**3GPP TSG-RAN4 Meeting #102e**

**Electronic Meeting, 21 February - 3 March, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.3.0** |  |
|  | | | | | | | | |
| *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:*** | Apple | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_HST\_FR1\_enh-Perf | | | | |  | ***Date:*** | | | 2022-02-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***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:*** | | RAN4 has agreed to define requirements for HST DPS for CA. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduced section for HST DPS requireemnts in CA with 4RX | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No requirements will be defined for HST DPS CA with 4RX | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.2A.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:*** | |  | | | | | | | | |

Start of Change 1

5.2A.3.5 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.3.5-7 and Table 5.2A.3.5-8 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.5-3 - Table 5.2A.3.5-6, with the parameters in Table 5.2A.3.5-2, 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.3.5-1.

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance of UE under 4 receive antenna conditions in the HST-DPS scenario defined in B.3.3 with CA with 1 active TCI state | 1-1, 1-2, 1-3 |
| Verify PDSCH performance of UE under 4 receive antenna conditions in the HST-DPS scenario defined in B.3.3 with CA with 2 active TCI states | 2-1, 2-2, 2-3 |

**Table 5.2A.3.5-1: Test purpose**

Table 5.2A.3.5-2: 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: 12  TDD: 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 3  l0 = 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 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0  Number 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 6  l0 = 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 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0  Number 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:20  30kHz 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:20  30kHz 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: FR1.15-1  30kHz 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 CCs  PUCCH 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. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  ,  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. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 3 is the number of slots for MAC CE processing, = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, = 2 is the number of slots for TRS processing. | | | | |

**Table 5.2A.3.5-3: 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 | 2x4 | 70 | [10.5] |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.8] |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.8] |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.9] |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |
| 45 | R.PDSCH.1-16.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [11.0] |

**Table 5.2A.3.5-4: 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 | 2x4 | 70 | [10.5] |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.8] |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.7] |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.8] |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.9] |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [10.7] |
| 45 | R.PDSCH.1-16.4 | | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | [11.0] |

**Table 5.2A.3.5-5 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 | 2x4 | 70 | [10.4] |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.6] |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.5] |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | [10.7] |

**Table 5.2A.3.5-6 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 | 2x4 | 70 | [10.4] |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.6] |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.7] |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.7] |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.5] |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.7] |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | [10.7] |

**Table 5.2A.3.5-7: Minimum performance for multiple CA configurations for HST-DPS with 1 active TCI state**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 1-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5-3 |
| 1-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5-5 |
| 1-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5-3 and Table 5.2A.3.5-5 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.3.5-8: Minimum performance for multiple CA configurations for HST-DPS with 2 active TCI states**

|  |  |  |
| --- | --- | --- |
| **Test number** | **CA duplex mode** | **Minimum performance requirements** |
| 2-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5-4 |
| 2-1 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5-6 |
| 2-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5-4 and Table 5.2A.3.5-6 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 Change 1