**3GPP TSG-RAN WG4 Meeting #** **111 *R4-2409016***

**Fukuoka City, Fukuoka , Japan, 20th – 24th May, 2024**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | **Draft CR** | **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:***  | Draft CR for 38.101-4: Introduction of PMI requirements for Rel-18 eRedCap |
|  |  |
| ***Source to WG:*** | Huawei,HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_redcap\_enh-Perf |  | ***Date:*** | 2024-05-06 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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:*** | PMI requirements for eRedCap are to be captured in the spec |
|  |  |
| ***Summary of change:*** | Capture PMI requirments and FRC for eRedCap in 38.101-4 |
|  |  |
| ***Consequences if not approved:*** | The PMI requirements and FRC will still be missing |
|  |  |
| ***Clauses affected:*** | 6.3.1, 6.3.2, A.3 |
|  |  |
|  | **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:*** |  |

## 6.3 Reporting of Precoding Matrix Indicator (PMI)

### 6.3.1 1RX requirements

#### 6.3.1.1 FDD

##### 6.3.1.1.1 Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap and eRedCap

For the parameters specified in Table 6.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.1.1.1-2.

Table 6.3.1.1.1-1: Test parameters (single layer)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | High ULA 4 x 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, l1) |  | (9) |
| Frequency Occupation | RB | Same as BWP size for RedCap0 to 27 for eRedCap |
| CSI-RSperiodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| 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 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| Frequency Occupation | RB | Same as BWP size for RedCap0 to 27 for eRedCap |
| CSI-RSperiodicity and offset |  | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfigperiodicity and offset | slot | Not configured |
| ReportConfigType |  | Aperiodic |
| 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 | Not configured |
| Aperiodic Report Slot Offset |  | 3 |
| CSI request |  | 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 |
| reportTriggerSize |  | 1 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report |  | PUSCH |
| CQI/RI/PMI delay  | ms | 6 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel (Note 4) |  | For RedCap:R.PDSCH.1-6.1 FDDR.PDSCH.1-3.1 HD-FDDFor eRedCap:R.PDSCH.1-6.5 FDDR.PDSCH.1-3.2 HD-FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i1, i2 combination.Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the gNB downlink before slot#(n+3).Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.Note 4: Applied reference channel depends on the supported operation mode: FDD or HD-FDD |

Table 6.3.1.1.1-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | 1.3 |

#### 6.3.1.2 TDD

##### 6.3.1.2.1 Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap and eRedCap

For the parameters specified in Table 6.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.1.2.1-2.

Table 6.3.1.2.1-1: Test parameters (single layer)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD DL-UL configuration |  | FR1.30-1 as specified in Annex A |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | High ULA 4 x 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 for eRedCap |  | PRB 0 to 24 |
| CSI-RSperiodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| 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 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| Frequency Occupation for eRedCap |  | PRB 0 to 24 |
| CSI-RSperiodicity and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfigperiodicity and offset | slot | Not configured |
| ReportConfigType |  | Aperiodic |
| 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 | Not configured |
| Aperiodic Report Slot Offset |  | 8 |
| CSI request |  | 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 |
| reportTriggerSize |  | 1 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report |  | PUSCH |
| CQI/RI/PMI delay  | ms | 5.5 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel |  | For RedCap:R.PDSCH.2-8.4 TDDFor eRedCap:R.PDSCH.2-8.6 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i1, i2 combination.Note 2: If the UE reports in an available uplink reporting instance at slot #n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3. |

Table 6.3.2.2.1-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| *g* | 1.3 |

### 6.3.2 2RX requirements

#### 6.3.2.1 FDD

##### 6.3.2.1.1 Single PMI with 4TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.1-2.

Table 6.3.2.1.1-1: Test parameters (single layer)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 10 |
| Subcarrier spacing | kHz | 15 |
| Duplex Mode |  | FDD |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | High XP 4 x 2(N1,N2) = (2,1) |
| 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, l1) |  | (9) |
| Frequency Occupation for eRedCap |  | PRB 0 to 27 |
| CSI-RSperiodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| 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 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| Frequency Occupation for eRedCap |  | PRB 0 to 27 |
| CSI-RSperiodicity and offset |  | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfigperiodicity and offset | slot | Not configured |
| ReportConfigType |  | Aperiodic |
| 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 | Not configured |
| Aperiodic Report Slot Offset |  | 4 for FDD3 for HD-FDD |
| CSI request |  | 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 |
| reportTriggerSize |  | 1 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report |  | PUSCH |
| CQI/RI/PMI delay  | ms | 6 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel (Note 4) |  | For RedCap:R.PDSCH.1-6.1 FDDR.PDSCH.1-3.1 HD-FDDFor eRedCap:R.PDSCH.1-6.5 FDDR.PDSCH.1-3.2 HD-FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i1, i2 combination.Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the gNB downlink before slot#(n+3).Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.Note 4: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. |

Table 6.3.2.1.1-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| *g* | 1.3 |

#### 6.3.2.2 TDD

<Unchanged skipped>

##### 6.3.2.2.7 Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap and eRedCap

For the parameters specified in Table 6.3.2.2.7-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.7-2.

Table 6.3.2.2.7-1: Test parameters (single layer)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 20 |
| Subcarrier spacing | kHz | 30 |
| Duplex Mode |  | TDD |
| TDD DL-UL configuration |  | FR1.30-1 as specified in Annex A |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | High XP 4 x 2(N1,N2) = (2,1) |
| 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 for eRedCap |  | PRB 0 to 24 |
| CSI-RSperiodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| 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 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| Frequency Occupation for eRedCap |  | PRB 0 to 24 |
| CSI-RSperiodicity and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfigperiodicity and offset | slot | Not configured |
| ReportConfigType |  | Aperiodic |
| 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 | Not configured |
| Aperiodic Report Slot Offset |  | 8 |
| CSI request |  | 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 |
| reportTriggerSize |  | 1 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report |  | PUSCH |
| CQI/RI/PMI delay  | ms | 5.5 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel |  | For eRedCapR.PDSCH.2-8.4 TDDFor eRedCap:R.PDSCH.2-8.6 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i1, i2 combination.Note 2: If the UE reports in an available uplink reporting instance at slot #n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3. |

Table 6.3.2.2.7-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| *g* | 1.3 |

# A.3 DL reference measurement channels

<Unchanged skipped>

## A.3.2 Reference measurement channels for PDSCH performance requirements

For PDSCH reference channels if more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

### A.3.2.1 FDD

#### A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.1.1-6: PDSCH Reference Channel for FDD PMI reporting requirements

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.1-6.1 FDD | R.PDSCH.1-6.2 FDD | R.PDSCH.1-6.3 FDD | R.PDSCH.1-6.4 FDD | R.PDSCH.1-6.5 FDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 | 10 |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 | 15 |
| Number of allocated resource blocks | PRBs | 52 | 52 | 52 | 52 | 25 |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames | Slots | 15 | 15 | 15 | 15 | 15 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| MCS index |  | 13 | 13 | 20 | 13 | 13 |
| Modulation |  | 16QAM | 16QAM | 64QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 0.48 | 0.48 | 0.55 | 0.48 | 0.48 |
| Number of MIMO layer |  | 1 | 2 | 2 | 2 | 1 |
| Number of DMRS REs (Note 3) |  | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 | 0 |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A | N/A | N/A | N/A |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2,3,4}, i={1,..19} | Bits | 12040 | 24072 | 40976 | 24072 | 5760 |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A | N/A | N/A | N/A |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2,3,4}, i={1,..19} | Bits | 24 | 24 | 24 | 24 | 24 |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A | N/A | N/A | N/A | N/A |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A | N/A | N/A | N/A |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2,3,4}, i={1,..,19} | CBs | 2 | 3 | 5 | 3 | 1 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 10 | Bits | 23712 | 47424 | 71136 | 44928 | 11400 |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2,3,4}, i={1,..9,11,…,19} | Bits | 24960 | 49920 | 74880 | 49920 | 12000 |
| Max. Throughput averaged over 2 frames | Mbps | 9.030 | 18.054 | 30.732 | 18.054 | 4.320 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data |

<Unchanged skipped>

### A.3.2.2 TDD

<Unchanged skipped>

#### A.3.2.2.2 Reference measurement channels for SCS 30 kHz FR1

Table A.3.2.2.2-8: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR1.30-1

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-8.1 TDD | R.PDSCH.2-8.2 TDD | R.PDSCH.2-8.3 TDD | R.PDSCH.2-8.4 TDD | R.PDSCH.2-8.5 TDD | R.PDSCH.2-8.6 TDD |
| Channel bandwidth | MHz | 40 | 40 | 40 | 20 | 40 | 20 |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | PRBs | 106 | 106 | 106 | 51 | 106 | 12 |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames |  | 23 | 23 | 23 | 23 | 23 | 23 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| MCS index |  | 13 | 13 | 20 | 13 | 13 | 13 |
| Modulation |  | 16QAM | 16QAM | 64QAM | 16QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 0.48 | 0.48 | 0.55 | 0.48 | 0.48 | 0.48 |
| Number of MIMO layers |  | 1 | 2 | 2 | 1 | 2 | 1 |
| Number of DMRS REs (Note 3) |  | 24 | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 | 0 | 0 |
| Information Bit Payload per Slot  |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slot i = 20 | Bits | 24576 | 49176 | 83976 | 11784 | 49176 | 2792 |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24576 | 49176 | 83976 | 11784 | 49176 | 2792 |
| Transport block CRC per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slot i = 20 | Bits | 24 | 24 | 24 | 24 | 24 | 24 |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24 | 24 | 24 | 24 | 24 | 24 |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A | N/A | N/A |
|  For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slot i = 20 | CBs | 3 | 6 | 10 | 2 | 6 | 1 |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | CBs | 3 | 6 | 10 | 2 | 6 | 1 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slot i = 20 | Bits | 48336 | 96672 | 145008 | 23256 | 91584 | 5472 |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 50880 | 101760 | 152640 | 24480 | 101760 | 5760 |
| Max. Throughput averaged over 2 frames | Mbps | 28.2624 | 56.5524 | 96.5724 | 13.5516 | 56.5524 | 6.6240 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data |

### A.3.2.3 HD-FDD

#### A.3.2.3.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.3.1-3: PDSCH Reference Channel for HD-FDD PMI reporting requirements

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.1-3.1 HD-FDD | R.PDSCH.1-3.2 HD-FDD |  |  |  |
| Channel bandwidth | MHz | 10 | 10 |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 |  |  |  |
| Number of allocated resource blocks | PRBs | 52 | 25 |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,19} |  | 8 | 8 |  |  |  |
|  For Slot i, if mod(i, 5) = {0,2} for i from {1,…,19} |  | 12 | 12 |  |  |  |
| Allocated slots per 2 frames | Slots | 11 | 11 |  |  |  |
| MCS table |  | 64QAM | 64QAM |  |  |  |
| MCS index |  | 13 | 13 |  |  |  |
| Modulation |  | 16QAM | 16QAM |  |  |  |
| Target Coding Rate |  | 0.48 | 0.48 |  |  |  |
| Number of MIMO layer |  | 1 | 1 |  |  |  |
| Number of DMRS REs (Note 3) |  | 24 | 24 |  |  |  |
| Overhead for TBS determination |  | 0 | 0 |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) =3, i={0,..19} | Bits | 7168 | 3496 |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2}, i={1,..19} | Bits | 12040 | 5760 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) =3, i={0,..19} | Bits | 24 | 24 |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2}, i={1,..19} | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A | N/A |  |  |  |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) =3, i={0,..,19} | CBs | 1 | 1 |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2}, i={1,..,19} | CBs | 2 | 1 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For CSI Slots i, if mod (i,5) =1, i={0,…,19} |  | N/A | N/A |  |  |  |
|  For Slots i = 10 | Bits | 23712 | 11400 |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) =3, i={0,..,19} | Bits | 14976 | 7200 |  |  |  |
|  For Non CSI-RS Slot i, if mod (i,5) ={0,2}, i={1,..9,11,…,19} | Bits | 24960 | 12000 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 5.648 | 2.715 |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data |