**3GPP TSG-RAN4 Meeting #104-e *<R4-22XXXXX>***

**Online, 15th Aug - 26th Aug, 2022**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **<->** | **rev** | **<->** | **Current version:** | **17.5.0** |  |
|  | | | | | | | | |
| *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, Samsung | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Perf  5G\_V2X\_NRSL-Perf  NR\_L1enh\_URLLC-Perf  NR\_HST-Perf  NR\_DL256QAM\_FR2-Perf  NR\_perf\_enh-Perf | | | | |  | ***Date:*** | | | 2022-08-30 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This big CR merges endorsed draft CR to 38.101-4 in RAN4#104-e. The reason for change in endorsed draft CR is copied below   * R4-2211573   As per the agreement from last meeting, SIB1 shall only be scheduled during call setup to prevent collisions between SIB1 and PDSCH. This now needs to captured in the specification   * R4-2211584   In Table 6.2.3.2.2.2.3-1 aperiodic TriggeringOffeset is set to 0 although NZP CSI-RS is set to periodic. According to TS 38.331 aperiodicTriggeringOffset is the "offset X between the slot containing the DCI that triggers a set of aperiodic NZP CSI-RS resources". Hence, for periodic CSI-RS, aperiodicTriggeringOffset should be "not present.   * R4-2213079   The table headers for PBCH TDD demodulation requirements are wrong, as the referred channel name BPCH is wrong.   * R4-2212336   For NR V2X PSCCH decoding capability test, it has been agreed that “10 UEs transmit PSCCHs and corresponding PSSCHs to the tested UE per slot with each UE occupying one subchannel” as described in Clause 11.1.8.1.1 of TS 38.101-4, which is also aligned with the content of Note 5 of Table 11.1.8.1.1-1 in TS 38.101-4. Besides, for the resource pool configuration setting, it was agreed that the subchannel size for the NR V2X demodulation testing is 10 RBs. So, the corresponding reference measurement channel for PSCCH decoding capability testing shall be configured with 10 RBs.  However, the reference measurement channel for PSSCH in table 11.1.8.1.1-1 of latest spec TS 38.101-4 use the R.PSSCH.2-1.1 as copied following, one UE will occupy 20PRBs corresponding to 2 subchannels, it will cause the PSSCH overlapping for different UEs, which is against with the above description that one UE will use one subchannel, e.g., 10 UEs will use 10 subchannels and each subchannel occupy 10 RBs.  Thus, it needs to modify the PSSCH RMC parameter for this test case. Considering it has been agreed that MCS 4(QPSK) is used for this testing and less spec modifcaiton impact, e.g., reuse the current PSSCH RMC as much as possible, the PSSCH RMC in table 11.1.8.1.1-1 in TS 38.101-4 should be replaced by R.PSSCH.2-1.4     * R4-2213908   NZP CSI-RS for CSI acquisition collides with PDCCH symbol as “First OFDM symbol in the PRB used for CSI-RS” is defined as 1 and PDCCH occupies the first two symbols in the slot.   * R4-2213909   No TDD UL-DL pattern defined in HST-DPS requirement   * R4-2214209  In general, the Doppler shift can be calculated by the formula of v\*fc/c, which is related to the frequency fc, which means different fc will cause different Doppler shift in the case of the same v.   In section B.3.2 HST-SFN Channel Profile, it can be seen in Figure B.3.2-3 and Figure B.3.2-4 that the Doppler trajectories are drawn with a fixed fd, i.e. fd = 870Hz or 1667Hz for different SCSs, respectively.  The Doppler trajectories figures seem to illustrate the relationship between Doppler shift and train position, which means no specific fc is considered. In other words, the Doppler trajectories figures have no relationship with fc, instead a fixed Doppler shift value fd is used.  However, it said the Doppler shift is given by equation B.3.2.5 in the descriptions, while the general Doppler shift formula is included in equation B.3.2.5 for Doppler shift (Hz) from kth RRH, where fc is considered. .  Therefore, discrepancy happened in the texts, and same situation existed for HST-DPS Channel Profile in section B.3.3.  To solve the discrepancy, it is proposed to modify the equations of B.3.2.5 and B3.3.5 to align with Doppler trajectories Figures and the corresponding descriptions.  Moreover, some error reference/typos exist for some figures or equations.   * R4-2213082   There is an error in Table A.4-2 which needs to be removed.   * R4-2213743   PUCCH format 1 can only contain <= 2 bits as per TS 38.211 Table 6.3.2.1-1, which is not always sufficient to carry ACK/NACK from 2 CCs since number of ACK/NACK to be transmitted on single PUCCH may be more than 2 on some 2 CA combinations, for example, when TDD PCell is used.   * R4-2211548   Current CQI/PMI/RI Delay are outdated due to previous RAN meeting CR on CSI report and NZP-CSI-RS acquisition.  -CSI report and NZP-CSI-RS acquisition are not fixed anymore for all the test conditions  -Basing from existing CQI/PMI/RI Delay in CQI TCs cl.6.2, The start point is the reference signal(CSI-RS for acquisition) and the end point is the PDSCH transmission timing that reflects the CSI report (at least 4ms after; 4slots for 15kHz SCS, 8 slots for 30kHz SCS)  -Refer to the following sheet in No.5\_FR1\_Perf-CQI-CA\_CQI-PMI-RI\_Delay.xlsx  --(Test1: FDD15kHz PCell + TDD30khz SCell)  See “1-1. CQI DLCA FDD15kHz+TDD30kHz” sheet.  --(Test1: TDD30khz PCell + FDD15kHz SCell)  See “1-2. CQI DLCA TDD30k+FDD15kHz” sheet.  --(Test2: FDD15kHz PCell + FDD15kHz SCell)  See “2. CQI DLCA FDD15kHz+FDD15kHz” sheet.  --(Test3: TDD30khz PCell + TDD30khz SCell)  See “3. CQI DLCA TDD30kHz+TDD30kHz” sheet. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in endorsed draft CR is copied as below:   * R4-2211573   Add statement on SIB1 scheduling to the Annex.   * R4-2211584:   aperiodicTriggeringOffset has been set to “Not Configured” in Table 6.2.3.2.2.2.3-1.  Editorial correction of incorrect table number.   * R4-2213079   The table headers for PBCH TDD demodulation requirements are corrected for 2 Rx (subclause 5.4.2.2) and for 4 Rx (subclause 5.4.3.2) to refer to SS/PBCH block index.   * R4-2212336   Modify the PSSCH RMC parameter of NR V2X PSCCH decoding capability test in Table 11.1.8.1.1-1 of Cluase 11.1.8 since the current PSSCH RMC is not correct.   * R4-2213908   Change “First OFDM symbol in the PRB used for CSI-RS” from 1 to 13.   * R4-2213909   Add TDD UL-DL pattern defined in HST-DPS requirement   * R4-2214209   Modify the equation of B.3.2.5 and B.3.3. 5, i.e. replace v\*fc/c with fixed fd and delete the sentences stating v, fc, c .  Correct the error reference/typos for some figures or equations   * R4-2213082   For Table A.4-2, the Information bit payload per slot is corrected for TBS.2-8, CQI index 1 and rank 2. It is calculated as 2856 according to TS 38.214, clause 5.1.3.2.   * R4-2213743   PUCCH format 1 is only applied when number of ACK/NACK to be transmitted on single PUCCH is <=2.   * R4-2211548   Separated CQI/PMI/RI Delay with condition based on CA band combinations stated for the tests. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The consequences if not approved for endorsed draft CR are coppied as below.   * R4-2211573   SIB1 scheduling remains ambiguous.   * R4-2211584   The specification will remain incorrect   * R4-2213079   Incorrect table headers with a wrong channel name remain in specification for PBCH TDD performance requirements.   * R4-2213908   The UE will not test PSCCH decoding capability correctly   * R4-2213910   Wrong NZP CSI-RS for CSI acquisition configuration.   * R4-2213909   TDD UL-DL pattern in HST-DPS requirement is missing   * R4-2214209   The equation(B.3.2.5 and B.3.3.5) are not consistent with subsequent table, figures and descriptions, which would cause confusion. In addition, error reference for some figures or equations would cause confusion   * R4-2213082   Wrong Information bit payload per slot remain which may cause testing issues.   * R4-2213743   Requirements for PDSCH CA tests will be incorrect   * R4-2211548   Outdated configuration will remain | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.2.2.2.10, 5.2.3.2.10, 5.2A , 5.4.2.2, 5.4.3.2, 6.2.2.2.1.2, 6.2.3.2.1.2, 6.2A.3.1.1, 6.2.3.2.2.2, 7.2.2.2.4, 11.1.8, Annex A.3.1, A.4 (Table A.4-2), B.3.2, B.3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | Skip the change 3 from R4-2213911 for Rel-16 big CR, since it was introduced in Rel-17  2.Include change 3 from R4-2213909 for Rel-17 big CR (big CR should be CAT F, and R4-2213909 shall be CAT F) | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start Of Change R4-2213909>

<SKIP UNCHANGED PART>

**Table 5.2.2.2.10-3: Minimum performance for HST-DPS**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-DPS | 1 | 2x2 | 70 | 13.0 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-DPS | 2 | 2x2 | 70 | 13.0 |

<SKIP UNCHANGED PART>

**Table 5.2.3.2.10-3: Minimum performance for HST-DPS**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-DPS | 1 | 2x4 | 70 | 10.2 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-DPS | 2 | 2x4 | 70 | 10.2 |

<End of Change R4-2213909>

<Start Of Change R4-2213743>

5.2A PDSCH demodulation requirements for CA

The parameters specified in Table 5.2-1 for PDSCH single carrier tests are reused for PDSCH CA tests unless otherwise stated.

**Table 5.2A-1: Common test parameters for CA**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | FDD: 12TDD: 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 | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | |  | 15kHz SCS: FR1.15-1  30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table 5.2A-3 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 for cases where the number of ACK/NACK to be transmitted on single PUCCH is 2 or less.  PUCCH format 3 for cases where the number of ACK/NACK to be transmitted on single PUCCH is more than 2. |

<End of Change R4-2213743>

<Start Of Change R4-2213079>

## PBCH demodulation requirements

#### **<< Unchanged sections omitted >>**

#### 5.4.2.2 TDD

Table 5.4.2.2-1: Test parameters for PBCH

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Single antenna port** |
| Physical Cell ID |  | 0 |
| Cyclic prefix |  | Normal |
| Number of SS/PBCH blocks within an SS burst set periodicity |  | 1 |
| SS/PBCH block index Note1 |  | 0 |
| SS/PBCH block periodicity | ms | 20 |
| TDD UL-DL pattern |  | FR1.30-1 |
| Note 1: as specified in clause 4.1 of TS 38.213 [11]  Note 2: as specified in clause 11.1 of TS 38.213 [11] | | |

For the parameters specified in Table 5.4.2.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.2.2-2 in case SS/PBCH block index is not known and below the specified values in Table.5.4.2.2-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.2.2-2: Minimum performance PBCH in case SS/PBCH block index is not known

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Reference channel** | **Propagation condition** | **Antenna configuration and correlation matrix** | **Reference value** | |
| **Pm-bch (%)** | **SNR (dB)** |
| 1 | 40 / 30 | R.PBCH.2 | TDLA30-10 | 1 x 2 Low | 1 | -5.3 |

Table 5.4.2.2-3 Minimum performance PBCH in case SS/PBCH block index is known

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) / Subcarrier spacing (kHz) | Reference channel | Propagation condition | Antenna configuration and correlation matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 40 / 30 | R.PBCH.2 | TDLA30-10 | 1 x 2 Low | 1 | -6.5 |

#### **<< Unchanged sections omitted >>**

#### 5.4.3.2 TDD

Table 5.4.3.2-1: Test parameters for PBCH

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Single antenna port |
| Physical Cell ID |  | 0 |
| Cyclic prefix |  | Normal |
| Number of SS/PBCH blocks within an SS burst set periodicity |  | 1 |
| SS/PBCH block index Note1 |  | 0 |
| SS/PBCH block periodicity | ms | 20 |
| TDD UL-DL pattern |  | FR1.30-1 |
| Note 1: as specified in clause 4.1 of TS 38.213 [11]  Note 2: as specified in clause 11.1 of TS 38.213 [11] | | |

For the parameters specified in Table 5.4.3.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.3.2-2 in case SS/PBCH block index is not known and below the specified values in Table.5.4.3.2-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.3.2-2: Minimum performance PBCH in case SS/PBCH block index is not known

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) / Subcarrier spacing (kHz) | Reference channel | Propagation condition | Antenna configuration and correlation matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 40 / 30 | R.PBCH.2 | TDLA30-10 | 1 x 4 Low | 1 | -8.6 |

Table 5.4.3.2-3: Minimum performance PBCH in case SS/PBCH block index is known

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) / Subcarrier spacing (kHz) | Reference channel | Propagation condition | Antenna configuration and correlation matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 40 / 30 | R.PBCH.2 | TDLA30-10 | 1 x 4 Low | 1 | -9.6 |

<End of Change R4-2213079>

<Start Of Change R4-2213908>

<SKIP UNCHANGED PART>

**Table 6.2.2.2.1.2-1: CQI reporting test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | |
| Bandwidth | | | MHz | 40 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| TDD UL-DL pattern | | |  | FR1.30-1 | |
| SNR | | | dB | 1 | 2 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 1×2 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 1 | |
| CDM Type | |  | No CDM | |
| Density (ρ) | |  | 3 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | |
| CSI-IM RE pattern | |  | 0 | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 3 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 16 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 000001 | |
| RI Restriction |  | N/A | |
| Physical channel for CSI report | | |  | PUCCH | |
| CQI/RI/PMI delay | | | ms | 9.5 | |
| Maximum number of HARQ transmission | | |  | 1 | |
| Measurement channel | | |  | As specified in Table A.4-4, TBS.4-2 | |

<SKIP UNCHANGED PART>

**Table 6.2.3.2.1.2-1: CQI reporting test parameters**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | |
| Bandwidth | | | MHz | 40 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| TDD UL-DL pattern | | |  | FR1.30-1 | |
| SNR | | | dB | -2 | -1 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 1×4 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 1 | |
| CDM Type | |  | No CDM | |
| Density (ρ) | |  | 3 | |
|  | |  |  | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | |
| CSI-IM RE pattern | |  | 0 | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 3 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 16 | |
| csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 000001 | |
| RI Restriction |  | N/A | |
| Physical channel for CSI report | | |  | PUCCH | |
| CQI/RI/PMI delay | | | ms | 9.5 | |
| Maximum number of HARQ transmission | | |  | 1 | |
| Measurement channel | | |  | As specified in Table A.4-4, TBS.4-2 | |

<End of Change R4-2213908>

<Start Of Change R4-2211584>

6.2.3.2.2.2 Minimum requirement for sub-band CQI reporting

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.2.2-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) A sub-band differential CQI offset level of 0 shall be reported at least α% of the time but less than β% of the time for each sub-band, where α and β are specified in Table 6.2.3.2.2.2-2;

b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be ≥ *γ*, where *γ* is specified in Table 6.2.3.2.2.2-2;

c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Table 6.2.3.2.2.2-1: Sub-band CQI reporting test under frequency-selective fading conditions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 40 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | Two tap model specified in Annex B.2.4 with *a*=1, *f*D = 5Hz, and τd=0.1125μs | | | |
| Antenna configuration | | |  | 2×4 | | | |
| Correlation configuration | | |  | As per Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5, (4) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | | | |
| CSI-IM RE pattern | |  | 0 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | | | |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | | | |
| ReportConfigType | | |  | Aperiodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Subband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 16 | | | |
| 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 Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 9.5 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-6 | | | |

Table 6.2.3.2.2.2-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.05 | 1.05 |

<End of Change R4-2211584>

<Start Of Change R4-2211548>

### 6.2A.3 2RX requirements

#### 6.2A.3.1 CQI reporting definition under AWGN conditions

##### 6.2A.3.1.1 Minimum requirement for periodic CQI reporting

For each CA CQI reporting test defined in Table 6.2A.3.1.1-6, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 6.2A.3.1.1-1. The additional parameters specified in Table 6.2A.3.1.1-2 are applicable for tests on FDD CC. The additional parameters specified in Table 6.2A.3.1.1-3 are applicable for tests on TDD CC.

For CA with 2 DL CC, for the SNR configuration specified in Table 6.2A.3.1.1-4, and using the downlink physical channels specified in Annex C.3.1 on each CC, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband CQIPCell – wideband CQISCell ≥ 2

for more than 90% of the time.

For CA with 3 or more DL CC, for the SNR configuration specified in Table 6.2A.3.1.1-5, and using the downlink physical channels specified in Annex C.3.1 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, 3… reported shall be such that

wideband CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2, 3… ≥ 2

for more than 90% of the time.

Table 6.2A.3.1.1-1: CA CQI reporting test parameters for FDD and TDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1×2 with static channel specified in Annex B.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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 2, 6 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4, 9) |
| ReportConfigType | |  | Periodic |
| CQI-table | |  | Table 2 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Csi-ReportingBand | |  | 1111111 |
| aperiodicTriggeringOffset | |  | Not configured |
| Physical channel for CSI report | |  | PUCCH |
| Maximum number of HARQ transmission | |  | 1 |
| Measurement channel | |  | Derived as per section 5.1.3.2 of TS 38.214 [12] |

Table 6.2A.3.1.1-2: Additional test parameters for FDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex Mode | |  | FDD |
| Subcarrier spacing | | kHz | 15 |
| ZP CSI-RS configuration | CSI-RS  periodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | NZP CSI-RS-timeConfig  periodicity and offset | slot | 5/1 |
|  |  |  | 10/1 if configured as SCell with TDD PCell (Test1) |
| CSI-IM configuration | CSI-IM timeConfig  periodicity and offset | slot | 5/1 |
| CSI-Report periodicity and offset | | slot | 5/0 if configured as PCell |
|  | |  | 5/1 if configured as SCell with FDD PCell (Test2) |
|  | |  | 20/18 if configured as SCell with TDD PCell (Test1) |
| CQI/RI/PMI delay | | ms | 8 if configured as PCell |
| 12 if configured as SCell |
| Sub-band Size | | RB | 8 for 5MHz and 10MHz,  16 for 15MHz, 20MHz and 25MHz, 32 for 30MHz, 40MHz and 50MHz |
| Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS. | | | |

Table 6.2A.3.1.1-3: Additional test parameters for TDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex Mode | |  | TDD |
| Subcarrier spacing | | kHz | 30 |
| TDD UL-DL pattern | |  | FR1.30-1 |
| ZP CSI-RS configuration | CSI-RS  periodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | NZP CSI-RS-timeConfig  periodicity and offset | slot | 10/1 if configured as SCell with FDD PCell (Test1) |
|  |  |  | 20/1 |
| CSI-IM configuration | CSI-IM timeConfig  periodicity and offset | slot | 10/1 |
| CSI-Report periodicity and offset | | slot | 20/19 if configured as PCell |
|  | |  | 20/18 if configured as SCell with TDD PCell (Test3) |
|  | |  | 5/1 if configured as SCell with FDD PCell (Test1) |
| CQI/RI/PMI delay | | ms | 14.5 if configured as PCell |
| 12.5 if configured as SCell with TDD PCell (Test3) |
| 9.5 if configured as SCell with FDD PCell (Test1) |
| Sub-band Size | | RB | 8 for 10MHz, 15MHz, 20MHz and 25MHz,  16 for 30MHz, 40MHz and 50MHz, 32 for 60MHz, 80MHz, 90MHz and 100MHz |
| Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS. | | | |

Table 6.2A.3.1.1-4: SNR configurations for 2 DL CA

|  |  |  |
| --- | --- | --- |
| Parameter | PCell | SCell |
| SNR (dB) | 10.0 | 4.0 |

Table 6.2A.3.1.1-5: SNR configurations for 3 or more DL CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | PCell | SCell1 | SCell2, 3… |
| SNR (dB) | 12.0 | 6.0 | 0.0 |

Table 6.2A.3.1.1-6: List of CA CQI reporting test

|  |  |
| --- | --- |
| Test number | CA duplex mode and SCS combination |
| 1 | FDD 15 kHz + TDD 30 kHz |
| 2 | FDD 15 kHz + FDD 15 kHz |
| 3 | TDD 30 kHz + TDD 30 kHz |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, is defined in 6.1.1.5.1.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 6.1.1.5.2. | |

<End of Change R4-2211548>

<Start Of Change R4-2213909>

<SKIP UNCHANGED PART>

**Table 7.2.2.2.4-3: Minimum performance for HST-DPS**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | [R.PDSCH.5-12.2 TDD] | 200 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-BI-B | 1 | 2x2 | 70 | [13.9] |
| 1-2 | [R.PDSCH.5-12.1 TDD] | 200 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-UNI-A | 2 | 2x2 | 70 | [13.7] |

<End of Change R4-2213909>

<Start Of Change R4-2212336>

### 11.1.8 PSCCH decoding capability test

#### 11.1.8.1 2RX requirements

##### 11.1.8.1.1 Minimum requirements

The purpose of this test is to verify the maximum number of received PSCCHs per TTI supported by the V2X UE.

The minimum requirements are specified in Table 11.1.8.1.1-2 with the test parameters specified in Table 11.1.8.1.1-1 and the test procedure is specified as follows:

- 10 UEs transmit PSCCHs and corresponding PSSCHs to the tested UE per slot with each UE occupying one subchannel.

- x UEs transmit PSCCHs and corresponding PSSCHs with high priority level on x subchannels that are randomly selected from 10 subchannels per slot and 10-x UEs transmit PSCCHs and corresponding PSSCHs with low priority level on the remaining subchannels. The indication of priority level specified in Clause 5.4.3.3 of TS 23.287 [12] and Clause 5.22.1.3.1 of TS 38.321 [8] is included in PSCCH.

Where x equals to:

- The number of PSFCH(s) resources that the tested UE can transmit in a slot (i.e. IE *psfch-TxNumber* specified in clause 4.2.16.1.6 of TS 38.306 [14]) if the number of PSFCH(s) resources that the tested UE can transmit in a slot is less than 10

- 10, otherwise.

The probability of PSCCH miss detection is calculated as follows:

Where:

- # (Tx high priority PSCCH/PSSCH) denotes the total number of transmitted PSCCH/PSSCH with high priority level.

- # (missing ACK/NACK) denotes the total number of missing ACK/NACK with high priority.

Table 11.1.8.1.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Member ID (Note 1) | | |  | 0 |
| Sidelink UE i,  0 ≤ i ≤ 9 (Note 5) | Sidelink Transmissions | |  | PSCCH + PSSCH |
| Timing offset (Note 2) | | μs | 0 |
| Frequency offset (Note 3) | | Hz | 0 |
| Synchronization source | |  | GNSS |
| Propagation Channel | |  | Static propagation condition without external noise |
| Antenna configuration | |  | 1x2 Low |
| PSSCH RMC | |  | R.PSSCH.2-1.4 |
| PSCCH RMC (Note 4) | |  | R.PSCCH.2-1.1 |
| Source ID | |  | 0 |
| PSFCH periodicity | | Slots | 1 |
| MinTimeGapPSFCH | | Slots | 2 |
| PSFCH Resource (Note 6) | RB index |  | 10\*i |
| CS pair index |  | 0 |
| Note 1: Member ID is an identifier uniquely identifying a member.  Note 2: Time offset of received signal by Sidelink UE with respect to GNSS reference timing.  Note 3: Frequency offset of Sidelink UE received signal by with respect to GNSS reference frequency.  Note 4: OCC index for PSCCH DMRS is randomly selected between {0, 1, 2} for each PSCCH transmission as per in Clause 8.4.1.3.2 of TS 38.211[9].  Note 5: Each UE occupies one sub-channel so that all sub-channels are filled.  Note 6: The mapping procedure of PSSCH resource and PSFCH resource is specified in Clause 16.3 of TS 38.213 [11]. | | | | |

Table 11.1.8.1.1-2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test  Number | Bandwidth (MHz) / Subcarrier spacing(kHz) | PSCCH Reference channel | Propagation Channel | Reference value |
| Probability of missed PSCCH (%) |
| 1 | 40 / 30 | R.PSCCH.2-1.1 | Static propagation condition without external noise | 1 |

<End of Change R4-2212336>

<Start Of Change R4-2211573>

# A.3 DL reference measurement channels

## A.3.1 General

The transport block size (TBS) determination procedure is described in clause 5.1.3.2 of TS 38.214 [12].

Unless otherwise stated, no user data is scheduled on slot #0 within 20 ms in order to avoid SSB and PDSCH transmissions in one slot and simplify test configuration.

Unless otherwise stated, SIB1 transmission shall only be scheduled during call setup to avoid SIB1 and PDSCH transmissions in the same slot.

<End of Change R4-2211573>

<Start Of Change R4-2213082>

# A.4 CSI reference measurement channels

This clause defines the DL signal applicable to the reporting of channel state information (Clauses 6 and 8).

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 | | | | 7524 | 7524 |  |  |  |  |
| 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] | | | | | | | | | |

Table A.4-2: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 1 and Rank 2)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | | | | TBS.2-1 | TBS.2-2 | TBS.2-3 | TBS.2-4 | TBS.2-5 | TBS.2-6 | TBS.2-7 | TBS.2-8 |
| MCS table | | | | 256QAM | | | | | | |  |
| Number of allocated PDSCH resource blocks | | | | 52 | 52 | 106 | 106 | 8 | 16 | 32 | 51 |
| Number of consecutive PDSCH symbols | | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Number of PDSCH MIMO layers | | | | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 |
| Number of DMRS REs (Note 1) | | | | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination | | | | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Available RE-s for PDSCH | | | | 6240 | 6240 | 12720 | 12720 | 960 | 1920 | 3680 | 6120 |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot | | | | | | |  |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1 | 0.2344 | 0 | QPSK | 1480 | 2976 | 2976 | 5896 | 224 | 456 | 848 | 2856 |
| 2 | 0.3770 | 1 | 2408 | 4744 | 4744 | 9480 | 368 | 736 | 1416 | 4616 |
| 3 | 0.8770 | 3 | 5504 | 11016 | 11016 | 22536 | 848 | 1736 | 3240 | 10760 |
| 4 | 1.4766 | 5 | 16QAM | 9224 | 18432 | 18960 | 37896 | 1416 | 2856 | 5376 | 17928 |
| 5 | 1.9141 | 7 | 12040 | 24072 | 24576 | 49176 | 1864 | 3752 | 6912 | 23568 |
| 6 | 2.4063 | 9 | 15112 | 30216 | 30728 | 61480 | 2408 | 4608 | 8712 | 29192 |
| 7 | 2.7305 | 11 | 64QAM | 16896 | 33816 | 34816 | 69672 | 2600 | 5248 | 9992 | 33816 |
| 8 | 3.3223 | 13 | 20496 | 40976 | 42016 | 83976 | 3240 | 6400 | 12040 | 40976 |
| 9 | 3.9023 | 15 | 24576 | 49176 | 49176 | 98376 | 3752 | 7424 | 14344 | 48168 |
| 10 | 4.5234 | 17 | 28168 | 56368 | 57376 | 114776 | 4352 | 8712 | 16392 | 55304 |
| 11 | 5.1152 | 19 | 31752 | 63528 | 65576 | 131176 | 4864 | 9736 | 18432 | 62504 |
| 12 | 5.5547 | 21 | 256QAM | 34816 | 69672 | 69672 | 139376 | 5248 | 10760 | 20496 | 67584 |
| 13 | 6.2266 | 23 | 38936 | 77896 | 79896 | 159880 | 6016 | 12040 | 22536 | 75792 |
| 14 | 6.9141 | 25 | 43032 | 86040 | 88064 | 176208 | 6656 | 13320 | 25104 | 83976 |
| 15 | 7.4063 | 27 | 46104 | 92200 | 94248 | 188576 | 7040 | 14088 | 27144 | 90176 |
| 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 5.1.3.1-2 of TS 38.214 [12] | | | | | | | | | | |  |

**Table A.4-3: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 3 and Rank 4)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | | | | TBS.3-1 | TBS.3-2 | TBS.3-3 | TBS.3-4 |  |  |
| MCS table | | | | 256QAM | | | | | |
| Number of allocated PDSCH resource blocks | | | | 52 | 52 | 106 | 106 |  |  |
| Number of consecutive PDSCH symbols | | | | 12 | 12 | 12 | 12 |  |  |
| Number of PDSCH MIMO layers | | | | 3 | 4 | 3 | 4 |  |  |
| Number of DMRS REs (Note 1) | | | | 24 | 24 | 24 | 24 |  |  |
| Overhead for TBS determination | | | | 0 | 0 | 0 | 0 |  |  |
| Available RE-s for PDSCH | | | | 6240 | 6240 | 12720 | 12720 |  |  |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot | | | | | |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A |  |  |
| 1 | 0.2344 | 0 | QPSK | 4360 | 5896 | 8976 | 11784 |  |  |
| 2 | 0.3770 | 1 | 7048 | 9480 | 14344 | 18976 |  |  |
| 3 | 0.8770 | 3 | 16392 | 22032 | 33816 | 45096 |  |  |
| 4 | 1.4766 | 5 | 16QAM | 27656 | 36896 | 56368 | 75792 |  |  |
| 5 | 1.9141 | 7 | 35856 | 48168 | 73776 | 98376 |  |  |
| 6 | 2.4063 | 9 | 45096 | 60456 | 92200 | 122976 |  |  |
| 7 | 2.7305 | 11 | 64QAM | 51216 | 67584 | 104496 | 139376 |  |  |
| 8 | 3.3223 | 13 | 62504 | 81976 | 127080 | 167976 |  |  |
| 9 | 3.9023 | 15 | 73776 | 98376 | 147576 | 196776 |  |  |
| 10 | 4.5234 | 17 | 83976 | 112648 | 172176 | 229576 |  |  |
| 11 | 5.1152 | 19 | 96264 | 127080 | 196776 | 262376 |  |  |
| 12 | 5.5547 | 21 | 256QAM | 104496 | 139376 | 213176 | 278776 |  |  |
| 13 | 6.2266 | 23 | 116792 | 155776 | 237776 | 319784 |  |  |
| 14 | 6.9141 | 25 | 129128 | 172176 | 262376 | 352440 |  |  |
| 15 | 7.4063 | 27 | 139376 | 184424 | 278776 | 376896 |  |  |
| 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 5.1.3.1-2 of TS 38.214 [12] | | | | | | | | | |

Table A.4-4: Mapping of CQI Index to Information Bit payload (CQI table 3)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | | | | TBS.4-1 | TBS.4-2 |  |  |  |  |
| MCS table | | | | 64QAMLowSE | | | | | |
| Number of allocated PDSCH resource blocks | | | | 52 | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols | | | | 12 | 12 |  |  |  |  |
| Number of PDSCH MIMO layers | | | | 1 | 1 |  |  |  |  |
| Number of DMRS REs (Note 1) | | | | 24 | 24 |  |  |  |  |
| Overhead for TBS determination | | | | 0 | 0 |  |  |  |  |
| Available RE-s for PDSCH | | | | 6240 | 12720 |  |  |  |  |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot | | | | | |
| 0 | OOR | OOR | OOR | N/A | N/A |  |  |  |  |
| 1 | 0.0586 | 0 | QPSK | 368 | 768 |  |  |  |  |
| 2 | 0.0977 | 2 | 608 | 1256 |  |  |  |  |
| 3 | 0.1523 | 4 | 984 | 2024 |  |  |  |  |
| 4 | 0.2344 | 6 | 1480 | 2976 |  |  |  |  |
| 5 | 0.3770 | 8 | 2408 | 4744 |  |  |  |  |
| 6 | 0.6016 | 10 | 3752 | 7680 |  |  |  |  |
| 7 | 0.8770 | 12 | 5504 | 11016 |  |  |  |  |
| 8 | 1.1758 | 14 | 7296 | 14856 |  |  |  |  |
| 9 | 1.4766 | 16 | 16QAM | 9224 | 18960 |  |  |  |  |
| 10 | 1.9141 | 18 | 12040 | 24576 |  |  |  |  |
| 11 | 2.4063 | 20 | 15112 | 30728 |  |  |  |  |
| 12 | 2.7305 | 22 | 64QAM | 16896 | 34816 |  |  |  |  |
| 13 | 3.3223 | 24 | 20496 | 42016 |  |  |  |  |
| 14 | 3.9023 | 26 | 24576 | 49176 |  |  |  |  |
| 15 | 4.5234 | 28 | 28168 | 57376 |  |  |  |  |
| 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 and CSI-RS for CSI acquisition or slots which are not full DL  Note 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicity | | | | | | | | | |

<End of Change R4-2213082>

<Start Of Change R4-2214209>

## B.3.2 HST-SFN Channel Profile

There is an infinite number of RRHs distributed equidistantly along the track with the same Cell ID as depicted in figure B.3.2-1.



Figure B.3.2-1: Deployment of HST-SFN

The location of RRH *k* is given as:

 (B.3.2.1)

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.3.2.2)

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

The HST-SFN scenario for the test of the baseband performance is a non fading propagation channel with four taps, namely the four nearest RRHs. Thus, RRH *k* is visible for the train only in the range:

 (B.3.2.3)

Power level  (dB) for the signal from *k*th RRH, normalized to the total power received from all visible RRHs, is given by:

 for  (B.3.2.4)

Doppler shift (Hz) from *k*th RRH is given by:

 for  (B.3.2.5)

The relative delay  (s) for the signal from *k*th RRH can be derived as:

 for  (B.3.2.6)

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

Power level, Doppler shift and relative delay are given by equations B.3.2.4 ~ B.3.2.6 respectively, where the required input parameters listed in table B.3.2-1 and the resulting Doppler shift shown in Figures B.3.2-3 and B.3.2-4 are applied for all frequency bands.

Table B.3.2-1: HST-SFN scenario

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

NOTE 1: The trajectories of relative power, Doppler shifts and absolute delays presented in Figures B.3.2-2, B.3.2-3, B.3.2-4 and B.3.2-5 are derived from the equations B.3.2.4 ~ B.3.2.6 respectively.

NOTE 2: Equation B.3.2.5 is a general formula for Doppler shift calculation. When defining the requirement for FR1 HST, max Doppler shifts fd which corresponds to fc\*v/C in equation B.3.2.5 are selected as defined in Table B.3.2-1 for HST-SFN scenario.

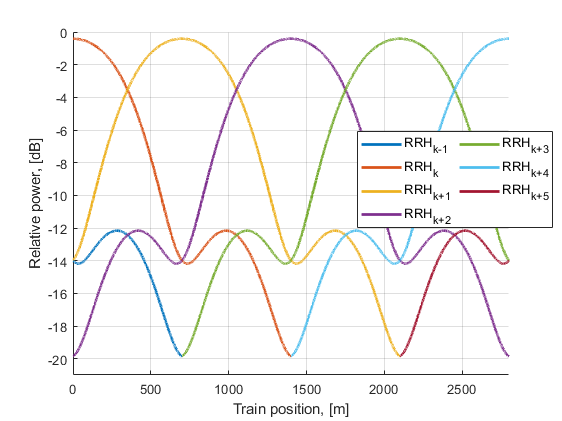


Figure B.3.2-2 Relative power level trajectories

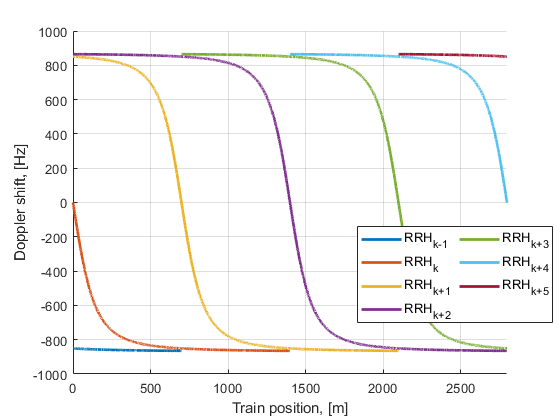


Figure B.3.2-3 Doppler shift trajectories (

= 870 Hz)

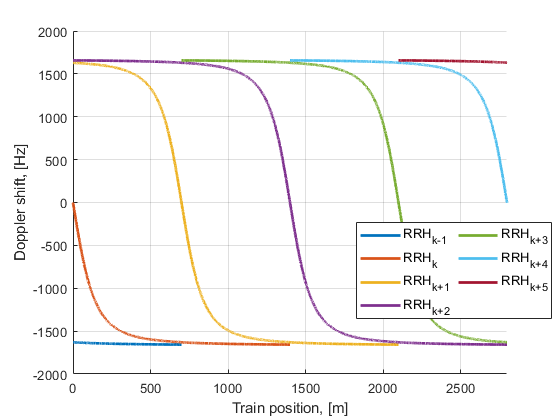


Figure B.3.2-4 Doppler shift trajectories (

= 1667 Hz)

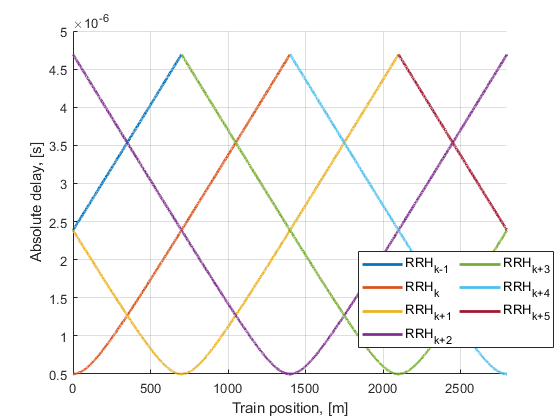


Figure B.3.2-5 Absolute delay trajectories

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

## 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.3.3-2 and B.3.3-4, RRH *k* is visible for the train only in the range:

(B.3.3.3)

However, as shown in Figures B.3.3-3 and B.3.3-5, 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.3.3.5, where the required input parameters listed in table B.3.3-1 and the resulting Doppler shift shown in Figures B.3.3-2 ~ B.3.3-5 are applied for all frequency bands.

Table B.3.3-1: 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 |

NOTE 1: Equation B.3.3.5 is a general formula for Doppler shift calculation. When defining the requirement for FR1 HST, max Doppler shifts fd which corresponds to fc\*v/C in equation B.3.3.5 are selected as defined in Table B.3.3-1 for HST-DPS scenario.

<End of Change R4-2214209>