**3GPP TSG-<TSG/WG> Meeting # <MTG\_SEQ**>**<MTG\_TITLE> *<TDoc#>***

 **<Location>, <Country>, <Start\_Date> - <End\_Date>**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **<Spec#>** | **CR** | **<CR#>** | **rev** | **<Rev#>** | **Current version:** | **<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 |  | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | <Title> |
|  |  |
| ***Source to WG:*** | <Source\_if\_WG> |
| ***Source to TSG:*** | <Source\_if\_TSG> |
|  |  |
| ***Work item code:*** | <Related\_WIs> |  | ***Date:*** | <Res\_date> |
|  |  |  |  |  |
| ***Category:*** | **<Cat>** |  | ***Release:*** | <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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** |  |
|  |  |
| ***Summary of change:*** |  |
|  |  |
| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## 6.2 Reporting of Channel Quality Indicator (CQI)

This clause includes the requirements for the reporting of channel quality indicator (CQI).

### 6.2.1 1RX requirements

#### 6.2.1.1 FDD

##### 6.2.1.1.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. 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.

Requirements are applicable for RedCap and eRedCap.

###### 6.2.1.1.1.1 Minimum requirement for periodic CQI reporting for RedCap and eRedCap

For the parameters specified in Table 6.2.1.1.1.1-1, 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 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.1.1.1.1-1: CQI reporting definition test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| SNR | dB | 5 | 6 | 11 | 12 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2×1 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 |
| Frequency Occupation | RB | Same as BWP for RedCap0 to 23 for eRedCap  |
| CSI-RSperiodicity and offset | slot | 10/5 |
| 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) |  | Row 3,(6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| Frequency Occupation | RB | Same as BWP for RedCap0 to 23 for eRedCap  |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/5 |
| 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 | 10/5 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 000001 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 10 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-1, TBS.1-3 for RedCapAs specified in [Table A 4-6, TBS 6-1] for eRedCap |
| Note 1: All test parametres are applicable for both RedCap and eRedCap if not oterwise specified. |

##### 6.2.1.1.2 CQI reporting under fading conditions

6.2.1.1.2.1 Minimum requirement for wideband CQI reporting for RedCap

Requirements are applicable for RedCap.

The purpose of the requirements is to verify that the RedCap UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the wideband CQI reporting under frequency selective fading conditions 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 6.2.1.1.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least *α*% of the time where *α*% is specified in Table 6.2.1.1.2.1-2;

b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ *γ*, where *γ* is specified in Table 6.2.1.1.2.1-2;

c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.1.1.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
|  SNR | dB | 9 | 10 | 15 | 16 |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | 2×1 |
| Correlation configuration |  | ULA high |
| 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 | 10/5 |
| 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) |  | Row 3,(6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/5 |
| 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 | 10/5 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 000001 |
| RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 10 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-1, TBS.1-3 |

Table 6.2.1.1.2.1-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| **  | 1.05 | 1.05 |

#### 6.2.1.2 TDD

##### 6.2.1.2.1 CQI reporting definition under AWGN conditions

6.2.1.2.1.1 Minimum requirement for periodic CQI reporting for RedCap and eRedCap

Requirements are applicable for RedCap and eRedCap.

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 6.2.1.2.1.1-1, 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 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.1.2.1.1-1: CQI reporting definition test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
| SNR |  dB | 5 | 6 | 11 | 12 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2×1 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 |
| Frequency Occupation | RB | Same as BWP size for RedCap0 to 23 for eRedCap |
| 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) |  | Row 3,(6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| Frequency Occupation | RB | Same as BWP size for RedCap0 to 23 for eRedCap |
| 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 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 000001 |
| 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.4-1, TBS.1-5 for RedCapAs specified in [Table A 4-6, TBS 6-2] for eRedCap |
| Note 1: All test parametres are applicable for both RedCap and eRedCap if not oterwise specified. |

##### 6.2.1.2.2 CQI reporting under fading conditions

6.2.1.2.2.1 Minimum requirement for wideband CQI reporting for RedCap and eRedCap

Requirements are applicable for RedCap.

The purpose of the requirements is to verify that the RedCap UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. 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 6.2.1.2.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least *α*% of the time where *α*% is specified in Table 6.2.1.2.2.1-2;

b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ *γ*, where *γ* is specified in Table 6.2.1.2.2.1-2;

c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.1.2.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
| SNR |  dB | 9 | 10 | 15 | 16 |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | 2×1  |
| Correlation configuration |  | ULA high |
| 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) |  | 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 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 000001 |
| 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.4-1, TBS.1-5 |

Table 6.2.1.2.2.1-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| **  | 1.05 | 1.05 |

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

### 6.2.2 2RX requirements

This sub-clause includes the requirements for reporting of CQI for UE equipped with 2 receiver antennas.

#### 6.2.2.1 FDD

##### 6.2.2.1.1 CQI reporting definition under AWGN conditions

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

###### 6.2.2.1.1.4 Minimum requirement for periodic CQI reporting for RedCap

Requirements are applicable for RedCap and eRedCap.

For the parameters specified in Table 6.2.2.1.1.4-1, 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 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.2.1.1.4-1: CQI reporting definition test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| SNR | dB | 8 | 9 | 14 | 15 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2×2 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 | 10/5 |
| 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) |  | Row 3,(6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/5 |
| 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 | 10/5 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 1 |
| 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 | 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 | 10 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-1, TBS.1-4 for RedCapAs specified in [Table A 4-6, TBS 6-1] for eRedCap |
| Note 1: All test parametres are applicable for both RedCap and eRedCap if not oterwise specified. |

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

##### 6.2.2.1.2 CQI reporting under fading conditions

###### 6.2.2.1.2.4 Minimum requirement for wideband CQI reporting for RedCap

Requirements are applicable for RedCap.

The purpose of the requirements is to verify that the RedCap UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the wideband CQI reporting under frequency selective fading conditions 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 6.2.2.1.2.4-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least *α*% of the time where *α*% is specified in Table 6.2.2.1.2.4-2;

b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ *γ*, where *γ* is specified in Table 6.2.2.1.2.4-2;

c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.1.2.4-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| SNR | dB | 6 | 7 |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | 2×2  |
| Correlation configuration |  | ULA high |
| 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 | 10/5 |
| 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) |  | Row 3,(6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/5 |
| 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 | 10/5 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
|  | Codebook Mode |  | 1 |
|  | (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
|  | CodebookSubsetRestriction |  | 000001 |
|  | RI Restriction |  | N/A |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 10 |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | As specified in Table A.4-1, TBS.1-3 |

Table 6.2.2.1.2.4-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| **  | 1.05 |

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

#### 6.2.2.2 TDD

##### 6.2.2.2.1 CQI reporting definition under AWGN conditions

###### 6.2.2.2.1.5 Minimum requirement for periodic CQI reporting for RedCap

Requirements are applicable for RedCap and eRedCap.

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 6.2.2.2.1.5-1, 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 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.2.2.1.5-1: CQI reporting definition test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
| SNR |  dB | 8 | 9 | 14 | 15 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2×2 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) |  | 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 1 |
| 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 | 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.4-1, TBS.1-6 for RedCapAs specified in [Table A 4-6, TBS 6-2] for eRedCap |
| Note 1: All test parametres are applicable for both RedCap and eRedCap if not oterwise specified. |

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

###### 6.2.2.2.2.4 Minimum requirement for wideband CQI reporting for RedCap

Requirements are applicable for RedCap.

The purpose of the requirements is to verify that the RedCap UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. 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 6.2.2.2.2.4-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least *α*% of the time where *α*% is specified in Table 6.2.2.2.2.4-2;

b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ *γ*, where *γ* is specified in Table 6.2.2.2.2.4-2;

c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.2.2.4-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD UL-DL pattern |  | FR1.30-1 |
| SNR | dB | 6 | 7 |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | 2×2  |
| Correlation configuration |  | ULA high |
| 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) |  | 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 1 |
| 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 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
|  | Codebook Mode |  | 1 |
|  | (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
|  | CodebookSubsetRestriction |  | 000001 |
|  | 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.4-1, TBS.1-5 |

Table 6.2.2.2.2.4-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| **  | 1.05 |

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

**Table A.4-6: Mapping of CQI Index to Information Bit payload (CQI table 1)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | TBS.6-1 | TBS.6-2 |  |  |  |  |
| MCS table | 64QAM |
| Number of allocated PDSCH resource blocks | 15 | 7 |  |  |  |  |
| Number of consecutive PDSCH symbols | 12 | 12 |  |  |  |  |
| Number of PDSCH MIMO layers | 1 | 1 |  |  |  |  |
| Number of DMRS REs (Note 1) | 24 | 24 |  |  |  |  |
| Overhead for TBS determination | 0 | 0 |  |  |  |  |
| Available RE-s | 1800 | 840 |  |  |  |  |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A |  |  |  |  |
| 1 | 0.2344 | 0 | QPSK | 432 | 192 |  |  |  |  |
| 2 | 0.2344 | 0 | 432 | 192 |  |  |  |  |
| 3 | 0.3770 | 2 | 672 | 320 |  |  |  |  |
| 4 | 0.6016 | 4 | 1128 | 504 |  |  |  |  |
| 5 | 0.8770 | 6 | 1608 | 736 |  |  |  |  |
| 6 | 1.1758 | 8 | 2152 | 984 |  |  |  |  |
| 7 | 1.4766 | 11 | 16QAM | 2664 | 1224 => 1256 |  |  |  |  |
| 8 | 1.9141 | 13 | 3496 | 1608 |  |  |  |  |
| 9 | 2.4063 | 15 | 4360 => 4352 | 2024 |  |  |  |  |
| 10 | 2.7305 | 18 | 64QAM | 4872 => 4864 | 2280 |  |  |  |  |
| 11 | 3.3223 | 20 | 6024 => 6016 | 2792 |  |  |  |  |
| 12 | 3.9023 | 22 | 7048 => 7040 | 3368 |  |  |  |  |
| 13 | 4.5234 | 24 | 8064 | 3824 |  |  |  |  |
| 14 | 5.1152 | 26 | 9224 | 4232 => 4224 |  |  |  |  |
| 15 | 5.5547 | 28 | 9992 | 4616 => 4608 |  |  |  |  |
| Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS for tracking, CSI-RS for CSI acquisition and CSI-RS for beam refinement or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-1 of TS 38.214 [12] |