**3GPP TSG- Meeting #109**

**Chicago, USA, 13th Nov – 17th Nov, 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | Draft big CR for TS 38.101-4 on Rel-18 FR2 HST demodulation |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  NR\_HST\_FR2\_enh-Perf  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | This big draft CR merges endorsed draft CRs to 38.101-4 in RAN4#109. The reason for change in endorsed draft CR is copied below* R4-2319741

Introduction of FRC tables used for Rel-18 FR2 HST UE demodulation requirements* R4-2319839

The channel model has been introduced in Rel-18 FR2 HST* R4-2321188

New Requirements for HST FR2 PDSCH with CA* R4-2321200

Introduce FR2 HST Enhancements Requirements – Applicability Rules |
|  |  |
| ***Summary of change:*** | The summary of change in endorsed draft CR is copied as below:* R4-2319741

Introduction of FRC tables used for Rel-18 FR2 HST UE demodulation requirements.* R4-2319839

Introduce new section for channel model for FR2 HST* R4-2321188

Adding new section for requirements for HST FR2 PDSCH with CA* R4-2321200

Introduce FR2 HST Enhancements Requirements – Applicability Rules |
|  |  |
| ***Consequences if not approved:*** | The consequences if not approved for endorsed draft CR are coppied as below.* R4-2319741

Not clear how to configure DL/UL scheduling durig the tests* R4-2319839

The UE demodulation requirement for FR2 HST scenario can not be verfied * R4-2321188

No requirements for HST FR2 PDSCH with CA* R4-2321200
 |
|  |  |
| ***Clauses affected:*** | 7.1.1.37.2A.2A.3.2.2.5B.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-4 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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

<Start Of Change R4-2321200>

7.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 7.1.1.3-1 shall apply for UEs which support optional UE features only.

**Table 7.1.1.3-1: Requirements applicability for optional UE features**

|  |  |  |  |
| --- | --- | --- | --- |
| **UE feature/capability [14]** | **Test type** | **Test list** | **Applicability notes** |
| SU-MIMO Interference Mitigation advanced receiver | FR2-1 TDD | PDSCH | Clause 7.2.2.2.1 (Test 3-1) |  |
| Basic DL NR-NR CA operation (*supportedBandCombinationList*) | NR CA | SDR | Clause 7.5A.1 | 1) Up to 16 DL carriers2) Same numerology across carrier for data/control channel at a given time |
| PDSCH repetitions over multiple slots *(pdsch-RepetitionMultiSlots)* | FR2-1 TDD | PDSCH | Clause 7.2.2.2.2 |  |
| DRX Adaptation (*drx-Adaptation-r16*) | FR2-1 TDD | PDCCH | Clause 7.3.2.2.3 | If the Test 3-1 in Clause 7.3.2.2.3 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 7.3.2.2.1. |
| 256QAM for PDSCH(*pdsch-256QAM-FR2*) | FR2-1 TDD | PDSCH | Clause 7.2.2.2.1 (Test 1-4) |  |
| 256QAM for PDSCH (*pdsch-256QAM-FR2*) | FR2-1 TDD | SDR | Clause 7.5A.1 | For UE capable of *pdsch-256QAM-FR2* for certain band(s), *mcs-Table* is configured to ‘64QAM’ for SDR test. |
| Support of FR2 HST operation [(FR2 UE power class PC6 signalling is used to indicate support of feature group)] | FR2-1 TDD | PDSCH | [Clause 7.2.2.2.4] |  |
| Support of Single Carrier operations with 120kHz SCS for FR2-2(*initialAccessSSB-120kHz-r17)* | FR2-2 TDD | PDSCH | Clause 7.2.2.2.1(Table 7.2.2.2.1-6: Test 4-1, 4-2, 4-3, 4-4) |  |
|  |  | PDCCH | Clause 7.3.2.2(Table 7.3.2.2.1-2: Test 1a-1, 1a-2, 1a-3) (Table 7.3.2.2.2-2, Test 3-1, 3-2) |  |
|  |  | PBCH | Clause 7.4.2.2(Table 7.4.2.2-2: Test 3) |  |
| Support of 480kHz SCS for FR2-2(*ul-FR2-2-SCS-480kHz-r17* and *initialAccessSSB-480kHz-r17)* | FR2-2 TDD | PDSCH | Clause 7.2.2.2.1(Table 7.2.2.2.1-6: Test 4-5, 4-6) |  |
|  |  | PDCCH | Clause 7.3.2.2(Table 7.3.2.2.1-2: Test 1a-4)(Table 7.3.2.2.2-2, Test 3-3) |  |
|  |  | PBCH | Clause 7.4.2.2(Table 7.4.2.2-2: Test 4) |  |
| Support of FR2 HST operation (FR2 UE power class PC6 signalling is used to indicate support of feature group) with simultaneous multiRX reception | FR2-1 TDD | PDSCH | Clause [TBD] | FR2 HST UE should support the following optional capabilities* *[simultaneousReceptionFR2HST-r18];*
* *multiDCI-MultiTRP-r16;*
* *overlapPDSCHsFullyFreqTime-r16;*

Additionally, the UE should report *maxNumberActiveTCI-PerBWP* > 1 |

<End of Change R4-2321200>

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

<Start Of Change R4-2321188>

7.2A PDSCH demodulation requirements for CA

The parameters specified in Table 7.2-1 for PDSCH single carrier tests are reused for PDSCH CA test unless otherwise stated.

7.2A.1 1RX requirements

(Void)

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 |

**Table 7.2A.2.1-3: Minimum performance for multiple CA configurations**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1 | TDD 120 kHz + TDD 120 kHz | As defined in Table 7.2A.2.1-2 |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 7.1.1.5. |

7.2A.2.2 Minimum Requirements for HST-FR2-DPS with CA

For HST-FR2-DPS with CA, the requirements are defined in Table 7.2A.2.2-5 based on the single carrier requirements for 120KHz SCS and different bandwidth specified in Table 7.2A.2.2-3 and Table 7.2A.2.2-4, with the additional parameters in Table 7.2A.2.2-2 and the downlink physical channel setup according to Annex C.5.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 7.2A.2.2-1.

**Table 7.2A.2.2-1: Test Purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-FR2-DPS scenario defined in B.3.4.2 with CA with 1 active PDSCH TCI states | 1 |
| Verify UE performance in the HST-FR2-DPS scenario defined in B.3.4.1 with CA with 2 active PDSCH TCI states | 2 |

**Table 7.2A.2.2-2: Test Parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration | TCI state |  | Note 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 |
| TCI state |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | Resource set #1 | 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 = 5 for CSI-RS resource 1 and 3 |
| l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 1 and 2 |
| 6 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #4 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #2 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 0 for CSI-RS resource 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 5 and 7 |
| l0 = 8 for CSI-RS resource 6 and 8 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 5,6,7,8 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 5 and 6 |
| 6 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #5 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #3 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 1 for CSI-RS resource 9,10,11,12 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 9 and 11 |
| l0 = 9 for CSI-RS resource 10 and 12 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 9,10,11,12 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 9 and 10 |
| 6 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #6 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #4 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 1 for CSI-RS resource 13,14,15,16 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 13 and 15 |
| l0 = 8 for CSI-RS resource 14 and 16 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 13,14,15,16 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 13 and 14 |
| 6 for CSI-RS resource 15 and 16 |
| QCL info |  | TCI state #7 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #13 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 2 for CSI-RS resource 17,18,19,20 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 17 and 19 |
| l0 = 9 for CSI-RS resource 18 and 20 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 17,18,19,20 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 17 and 18 |
| 6 for CSI-RS resource 19 and 20 |
| QCL info |  | TCI state #12 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #14 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 2 for CSI-RS resource 21,22,23,24 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 21 and 23 |
| l0 = 8 for CSI-RS resource 22 and 24 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 21,22,23,24 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 21 and 22 |
| 6 for CSI-RS resource 23 and 24 |
| QCL info |  | TCI state #13 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #15 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 3 for CSI-RS resource 25,26,27,28 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 25 and 27 |
| l0 = 9 for CSI-RS resource 26 and 28 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 25,26,27,28 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 25 and 26 |
| 6 for CSI-RS resource 27 and 28 |
| QCL info |  | TCI state #14 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| Resource set #16 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 3 for CSI-RS resource 29,30,31,32 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 29 and 31 |
| l0 = 8 for CSI-RS resource 30 and 32 |
| CSI-RS periodicity | Slots | 80 for CSI-RS resource 29,30,31,32 |
| CSI-RS offset | Slots | 5 for CSI-RS resource 29 and 30 |
| 6 for CSI-RS resource 31 and 32 |
| QCL info |  | TCI state #15 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB =ceil(BWP size/4)\*4 |
| NZP CSI-RS for CSI acquisition | Resource set #5 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #6 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 2 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #7 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 4 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| Resource set #8 | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 6 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #3 |
| Resource set #17 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #8 |
| Resource set #18 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 2 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #9 |
| Resource set #19 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 4 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #10 |
| Resource set #20 (Note2) | First subcarrier index in the PRB used for CSI-RS (*k0*) |  | 6 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #11 |
| CSI-RS for beam refinement | Resource set #9 | 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 1l0 = 9 for CSI-RS resource 2 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #10 | First subcarrier index in the PRB used for CSI-RS  |  | k0=1 for CSI-RS resource 3,4 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 8 for CSI-RS resource 3l0 = 9 for CSI-RS resource 4 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #11 | First subcarrier index in the PRB used for CSI-RS  |  | k0=2 for CSI-RS resource 5,6 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 8 for CSI-RS resource 5l0 = 9 for CSI-RS resource 6 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| Resource set #12 | First subcarrier index in the PRB used for CSI-RS  |  | k0=3 for CSI-RS resource 7,8 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 8 for CSI-RS resource 7l0 = 9 for CSI-RS resource 8 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #3 |
| Resource set #21 (Note2) | First subcarrier index in the PRB used for CSI-RS  |  | k0=0 for CSI-RS resource 9,10 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 10 for CSI-RS resource 9l0 = 11 for CSI-RS resource 10 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #8 |
| Resource set #22 (Note2) | First subcarrier index in the PRB used for CSI-RS  |  | k0=1 for CSI-RS resource 11,12 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 10 for CSI-RS resource 11l0 = 11 for CSI-RS resource 12 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #9 |
| Resource set #23 (Note2) | First subcarrier index in the PRB used for CSI-RS  |  | k0=2 for CSI-RS resource 13,14 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 10 for CSI-RS resource 13l0 = 11 for CSI-RS resource 14 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #10 |
| Resource set #24 (Note2) | First subcarrier index in the PRB used for CSI-RS  |  | k0=3 for CSI-RS resource 15,16 |
| First OFDM symbol in the PRB used for CSI-RS |  | l0 = 10 for CSI-RS resource 15l0 = 11 for CSI-RS resource 16 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 1 |
| QCL info |  | TCI state #11 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type D |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type D |
| TCI state #3 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 13 from 'CSI-RS for tracking Resource set #4' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 13 from 'CSI-RS for tracking Resource set #4' configuration |
| QCL Type |  | Type D |
| TCI state #8 (Note2) | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 17 from 'CSI-RS for tracking Resource set #13' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 17 from 'CSI-RS for tracking Resource set #13' configuration |
| QCL Type |  | Type D |
| TCI state #9 (Note2) | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 21 from 'CSI-RS for tracking Resource set #14' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 21 from 'CSI-RS for tracking Resource set #14' configuration |
| QCL Type |  | Type D |
| TCI state #10 (Note2) | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 25 from 'CSI-RS for tracking Resource set #15' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 25 from 'CSI-RS for tracking Resource set #15' configuration |
| QCL Type |  | Type D |
| TCI state #11 (Note2) | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 29 from 'CSI-RS for tracking Resource set #16' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 29 from 'CSI-RS for tracking Resource set #16' configuration |
| QCL Type |  | Type D |
| TCI state #4 | 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 #5 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type D |
| TCI state #6 | Type 1 QCL information | SSB index |  | SSB #2 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #2 |
|  | QCL Type |  | Type D |
| TCI state #7 | Type 1 QCL information | SSB index |  | SSB #3 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #3 |
|  | QCL Type |  | Type D |
| TCI state #12 (Note2) | Type 1 QCL information | SSB index |  | SSB #4 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #4 |
|  | QCL Type |  | Type D |
| TCI state #13 (Note2) | Type 1 QCL information | SSB index |  | SSB #5 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #5 |
|  | QCL Type |  | Type D |
| TCI state #14 (Note2) | Type 1 QCL information | SSB index |  | SSB #6 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #6 |
|  | QCL Type |  | Type D |
| TCI state #15 (Note2) | Type 1 QCL information | SSB index |  | SSB #7 |
|  | QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #7 |
|  | QCL Type |  | Type D |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | Specific to each TDD UL-DL pattern and as defined in TS38.101-4 Annex A.1.3 |
| Note 1: For Test 1, SSB # (2k mod 8) , CSI-RS (for tracking) resource set # ((k mod 4)+1), CSI-RS (for CSI acquisition) resource set # ((k mod 4) + 5) and CSI-RS (for beam refinement) resource set # ((k mod 4) + 9) are transmitted by kth RRH; SSB # ((2k mod 8)+1) , CSI-RS (for tracking) resource set # ((k mod 4) + 13), CSI-RS (for CSI acquisition) resource set # ((k mod 4) + 17) and CSI-RS (for beam refinement) resource set # ((k mod 4) + 21) are transmitted by kth RRH. TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy (i≠0). PDCCH and PDSCH associated with TCI # (k mod 4) is transmitted by kth RRH from slot#to slot#,PDCCH and PDSCH associated with TCI # ((k mod 4)+8) is transmitted by kth RRH from slot#to slot#,where k is the RRH number, n = 28800 is half of the number of slots between two RRH, = 4 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 24 is the number of slots for MAC CE processing, = 132 is the number of slots to first SSB transmission occasion after MAC CE command is decoded by the UE, = 16 is the number of slots for SSB processing, = 66 is the number of slots to first TRS transmission occasion after first SSB is processed by the UE, = 16 is the number of slots for TRS processing. PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.For Test 2, SSB # (k mod 4) , CSI-RS (for tracking) resource set # ((k mod 4)+1), CSI-RS (for CSI acquisition) resource set # ((k mod 4) + 5) and CSI-RS (for beam refinement) resource set # ((k mod 4) + 9) are transmitted by kth RRH. TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy. PDCCH and PDSCH associated with TCI # (k mod 4) is transmitted by kth RRH from slot#to slot#where k is the RRH number, n = 57600 is half of the number of slots between two RRH, = 4 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 24 is the number of slots for MAC CE processing. PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.Note 2: Only configured for Test 1. |

**Table 7.2A.2.2-3: Single carrier performance of HST-FR2-DPS-Bidirectional-B for CA configurations**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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)** |
| R.PDSCH.5-16.1 TDD | 50 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-BI-B | 1 | 2x2, ULA Low | 70 | [13,3]  |
| R.PDSCH.5-16.2 TDD | 100 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-BI-B | 1 | 2x2, ULA Low | 70 | [13,6]  |
| R.PDSCH.5-12.2 TDD | 200 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-BI-B | 1 | 2x2, ULA Low | 70 | [13,7]  |
| R.PDSCH.5-16.3 TDD | 400 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-BI-B | 1 | 2x2, ULA Low | 70 | [13,5]  |

**Table 7.2A.2.2-4: Single carrier performance of HST-FR2-DPS-Unidirectional-A for CA configurations**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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)** |
| R.PDSCH.5-17.1 TDD | 50 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-UNI-A | 2 | 2x2, ULA Low | 70 | [13,4]  |
| R.PDSCH.5-17.2 TDD | 100 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-UNI-A | 2 | 2x2, ULA Low | 70 | [13,6]  |
| R.PDSCH.5-12.1 TDD | 200 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-UNI-A | 2 | 2x2, ULA Low | 70 | [13,7]  |
| R.PDSCH.5-17.3 TDD | 400 / 120 | 64QAM, 0.43 | FR2.120-1 | HST-DPS-FR2-UNI-A | 2 | 2x2, ULA Low | 70 | [13,5]  |

**Table 7.2A.2.2-5: Minimum performance for HST-FR2-DPS multiple CA configurations**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1 | TDD 120 kHz + TDD 120 kHz | As defined in Table 7.2A.2.2-3 |
| 2 | TDD 120 kHz + TDD 120 kHz | As defined in Table 7.2A.2.2-4 |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 7.1.1.5. |

<End of Change R4-2321188>

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

# A.3 DL reference measurement channels

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

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

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

### A.3.2.2 TDD

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

#### A.3.2.2.5 Reference measurement channels for SCS 120 kHz FR2

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

<Start Of Change R4-2319741>

Table A.3.2.2.5-16 PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 and bi-directional HST-DPS with CA scenario

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.PDSCH.5-16.1 TDD | R.PDSCH.5-16.2 TDD | R.PDSCH.5-16.3 TDD |  |
| Channel bandwidth | MHz | 50 | 100 | 400 |  |
| Subcarrier spacing | kHz | 120 | 120 | 120 |  |
| Allocated resource blocks | PRBs | 32 | 66 | 264 |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} |  | 9 | 9 | 9 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} |  | 13 | 13 | 13 |  |
| For Slot i=1,2,3 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Allocated slots per 2 frames |  | 124 | 124 | 124 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM |  |
| MCS index |  | 17 | 17 | 17 |  |
| Modulation |  | 64QAM | 64QAM | 64QAM |  |
| Target Coding Rate |  | 0.43 | 0.43 | 0.43 |  |
| Number of MIMO layers |  | 2 | 2 | 2 |  |
| Number of DMRS REs |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} |  | 18 | 18 | 18 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} |  | 18 | 18 | 18 |  |
|  For Slot i = 1,2,3 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Overhead for TBS determination |  | 6 | 6 | 6 |  |
| Information Bit Payload per Slot  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | Bits | 13832 | 28680 | 114776 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | Bits | 21504 | 45096 | 180376 |  |
|  For Slot i = 1,2,3 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Transport block CRC per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | Bits | 24 | 24 | 24 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | Bits | 24 | 24 | 24 |  |
|  For Slot i = 1,2,3 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Number of Code Blocks per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | CBs | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | CBs | 2 | 4 | 14 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | CBs | 3 | 6 | 22 |  |
|  For Slot i = 1,2,3 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slots i = 5 and 85 (Note 3) | Bits | 33408 | 76632 | 392640 |  |
|  For Slots i = 6 and 86 (Note 3) | Bits | 33408 | 76632 | 392640 |  |
|  For Slot i, if mod(i, 5) = 3 for i from {7,…, 94,87, …, 159} | Bits | 33408 | 68904 | 275616 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {7,…,84,87,…,159} | Bits | 51072 | 105336 | 421344 |  |
|  For Slot i = 1,2,3 | Bits | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| Max. Throughput averaged over 2 frames | Mbps | 121.433 | 254.15 | 1016.651 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Binary Channel Bits are calculated under assumption of 52 PRBs TRS allocation when the number of allocated resource blocks are more than 52.Note 4: SS/PBCH block is transmitted in slot #1, slot #2 and slot #3 with periodicity 20ms |

Table A.3.2.2.5-17 PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 and uni-directional HST-DPS with CA scenario

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.PDSCH.5-17.1 TDD | R.PDSCH.5-17.2 TDD | R.PDSCH.5-17.3 TDD |  |
| Channel bandwidth | MHz | 50 | 100 | 400 |  |
| Subcarrier spacing | kHz | 120 | 120 | 120 |  |
| Allocated resource blocks | PRBs | 32 | 66 | 264 |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} |  | 9 | 9 | 9 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} |  | 13 | 13 | 13 |  |
| For slot i = 1 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
| For slot i = 2 |  | 13 | 13 | 13 |  |
| For slot i = 3 |  | 9 | 9 | 9 |  |
| Allocated slots per 2 frames |  | 126 | 126 | 126 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM |  |
| MCS index |  | 17 | 17 | 17 |  |
| Modulation |  | 64QAM | 64QAM | 64QAM |  |
| Target Coding Rate |  | 0.43 | 0.43 | 0.43 |  |
| Number of MIMO layers |  | 2 | 2 | 2 |  |
| Number of DMRS REs |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} |  | 18 | 18 | 18 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} |  | 18 | 18 | 18 |  |
|  For Slot i = 1 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slot i = 2 |  | 18 | 18 | 18 |  |
|  For Slot i = 3 |  | 18 | 18 | 18 |  |
| Overhead for TBS determination |  | 6 | 6 | 6 |  |
| Information Bit Payload per Slot  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | Bits | 13832 | 28680 | 114776 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | Bits | 21504 | 45096 | 180376 |  |
|  For Slot i = 1 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slot i = 2 |  | 21504 | 45096 | 180376 |  |
|  For Slot i = 3 |  | 13832 | 28680 | 114776 |  |
| Transport block CRC per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | Bits | 24 | 24 | 24 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | Bits | 24 | 24 | 24 |  |
|  For Slot i = 1 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slot i = 2 |  | 24 | 24 | 24 |  |
|  For Slot i = 3 |  | 24 | 24 | 24 |  |
| Number of Code Blocks per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | CBs | N/A | N/A | N/A |  |
|  For Slot i, if mod(i, 5) = 3 for i from {4,…, 159} | CBs | 2 | 4 | 14 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {5,…,159} | CBs | 3 | 6 | 22 |  |
|  For Slot i = 1 |  | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slot i = 2 |  | 3 | 6 | 22 |  |
|  For Slot i = 3 |  | 2 | 4 | 14 |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |
|  For Slots i = 5 and 85 (Note 3) | Bits | 41856 | 90360 | 406368 |  |
|  For Slots i = 6 and 86 (Note 3) | Bits | 41856 | 90360 | 406368 |  |
|  For Slot i, if mod(i, 5) = 3 for i from {7,…, 84, 87, …, 159} | Bits | 33408 | 68904 | 275616 |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {7,…,84,87,…,159} | Bits | 51072 | 105336 | 421344 |  |
|  For Slot i = 1 | Bits | N/A (Note 4) | N/A (Note 4) | N/A (Note 4) |  |
|  For Slot i = 2 |  | 51072 | 105336 | 421344 |  |
|  For Slot i = 3 |  | 33408 | 68904 | 275616 |  |
| Max. Throughput averaged over 2 frames | Mbps | 123.2 | 257.839 | 1031.409 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Binary Channel Bits are calculated under assumption of 52 PRBs TRS allocation when the number of allocated resource blocks are more than 52.Note 4: SS/PBCH block is transmitted in slot #1 with periodicity 20ms |

<End of Change R4-2319741>

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

# B.3 High Speed Train Scenario

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

<Start Of Change R4-2319839>

## B.3.4 FR2 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.3.4.1-1 for Unidirectional, Figure B.3.4.2-1 for Bidirectional, and Figure 8.3.4.X-1 for Bidirectional with Multi-Rx chain reception

The location of RRH *k* is given as:

 (B.3.4.1)

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.3.4.2)

where: and *a* means distance in meters, which means the train is right on the track. where *v* (m/s) is the moving speed of the train, for B.3.4.1 Unidirectional Deployment Channel Profile and for B.3.4.x Bidirectional Deployment Channel Profile with multi-Rx chain reception, and for B.3.4.2 Bidirectional Deployment Channel Profile.

<End of Change R4-2319839>

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

### B.3.4.2 Bidirectional Deployment Channel Profile

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

<Start Of Change R4-2319839>

### B.3.4.x Bidirectional Deployment Channel Profile with Multi-Rx Chain Reception

The FR2 HST DPS Bidirectional Deployment Channel Profile with Multi-Rx Reception is a single tap propagation channel for each Rx chain, switching transmission point between adjacent RRHs for UE with each Rx Chain when the UE reaches a distance equal to DS\_offset from the serving RRH as illustrated in Figure B.3.4.x-1:



Figure B.3.4.x-1: Bidirectional deployment of FR2 HST-DPS with Multi-Rx Chain Reception (To be updated)

RRH *k* is visible for the train only in the range:

 (B.3.4.x.1)

However, as shown in Figures B.3.4.x-1, RRH k is considered for PDSCH and PDCCH signal transmission only received by UE with right Rx Chain in the range:

 (B.3.4.x.2)

and RRH k is considered for PDSCH and PDCCH signal transmission only received by UE with left Rx Chain in the range:

 (B.3.4.x.3)

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) for PDSCH and PDCCH received by train with right Rx Chain is given by:

 (B.3.4.x.4)

Doppler shift (Hz) for PDSCH and PDCCH received by train with left Rx Chain is given by:

 (B.3.4.x.5)

Doppler shift is given by equation B.3.4.x.4 and B.3.4.x.5, where the required input parameters listed in table B.3.4.x-1 and the resulting Doppler shift shown in Figures B.3.4.x-2 and B.3.4.x-3 are applied for all frequency bands.

Table B.3.4.x-1: FR2 HST-DPS Bidirectional scenario

|  |  |
| --- | --- |
| Parameter | Value |
| HST-DPS-FR2-BI-B1-MR |
|  | 700 m |
|  | 100 m |
|  | 150 m |
|  | 350 km/h |
|  | 9722 Hz |

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



Figure B.3.4.x-2: Doppler shift trajectory (f\_d = 9722 Hz) showing visibility
of each RRH for FR2 HST-DPS Bidirectional scenario with mutlit-Rx Chain Reception



Figure B.3.4.2-3: Doppler shift trajectory (f\_d = 9722 Hz) as seen by PDCCH and PDSCH
for each RRH for FR2 HST-DPS Bidirectional scenario with multi-Rx Chain Reception

<End of Change R4-2319839>