**3GPP TSG-RAN WG4 Meeting #110 R4-2401700**

**Athens, Greece, 26th Feb - 1st Mar, 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | **draft** | **rev** | **-** | **Current version:** | **18.2.0** |  |
|  |
| *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:***  | Draft CR on PDSCH requirement with multi-Rx reception for FR2 HST (TS38.101-4, Rel-18) |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_HST\_FR2\_enh-Perf |  | ***Date:*** | 2024-02-19 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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:*** | Introduce PDSCH requirement with multi-Rx reception. |
|  |  |
| ***Summary of change:*** | For introducing PDSCH requirement with multi-Rx reception, add clause 7.2.2.2.5. |
|  |  |
| ***Consequences if not approved:*** | There will be inconsist between specification and RAN4 agreements. |
|  |  |
| ***Clauses affected:*** | 7.2.2.2.5 (New clause) |
|  |  |
|  | **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:*** | New clause: 7.2.2.2.5 |
|  |  |
| ***This CR's revision history:*** | R4-2320225 |

*<START OF THE CHANGE 1>*

7.2.2.2.5 Minimum requirements for multi-Rx simultaneous reception under HST scenario

The performance requirements are specified in Table 7.2.2.2.5-3, with the addition of test parameters in Table 7.2.2.2.5-2 and the downlink physical channel setup according to Annex C.5.1.

The test purposes are specified in Table 7.2.2.2.5-1.

**Table 7.2.2.2.5-1: Tests purpose**

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| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the multi-Rx simulataneous reception under HST scenario defined in [B.3.7] when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling with fully-overlapping PDSCHs | 1-1 |

**Table 7.2.2.2.5-2: 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 Annex A.1.3 |
| Note 1: For Test 1-1, 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) and . 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 = 57600 is 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 and = 155 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, = 69 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. |

**Table 7.2.2.2.5-3: Minimum performance for multi-Rx simultaneous reception under HST scenario**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | [TRxP#i] | 200 / 120 | 64QAM, 0.50 | FR2.120-1 | HST-DPS-FR2-BI-B1-MR | 2 | 2x2 | 70 | [14.78] |
| [R.PDSCH.x-x.x TDD] |
| [TRxP#j] | 200 / 120 | [16QAM, 0.37]or [16QAM0.48] | FR2.120-1 | HST-DPS-FR2-BI-B1-MR | 2 | 2x2 | 70 | [10.24] or [8.56] |
| [R.PDSCH.x-x.x TDD] |
| Note 1 : The TRxP#i and TRxP#j are the TRxP with the active TCI states that UE uses to receive the PDSCH dataNote 2: PDSCH signals receiving timing difference (RTD) between two Rx Chains is 1.5xCP=0.88 us  |

*<END OF THE CHANGE 1>*