 8.13.3.4.3 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.3.2 Measurement Requirements

The requirements in section 8.13.3.4.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.3.3.

8.13.3.4.3.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.4.4 Inter-frequency E-CID FDD RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.4.1 Introduction

The requirements in section 8.13.3.4.4 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.4.2 Measurement Requirements

The requirements in section 8.13.3.5.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.4.3.

8.13.3.4.4.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.4.5 Inter-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.5.1 Introduction

The requirements in section 8.13.3.4.5 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.5.2 Measurement Requirements

The requirements in section 8.13.3.5.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.5.3.

8.13.3.4.5.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.4.6 Inter-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.6.1 Introduction

The requirements in section 8.13.3.4.6 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.6.2 Measurement Requirements

The requirements in section 8.13.3.5.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.6.3.

8.13.3.4.6.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5 E-UTRAN inter frequency measurements by UE category M1 with CE Mode B

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. During the RRC\_CONNECTED state the UE shall continuously measure identified inter frequency cells and additionally search for and identify new inter frequency cells.

8.13.3.5.1 E-UTRAN FDD - FDD inter frequency measurements

8.13.3.5.1.1 E-UTRAN FDD - FDD inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable FDD inter-frequency cell according to requirements in Table 8.13.3.5.1.1-1 when additional condition in Table 8.13.3.5.1.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.5.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.3.5.1.1-1: Requirement on cell identification delay and measurement delay for FDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1)** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 321.6 \* Kinter\_M1 s | 1600 \* Kinter\_M1 ms |
| Q2≥-6 | 0 | 21.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC  ms |
| 1 | 22.6 \* Kinter\_M1\_EC s | 1600 \* Kinter\_M1\_EC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.5.1.1-2.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

**Table 8.13.3.5.1.1-2: Value of parameter X for CEModeB**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

**Table 8.13.3.5.1.1-3: Requirement on cell identification delay and measurement delay for FDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1)** | **Measurement delay (Tmeasure\_inter\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_inter\_UE cat M1\_EC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for inter frequency measurements is according to Table 8.13.3.5.1.1-1. When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.13.3.5.1.1-1.

8.13.3.5.1.1.1 Measurement Reporting Requirements

8.13.3.5.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.1.1.1.3.

8.13.3.5.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_EC defined in Clause 8.13.3.5.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_EC, Inter provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.1.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.1.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.1.2-1.

**Table 8.13.3.5.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.5.1.2-1B: Requirement to identify a newly detectable FDD interfrequency cell when eDRX\_CONN is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.18-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.1.2-2.

**Table 8.13.3.5.1.2-2: Requirement to measure FDD interfrequency cells**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | 0 | ≤0.16 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.5.1.2-3: Requirement to measure FDD interfrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.1.2.1 Measurement Reporting Requirements

8.13.3.5.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.1.2.1.3.

8.13.3.5.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter, UE cat M1\_EC defined in Clause 8.13.3.5.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.2 E-UTRAN inter-frequency measurements for HD-FDD

8.13.3.5.2.1 E-UTRAN inter-frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.5.1.1 also apply for this section provided the following conditions are met:

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-2 for a corresponding Band

8.13.3.5.2.2 E-UTRAN inter frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.2.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.2.2-1.

**Table 8.13.3.5.2.2-1: Requirement to identify a newly detectable HD-FDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.5.2.2-1B: Requirement to identify a newly detectable HD-FDD interfrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-2 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.2.2-2.

**Table 8.13.3.5.2.2-2: Requirement to measure HD-FDD interfrequency cells**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | 0 | <0.128 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.128≤DRX-cycle≤0.16 | Note2 (7 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.5.2.2-3: Requirement to measure HD-FDD interfrequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.2.2.1 Measurement Reporting Requirements

8.13.3.5.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.2.2.1.3.

8.13.3.5.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_EC defined in Clause 8.13.3.5.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.3 E-UTRAN TDD inter frequency measurements

8.13.3.5.3.1 E-UTRAN inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable TDD inter frequency cell according to requirements in Table 8.13.3.5.3.1-1 when additional condition in Table 8.13.3.5.3.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.5.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

**Table 8.13.3.5.3.1-1: Requirement on cell identification delay and measurement delay for TDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_intra\_UE cat M1) for neighbouring cell SCH Ês/Iot (Q): -15≤ Q2 < -6 [dB]** | **Measurement delay (Tmeasure\_intra\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter \_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kinter \_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 321.6 \* Kinter\_M1\_EC s | 1600 \* Kinter\_M1\_EC ms Note1  3200 \* Kinter\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | 21.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC S | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 22.6 \* Kinter\_M1\_EC S | 1600 \* Kinter\_M1\_EC ms Note1  3200 \* Kinter\_M1\_EC ms Note2 |
| Note 1: Under TDD UL/DL configuration other than 0.  Note 2: Under TDD UL/DL configuration 0. | | | |



where X is signalled by the RRC parameter *measGapSharingScheme* and is defined as in Table 8.13.3.5.3.1-2.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

**Table 8.13.3.5.3.1-2: Value of parameter X for CEModeB**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

**Table 8.13.3.5.3.1-3: Requirement on cell identification delay and measurement delay for TDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **Cell identification delay (Tidentify\_inter\_UE cat M1)** | **Measurement delay (Tmeasure\_inter\_UE cat M1)** |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 3200) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 3200) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0. | | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.16-1 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16 with measurement period (Tmeasure\_inter\_UE cat M1\_EC) given by table 8.13.3.5.3.1-1:

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC.

8.13.3.5.3.1.1 Measurement Reporting Requirements

8.13.3.5.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.3.1.1.3.

8.13.3.5.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_EC defined in Clause 8.13.3.5.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.3.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_ UE catM1 as shown in table 8.13.3.5.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.3.2-1.

**Table 8.13.3.5.3.2-1: Requirement to identify a newly detectable TDD interfrequency cell**

|  |  |  |  |
| --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **Gap pattern ID** | **DRX cycle length (s)** | **Tidentify\_intra\_UE cat M1 (s) (DRX cycles)** |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

**Table 8.13.3.5.3.2-1A: Requirement to identify a newly detectable TDD interfrequency cell when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.16-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.3.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC  is as defined in Table 8.13.3.5.3.2-2.

**Table 8.13.3.5.3.2-2: Requirement to measure TDD inter frequency cells**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Neighbouring cell SCH Ês/Iot: Q2 [dB]** | **TDD Uplink-downlink**  **configuration** | **Gap pattern ID** | **DRX cycle length (s)** | **Tmeasure\_intra\_UE cat M1 (s) (DRX cycles)** |
| Q2≥-15 | Other than 0 | 0 | ≤0.16 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1) |
| 0 | 0 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.64 | 3.2 \* Kinter\_M1 (Note1) |
| 0.64<DRX-cycle≤2.56 | Note2(5) \* Kinter\_M1 |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use.  Note 2: Time depends upon the DRX cycle in use. | | | | |

**Table 8.13.3.5.3.2-3: Requirement to measure TDD inter frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.3.2.1 Measurement Reporting Requirements

8.13.3.5.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.3.2.1.3.

8.13.3.5.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_EC defined in Clause 8.13.3.5.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.6 Maximum allowed layers for multiple monitoring for UE category M1 with CE mode B

The UE UE category M1 configured with CE mode B shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

8.13.3.7 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M1 UE in CEModeB

All inter-frequency RSTD measurement requirements specified in Sections 8.13.3.7 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.13.3.7 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.21.18 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.13.3.7 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

8.13.3.7.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+ TMIB  ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.3.7.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.18.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.3.7.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.18.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.3.7.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.7.1.

8.13.3.7.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB  ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.3.7.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.18.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

**Table 8.13.3.7.2-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.18.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.13.3.7.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.3.7.2-2.

**Table 8.13.3.7.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.3.7.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.7.2.

8.13.3.7.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.7.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.18 are available for RSTD measurements in the measured and reference cells.

8.13.3.7.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period as defined in Clause 8.13.3.7.3.

8.14 Measurements for UE category NB1

8.14.1 Introduction

This clause contains requirements on the UE category NB1 regarding measurement in RRC\_CONNECTED state. The requirements are specified for NB-IoT intra frequency measurements for serving NB-IoT cell. These measurements may be used by the NB-IoT for uplink power control. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9. During the RRC\_CONNECTED state the UE shall continuously measure serving NB-IoT cell.

The UE shall meet all applicable requirements specified in clause 8.14 under the following conditions:

- at least 1 DL subframe per radio frame of serving NB-IoT cell is available at the UE during measurement period.

8.14.2 NB-IoT intra frequency measurements under normal coverage

8.14.2.1 NB-IoT intra frequency measurements when no DRX is used

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 800ms, unless the UE is capable of NSSS-based RRM measurements and *nsss-NumOccDiffPrecoders* value *n1* [2] is indicated by higher layers, by which the measurement period is [1600] ms. The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

8.14.2.2 NB-IoT intra frequency measurements when DRX is used

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.14.2.2-1.

**Table 8.14.2.2-1: Requirement for intrafrequency measurement**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| 0.256<DRX-cycle≤10.24 | Note1 (5) |
| Note1: Time depends upon the DRX cycle in use | |

The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1

8.14.3 NB-IoT intra frequency measurements under enhanced coverage

8.14.3.1 NB-IoT intra frequency measurements when no DRX is used

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 1600ms. The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

8.14.3.2 NB-IoT intra frequency measurements when DRX is used

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.14.3.2-1.

**Table 8.14.3.2-1: Requirement for intrafrequency measurement**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| 0.256<DRX-cycle≤10.24 | Note1 (5) |
| Note1: Time depends upon the DRX cycle in use | |

The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

*Change 23*

8.17 Measurements for E-UTRA – NR Dual Connectivity

8.17.1 Introduction

This clause contains requirements for UE supporting dual connectivity with E-UTRA PCell and NR PSCell.

Requirements in this clause are applicable to UEs which have been configured with EN-DC. Requirements in this clause are applicable to both E-UTRA FDD and E-UTRA TDD PCell in combination with an NR PSCell.

8.17.1.1 Measurement Gap Sharing

For UE configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on NR intra-frequency carriers or when SMTC configured for NR intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to identify and measure cells on E-UTRA gap-needed inter-frequency carriers, NR inter-frequency carriers, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on NR FR1 intra-frequency carriers or when SMTC configured for NR FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE is configured to identify and measure cells on E-UTRA gap-needed inter-frequency carriers, NR inter-frequency carriers, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

In this clause, NR intra-freuqency or NR inter-frequency measurement is defined respective to NR serving carriers as specified in clauses 9.2 and 9.3 of TS 38.133 [50], which is also inter-RAT measurement respective to E-UTRA serving carriers.

When network signals “01”, “10” or “11” with RRC parameter *measGapSharingScheme* [2] and the value of X is defined as in Table 8.17.1.1-1, and Kinter = 1 / (100 – X) \* 100.

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.1 of TS 38.133 [50]

**Table 8.17.1.1-1: Value of parameter X for EN-DC measurement gap sharing**

|  |  |
| --- | --- |
| ***measGapSharingScheme*** | **Value of X (%)** |
| ‘00’ | Equal splitting |
| ‘01’ | 25 |
| ‘10’ | 50 |
| ‘11’ | 75 |
| Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table *to be applied*, when *MeasGapSharingScheme is absent and there is* no stored value in the field. | |

8.17.1A Intrafrequency Measurements

PCC intra-frequency measurements shall meet all applicable requirements in clause 8.1.2.2. If MCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

SCC intra-frequency measurements shall meet all applicable requirements in clause 8.3.3. If MCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

8.17.2 SFTD Measurements

8.17.2.1 Introduction

This clause contains SFTD measurement requirements on UE capabilities for support of EN-DC in RRC\_CONNECTED state. The overall delay includes RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2], and SFTD measurement reporting delay in clause 8.17.2.3.

8.17.2.2 SFTD Measurement requirements

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be Tmeasure\_SFTD1 = max(200,[5] x SMTC period) ms.

When DRX is used in either of the E-UTRA PCell or the NR PSCell, or in both PCell and PSCell, the physical layer measurement period (Tmeasure\_SFTD1) of the SFTD measurement shall be as specified in table 8.17.2.2-1.

**Table 8.17.2.2-1: SFTD measurement requirement when DRX is used**

|  |  |
| --- | --- |
| **DRX cycle length (s) Note 3** | **Tmeasure\_SFTD1 (s)** |
| ≤0.04 | max(0.2,5 x SMTC period) (Note1) |
| 0.04<DRX cycle≤0.32 | 8 x max(DRX cycle, SMTC period) |
| 0.32<DRX cycle≤10.24 | 5 x DRX cycle |
| Note 1: Number of DRX cycles depends upon the DRX cycle in use  Note 2: (Void)  Note 3: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell. | |

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed Tmeasure\_SFTD2 as defined by the following expression:

Tmeasure\_SFTD2 = (M+1)\*(Tmeasure\_SFTD1) + M\*TPSCell\_change\_ENDC

where:

M is the number of times the NR PSCell is changed over the measurement period (Tmeasure\_SFTD2), and

TPSCell\_change\_ENDC is the time necessary to change the PSCell; it can be up to 25 ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from PSCell, the UE shall terminate SFTD measurements.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.27.

8.17.2.3 SFTD Measurement Reporting Delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier-based switching, an additional delay can be expected.

The SFTD measurement reporting delay shall be less than measurement period defined in clause 8.17.2.2.

8.17.3 E-UTRA Inter-frequency Measurements when Configured with E-UTRA-NR Dual Connectivity Operation

8.17.3.1 Introduction

The E-UTRAN inter frequency measurement requirements defined in section 8.17.3 shall apply when the UE capable of EN-DC is operating in EN-DC mode. The requiremenents in section 8.17.3 are applicable for gap pattern id # 0, 1, 2, 3, 4, 6, 7, 8, 10 as defined specified in Table 8.1.2.1-1.

When per-UE measurement gap is configured, the scaling factor CSSFE-UTRA, NSA used in the E-UTRAN inter frequency measurement requirements for the UE configured with EN-DC mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When per-FR gap is configured, the scaling factor CSSFE-UTRA, NSA shall exclude the frequencies not on the corresponding frequency range. When the UE is not configured with EN-DC mode then the E-UTRAN inter frequency measurement requirements defined in section 8.1.2.3 shall apply.

8.17.3.2 E-UTRAN FDD inter frequency measurements

8.17.3.2.1 E-UTRAN FDD inter frequency measurements when no DRX is used

8.17.3.2.1.1 Introduction

The requirements in this section shall apply for E-UTRAN FDD-FDD inter frequency measurements and for E-UTRAN TDD-FDD inter frequency measurements when the UE is operating in EN-DC mode.

8.17.3.2.1.2 Requirements

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, then the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:



Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Tinter1 is defined in clause 8.1.2.1.

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.17.3.2.1.2-1.

**Table 8.17.3.2.1.2-1: Measurement period and measurement bandwidth**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms]** | **Measurement bandwidth [RB]** |
| 0 | 480 x CSSFE-UTRA, NSA | 6 |
| 1 (Note 1) | 240 x CSSFE-UTRA, NSA | 50 |
| Note 1: This configuration is optional | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 6 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.17.3.2.2-1.

8.17.3.2.1.3 Measurement Reporting Requirements

8.17.3.2.1.3.1 Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.2.1.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.2.1.3.3.

8.17.3.2.1.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T Identify Inter defined in clause 8.17.3.2.1When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period, TIdentify Inter defined in clause 8.17.3.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.17.3.2.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.17.3.2.2 E-UTRAN FDD inter frequency measurements when DRX is used

8.17.3.2.2.1 Introduction

The requirements in this section shall apply for E-UTRAN FDD-FDD inter frequency measurements and for E-UTRAN TDD-FDD inter frequency measurements when the UE is operating in EN-DC mode.

8.17.3.2.2.2 Requirements

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within TIdentify Inter. When DRX is in use, Tidentify\_inter is as defined in Table 8.17.3.2.2.2-1, and when eDRX\_CONN is in use, TIdentify Inter is as defined in Table 8.17.3.2.2.2-1A. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

**Table 8.17.3.2.2.2-1: Requirement to identify a newly detectable FDD interfrequency cell**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **Tidentify\_inter (s) (DRX cycles)** | |
|  | **Gap period = 40 ms, 20 ms** | **Gap period = 80 ms** |
| ≤ 0.16 | Non DRX Requirements in clause 8.17.3.1 are applicable | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.256 | 5.12\* CSSFE-UTRA, NSA  (20\* CSSFE-UTRA, NSA) | 7.68\* CSSFE-UTRA, NSA (30\* CSSFE-UTRA, NSA) |
| 0.32 | 6.4\* CSSFE-UTRA, NSA (20\* CSSFE-UTRA, NSA) | 7.68\* CSSFE-UTRA, NSA (24\* CSSFE-UTRA, NSA) |
| 0.32< DRXcycle ≤2.56 | Note (20\* CSSFE-UTRA, NSA) | Note (20\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | | |

**Table 8.17.3.2.2.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used**

|  |  |  |
| --- | --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tidentify\_inter (s) (eDRX\_CONN cycles)** | |
|  | **Gap period = 40 ms, 20 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\* CSSFE-UTRA, NSA) | Note (20\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.17.3.2.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.17.3.2.2.2-3. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

**Table 8.17.3.2.2.2-2: Requirement to measure FDD interfrequency cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_inter (s) (DRX cycles)** |
| ≤ 0.08 | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (5\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | |

**Table 8.17.3.2.2.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| **eDRX\_CONN cycle length (s)** | **Tmeasure\_inter (s) (eDRX\_CONN cycles)** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

8.17.3.3.2.3 Measurement Reporting Requirements

8.17.3.3.2.3.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.3.2.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.3.2.3.3.

8.17.3.3.2.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.17.3.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify Inter defined in clause 8.17.3.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasure\_Inter defined in clause 8.17.3.2.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.17.3.3 E-UTRAN TDD inter frequency measurements

8.17.3.3.1 E-UTRAN TDD inter frequency measurements when no DRX is used

8.17.3.3.1.1 Introduction

The requirements in this section shall apply for E-UTRAN TDD-TDD inter frequency measurements and for E-UTRAN FDD-TDD inter frequency measurements when the UE is operating in EN-DCmode.

8.17.3.3.1.2 Requirements

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, then the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter according to the following expression:



Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

Tinter1 is defined in clause 8.1.2.1.

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.17.3.3.1.2-1.

**Table 8.17.3.3.1.2-1: TMeasurement\_Period\_TDD\_Inter for different configurations**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Configuration** | **Measurement bandwidth [RB]** | **Number of UL/DL sub-frames per half frame (5 ms)** | | **DwPTS** | | **TMeasurement\_Period\_TDD\_Inter [ms]** |
|  | **DL** | **UL** | **Normal CP** | **Extended CP** |
| 0 | 6 | 2 | 2 |  |  | 480 x CSSFE-UTRA, NSA |
| 1 (Note 1) | 50 | 2 | 2 |  |  | 240 x CSSFE-UTRA, NSA |
| 2 | 6 | 1 | 3 |  |  | 720 x CSSFE-UTRA, NSA |
| 3 (Note 1) | 50 | 1 | 3 |  |  | 480 x CSSFE-UTRA, NSA |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16] | | | | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 6 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.17.3.3.1.2-1.

8.17.3.3.1.3 Measurement Reporting Requirements

8.17.3.3.1.3.1 Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.3.1.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.3.1.3.3.

8.17.3.3.1.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T Identify Inter defined in clause 8.17.3.3.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period, TIdentify Inter defined in clause 8.17.3.3.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_TDD defined in clause 8.17.3.3.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

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9.1.6A Inter-frequency RSRQ Accuracy Requirements in High Doppler Conditions

The accuracy requirements in this clause are applicable for EVA300 and EVA600 propagation conditions and assume independent interference (noise) at each receiver antenna port.

9.1.6A.1 Absolute RSRQ Accuracy in high Doppler conditions

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6A.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

**Table 9.1.6A.1-1: RSRQ Inter frequency absolute accuracy**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.6A.2 Relative Accuracy of RSRQ in high Doppler conditions

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.6A.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

**Table 9.1.6A.2-1: RSRQ Inter frequency relative accuracy**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±3.5 | ±5.0 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.5 | ±5.0 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

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9.1.20.2 SSTD Measurement Report Mapping

SFN and subframe timing difference (SSTD) measurement report comprises 3 elements:

SFN offset between MeNB and SeNB (ΔX)

Reporting range of ΔX is between frame number # 0 to frame number # 1023 as defined in TS 36.331 [2].

Frame boundary offset between MeNB and SeNB (ΔY)

Reporting range of ΔY is between subfrane number #-5 and subframe number# 4 as defined in TS 36.331 [2].

Subframe boundary offset between MeNB and SeNB (ΔZ)

The reporting range of value of ΔZ is within -1320Ts, -700T] and 700Ts, 1320Ts with reporting granularity of 10Ts.

The mapping of measured Subframe boundary offset (ΔZ) is defined in Table 9.1.20.2-1.

**Table 9.1.20.2-1: SSTD report mapping**

|  |  |  |
| --- | --- | --- |
| **Reported Value** | **Measured Quantity Value** | **Unit** |
| SUBFRAME\_BOUNDARY\_OFFSET\_00 | ΔZ ≤ -1320 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_01 | -1320 < ΔZ ≤ -1310 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_02 | -1310 < ΔZ ≤ -1300 | Ts |
| … | … | … |
| SUBFRAME\_BOUNDARY\_OFFSET\_62 | -710 < ΔZ ≤ -700 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_63 | -700 < ΔZ ≤ 0 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_64 | 0 < ΔZ ≤ 700 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_65 | 700 < ΔZ ≤ 710 | Ts |
| … | … | … |
| SUBFRAME\_BOUNDARY\_OFFSET\_125 | 1300 < ΔZ ≤ 1310 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_126 | 1310 < ΔZ ≤ 1320 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_127 | 1320 < ΔZ | Ts |

9.1.21 Measurement accuracy for UE category M1

The requirements in this clause are applicable for UE category M1. The requirements in clause 9.1.21.1, 9.1.21.2, 9.1.21.6, 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14 are also applicable for ETU220 propagation condition when *highSpeedMeasGapCE-ModeA* is configured.

9.1.21.1 Intra-frequency Absolute RSRP Accuracy for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.1-1 and Table 9.1.21.1-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.1-1: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.21.1-2: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.21.2 Intra-frequency Relative Accuracy of RSRP for UE category M1 with CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for category M1 UE.

The accuracy requirements in Table 9.1. 21.2-1 and Table 9.1. 21.2-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.2-1: RSRP Intra frequency relative accuracy for UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±3 | ±4 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.2-2: RSRP Intra frequency relative accuracy for UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±3 | ±4 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.3 Intra-frequency Absolute RSRP Accuracy for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.3-1 and Table 9.1.21.3-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.3-1: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.21.3-2: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.21.4 Intra-frequency Relative Accuracy of RSRP for UE category M1 with CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.4-1 and Table 9.1.21.4-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.4-1: RSRP Intra frequency relative accuracy for UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±4 | ±4 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.4-2: RSRP Intra frequency relative accuracy for UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±4 | ±4 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.5 RSRP Measurement Report Mapping

The reporting range of RSRP is the same as defined in section 9.1.4.

9.1.21.6 Intra-frequency Absolute Accuracy of RSRQ for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Tables 9.1.21.6-1 and 9.1.21.6-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

**Table 9.1.21.6-1: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.6-2: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.7 Intra-frequency Absolute Accuracy of RSRQ for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Tables 9.1.21.7-1 and 9.1.21.7-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

**Table 9.1.21.7-1: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.7-2: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.8 RSRQ Measurement Report Mapping

The reporting range of RSRQ is the same as defined in section 9.1.7.

9.1.21.9 Inter-frequency Absolute RSRP Accuracy for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.9-1 and Table 9.1.21.9-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.9-1: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.21.9-2: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.21.10 Inter-frequency Relative Accuracy of RSRP for UE category M1 with CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.10-1 and Table 9.1.21.10-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.10-1: RSRP Inter frequency relative accuracy for UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±7 | ±8 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±8 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.10-2: RSRP Inter frequency relative accuracy for UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±7 | ±8 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±8 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.11 Inter-frequency Absolute RSRP Accuracy for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.11-1 and Table 9.1.21.11-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.11-1: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.21.11-2: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| [8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.21.12 Inter-frequency Relative Accuracy of RSRP for UE category M1 with CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.12-1 and Table 9.1.21.12-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.21.12-1: RSRP Inter frequency relative accuracy for UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.12-2: RSRP Inter frequency relative accuracy for UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.13 Inter-frequency Absolute Accuracy of RSRQ for UE category M1 in CE mode A

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Tables 9.1.21.13-1 and 9.1.21.13-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

**Table 9.1.21.13-1: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.13-2: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.14 Inter-frequency Relative Accuracy of RSRQ for UE category M1 in CE mode A

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.21.14-1 and 9.1.21.14-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

**Table 9.1.21.14-1: RSRQ Inter frequency relative accuracy UE category M1 with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±4.5 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5.5 | ±5.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.14-2: RSRQ Inter frequency relative accuracy UE category M1 with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±4.5 | ±5.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5.5 | ±5.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.15 Inter-frequency Absolute Accuracy of RSRQ for UE category M1 in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Tables 9.1.21.15-1 and 9.1.21.15-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

**Table 9.1.21.15-1: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.15-2: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.16 Inter-frequency Relative Accuracy of RSRQ for UE category M1 in CE mode B

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.21.16-1 and 9.1.21.16-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

**Table 9.1.21.16-1: RSRQ Inter frequency relative accuracy UE category M1 with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±5.5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.21.16-2: RSRQ Inter frequency relative accuracy UE category M1 with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±5.5 | ±6.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.17 Inter-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode A

The accuracy requirements in Table 9.1.21.17-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.31 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.21.17-1: RSTD measurement accuracy for CEModeA**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i*** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 4 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

9.1.21.18 Inter-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode B

The accuracy requirements in Table 9.1.21.18-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.31 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.21.18-1: RSTD measurement accuracy for CEModeB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i*** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 4 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| [±21] | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

9.1.21.19 UE RX-TX time difference Accuracy Requirement for Cat-M1

The UE RX-TX time difference is measured from the PCell.

The accuracy requirements in Table 9.1.21.19-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.2.14 for a corresponding Band

**Table 9.1.21.19-1: UE Rx – Tx time difference measurement accuracy for CEModeA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | |
| **Ês/Iot** | **Downlink transmission**  **bandwidth of PCell** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±20 | ≥-3 dB | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.21.20 Intra-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode A

The accuracy requirements in Table 9.1.21.20-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.33 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.21.20-1: RSTD measurement accuracy for CEModeA**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 4** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 5 range** | | |
| **E-UTRA operating band groups Note 6** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±15Note7 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15 Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 8: The requirement applies when measurement gaps are required. | | | | | | | |

9.1.21.21 Intra-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode B

The accuracy requirements in Table 9.1.21.21-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.33 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.21.21-1: RSTD measurement accuracy for CEModeB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 4** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 5 range** | | |
| **E-UTRA operating band groups Note 6** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±15Note7 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 30 | ≥6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15 Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 30 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 8: The requirement applies when measurement gaps are required. | | | | | | | |

9.1.22 Measurement accuracy for UE Category NB1

9.1.22.1 Intra-frequency Absolute NRSRP Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE Category NB1 for stand-alone, guard-band and in-band deployments. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.1-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.1-1 shall apply.

The accuracy requirements in Table 9.1.22.1-1 and Table 9.1.22.1-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.25 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRP measurement assuming measured cell is identified cell.

**Table 9.1.22.1-1: NRSRP Intra frequency absolute accuracy for UE Category NB1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±10.3 | ±13.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | - 122.9 | N/A | -70 |
| ±12.3 | ±15.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.22.1-2: NRSRP Intra frequency absolute accuracy for UE Category NB1 under NSSS-based measurement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±4 | ±7 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±6 | ±9 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.22.2 Void

9.1.22.3 Intra-frequency Absolute NRSRQ Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRQ in this clause apply to a cell on the same frequency as that of the serving cell for NB-IoT UE for stand-alone, guard-band and in-band deployments. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.3-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.3-1 shall apply.

The accuracy requirements in Table 9.1.22.3-1 and Table 9.1.22.3-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.25 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRQ measurement assuming measured cell is identified cell.

**Table 9.1.22.3-1: NRSRQ Intra frequency absolute accuracy for UE Category NB1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±5.2 | ±8.2 | ≥-3 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±7.2 | ±10.2 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| ±9.5 | ±12.5 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±11.5 | ±14.5 | -15≤Ês/Iot≤--6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.22.3-2: NRSRQ Intra frequency absolute accuracy for UE Category NB1 under NSSS-based measurement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±3.2 | ±6.2 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±5.2 | ±8.2 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±5.2 | ±8.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±7.2 | ±10.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.22.4 Void

9.1.22.5 Inter-frequency Absolute NRSRP Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRP in this clause apply to a cell that has different carrier frequency from the serving cell. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.5-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.5-1 shall apply.

The accuracy requirements in Table 9.1.22.5-1 and Table 9.1.22.5-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.26 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRP measurement assuming measured cell is identified cell.

**Table 9.1.22.5-1: NRSRP Inter frequency absolute accuracy for UE Category NB1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±10.3 | ±13.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±12.3 | ±15.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.22.5-2: NRSRP Inter frequency absolute accuracy for UE Category NB1 under NSSS-based measurement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±4 | ±7 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±6 | ±9 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.22.6 Void

9.1.22.7 Inter-frequency Absolute NRSRQ Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRQ in this clause apply to a cell that has different carrier frequency from the serving cell. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.7-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.7-1 shall apply.

The accuracy requirements in Table 9.1.22.7-1 and Table 9.1.22.7-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.26 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRQ measurement assuming measured cell is identified cell.

**Table 9.1.22.7-1: NRSRQ Inter frequency absolute accuracy for UE Category NB1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±5.2 | ±8.2 | ≥-3 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±7.2 | ±10.2 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| ±9.5 | ±12.5 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±11.5 | ±14.5 | -15≤Ês/Iot≤--6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.22.7-2: NRSRQ Inter frequency absolute accuracy for UE Category NB1 under NSSS-based measurement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 2** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±3.2 | ±6.2 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±5.2 | ±8.2] | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±5.2 | ±8.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±7.2 | ±10.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.22.8 Void

9.1.22.9 NRSRP Measurement Report Mapping

The reporting range of NRSRP is defined from -156 dBm to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 9.1.22.9-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 9.1.22.9-1: NRSRP measurement report mapping**

|  |  |  |
| --- | --- | --- |
| **Reported value** | **Measured quantity value** | **Unit** |
| NRSRP\_00 | NRSRP < -156 | dBm |
| NRSRP\_01 | -156 ≤ NRSRP < -155 | dBm |
| NRSRP\_02 | -155 ≤ NRSRP < -154 | dBm |
| … | … | … |
| NRSRP\_111 | -46 ≤ NRSRP < -45 | dBm |
| NRSRP\_112 | -45 ≤ NRSRP < -44 | dBm |
| NRSRP\_113 | -44 ≤ NRSRP | dBm |

9.1.22.10 Intra-Frequency RSTD Accuracy Requirement for NB1 for normal coverage

The accuracy requirements in Table 9.1.22.10-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

**Table 9.1.22.10-1: Intra RSTD measurement accuracy for normal coverage**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **NPRS Ês/Iot** | **UE NPRS measurement**  **bandwidth on the reference cell and the measured neighbour cell *i* Note 3** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*, *NNPRS\_total* Note 6** | **Io Note 7 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±20 | (NPRS Ês/Iot)ref ≥-6dB  and  (NPRS Ês/Iot)*i* ≥-13dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

9.1.22.11 Inter-Frequency RSTD Accuracy Requirement for NB1 for normal coverage

The accuracy requirements in Table 9.1.22.11-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

**Table 9.1.22.11-1: Inter RSTD measurement accuracy for normal coverage**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **NPRS Ês/Iot** | **UE NPRS measurement**  **bandwidth on the reference cell and the measured neighbour cell *i* Note 3** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*, *NNPRS\_total* Note 6** | **Io Note 7 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±28 | (NPRS Ês/Iot)ref ≥-6dB  and  (NPRS Ês/Iot)*i* ≥-13dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

9.1.22.12 Intra-Frequency RSTD Accuracy Requirement for NB1 for enhanced coverage

The accuracy requirements in Table 9.1.22.12-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

**Table 9.1.22.12-1: RSTD measurement accuracy for enhanced coverage**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **NPRS Ês/Iot** | **UE NPRS measurement**  **bandwidth on the reference cell and the measured neighbour cell *i* Note 3** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* , *NNPRS\_total* Note 6** | **Io Note 7 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±32 | (NPRS Ês/Iot)ref ≥-15dB  and  (NPRS Ês/Iot)*i* ≥-15dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

9.1.22.13 Inter-Frequency RSTD Accuracy Requirement for NB1 for enhanced coverage

The accuracy requirements in Table 9.1.22.13-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

**Table 9.1.22.13-1: RSTD measurement accuracy for enhanced coverage**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **NPRS Ês/Iot** | **UE NPRS measurement**  **bandwidth on the reference cell and the measured neighbour cell *i* Note 3** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* , *NNPRS\_total* Note 6** | **Io Note 7 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±40 | (NPRS Ês/Iot)ref ≥-15dB  and  (NPRS Ês/Iot)*i* ≥-15dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

9.1.22.14 NRSRQ Measurement Report Mapping

The reporting range of NRSRQ is defined from -34 dB to 2.5 dB with 0.5 dB resolution.

The mapping of measured quantity is defined in table 9.1.22.14-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 9.1.22.14-1: NRSRQ measurement report mapping**

|  |  |  |
| --- | --- | --- |
| **Reported value** | **Measured quantity value** | **Unit** |
| NRSRQ\_-30 | NRSRQ < -34 | dB |
| NRSRQ\_-29 | -34 ≤ NRSRQ < -33.5 | dB |
| … | … | … |
| NRSRQ\_-02 | -20.5 ≤ NRSRQ < -20 | dB |
| NRSRQ\_-01 | -20 ≤ NRSRQ < -19.5 | dB |
| NRSRQ\_00 | NRSRQ < -19.5 | dB |
| NRSRQ\_01 | -19.5 ≤ NRSRQ < -19 | dB |
| NRSRQ\_02 | -19 ≤ NRSRQ < -18.5 | dB |
| … | … | … |
| NRSRQ\_32 | -4 ≤ NRSRQ < -3.5 | dB |
| NRSRQ\_33 | -3.5 ≤ NRSRQ < -3 | dB |
| NRSRQ\_34 | -3 ≤ NRSRQ | dB |
| NRSRQ\_35 | -3 ≤ NRSRQ < -2.5 | dB |
| NRSRQ\_36 | -2.5 ≤ NRSRQ < -2 | dB |
| … | … | … |
| NRSRQ\_45 | 2 ≤ NRSRQ < 2.5 | dB |
| NRSRQ\_46 | 2.5 ≤ NRSRQ | dB |

9.1.22.15 MSG3-based Measurement Report Mapping for UE Category NB1

**Table 9.1.22.15-1: Downlink channel quality measurement report mapping of CQI-NPDCCH-NB when the DL channel quality reporting is supported [7]**

|  |  |
| --- | --- |
| **Reported value** | **NPDCCH repetition level** |
| noMeasurement | No measurement reporting |
| candidateRep-A | 1 |
| candidateRep-B | 2 |
| candidateRep-C | 4 |
| candidateRep-D | 8 |
| candidateRep-E | 16 |
| candidateRep-F | 32 |
| candidateRep-G | 64 |
| candidateRep-H | 128 |
| candidateRep-I | 256 |
| candidateRep-J | 512 |
| candidateRep-K | 1024 |
| candidateRep-L | 2048 |

The NPDCCH repetition level for CQI-NPDCCH-Short-NB is chosen with regard to the signalled parameter Rmax, the maximum number of repetitions for NPDCCH common search space for random access response (npdcch-NumRepetitions-RA) in SystemInformationBlockType2-NB. The report mapping is defined in Table 9.1.22.15-2.

**Table 9.1.22.15-2: Downlink channel quality measurement report mapping of CQI-NPDCCH-Short-NB when the DL channel quality reporting is supported [7]**

|  |  |
| --- | --- |
| **Reported value** | **NPDCCH repetition level** |
| noMeasurements | No measurement reporting |
| candidateRep-1 | Rmax/8 (NOTE 1) |
| candidateRep-2 | Rmax (NOTE 3) |
| candidateRep-3 | 4×Rmax (NOTE 2) |
| NOTE 1: When Rmax is less than 8, set candidateRep-1 to 1.  NOTE 2: When Rmax is more than 512, set candidateRep-3 to 2048.  NOTE 3: When Rmax is 1, set candidateRep-2 to 2. | |

9.1.22.16 Downlink Channel Quality Measurement Accuracy for UE Category NB1

The requirements for accuracy of downlink channel quality reporting in this clause apply only to the serving cell on the anchor carrier for UE Category NB1.

The accuracy requirements in Table 9.1.22.16-1 are valid under the following conditions:

- Cell specific reference signals are transmitted either from one or two ports.

- Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

- NRSRP|dBm according to Annex B.3.25 for a corresponding Band.

**Table 9.1.22.16-1: Downlink channel quality reporting accuracy for UE Category NB1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **NPDCCH Repetition** | **Pm-Dsg (%)** | **Conditions** | | | | |
| **Ês/Iot** | **Io NOTE 1 range** | | | |
| **E-UTRA operating band groups NOTE 2** | **Minimum Io** | | **Maximum Io** |
|  | **dB** |  | **dBm/15kHz** | **dBm/BWChannel** | **dBm/BWChannel** |
| R NOTE 1 | ≤1 | ≥ -6 dB | NFDD\_G | -122.9 | N/A | -70 |
| R/4 NOTE 1 | >1 | ≥ -6 dB | NFDD\_G | -122.9 | N/A | -70 |
| R NOTE 1 | ≤1 | -15 ≤ Ês/Iot ≤ -6 dB | NFDD\_G | - 122.9 | N/A | -70 |
| R/8 NOTE 1 | >1 | -15 ≤ Ês/Iot ≤ -6 dB | NFDD\_G | - 122.9 | N/A | -70 |
| NOTE 1: R is the reported NPDCCH repetition level that UE has reported in CQI-NPDCCH-NB or CQI-NPDCCH-Short-NB.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.23 Power Headroom for UE Category NB1

The requirements in this clause shall apply for power headroom for UE Category NB1 as defined in [31].

The power headroom provides the serving eNB with information about the differences between the UE configured maximum output power (PCMAX,) defined in TS 36.101 [5] and the estimated power for UL-NSCH transmission of the serving cell [3].

**Table 9.1.23 -1: The applicability of power headroom report mapping requirements for different power class UE**

|  |  |
| --- | --- |
| **Power class** | **Power headroom report mapping** |
| PC3 and PC5 | As defined in section 9.1.23.3 |
| PC6 | As defined in section 9.1.23.4 |

9.1.23.1 Period

The reported power headroom shall be estimated over 1 slot of NPUSCH transmissions.

9.1.23.2 Reporting Delay

The power headroom reporting delay is defined as the time between the beginning of the power headroom reference period and the time when the UE starts transmitting the power headroom over the radio interface. The reporting delay of the power headroom shall be 0 ms, which is applicable for all configured triggering mechanisms for power headroom reporting.

9.1.23.3 Report Mapping for UE Category NB1

The power headroom reporting range is from -54 dB ...+11 dB for UE category NB1 when the enhanced coverage level 0 is selected during the random access procedure [17]. The report mapping is defined in Table 9.1.23.3-1 for UEs not supporting enhanced PHR, and in Table 9.1.23.3-1A for UEs supporting enhanced PHR[31].

**Table 9.1.23.3-1: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17]**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < 5 |
| POWER\_HEADROOM\_1 | 5 ≤ PH < 8 |
| POWER\_HEADROOM\_2 | 8 ≤ PH < 11 |
| POWER\_HEADROOM\_3 | PH ≥ 11 |

**Table 9.1.23.3-1A: Power headroom report mapping for UE category NB1 UEs supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17]**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -5 ≤ PH < -37 |
| POWER\_HEADROOM\_1 | -37 ≤ PH < -33 |
| POWER\_HEADROOM\_2 | -33 ≤ PH < -29 |
| POWER\_HEADROOM\_3 | -29 ≤ PH < -25 |
| POWER\_HEADROOM\_4 | -25 ≤ PH < -21] |
| POWER\_HEADROOM\_5 | -21 ≤ PH < -17 |
| POWER\_HEADROOM\_6 | -17 ≤ PH < -13 |
| POWER\_HEADROOM\_7 | -13 ≤ PH < -9 |
| POWER\_HEADROOM\_8 | -9 ≤ PH < -5 |
| POWER\_HEADROOM\_9 | -5 ≤ PH < -1 |
| POWER\_HEADROOM\_10 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_11 | 3]≤ PH < 7 |
| POWER\_HEADROOM\_12 | 7≤ PH < 1] |
| POWER\_HEADROOM\_13 | 11] ≤ PH < 15 |
| POWER\_HEADROOM\_14 | 15 ≤ PH < 19 |
| POWER\_HEADROOM\_15 | PH ≥ 19 |

The power headroom reporting range is from -54 dB ...+6 or 11 dB for UE category NB1 when enhanced coverage level other than 0 is selected during the random access procedure [17]. The report mapping is defined in Table 9.1.23.3-2 for the UEs not supporing enhanced PHR, and in Table 9.1.23.3-2A for UEs supporting enhanced PHR [31].

**Table 9.1.23.3-2: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR [31] when the enhanced coverage level other than 0 is selected during random access procedure [17]**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -10 |
| POWER\_HEADROOM\_1 | -10 ≤ PH < -2 |
| POWER\_HEADROOM\_2 | -2 ≤ PH < 6 |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

**Table 9.1.23.3-2A: Power headroom report mapping for UE category NB1 supporting enhanced PHR [31] when the enhanced coverage level other than 0 is selected during random access procedure [17]**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -45 |
| POWER\_HEADROOM\_1 | -45 ≤ PH < -41] |
| POWER\_HEADROOM\_2 | -41 ≤ PH < -37 |
| POWER\_HEADROOM\_3 | -37 ≤ PH < -33 |
| POWER\_HEADROOM\_4 | -33 ≤ PH < -29 |
| POWER\_HEADROOM\_5 | -29 ≤ PH < [25 |
| POWER\_HEADROOM\_6 | -25 ≤ PH < -21 |
| POWER\_HEADROOM\_7 | -21 ≤ PH < -17 |
| POWER\_HEADROOM\_8 | -17 ≤ PH < -13] |
| POWER\_HEADROOM\_9 | -13 ≤ PH < -9 |
| POWER\_HEADROOM\_10 | -9 ≤ PH < -5 |
| POWER\_HEADROOM\_11 | -5 ≤ PH < -1 |
| POWER\_HEADROOM\_12 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_13 | 3 ≤ PH < 7 |
| POWER\_HEADROOM\_14 | 7 ≤ PH < 1] |
| POWER\_HEADROOM\_15 | PH ≥ 11 |

9.1.23.3.1 Void

9.1.23.3.2 Void

9.1.23.4 Report Mapping for UE Category NB1 for UE Power Class 6

The power headroom reporting range is -54 dB … +11 dB for UE category NB1 when the enhanced coverage level 0 is selected during the random access procedure [17] for UE power class 6 [5]. The report mapping is defined in Table 9.1.23.4-1 for the UEs not supporting enhanced PHR, and in Table 9.1.23.4-1A for UEs supporting enhanced PHR [31].

**Table 9.1.23.4-1: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR when the enhanced coverage level 0 is selected during random access procedure [17] for UE PC6**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < 5] |
| POWER\_HEADROOM\_1 | 5 ≤ PH < 8 |
| POWER\_HEADROOM\_2 | 8 ≤ PH < 11 |
| POWER\_HEADROOM\_3 | PH ≥ 11 |

**Table 9.1.23.4-1A: Power headroom report mapping for UE category NB1 for UE PC6 and supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17] for UE PC6**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < [45 |
| POWER\_HEADROOM\_1 | -45 ≤ PH < [41 |
| POWER\_HEADROOM\_2 | -41 ≤ PH < [37 |
| POWER\_HEADROOM\_3 | -37 ≤ PH < [33 |
| POWER\_HEADROOM\_4 | -33 ≤ PH < [29 |
| POWER\_HEADROOM\_5 | -29 ≤ PH < [25 |
| POWER\_HEADROOM\_6 | -25 ≤ PH < [-1 |
| POWER\_HEADROOM\_7 | -21 ≤ PH < [17 |
| POWER\_HEADROOM\_8 | -17 ≤ PH < [1] |
| POWER\_HEADROOM\_9 | -13 ≤ PH < [] |
| POWER\_HEADROOM\_10 | -9 ≤ PH < [5 |
| POWER\_HEADROOM\_11 | -5 ≤ PH < [1 |
| POWER\_HEADROOM\_12 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_13 | 3 ≤ PH < 7 |
| POWER\_HEADROOM\_14 | 7 ≤ PH < 11 |
| POWER\_HEADROOM\_15 | PH ≥ 11 |

The power headroom reporting range is from -54 dB ...0 dB for UE category NB1 when the enhanced coverage level other than 0 is selected during the random access procedure [17] for UE power class of 6 [5]. The report mapping is defined in Table 9.1.23.4-2.

**Table 9.1.23.4-2: Power headroom report mapping for UE category NB1 when the enhanced coverage level other than 0 is selected during random access procedure [17] for UE PC6**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -5] ≤ PH < -20 |
| POWER\_HEADROOM\_1 | -20 ≤ PH < -10 |
| POWER\_HEADROOM\_2 | -10 ≤ PH < 0 |
| POWER\_HEADROOM\_3 | PH ≥ 0 |

9.1.24 Void

9.1.25 Measurement accuracy for UE category M2

9.1.25.1 Inter-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode A

The accuracy requirements in Table 9.1.25.1-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.32 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.25.1-1: RSTD measurement accuracy for CEModeA**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i*** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 5 range** | | |
| **E-UTRA operating band groups Note 6** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| [21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 24 | ≥ 4 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

9.1.25.2 Inter-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode B

The accuracy requirements in Table 9.1.25.2-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.32 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.25.2-1: RSTD measurement accuracy for CEModeB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i*** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 5 range** | | |
| **E-UTRA operating band groups Note 6** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±21 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10] | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 24 | ≥ 8 | ≥ 4 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

9.1.25.3 UE RX-TX time difference Accuracy Requirement for Cat-M2

The UE RX-TX time difference is measured from the PCell.

The accuracy requirements in Table 9.1.25.3-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.2.14 for a corresponding Band

**Table 9.1.25.3-1: UE Rx – Tx time difference measurement accuracy for CEModeA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | |
| **Ês/Iot** | **Downlink transmission**  **bandwidth of PCell** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  | **dBm/15kHz** | **dBm/BWChannel** |
| [20 | ≥-3 dB | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10 | ≥-3 dB | ≥ 24 | Note 3 | Note 3 | Note 3 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≥1.4 MHz.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.25.4 Intra-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode A

The accuracy requirements in Table 9.1.25.4-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.34 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.25.4-1: RSTD measurement accuracy for CEModeA**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 6 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±15Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15Note9 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 24 | ≥ 4 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 8: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 9: The requirement applies when measurement gaps are required. | | | | | | | |

9.1.25.5 Intra-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode B

The accuracy requirements in Table 9.1.25.5-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.34 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

**Table 9.1.25.5-1: RSTD measurement accuracy for CEModeB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS**  **bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5** | **Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*** | **The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24]** | **Io Note 6 range** | | |
| **E-UTRA operating band groups Note 7** | **Minimum Io Note 1** | **Maximum Io** |
| **Ts Note 2** | **dB** | **RB** |  |  |  | **dBm/15kHz** | **dBm/BWChannel** |
| ±15Note8 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15Note9 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 24 | ≥ 8 | ≥ 4 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 8: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 9: The requirement applies when measurement gaps are required. | | | | | | | |

9.1.26 Measurement Accuracy for non-BL CE UE

The requirements defined in Section 9.1.26 do not apply when the UE is of category 1bis.

9.1.26.1 Intra-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.1-1 and Table 9.1.26.1-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.1-1: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode A for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.26.1-2: RSRP Intra frequency absolute accuracy for non-BL DE UE with CE mode A for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.26.2 Intra-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.2 applies.

9.1.26.3 Intra-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.3-1 and Table 9.1.26.3-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.3-1: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.26.3-2: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.26.4 Intra-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for the non-BL CE UE.

The accuracy requirements in Table 9.1.26.4-1 and Table 9.1.26.4-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.4-1: RSRP Intra frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±3 | ±3 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.4-2: RSRP Intra frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±3 | ±3 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.26.5 RSRP Measurement Report Mapping

The same RSRP reporting range as for UE category M1 in Clause 9.1.21.5 applies.

9.1.26.6 Intra-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.6 applies.

9.1.26.7 Intra-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell for the non-BL CE UE.

The accuracy requirements in Tables 9.1.26.7-1 and 9.1.26.7-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

**Table 9.1.26.7-1: RSRQ Intra frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.7-2: RSRQ Intra frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| [±4] | ±5.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.26.8 RSRQ Measurement Report Mapping

The same RSRQ reporting range as for UE category M1 in Clause 9.1.21.8 applies.

9.1.26.9 Inter-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.9-1 and Table 9.1.26.9-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.9-1: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode A for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.26.9-2: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode A for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.26.10 Inter-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for the non-BL CE UE.

The accuracy requirements in Table 9.1.26.10-1 and Table 9.1.26.10-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.10-1: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode A for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±5.5 | ±6.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.10-2: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode A for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±5.5 | ±6.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.26.11 Inter-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for the non-BL UE.

The accuracy requirements in Table 9.1.26.11-1 and Table 9.1.26.11-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.11-1: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

**Table 9.1.26.11-2: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | | |
| **E-UTRA operating band groups Note 3** | **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 2** | **dBm/BWChannel** | **dBm/BWChannel** |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| [6] | [9] | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

9.1.26.12 Inter-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency.

The accuracy requirements in Table 9.1.26.12-1 and Table 9.1.26.12-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

**Table 9.1.26.12-1: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.12-2: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz Note 4** | **dBm/BWChannel** |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.26.13 Inter-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.13 applies.

9.1.26.14 Inter-frequency Relative Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.14 applies.

9.1.26.15 Inter-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell for the non-BL CE UE.

The accuracy requirements in Tables 9.1.26.15-1 and 9.1.26.15-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

**Table 9.1.26.15-1: RSRQ Inter frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.15-2: RSRQ Inter frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 4** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 3 | **dBm/BWChannel** |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

9.1.26.16 Inter-frequency Relative Accuracy of RSRQ for non-BL CE UE in CE mode B

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.26.16-1 and 9.1.26.16-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

**Table 9.1.26.16-1: RSRQ Inter frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±4.5 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

**Table 9.1.26.16-2: RSRQ Inter frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Ês/Iot Note 2** | **Io Note 1 range** | | |
| **E-UTRA operating band groups Note 5** | **Minimum Io** | **Maximum Io** |
| **dB** | **dB** | **dB** |  | **dBm/15kHz** Note 4 | **dBm/BWChannel** |
| ±4.5 | ±5.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

*Change 26*

13.10 Selection / Reselection of V2X Synchronization Reference Source for V2X Carrier Aggregation

Requirements in this clause are applicable to UE supporting V2X sidelink carrier aggregation.

When the UE is synchronized to a SyncRef UE in a carrier and required only to search other SyncRef UEs in the synchronized carrier, the UE shall be able to identify a newly detectable V2X SyncRef UE within Tdetect,SyncRef UE\_V2X if the SyncRef UE meets the selection/reselection criterion defined in TS 36.331 [2]. UE shall be capable of performing S-RSRP measurements for 3 identified V2X SyncRef UE with the measurement period of 320 ms.

When the synchronization reference source for V2X sidelink carrier aggregation is lost and has to search SyncRef UE on the aggregated carriers which are configured as synchronization carrier, the UE shall be able to identify a newly detectable V2X SyncRef UE within N×Tdetect,SyncRef UE\_V2X if the SyncRef UE meets the selection/reselection criterion defined in TS 36.331 [2]. UE shall be capable of performing S-RSRP measurements for 3 identified V2X SyncRef UE per carrier with the measurement period of N×320 ms.

It is assumed that the identified V2X SyncRef UE does not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,

- The value of Tdetect,SyncRef UE\_V2X is as 1.6 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- in other case

- The value of Tdetect,SyncRef UE\_V2X is as 8 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 subframes of its V2X data reception on each carrier operating V2X sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- The value of Tdetect,SyncRef UE\_V2X is as 8 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 subframes of its V2X data reception on each carrier operating V2X sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

N is the number of aggregated carriers configured as synchronization carrier.