**3GPP TSG-RAN WG4 Meeting #102-e *R4-2207487***

**Electronic meeting, February 21 – March 3, 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **TBA** | **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:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MCC, Intel Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Perf | | | | |  | ***Date:*** | | | 2022-03-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This big CRs merge the multiple endorsed draft CRs. The reason for change in each endorsed draft CR is copied below.  **R4-2205780 CR for Rel-16 TS 38.101-4: Modification on test setup for PDSCH and PDCCH requirments**   1. Antenna configuration in Table 5.2.3.1.2-3 is not aligned with agreed simulation assumptions, it should be 2T4R rather than 4T4R for cases with rank 2. 2. PDCCH DMRS mapping depends on precoding granularity, however, only precoding granularity for 2TX is specified in common parameter table. Therefore, it is not clear how PDCCH DMRS is mapping for case with 1TX. 3. For NZP CSI-RS configuration and ZP CSI-RS configuration in common parameters table for PDSCH demodulation requirements, the row index missing. According to the agreed simulation assumptions, the row index should be 3 for 2TX and 5 for 4TX for NZP CSI-RS and 3 for ZP CSI-RS.   **R4-2205101 draft CR: Correction of TBS for CQI reporting tests**  Wrong TBS is set for CQI index 8 in TBS.1-1  **R4-2205909 Draft CR to TS38.101-4, Correction to reference channels for PDSCH requirements with single-DCI based FDM Scheme A (Rel-16)**   1. Redundant “space” for refrence channel R.PDSCH.1-2.6 FDD, R.PDSCH.2-2.6 TDD, R.PDSCH.1-2.6 FDD, R.PDSCH.2-1.3 TDD, R.PDSCH.2-2.6 TDD 2. The values in the column of R.PDSCH.1-2.5 FDD is the same as R.PDSCH.1-2.6 FDD. Some values for R.PDSCH.1-2.5 FDD in Table A.3.2.1.1 are wrong. 3. There is a typo in “tapped delay line”   **R4-2205572 Draft CR on removing square brakets for CA demodulation test requirements (Rel-16)**  There still remain square brakets on some CA demodulation test requirements.  **R4-2207256 CR for Rel-16 TS 38.101-4: Modification on test setup for CSI requirments**  There are two set of repeated parameters in table 6.3.3.2.1-1.  **R4-2207258 Draft CR on correction to test applicability reference for CA performance requirements (TS38.101-4, Rel-16)**  There is wrong reference to the applicability rule for normal CA performance requirements.  **R4-2207259 Draft CR on corrections for HST DPS channel model**  Visibility of each RRH is incorrectly captured in HST-DPS channel model.  **R4-2207260 Draft CR on updating to power saving requirements (TS38.101-4, Rel-16)**  Remove square brackets for Rel-16 power saving requirements and URLLC requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in each endorsed draft CR is copied below.  **R4-2205780 CR for Rel-16 TS 38.101-4: Modification on test setup for PDSCH and PDCCH requirments**   1. Change the antenna configuarion from 4x4 to 2x4 in Table 5.2.3.1.2-3. 2. Add the clarification of PDCCH DMRS mapping type in Table 5.3.1 and Table 7.3.1 3. Add the row index according to the agreed simulation assumptions to the common parameters table for PDSCH demodulation requirments.   **R4-2205101 draft CR: Correction of TBS for CQI reporting tests**  TBS changed from 14343 to 14344  **R4-2205909 Draft CR to TS38.101-4, Correction to reference channels for PDSCH requirements with single-DCI based FDM Scheme A (Rel-16)**   1. Remove the redundant ‘space’ for for refrence channel R.PDSCH.1-2.6 FDD, R.PDSCH.2-2.6 TDD, R.PDSCH.1-2.6 FDD, R.PDSCH.2-1.3 TDD, R.PDSCH.2-2.6 TDD 2. Modify some values for R.PDSCH.1-2.5 FDD in Table A.3.2.1.1 3. Fix the typo for “tapped delay line”   **R4-2205572 Draft CR on removing square brakets for CA demodulation test requirements (Rel-16)**  Remove the square brakets on all the CA demodulation test requirements for FR1 and FR2 tests.  **R4-2207256 CR for Rel-16 TS 38.101-4: Modification on test setup for CSI requirments**  Delete the 1st part of table 6.3.3.2.1-1  **R4-2207258 Draft CR on correction to test applicability reference for CA performance requirements (TS38.101-4, Rel-16)**  For correcting clause reference, update clause 5.2A.2.1 and 5.2A.3.1.  **R4-2207259 Draft CR on corrections for HST DPS channel model**  Corrected the visibility of RRH and clarified the purpose of two figures in Doppler shift figures.  **R4-2207260 Draft CR on updating to power saving requirements (TS38.101-4, Rel-16)**  For removing square brackets, update clause 5.3.2.1.3, 5.2.2.1.7, 5.2.3.1.7. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The consequences if not approved for each endorsed draft CR are copied below.  **R4-2205780 CR for Rel-16 TS 38.101-4: Modification on test setup for PDSCH and PDCCH requirments**   1. The antenna configuration will still be not correct 2. The PDCCH DMRS mapping type will still be not confusing 3. The NZP CSI-RS and ZP CSI-RS configuration are still confusing   **R4-2205101 draft CR: Correction of TBS for CQI reporting tests**  TE cannot set the correct TBS value.  **R4-2205909 Draft CR to TS38.101-4, Correction to reference channels for PDSCH requirements with single-DCI based FDM Scheme A (Rel-16)**   1. Redundant “space” for refrence channel R.PDSCH.1-2.6 FDD, R.PDSCH.2-2.6 TDD, R.PDSCH.1-2.6 FDD, R.PDSCH.2-1.3 TDD, R.PDSCH.2-2.6 TDD 2. Wrong values for R.PDSCH.1-2.5 FDD in Table A.3.2.1.1 3. Typo for “tapped delay line”   **R4-2205572 Draft CR on removing square brakets for CA demodulation test requirements (Rel-16)**  The CA demodulation tests can not be tested.  **R4-2207256 CR for Rel-16 TS 38.101-4: Modification on test setup for CSI requirments**  The parameters in table 6.3.3.2.1-1 will be confusing  **R4-2207258 Draft CR on correction to test applicability reference for CA performance requirements (TS38.101-4, Rel-16)**  There will be inconsistence between the specification 38.101-4 and RAN 4 agreements.  **R4-2207259 Draft CR on corrections for HST DPS channel model**  HST-DPS requirements will be incorrect.  **R4-2207260 Draft CR on updating to power saving requirements (TS38.101-4, Rel-16)**  There will be inconsistence between the specification 38.101-4 and RAN 4 agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | The clauses affected in each endorsed draft CR are copied below.  **R4-2205781 CR for Rel-17 TS 38.101-4: Modification on test setup for PDSCH and PDCCH requirments**  5.2, 5.3, 7.2, 7.3  **R4-2205102 draft CR: Correction of TBS for CQI reporting tests**  A.4  **R4-2205910 Draft CR to TS38.101-4, Correction to reference channels for PDSCH requirements with single-DCI based FDM Scheme A (Rel-17)**  5.2.2.1.8, 5.2.2.2.8, 5.2.3.1.8, 5.2.3.2.3, 5.2.3.2.8, A.3.2.1.1, A.3.2.2.2, B.2  **R4-2205573 Draft CR on removing square brakets for CA demodulation test requirements (Rel-17)**  5.2A.3, 7.2A.2  **R4-2205784 CR for Rel-17 TS 38.101-4: Modification on test setup for CSI requirments**  6.3.3.2.1  **R4-2205741 Draft CR on correction to test applicability reference for CA performance requirements (TS38.101-4, Rel-17)**  5.2A.2.1, 5.2A.3.1  **R4-2206128 Draft CR on corrections for HST DPS channel model**  B.3.3  **R4-2205745 Draft CR on updating to power saving requirements (TS38.101-4, Rel-17)**  5.3.2.1.3, 5.2.2.1.7, 5.2.3.1.7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 of change1>***

## 5.2 PDSCH demodulation requirements

The parameters specified in Table 5.2-1 are valid for all PDSCH tests unless otherwise stated.

Table 5.2-1: Common test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 15 or 30 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Number of contiguous PRB | | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | | Symbols | 0, 1 |
| Number of PRBs in CORESET | |  | Table 5.2-2 for tested channel bandwidth and subcarrier spacing |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI state | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 |
| Cross carrier scheduling | | |  | Not configured |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM’ for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20 for CSI-RS resource 1,2,3,4  30 kHz SCS: 40 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Row index (Note 3) | |  | 3 for 2 CSI-RS ports and 5 for 4 CSI-RS ports |
| First subcarrier index in the PRB used for CSI-RS | |  | k0 = 0 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | 'No CDM' for 1 transmit antenna  'FD-CDM2' for 2 and 4 transmit antenna |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Row index (Note 3) | |  | 5 |
| First subcarrier index in the PRB used for CSI-RS | |  | k0 = 4 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| PDSCH DMRS configuration | Antenna ports indexes | |  | {1000} for Rank 1 tests {1000, 1001} for Rank 2 tests  {1000-1002} for Rank 3 tests  {1000-1003} for Rank 4 tests |
| Position of the first DMRS for PDSCH mapping type A | |  | 2 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 for Rank 1 and Rank 2 tests  2 for Rank 3 and Rank 4 tests |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| PT-RS configuration | | |  | PT-RS is not configured |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with PRB bundling granularity |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.  Note 3: Refer to Table 7.4.1.5.3-1 in [9] | | | | |

***<End of change1>***

***<Start of change2>***

### 5.2.2 2RX requirements

#### 5.2.2.1 FDD

<SKIP UNCHANGED PART>

##### 5.2.2.1.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.2.1.7-3, with the addition of test parameters in Table 5.2.2.1.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.7-1.

Table 5.2.2.1.7-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions | 1-1 |

Table 5.2.2.1.7-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 2 |
|  | 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 |  | 0 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.2.1.7-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x2, ULA Low | 70 | 0.8 |

***<End of change2>***

***<Start of change3>***

5.2.2.1.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.2.1.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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.1-2.6 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x2, ULA Low | 70 | 10.5 |

***<End of change3>***

***<Start of change4>***

#### 5.2.2.2 TDD

<SKIP UNCHANGED PART>

5.2.2.2.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.2.2.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.6 TDD | 40 / 30 | 16QAM  0.64 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 12.5 |

***<End of change4>***

***<Start of change5>***

### 5.2.3 4RX requirements

#### 5.2.3.1 FDD

<SKIP UNCHANGED PART>

##### 5.2.3.1.2 Minimum requirements for PDSCH Mapping Type A and CSI-RS overlapped with PDSCH

The performance requirements are specified in Table 5.2.3.1.2-3, with the addition of test parameters in Table 5.2.3.1.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.2-1.

Table 5.2.3.1.2-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and CSI-RS overlapped with PDSCH | 1-1 |

Table 5.2.3.1.2-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| 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 |
| NZP CSI-RS for CSI acquisition | OFDM symbols in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 5 |
| ZP CSI-RS for CSI acquisition | Subcarrier index in the PRB used for CSI-RS |  | (k0, k1, k2, k3)=(2, 4, 6, 8) |
| Number of CSI-RS ports (X) |  | 8 |
| CSI-RS periodicity | Slots | 5 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.2-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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.1-5.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | | 9.1 |

***<End of change5>***

***<Start of change6>***

##### 5.2.3.1.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.3.1.7-3, with the addition of test parameters in Table 5.2.3.1.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.7-1.

Table 5.2.3.1.7-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions | 1-1 |

Table 5.2.3.1.7-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 2 |
| 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 |  | 0 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.3.1.7-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x4, ULA Low | 70 | -2.3 |

***<End of change6>***

***<Start of change7>***

5.2.3.1.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.3.1.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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.1-2.6 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x4, ULA Low | 70 | 6. 6 |

***<End of change7>***

***<Start of change8>***

#### 5.2.3.2 TDD

<SKIP UNCHANGED PART>

5.2.3.2.3 Minimum requirements for PDSCH Mapping Type B

<SKIP UNCHANGED PART>

Table 5.2.3.2.3-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation**  **condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-1.3 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | -3.9 |

***<End of change8>***

***<Start of change9>***

5.2.3.2.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.3.2.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.6 TDD | 40 / 30 | 16QAM  0.64 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |

***<End of change9>***

***<Start of change10>***

### 5.2A.2 2RX requirements

#### 5.2A.2.1 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.1-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1-1 ~ Table 5.2A.2.1-3, with the parameters in Table 5.2A-1 ~ Table 5.2A-3 and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 5.2A.2.1-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.4 |

Table 5.2A.2.1-2 Single carrier performance for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.2 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.5 |

Table 5.2A.2.1-3 Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.1 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.5 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.3 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |

Table 5.2A.2.1-4: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.1-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1-1 and Table 5.2A.2.1-3 per CC |
| 4 | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.2.1-1 and Table 5.2A.2.1-2 per CC |
| 5 | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1-2 and Table 5.2A.2.1-3 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

***<End of change10>***

***<Start of change11>***

### 5.2A.3 4RX requirements

#### 5.2A.3.1 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.1-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1-1 ~ Table 5.2A.3.1-3, with the parameters in Table 5.2A-1 ~ Table 5.2A-3 and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 5.2A.3.1-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.9 |

Table 5.2A.3.1-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.0 |

Table 5.2A.3.1-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.9 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.1 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.0 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.3 |

Table 5.2A.3.1-4: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.1-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1-1 and Table 5.2A.3.1-3 per CC |
| 4 | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.3.1-1 and Table 5.2A.3.1-2 per CC |
| 5 | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1-2 and Table 5.2A.3.1-3 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

***<End of change11>***

***<Start of change12>***

## 5.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 5.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 5.3-1: Common test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | |  | 0 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Number of PDCCH candidates | |  | 1 |
| Frequency domain resource allocation for CORESET | |  | Start from RB = 0 with contiguous RB allocation |
| TCI state | |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8 |
| Number of CSI-RS ports (*X*) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (*ρ*) | |  | 3 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size /4)\*4 |
| QCL info | |  | TCI state #0 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PDCCH Precoding configuration | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 for FDD.  For TDD, specific to each TDD UL-DL pattern and as defined in Annex A.1.2. |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.  Note 2: The high layer parameter *precoderGranularity* equals to *sameAsREG-bundle* as defined in clause 7.4.1.3 of TS 38.211 [9]. | | | | |

***<End of change12>***

***<Start of change13>***

### 5.3.2 2RX requirements

#### 5.3.2.1 FDD

<SKIP UNCHANGED PART>

##### 5.3.2.1.3 Minimum requirements for power saving

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.2.1.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.2.1.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| CCE to REG mapping type | |  | nonInterleaved |
| REG bundle size | |  | 6 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  |  |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
|  | |  |  |
| Note: TminimumTimeGap­ is signaled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 5.3.2.1.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.1.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.3-2: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

***<End of change13>***

***<Start of change14>***

## 6.3 Reporting of Precoding Matrix Indicator (PMI)

<SKIP UNCHANGED PART>

### 6.3.3 4RX requirements

<SKIP UNCHANGED PART>

#### 6.3.3.2 TDD

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

For the parameters specified in Table 6.3.3.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.1-2.

Table 6.3.3.2.1-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 40 |
| 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 4  (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, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval 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, k1 ) |  | Row 4, (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) |
| CSI-RS  interval 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 timeConfig  interval 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 | 16 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report interval 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 Configuration  Associated 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 | |  | R.PDSCH.2-8.1 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. | | | |

***<End of change14>***

***<Start of change15>***

## 7.2 PDSCH demodulation requirements

The parameters specified in Table 7.2-1 are valid for all PDSCH demodulation tests unless otherwise stated.

Table 7.2-1: Common Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| PTRS *epre-Ratio* | | |  | 0 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 60 or 120 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Number of contiguous PRB | | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | 0 |
| Number of PRBs in CORESET | |  | Table 7.2-2 for tested channel bandwidth and subcarrier spacing |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI state | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 |
| Cross carrier scheduling | | |  | Not configured |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 6 for CSI-RS resource 1 and 3 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (*X*) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2,3,4 |
| Density (*ρ*) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80 for CSI-RS resource 1,2,3,4  120 kHz SCS: 160 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 60 kHz SCS:  40 for CSI-RS resource 1 and 2  41 for CSI-RS resource 3 and 4  120 kHz SCS:  80 for CSI-RS resource 1 and 2  81 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Row index (Note 3) | |  | 3 for 2 CSI-RS ports and 5 for 4 CSI-RS ports |
| First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 12 |
| Number of CSI-RS ports (*X*) | |  | 2 |
| CDM Type | |  | FD-CDM2 |
| Density (*ρ*) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4) \*4 |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Row index (Note 3) | |  | 5 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | 4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 12 |
| Number of CSI-RS ports (*X*) | |  | 4 |
| CDM Type | |  | FD-CDM2 |
| Density (*ρ*) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4) \*4 |
| CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 8 for CSI-RS resource 1  l0 = 9 for CSI-RS resource 2 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80 for CSI-RS resource 1,2  120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| PDSCH DMRS configuration | Antenna ports indexes | |  | {1000} for Rank 1 tests {1000, 1001} for Rank 2 tests |
| Position of the first DMRS for PDSCH mapping type A | |  | 2 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | 2 |
| Time density (*LPT-RS*) | |  | 1 |
| Resource Element Offset | |  | 2 |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, andwith Wideband granularity |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing.  Note 3: Refer to Table 7.4.1.5.3-1 in [9] | | | | |

***<End of change15>***

***<Start of change16>***

### 7.2A.2 2RX requirements

#### 7.2A.2.1 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 7.2A.2.1-3 based on the single carrier requirements for different bandwidth specified in Table 7.2A.2.1-2, with the parameters in Table 7.2A.2.1-1 and the downlink physical channel setup according to Annex C.5.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 7.2A.2.1-1: Test parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 1 |
| Length (L) |  | Specific to each Reference channel |
| 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 |
| TDD UL-DL pattern | |  | 120kHz SCS: FR2.120-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Annex A.1.3 |

Table 7.2A.2.1-2: Single carrier performance for TDD 120 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 50 | R.PDSCH.5-9.1 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 10.4 |
| 100 | R.PDSCH.5-9.2 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 10.2 |
| 200 | R.PDSCH.5-9.3 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 10.3 |
| 400 | R.PDSCH.5-9.4 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 10.3 |

***<End of change16>***

***<Start of change17>***

## 7.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 7.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 7.3-1: Common test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | |  | 0 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Number of PDCCH candidates | |  | 1 |
| Frequency domain resource allocation for CORESET | |  | Start from RB = 0 with contiguous RB allocation |
| TCI state | |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (k0) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8 |
| Number of CSI-RS ports (X) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (ρ) | |  | 3 |
| CSI-RS periodicity | | Slots | 160 |
| CSI-RS offset | | Slots | 80 for CSI-RS resource 1 and 2  81 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS (k0) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | CSI-RS resource 1: 8  CSI-RS resource 2: 9 |
| Number of CSI-RS ports (X) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (ρ) | |  | 3 |
| CSI-RS periodicity | | Slots | 120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4) \*4 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | | |  | Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.3. |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.  Note 2: The high layer parameter *precoderGranularity* equals to *sameAsREG-bundle* as defined in clause 7.4.1.3 of TS 38.211 [9]. | | | | |

***<End of change17>***

***<Start of change18>***

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

<SKIP UNCHANGED PART>

### A.3.2.1 FDD

<SKIP UNCHANGED PART>

A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

<SKIP UNCHANGED PART>

Table A.3.2.1.1-2: PDSCH Reference Channel for FDD (16QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | | | | | |
| Reference channel |  | R.PDSCH.1-2.1 FDD | R.PDSCH.1-2.2 FDD | R.PDSCH.1-2.3 FDD | R.PDSCH.1-2.4 FDD | R.PDSCH.1-2.5 FDD | R.PDSCH.1-2.6 FDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 | 10 | 10 |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 | 15 | 15 |
| Number of allocated resource blocks | PRBs | 52 | 52 | 52 | 52 | 52 | 52 |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames | Slots | 19 | 19 | 19 | 19 | 19 | 19 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAMLowSE | 64QAM |
| MCS index |  | 13 | 13 | 13 | 13 | 19 | 16 |
| Modulation |  | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 0.48 | 0.48 | 0.48 | 0.48 | 0.54 | 0.64 |
| Number of MIMO layers |  | 1 | 2 | 3 | 4 | 2 | 1 |
| Number of DMRS REs |  | 12 | 12 | 24 | 24 | 12 | 12 |
| Overhead for TBS determination |  | 0 | 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 | N/A |
| For Slots i = 1,…, 19 | Bits | 13064 | 26120 | 35856 | 48168 | 29704 | 17424 |
| Transport block CRC per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
| For Slots i = 1,…, 19 | Bits | 24 | 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 | N/A |
| For Slots i = 1,…, 19 | CBs | 2 | 4 | 5 | 6 | 4 | 3 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
| For Slots i = 10, 11 | Bits | 26208 | 52416 | 71136 | 94848 | 49920 | 26208 |
| For Slots i = 1,…, 9, 12, …, 19 | Bits | 27456 | 54912 | 74880 | 99840 | 54912 | 27456 |
| Max. Throughput averaged over 2 frames | Mbps | 12.411 | 24.814 | 34.063 | 45.760 | 28.219 | 16.553 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | | |

***<End of change18>***

***<Start of change19>***

### A.3.2.2 TDD

<SKIP UNCHANGED PART>

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

<SKIP UNCHANGED PART>

**Table A.3.2.2.2-16: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | |
| Reference channel |  | R.PDSCH.2-16.1 TDD | R.PDSCH.2-16.2 TDD |  |  |  |
| Channel bandwidth | MHz | 40 | 40 |  |  |  |
| Subcarrier spacing | kHz | 30 | 30 |  |  |  |
| Allocated resource blocks | PRBs | 106 | 106 |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0, 7} for i from {0,…,39} |  | N/A | N/A |  |  |  |
| For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 |  |  |  |
| Allocated slots per 2 frames |  | 24 | 24 |  |  |  |
| MCS table |  | 64QAMLowSE | 64QAMLowSE |  |  |  |
| MCS index |  | 19 | 19 |  |  |  |
| Modulation |  | 16QAM | 16QAM |  |  |  |
| Target Coding Rate |  | 0.54 | 0.54 |  |  |  |
| Number of MIMO layers |  | 1 | 1 |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0, 7} for i from {0,…,39} |  | N/A | N/A |  |  |  |
| For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 |  |  |  |
| Overhead for TBS determination |  | 0 | 0 |  |  |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
| For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | Bits | 30216 | 30216 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
| For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | CBs | N/A | N/A |  |  |  |
| For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | CBs | 4 | 4 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
| For Slot i = 21 | Bits | 53424 | 50880 |  |  |  |
| For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 55968 | 55968 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 18.130 (NOTE 3) | 18.130 (NOTE 4) |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames  Note 3: Throughput is calculated under assumption of aggregation factor 2.  Note 4: Throughput is calculated under assumption of repetition number 2 | | | | | | |

***<End of change19>***

***<Start of change20>***

# A.4 CSI reference measurement channels

This clause defines the DL signal applicable to the reporting of channel state information (Clause X).

Tables in this clause specifies the mapping of CQI index to Information Bit payload, which complies with the CQI definition specified in clause 5.2.2.1 of TS 38.214 [12] and with MCS definition specified in clause 5.1.3 of TS 38.214 [12].

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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | | | | TBS.1-1 | TBS.1-2 |  |  |  |  |
| MCS table | | | | 64QAM | | | | | |
| Number of allocated PDSCH resource blocks | | | | 66 | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols | | | | 12 | 12 |  |  |  |  |
| Number of PDSCH MIMO layers | | | | 1 | 2 |  |  |  |  |
| Number of DMRS REs (Note 1) | | | | 24 | 24 |  |  |  |  |
| Overhead for TBS determination | | | | 6 | 6 |  |  |  |  |
| Available RE-s | | | | 7590 | 7590 |  |  |  |  |
| 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 | 1800 | 3624 |  |  |  |  |
| 2 | 0.2344 | 0 | 1800 | 3624 |  |  |  |  |
| 3 | 0.3770 | 2 | 2856 | 5640 |  |  |  |  |
| 4 | 0.6016 | 4 | 4480 | 8968 |  |  |  |  |
| 5 | 0.8770 | 6 | 6528 | 13064 |  |  |  |  |
| 6 | 1.1758 | 8 | 8712 | 17928 |  |  |  |  |
| 7 | 1.4766 | 11 | 16QAM | 11016 | 22032 |  |  |  |  |
| 8 | 1.9141 | 13 | 14344 | 28680 |  |  |  |  |
| 9 | 2.4063 | 15 | 17928 | 35856 |  |  |  |  |
| 10 | 2.7305 | 18 | 64QAM | 20496 | 40976 |  |  |  |  |
| 11 | 3.3223 | 20 | 25104 | 50184 |  |  |  |  |
| 12 | 3.9023 | 22 | 29192 | 58384 |  |  |  |  |
| 13 | 4.5234 | 24 | 33816 | 67584 |  |  |  |  |
| 14 | 5.1152 | 26 | 38936 | 77896 |  |  |  |  |
| 15 | 5.5547 | 28 | 42016 | 83976 |  |  |  |  |
| Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data  Note 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 DL  Note 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicity  Note 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-1 of TS 38.214 [12] | | | | | | | | | |

***<End of change20>***

***<Start of change21>***

# B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.

- A combination of channel model parameters that include the Delay profile and the Doppler spectrum that is characterized by a classical spectrum shape and a maximum Doppler frequency.

- Different models are used for FR1 (below 6 GHz) and FR2 (above 6 GHz).

Initial channel matrix for LOS component of TDL-D channel model is equal to channel matrix of Static propagation conditions in Clause B.1.

***<End of change21>***

***<Start of change22>***

# B.3 High Speed Train Scenario

<SKIP UNCHANGED PART>

## B.3.3 HST-DPS Channel Profile

There is an infinite number of RRHs distributed equidistantly along the railway track with the same Cell ID as illustrated in Figure B.3.3-1.



Figure B.3.3-1: Deployment of HST-DPS

The location of RRH *k* is given as:

 (B.3.3.1)

where: ,  and is the distance between the RRHs and railway track, while  is the distance of two RRHs, both in meters.

The train location is denoted as:

 (B.3.3.2)

where:  and *a* means distance in meters, which means the train is right on the track.

The HST DPS multi-RRH scenario for the test of the baseband performance is a single tap propagation channel at each time with switching of transmission point in the middle point between two RRHs. As shown in Figures B.3.3-2A and B.3.3-3A, RRH *k* is visible for the train only in the range:

(B.3.3.3)

However, as shown in Figures B.3.3-2B and B.3.3-3B, RRH k is considered for PDSCH and PDCCH signal transmission only in the range:

 (B.3.3.4)

Propagation delay difference are not considered between signals from different RRHs.

Power level  (dB) for the signal from each RRH equals to 0. Doppler shift (Hz) from *k*th RRH is given by:

 for  (B.3.3. 5)

In the above v (m/s) is the moving speed of the train, fC (Hz) is the centre frequency, and C (m/s) is the velocity of light.

Doppler shift is given by equation B.3.3.4, where the required input parameters listed in table B.3.3-1 and the resulting Doppler shift shown in Figures B.3.3-2 and B.3.3-3 are applied for all requency bands.

Table B.3.2-1: HST-DPS scenario

|  |  |
| --- | --- |
| Parameter | Value |
|  | 700 m |
|  | 150 m |
|  | 500 km/h |
|  | 870 Hz for 15 kHz SCS test;  1667 Hz for 30 kHz SCS test |



Figure B.3.3-2A Doppler shift trajectory (

= 870 Hz) showing visibility of each RRH



Figure B.3.3-2B Doppler shift trajectory (

= 870 Hz) as seen by PDCCH and PDSCH for each RRH



Figure B.3.3-3A Doppler shift trajectory (

= 1667 Hz) showing visibility of each RRH



Figure B.3.3-3B Doppler shift trajectory (

= 1667 Hz) as seen by PDCCH and PDSCH for each RRH

Static channel matrix will be used as defined in Annex B.1.

***<End of change22>***