3GPP TSG-RAN WG4 Meeting # 111 R4-2410325

Fukuoka, JP, 20 May – 24 May 2024

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **Drafts** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | TC for sDCI MAC-CE based joint TCI state switching (Rel-18) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MediaTek inc. | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Perf | | | | |  | ***Date:*** | | | 2024-05-20 |
|  |  | | | |  | |  | | |  |
| ***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 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:*** | | To introduce test case for sDCI mTRP, FR2 joint TCI state switching for MIMO evo. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add test case for sDCI mTRP, FR2 joint TCI state switching for MIMO evo. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The test case of MIMO evo does not implement. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | (new) A.3.10.2.19, A3.16A.2, A.3.17.2.1, (new) A.7.5.13.X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of the 1st change>

#### A.3.10.2.19 SSB pattern 17 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.1-1: SSB.17 FR2: SSB Pattern 17 for SSB SCS = 120 kHz in 100 MHz channel with 3 SSBs per SS-burst

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SSB Parameters | Values | | | |
| Channel bandwidth | 100 MHz | | | |
| SSB SCS | 120 kHz | | | |
| SSB periodicity (TSSB) | 20 ms | | | |
| Number of SSBs per SS-burst | 3 | | | |
| SS/PBCH block index | 0 | 1 | 2 | 3 |
| Symbol numbers containing SSBs Note 2 | 4-7 | 8-11 | 2-5 | 6-9 |
| Slot numbers containing SSB Note 2 | 0 | 0 | 1 | 1 |
| SFN containing SSB | SFN mod (max(TSSB,10ms)/10ms) = 0 | | | |
| RB numbers containing SSBs within channel BW | (RBJ, RBJ+1,.…, RBJ+19)Note 1 | | | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].  Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves. | | | | |

<End of the 1st change>

<Start of the 2nd change>

### A.3.16A.2 DLorJoint TCI states

Table A.3.16A.2-1: DLorJoint TCI States

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | DLorJoint TCI.State.0 | DLorJoint TCI.State.1 | DLorJoint TCI.State.2 | DLorJoint TCI.State.3 | DLorJoint TCI.State.4 | DLorJoint TCI.State.5 | DLorJoint TCI.State.6 | DLorJoint TCI.State.7 | DLorJoint TCI.State.8 | DLorJoint TCI.State.9 | DLorJoint TCI.State.10 | DLorJoint TCI.State.11 |
| tci-StateUnifiedId | | Id0 | Id1 | Id2 | Id3 | Id4 | Id5 | Id6 | Id7 | Id8 | Id9 | Id10 | Id11 |
| qcl-Type1 | | typeA | typeA | typeA | typeA | typeC | typeC | typeA | typeA | typeA | typeC | typeC | typeC |
| qcl-Type2Note1 | | typeD | typeD | typeD | typeD | typeD | typeD | typeD | typeD | typeD | typeD | typeD | typeD |
| referenceSignal Note2 | | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 2 Note 5 | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 2 Note3 | SSB0 | SSB1 from the cell with different PCI | Resource #4 in TRS resource set 3  Note 6 | Resource #4 in TRS resource set 4  Note 7 | Resource #4 in TRS resource set 5  Note 8 | SSB1 | SSB2 | SSB3 |
| pathlossReferenceRS | | N/A | N/A | Resource #4 in TRS resource set 1 Note3 | Resource #4 in TRS resource set 1 Note3 | N/A | N/A | Resource #4 in TRS resource set 3  Note 6 | Resource #4 in TRS resource set 4  Note 7 | Resource #4 in TRS resource set 5  Note 8 | N/A | N/A | N/A |
| additionalPCI | | N/A | configured Note4 | N/A | N/A | N/A | configured Note4 | N/A | N/A | N/A | N/A | N/A | N/A |
|  | Note 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2  Note 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.  Note 3: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.4.  Note 4: Only one PCI than serving cell PCI is included in the additionalPCIList, and the additionalPCIIndex is configured as 0.  Note 5: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.5.  Note 6: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.9.  Note 7: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.10.  Note 7: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.11. | | | | | | | | | | | |  |

<End of the 2nd change>

<Start of the 4th change>

#### A.7.5.13.X sDCI MAC-CE based joint TCI state switching

###### A.7.5.13.X.1 Test Purpose and Environment

The purpose of this test is to verify both active downlink and uplink TCI state switch delay requirement defined in clause 8.21 and 8.23, respectively, by using joint TCI state of unified TCI state switch framework. Supported test configuration is shown in Table A.7.5.13.X.1-1.

Table A.7.5.13.X.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

Table A.7.5.13.X.2-2: General test parameters for dual TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| L1-RSRP reporting period | slot | 320 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0 and SSB2 of TRP0, SSB1 and SSB3 of TRP1 | L1-RSRP measurements of SSB0, SSB1 SSB2 and SSB3. |
| Number of RS for L1-RSRP reporting |  | 4 | SSB0, SSB1, SSB2 and SSB3 in Joint TCI state 0, 1, 2, and 3. |
| Cell2 timing offset to cell1 | us | <CP |  |
| T1 | s | 0.2 |  |
| T2 | s | 1 | UE is required to activate dual joint TCI states (TCI state 2 and TCI state 3). |

###### A.7.5.13.X.2 Test parameters

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.7.5.13.X.2-1. Cell-specific parameters of NR PCell are specified in Table A.7.5.13.X.2-2 below. The OTA related test parameters for FR2 are shown in Table A.7.5.13.X.2-3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

- PDCCHs indicating new transmissions shall be sent continuously on Pcell to ensure that the UE would have ACK/NACK sending.

- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE’s higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint*.

- applyIndicatedTCI-State-r18 is set as {first} for TRP0 (CORESET index p associated with Joint TCI state 0 and Joint TCI state 2) and as {second} for TRP1 (CORESET index q associated with Joint TCI state 1 and Joint TCI state 3).

- tci-SelectionPresentInDCI-r18is configured in the BWP configuration, i.e. TCI state for the PDSCH is indicated by DCI format 1\_1 and PDSCHs on two TRPs are scheduled in TDM manner.

- UE is configured with two joint TCI states (TCI state 0 and TCI state 2) for TRP0 and two joint TCI states (TCI state 1 and TCI state 3) for TRP1. QCL info to Joint TCI state 0,1,2 and 3 are provided by SSB0, SSB1, SSB2 and SSB3, respectively.

- UE is indicated in TCI state 0 and TCI state 1 as the active TCI state for TRP0 and TRP1.

The test consists of two time periods, T1 and T2. During T1, SSB0 in joint TCI state 0 and SSB1 in joint TCI state 1 are transmitted.

At the beginning of T2, SSB2 in joint TCI state 2 and SSB3 in joint TCI state 3 start transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms after the slot in which UE provides L1-RSRP report with results for SSB2 and SSB3 in joint TCI state 2 and joint TCI state 3, UE receives a MAC-CE command indicating a switch to dual joint TCI state 2 and TCI state 3 for two TRPs.

The test equipment verifies that UE can be scheduled by two TRPs on joint TCI state 0 and joint TCI state 1 till slot n+ THARQ +. The test equipment also verifies the TCI state switch time for two TRPs by scheduling the UE on joint TCI state 2 and joint TCI state 3 after slot n+THARQ + + max{NM1\* (Tfirst\_target-PL-RS1 + 4\*Ttarget\_PL-RS1 + 2ms), NM2\* (Tfirst\_target-PL-RS2 + 4\*Ttarget\_PL-RS 2+ 2ms) }/ *NR slot length*.

Table A.7.5.13.X.2-1: General test parameters for dual TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| L1-RSRP reporting period | slot | 320 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0 and SSB2 of TRP0, SSB1 and SSB3 of TRP1 | L1-RSRP measurements of SSB0, SSB1 SSB2 and SSB3. |
| Number of RS for L1-RSRP reporting |  | 4 | SSB0, SSB1, SSB2 and SSB3 in Joint TCI state 0, 1, 2, and 3. |
| Cell2 timing offset to cell1 | us | <CP |  |
| T1 | s | 0.2 |  |
| T2 | s | 1 | UE is required to activate dual joint TCI states (TCI state 2 and TCI state 3). |

Table A.7.5.13.X.2-2: NR Cell specific test parameters for dual TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 66 |
| Initial BWP Configuration |  | DLBWP.0.2  ULBWP.0.2 |
| Dedicated BWP Configuration |  | DLBWP.1.1  ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters (CORESET index p) |  | CCR.3.1 TDD |
| Dedicated CORESET parameters (CORESET index q) |  | CCR.3.2 TDD |
| OCNG Patterns |  | OP.5 defined in A.3.2.1 |
| SSB Configuration |  | SSB.17 FR2 |
| SMTC Configuration |  | SMTC.1 |
| Joint TCI State 0 |  | DLorJoint TCI.State.2 |
| Joint TCI State 1 |  | DLorJoint TCI.State.6 |
| Joint TCI State 2 |  | DLorJoint TCI.State.7 |
| Joint TCI State 3 |  | DLorJoint TCI.State.8 |
| TRS Configuration |  | TRS.2.1 TDD for DLorJoint TCI.State.2  TRS.2.4 TDD for DLorJoint TCI.State.6  TRS.2.5 TDD for DLorJoint TCI.State.7  TRS.2.6 TDD for DLorJoint TCI.State.8 |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. |  |  |
|  | | |

Table A.7.5.13.X.2-3: OTA related test parameters for dual TCI state switch

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Units | TRP0 | | | | TRP1 | | | |
|  |  | SSB0 | | SSB2 | | SSB1 | | SSB3 | |
|  |  | T1 | T2 | T1 | T2 | T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup [TBD] according to clause A.3.XX | | | | | | | |
|  |  | AoA1 | | AoA2 | | AoA2 | | AoA3 | |
| Assumption for UE beams Note 6 |  | Rough | | | | | | | |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | -80.6 | -80.6 | -80.6 | -Infinity | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | -Infinity | -80.6 | -80.6 | -80.6 | -Infinity | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | 8.3 | 8.3 | 8.3 | -Infinity | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | -56.0 | -56.0 | -56.0 | - Infinity | -56.0 |
| Note 1: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 3: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 4: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | | | | |

###### A.7.5.13.X.3 Test Requirements

During T2, the test verifies that UE can be scheduled by two TRPs on joint TCI state 2 and joint TCI state 3.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive and transmit with joint TCI state 0 and joint TCI state 1 till slot n+ THARQ +3

- be able to start receiving and transmitting with joint TCI state 2 and joint TCI state 3 after slot n+THARQ + + max{NM1\* (Tfirst\_target-PL-RS1 + 4\*Ttarget\_PL-RS1 + 2ms), NM2\* (Tfirst\_target-PL-RS2 + 4\*Ttarget\_PL-RS 2+ 2ms) }/ *NR slot length*.

- where NM1=1, NM2=1.

The rate of correct events observed during repeated tests shall be at least 90%.

<End of the 4th change>