**3GPP TSG- Meeting #5-e**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **6856** | **rev** | 1 | **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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| ***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:*** | | The MPDCCH transmission parameter for RLM is missing for BL/CE UEs configured with enhanced MPDCCH. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introducion of MPDCCH transmission parameters for BE/CE UEs configured with enhanced MPDCCH. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | It is not clear the MPDCCH transmissoin parameter UE should assume when the network configures enhanced MPDCCH for BL/CE UEs. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 7.19.2, 7.19.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS36.521-3 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

----------------------------------------------------- Beginning of Change ------------------------------------------------------------

## 7.19 Radio Link Monitoring for UE Category M1

### 7.19.1 Introduction

The UE category M1 applicability of the requirements for performing radio link monitoring in subclause 7.19 is defined in Section 3.6.

All the requirements in Section 7.19 apply, provided that:

- the UE is not configured with any of the measurement gap patterns defined in Table 8.1.2.1-3, or

- the UE is configured with a measurement gap pattern for RSTD measurements specified in Table 8.1.2.1-3 and there is no overlap between these measurement gaps and configured MPDCCH subframes for UE monitoring.

If the UE is configured with a measurement gap pattern for RSTD measurements specified in Table 8.1.2.1-3 and there is overlap between these measurement gaps and configured MPDCCH subframes for UE monitoring, the UE shall also perform RLM according to Section 7.19, but the out-of-sync evaluation period (TEvaluate\_Qout\_CatM1) and in-sync evaluation periods can be longer than those defined in 7.19.

The UE shall monitor the downlink link quality based on the cell-specific reference signal in order to detect the downlink radio link quality of the PCell as specified in TS 36.213 [3].

### 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-[1]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 ≥ 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. | | |

For a UE configured with *mpdcch-crs-connected-config*, 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 7.19.2-3, provided:

* Even E1 is triggered in the UE, or
* Out-of-sync indication is triggered in the UE.

Table 7.19.2-3 MPDCCH transmission parameters for Out-of-sync for UE category M1 with CE mode A configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Out-of-sync |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax Note1 |
| Aggregation level (ECCE) | L’max Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max 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. | |

#### 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.

------------------------------------------------- Unchanged sections omitted --------------------------------------------------------

### 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-[1]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 ≥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. | | |

For a UE configured with *mpdcch-crs-connected-config*, 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 7.19.4-3, provided:

* Even E1 is triggered in the UE, or
* Out-of-sync indication is triggered in the UE.

Table 7.19.4-3 MPDCCH transmission parameters for Out-of-sync for UE category M1 with CE mode B configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Out-of-sync |
| DCI format | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax Note1 |
| Aggregation level (ECCE) | L’max Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max 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. | |

#### 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.

------------------------------------------------------------- End of change ------------------------------------------------------------