**3GPP TSG- Meeting #R4-2017499**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** | **0114** | **rev** | **1** | **Current version:** |  |  |
|  |
| *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:***  |  |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_L1enh\_URLLC-Perf |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | B |  | ***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 canbe 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | CQI Table 3 is introduced for target BLER of 10-5 on PDSCH. CQI reporting requirements for Table 3 are agreed to be introduced for URLLC in RAN4. |
|  |  |
| ***Summary of change:*** | Applicability of newly introduced tests for optional UE featuresAdded new section for Minimum requirement for periodic CQI reporting with Table 3 in clause 6.2.2.1.1.Added new section for Minimum requirement for periodic CQI reporting with Table 3 in clause 6.2.2.2.1.Added new section for Minimum requirement for periodic CQI reporting with Table 3 in clause 6.2.3.1.1.Added new section for Minimum requirement for periodic CQI reporting with Table 3 in clause 6.2.3.2.1. |
|  |  |
| ***Consequences if not approved:*** | CQI reporting Requirements with CQI table 3 will be undefined |
|  |  |
| ***Clauses affected:*** | Sections 6.2.2.1.1, 6.2.2.2.1, 6.2.3.1.1, 6.2.3.2.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-4  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2016375 |

Start of Change 1

6.2.2.1.1.2 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.1.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of ±1 of the reported median more than 90% of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10-5, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10-5. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10-5, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10-5.

Table 6.2.2.1.1.2-1: CQI reporting definition test

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 10 |
| Duplex Mode |  | FDD |
| Subcarrier spacing | kHz | 15 |
| SNR | dB | TBD | TBD |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 1×2 with static channel specified in Annex B.1 |
| Beamforming Model |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| CSI-RSperiodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3,(6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 5/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4, 9) |
| CSI-IM timeConfigperiodicity and offset | slot | 5/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 3 |
| reportQuantity |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | Not configured |
| timeRestrictionForInterferenceMeasurements |  | Not configured |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 8 |
| Csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 5/0 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 8 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-2, TBS.2-2 |

End of Change 1

Start of Change 2

6.2.2.2.1.2 Minimum requirement for periodic CQI reporting with Table 3

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.2.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of ±1 of the reported median more than 90% of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10-5, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10-5. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10-5, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10-5.

Table 6.2.2.2.1.2-1: CQI reporting definition test

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 40 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
| SNR |  dB | TBD | TBD |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 1×2 with static channel specified in Annex B.1 |
| Beamforming Model |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| CSI-RSperiodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3,(6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4, 9) |
| CSI-IM timeConfigperiodicity and offset | slot | 10/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 3 |
| reportQuantity |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | Not configured |
| timeRestrictionForInterferenceMeasurements |  | Not configured |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 16 |
| Csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 9.5 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-2, TBS.2-4 |

End of Change 2

Start of Change 3

6.2.3.1.1.2 Minimum requirement for period CQI reporting with Table 3

For the parameters specified in Table 6.2.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of ±1 of the reported median more than 90 % of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10-5, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10-5. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10-5, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10-5.

Table 6.2.2.1.1.2-1: CQI reporting definition test

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| SNR |  dB | TBD | TBD |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 1×4 with static channel specified in Annex B.1 |
| Beamforming Model |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| CSI-RSperiodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3,(6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 5/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4, 9) |
| CSI-IM timeConfigperiodicity and offset | slot | 5/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 3 |
| reportQuantity |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | Not configured |
| timeRestrictionForInterferenceMeasurements |  | Not configured |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 8 |
| csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 5/0 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 8 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-2, TBS.2-2 |

End of Change 3

Start of Change 4

6.2.3.2.1.2 Minimum requirement for CQI periodic reporting with Table 3

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of ±1 of the reported median more than 90% of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10-5, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10-5. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10-5, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10-5.

Table 6.2.3.2.1.2-1: CQI reporting definition test

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 40 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
|  SNR |  dB | TBD | TBD |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 1×4 with static channel specified in Annex B.1 |
| Beamforming Model |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| CSI-RSperiodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
|  |  |  |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3,(6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic  |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4, 9) |
| CSI-IM timeConfigperiodicity and offset | slot | 10/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 3 |
| reportQuantity |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | Not configured |
| timeRestrictionForInterferenceMeasurements |  | Not configured |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 16 |
| csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 9.5 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-2, TBS.2-4 |

End of Change 4