**3GPP TSG- Meeting # *R4-22XXXXX***

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | **XXXX** | **rev** |  | **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:*** | Big CR for Inter-cell MMSE-IRC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_demod\_enh2-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 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RAN4 has agreed to introduce requriements for PDSCH demodulation and CQI reporting in ICI with MMSE-IRC receiver | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Big CR to include changes from the following endorsed CRs:   1. R4-2210952 2. R4-2210950 3. R4-2210947 4. R4-2210949 5. R4-2210953 6. R4-2210948 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be no requirements for PDSCH demodulation and CQI reporting in ICI with MMSE-IRC receiver | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.4, 5.1.1, 5.2.2.1, 5.2.2.2, 5.3.2.1, 5.3.2.2, 6.2.2.1, 6.2.2.2, 6.2.3.1, 6.2.3.2, B | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

*-----------------Start Change 1---------------------*

### 4.4.5 SINR definition

Where is the averaged received energy per Hz of the wanted signal during the useful part of the symbol, i.e. excluding the cyclic prefix, at the j-th UE receiver antenna connector; average power is computed within a set of REs used for the transmission of physical, divided transmission bandwidth within the set.

And is the power spectral density (average power per RE normalised to the subcarrier spacing) of the summation of the received power spectral densities of the strongest interfering cells explicitly defined in a test procedure plus , as measured at the j-th UE receiver antenna connector. The respective power spectral density of each interfering cell relative to is defined by its associated Es/Noc value.

*-----------------End Change 1---------------------*

*-----------------Start Change 2---------------------*

5.1.1.10 Applicability of requirements for PDSCH with inter cell interference

|  |  |
| --- | --- |
| Tests | Applicability notes |
| All tests in Clause 5.2.2.1.15, 5.2.3.1.15, 5.2.2.2.16 and 5.2.3.2.16 | If UE supporting both duplex mode TDD and FDD with 2RX, only test 1-1 in clause 5.2.2.1.15 and test 1-2 in clause 5.2.2.2.16 will be applied.  If UE supporting both duplex mode TDD and FDD with 4RX, only test 1-1 in clause 5.2.3.1.15 and test 1-2 in clause 5.2.3.2.16 will be applied. |

*-----------------End Change 2---------------------*

*-----------------Start Change 3---------------------*

5.2.2.1.15 Minimum requirements for PDSCH with inter-cell interference

The performance requirements are specified in Table 5.2.2.1.15-3, with the addition of test parameters in Table 5.2.2.1.15-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.15-1.

**Table 5.2.2.1.15-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

**Table 5.2.2.1.15-2: Test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in [B.X.2] | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| [PDCCH configuration] | | [TBD] |  | [TBD] | [TBD] | [TBD] |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.X.1 | | | | | |

**Table 5.2.2.1.15-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | [R.PDSCH.1-2.1 FDD] | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | [15.2] |
| 1-2 | [R.PDSCH.1-2.1 FDD] | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | [12.4] |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

*-----------------End Change 3---------------------*

*-----------------Start Change 4---------------------*

5.2.2.2.16 Minimum requirements for PDSCH with inter-cell interference

The performance requirements are specified in Table 5.2.2.2.16-3, with the addition of test parameters in Table 5.2.2.2.16-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.16-1.

**Table 5.2.2.2.16-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

**Table 5.2.2.2.16-2: Test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in [B.X.2] | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| [PDCCH configuration] | [TBD] |  | [TBD] | [TBD] | [TBD] |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2, 3 are interference cells.  Note 2: INR is defined in Annex B.X.1 | | | | | |

**Table 5.2.2.2.16-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Cell1** | **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | [TBD] |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | [TBD] |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

*-----------------End Change 4---------------------*

*-----------------Start Change 5---------------------*

##### 5.2.3.1.15 Minimum requirements for PDSCH with inter-cell interference

The performance requirements are specified in Table 5.2.3.1.15-3, with the addition of test parameters in Table 5.2.3.1.15-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.15-1.

Table 5.2.3.1.15-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH performance in 4 receive antenna conditions, when the transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

**Table 5.2.3.1.15-2: Test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in [B.X.2] | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| [PDCCH configuration] | [TBD] |  | [TBD] | [TBD] | [TBD] |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.X.1 | | | | | |

**Table 5.2.3.1.15-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | [R.PDSCH.1-2.1 FDD] | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | [TBA] |
| 1-2 | [R.PDSCH.1-2.1 FDD] | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | [TBA] |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

*-----------------End Change 5---------------------*

*-----------------Start Change 6---------------------*

##### 5.2.3.2.16 Minimum requirements for PDSCH with inter-cell interference

The performance requirements are specified in Table 5.2.3.2.16-3, with the addition of test parameters in Table 5.2.3.2.16-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.16-1.

Table 5.2.3.2.16-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

**Table 5.2.3.2.16-2: Test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in [B.X.2] | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| [PDCCH configuration] | [TBD] |  | [TBD] | [TBD] | [TBD] |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2 , 3 are interference cells.  Note 2: INR is defined in Annex B.X.1 | | | | | |

**Table 5.2.3.2.16-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Cell1** | **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | [TBD] |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | [TBD] |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

*-----------------End Change 6---------------------*

*-----------------Start Change 7---------------------*

###### 6.2.2.1.2.3 Minimum requirement for wideband CQI reporting with inter-cell interference

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

For the parameters specified in Table 6.2.2.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ ** where ** is specified in Table 6.2.2.1.2.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.1.2.3-1 Wideband CQI reporting test with inter-cell interference

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test1** | |
| **Cell 1** | **Cell 2** |
| Bandwidth | | | MHz | 10 | 10 |
| Duplex Mode | | |  | FDD | FDD |
| Subcarrier spacing | | | kHz | 15 | 15 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 5/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6, 9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | - |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 5/0 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 8 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-1 | - |
| INR (Note 6) | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×2 | 1×2 |
| Correlation configuration | | |  | ULA Low | |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause [B.xxx].  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 3: Both cells are time-synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 5: SINR corresponds to  of Cell 1 as defined in clause [xxx].  Note 6: INR is defined in clause B.X.1. | | | | | |

Table 6.2.2.1.2.3-2 Minimum requirements

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | TBD |

*-----------------End Change 7---------------------*

*-----------------Start Change 8---------------------*

###### 6.2.2.2.2.3 Minimum requirement for wideband CQI reporting with inter-cell interference

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

For the parameters specified in Table 6.2.2.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ ** where ** is specified in Table 6.2.2.2.2.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.2.2.3 -1 Wideband CQI reporting test with inter-cell interference (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | |
| **Cell 1** | **Cell 2** |
| Bandwidth | | | MHz | 40 | 40 |
| Duplex Mode | | |  | TDD | TDD |
| Subcarrier spacing | | | kHz | 30 | 30 |
| TDD UL-DL pattern | | |  | FR1.30-1 | FR1.30-1 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3(8) | Row 2(8) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 10/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 16 |  |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 10/9 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 9.5 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-3 |  |
| INR | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×2 | 1×2 |
| Correlation configuration | | |  | ULA Low | |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause [B.xxx].  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 3: Both cells are time-synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present. The sum of power of white noise for white Gaussian noise model equals to the power of white noise and interference for inter-cell interference model.  Note 5: SINR corresponds to  of Cell 1 as defined in clause [4.4.5].  Note 6: INR corresponds to Cell 2 is defined in clause [B.X.1] | | | | | |

Table 6.2.2.2.2.3 -2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | TBD |

*-----------------End Change 8---------------------*

*-----------------Start Change 9---------------------*

###### 6.2.3.1.2.3 Minimum requirement for wideband CQI reporting with inter-cell interference

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

For the parameters specified in Table 6.2.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ ** where ** is specified in Table 6.2.3.1.2.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.1.2.3-1 Wideband CQI reporting test with inter-cell interference

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test1** | |
| **Cell 1** | **Cell 2** |
| Bandwidth | | | MHz | 10 | 10 |
| Duplex Mode | | |  | FDD | FDD |
| Subcarrier spacing | | | kHz | 15 | 15 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 5/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6, 9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | - |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 5/0 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 8 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-1 | - |
| INR (Note 6) | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×4 | 1×4 |
| Correlation configuration | | |  | ULA Low | |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause [B.xxx].  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 3: Both cells are time-synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 5: SINR corresponds to  of Cell 1 as defined in clause [xxx].  Note 6: INR is defined in clause B.X.1. | | | | | |

Table 6.2.3.1.2.3-2 Minimum requirements

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | TBD |

*-----------------End Change 9---------------------*

*-----------------Start Change 10---------------------*

###### 6.2.3.2.2.3 Minimum requirement for wideband CQI reporting with inter-cell interference

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

For the parameters specified in Table 6.2.3.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ ** where ** is specified in Table 6.2.3.2.2.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.2.2.3 -1 Wideband CQI reporting test with inter-cell interference (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | |
| **Cell 1** | **Cell 2** |
| Bandwidth | | | MHz | 40 | 40 |
| Duplex Mode | | |  | TDD | TDD |
| Subcarrier spacing | | | kHz | 30 | 30 |
| TDD UL-DL pattern | | |  | FR1.30-1 | FR1.30-1 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3(8) | Row 2(8) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 10/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 16 |  |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 10/9 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 9.5 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-3 |  |
| INR | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×4 | 1×4 |
| Correlation configuration | | |  | ULA Low | |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause [B.xxx].  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 3: Both cells are time-synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present. The sum of power of white noise for white Gaussian noise model equals to the power of white noise and interference for inter-cell interference model.  Note 5: SINR corresponds to  of Cell 1 as defined in clause [4.4.5].  Note 6: INR corresponds to Cell 2 is defined in clause [B.X.1]. | | | | | |

Table 6.2.3.2.2.3-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | TBD |

*-----------------End Change 10---------------------*

*-----------------Start Change 11---------------------*

## B.X Interference model for PDSCH requirements with intercell interference

### B.X.1 Interference to Noise ratio (INR)

Each interfering cell involved in PDSCH performance requirements with intercell interference is characterized by its associated interferer to noise ratio (INR) value:

where is the average received power spectral density from the i-th strongest interfering cell involved in the requirement scenario on the j-th antenna connector and is the average power spectral density of a white noise source consistent with definition provided in section [4.4.3/4.5.3].

### B.X.2 Interference model for PDSCH requirements

This subclause provides synchronous network deployment interference model for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit 16 QAM based randomly modulated data over the entire PDSCH region and over the full transmission bandwidth of the specified reference measurement channel. Transmitted physical channels shall include SSB and TRS/CSI-RS as specified in requirements section.

Transmission rank of the interfering cell shall be randomly determined with probabilities as specified in the requirements. The rank configuration will be independent for each interfering cell

For each slot a single precoding matrix for the number of layers υ associated to the selected rank shall be selected randomly from Table 5.2.2.2.1-1 of TS 38.214 [12] with PRB bundling size as given in the requirements.

The generic beamforming model in subclause B.4.1 shall be applied assuming number of antenna ports as specified in the requirement scenario.

Random precoding with selected rank and precoding matrices for each slot shall be applied to 16 QAM randomly modulated layer symbols including the demodulation reference symbols over antenna port 1000 when the rank is one and antenna ports 1000, 1001 when the rank is two. DMRS type 1 with front loaded single symbol and one additional DMRS position with FDM applied between DMRS and data (number of CDM groups without data is 1)

Editors’s note: Discussion on PDCCH interference modeling is ongoing and will be updated once there is a decision.

*-----------------End Change 11---------------------*