**3GPP TSG-RAN WG4 Meeting #104-e R4-2213843**

**Electronic Meeting, 15th – 26th Aug, 2022**

|  |
| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | **Draft** | **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 |  |

|  |
| --- |
|  |
| ***Title:***  | Draft CR on HST FR1 CA requirements (TS38.101-4, Rel-17) |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_HST\_FR1\_enh-Perf |  | ***Date:*** | 2022-08-05 |
|  |  |  |  |  |
| ***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 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Remove square brackets for HST FR1 CA requirements, correct the wrong calculated SNR requirements. |
|  |  |
| ***Summary of change:*** | For HST FR1 CA requirements, update clause 5.2A.2.4, 5.2A.2.5, 5.2A.3.4. |
|  |  |
| ***Consequences if not approved:*** | There will be still square brackets for HST FR1 CA requirements. |
|  |  |
| ***Clauses affected:*** | 5.2A.2.4, 5.2A.2.5, 5.2A.3.4. |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-4 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*<START OF THE CHANGE 1>*

5.2A.2.4 Minimum requirements for HST-SFN CA

For HST-SFN CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.4-5 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.4-3 and Table 5.2A.2.4-4. Test parameters are specified in Table 5.2A.2.4-2, Table 5.2A-2, and Table 5.2A-3 with downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.4-1.

**Table 5.2A.2.4-1: Test purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA | 1,2,3 |

**Table 5.2A.2.4-2: Test parameters**

|  |  |  |
| --- | --- | --- |
| **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) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | FDD: 10 for CSI-RS resource 1,2,3,4.TDD: 20 for CSI-RS resource 1,2,3,4. |
|  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 22 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern |  | 15 kHz SCS: FR1.15-130 kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups |  | 1 |
| PUCCH format for HARQ-ACK feedback |  | PUCCH format 1 for cases with no more than 2 DL CCsPUCCH format 3 for cases with more than 2 DL CCs |

**Table 5.2A.2.4-3: Single carrier performance for FDD 15 kHz SCS for CA configurations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 12.9 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.1 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.4 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |

**Table 5.2A.2.4-4 Single carrier performance for TDD 30 kHz SCS for CA configurations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.4 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.7 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.1 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.6 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.7 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.9 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.4 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.8 |

**Table 5.2A.2.4-5: Minimum performance for multiple CA configurations**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.4-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4-3 and Table 5.2A.2.4-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4. |

*<END OF THE CHANGE 1>*

*<START OF THE CHANGE 2>*

5.2A.2.5 Minimum requirements for PDSCH HST-DPS CA

For HST-DPS CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.5-7 and Table 5.2A.2.5-8 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.5-3 ~ Table 5.2A.2.5-6, with the parameters in Table 5.2A.2.5-2, Table 5.2A-2 and Table 5.2A-3 and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.5-1.

**Table 5.2A.2.5-1: Test purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 1 active PDSCH TCI states | 1-1, 1-2, 1-3 |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 2 active PDSCH TCI states | 2-1, 2-2, 2-3 |

**Table 5.2A.2.5-2: Test parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | FDD and TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration | TCI state |  | Note 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 |
| 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 OFDM symbol in the PRB used for CSI-RS  |  |  l0 = 5 for CSI-RS resource 1 and 3l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 1,2,3,4.30kHz SCS: 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 22 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0Number of PRB = min(52, ceil(BWP size/4)\*4) |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS  |  |  l0 = 6 for CSI-RS resource 5 and 6l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 5,6,7,8.30kHz SCS: 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 62 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0Number of PRB = min(52, ceil(BWP size/4)\*4) |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS  |  | l0 = 12 |
| CSI-RS periodicity | Slots | 15kHz SCS:2030kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #4 | First OFDM symbol in the PRB used for CSI-RS  |  | l0 = 13 |
| CSI-RS periodicity | Slots | 15kHz SCS:2030kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| 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 |  | N/A |
| QCL Type |  | N/A |
| 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 |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information  | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information  | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern |  | 15kHz SCS: FR1.15-130kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups |  | 1 |
| PUCCH format for HARQ-ACK feedback |  | PUCCH format 1 for cases with no more chan 2 DL CCsPUCCH format 3 for cases with more than 2 DL CCs |
| Note 1: SSB # (k mod 2), CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy$ mod\left(i,2n\right)=n$. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#$$max⁡[\left(2k-1\right)n+1+T\_{HARQ}+T\_{MAC proc}+T\_{firstTRS}+T\_{TRS proc}, 0]$$to slot#$\left(2k+1\right)n+T\_{HARQ}+T\_{MAC proc}$,PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy$ mod\left(i,2n\right)=n$. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#$$max⁡[\left(2k-1\right)n+1+T\_{HARQ}+T\_{MAC proc}, 0]$$to slot#$$\left(2k+1\right)n+T\_{HARQ}+T\_{MAC proc}$$Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, $T\_{HARQ}$ = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, $T\_{MAC proc}$ = 3 is the number of slots for MAC CE processing, $T\_{firstTRS}$ = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T\_{TRS proc}$ = 2 is the number of slots for TRS processing. |

**Table 5.2A.2.5-3: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.2 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 45 | R.PDSCH.1-16.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.7 |

**Table 5.2A.2.5-4: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.2 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 45 | R.PDSCH.1-16.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.7 |

**Table 5.2A.2.5-5 Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.2 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |

**Table 5.2A.2.5-6 Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Number of active PDSCH TCI states** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.2 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |

**Table 5.2A.2.5-7: Minimum performance for HST-DPS CA configurations with 1 active PDSCH TCI states**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.5-3 |
| 1-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5-5 |
| 1-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5-3 and Table 5.2A.2.5-5 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4. |

**Table 5.2A.2.5-8: Minimum performance for HST-DPS CA configurations with 2 active PDSCH TCI states**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 2-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.5-4 |
| 2-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5-6 |
| 2-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5-4 and Table 5.2A.2.5-6 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4. |

*<END OF THE CHANGE 2>*

*<START OF THE CHANGE 3>*

5.2A.3.4 Minimum requirements for HST-SFN CA

For HST-SFN CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.4-5 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.4-3 ~ Table 5.2A.3.4-4, with the parameters in Table 5.2A.3.4-2, Table 5.2A-2, Table 5.2A-3, and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.3.4-1.

**Table 5.2A.3.4-1: Test purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA | 1, 2, 3 |

**Table 5.2A.3.4-2: Test parameters**

|  |  |  |
| --- | --- | --- |
| **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) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | FDD: 10 for CSI-RS resource 1,2,3,4.TDD: 20 for CSI-RS resource 1,2,3,4. |
|  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 22 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern |  | 15 kHz SCS: FR1.15-130 kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups |  | 1 |
| PUCCH format for HARQ-ACK feedback |  | PUCCH format 1 for cases with no more than 2 DL CCsPUCCH format 3 for cases with more than 2 DL CCs |

**Table 5.2A.3.4-3: Single carrier performance for FDD 15 kHz SCS for CA configurations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 10.5 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 10.7 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.1 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.5 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.6 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.7 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.7 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |

**Table 5.2A.3.4-4: Single carrier performance for TDD 30 kHz SCS for CA configurations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bandwidth (MHz)**  | **Reference channel** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.0 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.1 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.2 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.4 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.6 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.5 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |

**Table 5.2A.3.4-5: Minimum performance for multiple CA configurations**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.4-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.4-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.X1-3 and Table 5.2A.3.4-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in Section 5.1.1.7.4. |

*<END OF THE CHANGE 3>*