**3GPP TSG-RAN4 Meeting #102b-e *R4-2204403***

**Electronic meeting, 21th Feb.-3th, Mar., 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** |  | **rev** | **-** | **Current version:** | **17.3.0** |  |
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| *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:***  | DraftCR to TS 38.133: MAC-CE based downlink/uplink TCI state switch delay for unified TCI state |
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| ***Source to WG:*** | Intel |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_feMIMO-Core |  | ***Date:*** | 2022-1-30 |
|  |  |  |  |  |
| ***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 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)* |
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| ***Reason for change:*** | * + In Rel-17, MAC-CE based downlink/uplink TCI state switch delay requirement for Unified TCI state needs to be defined.
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| ***Summary of change:*** | * + Add MAC-CE based downlink/uplink TCI state switch delay requirement for Unified TCI state.
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| ***Consequences if not approved:*** | * + MAC-CE based downlink/uplink TCI state switch delay requirement will be missing.
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| ***Clauses affected:*** | * + 8.15.3, 8.16.3
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|  | **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 first change =============================

8.15.3 MAC-CE based downlink TCI state switch delay

The requirements in this clause shall apply for DL TCI state switch in separate DL TCI state or joint TCI state.

In case that source RS in DL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the following conditions are met:

* + - Active BWP of cell with different PCI shall be equal to the active BWP of serving cell
		- SCS between cell with different PCI and serving cell shall be the same
		- Timing offset between cell with different PCI and serving cell shall be within CP
		- The cell with different PCI meets the existing intra-frequency cell detectable conditions defined in clause 9.2.5 during the last [x] seconds.

In case of joint TCI state switch, it is not expected that UE will be required to make DL reception before UE completes the DL and UL TCI state switch.

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + + TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ THARQ + .Where THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

- TSSB-proc = 2 ms;

- TOk = 1 if target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + + TL1-RSRP +TOuk\*(Tfirst-SSB+ TSSB-proc) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ THARQ + .

Where

- T L1-RSRP = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,

- T L1-RSRP is the time for Rx beam refinement in FR2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

- configured with higher layer parameter *repetition* set to ON

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

- TOuk = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD

- TOuk = 1 when TCI state switching involves other QCL types only

- Tfirst-SSB is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;

- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

==========================End of first change =============================

==========================Start of 2nd change =============================

8.16.3 MAC-CE based uplink TCI state switch delay

The requirements in this clause shall apply for UL TCI state switch in separate UL TCI state or joint TCI state.

PL-RS may be associated with or included in UL TCI state or joint TCI state. The requirements in this clause shall apply if the following conditions are met:

* PL-RS is identical to source RS in UL TCI state or joint TCI state
* PL-RS and source RS in UL TCI state or joint TCI state are QCL-Type D

In case that source RS in UL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the following conditions are met:

* + - Active BWP of cell with different PCI shall be equal to the active BWP of serving cell
		- SCS between cell with different PCI and serving cell shall be the same
		- Timing offset between cell with different PCI and serving cell shall be within CP
		- The cell with different PCI meets the existing intra-frequency cell detectable conditions defined in clause 9.2.5 during the last [x] seconds.

In case of joint TCI state switch, it is not expected that UE will be required to make UL transmission before UE completes the DL and UL TCI state switch.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

* + - If target TCI state is known,
* The UE shall be able to transmit uplink signal with the target TCI state in the slot n+THARQ + 3ms + NM*\** (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms).
	+ - If target TCI state is unknown,
* The UE shall be able to transmit uplink signal with the target TCI state in the slot n+THARQ + 3ms *+* TL1-RSRP+ Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms.

Where,

 - THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

 - NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.

 - Tfirst\_target-PL-RS is time to first pathloss RS transmission after L1-RSRP measurement when TCI state switching

 involves QCL-TypeD.

- Tfirst\_target-PL-RS is time to first pathloss RS transmission after MAC CE command is decoded by the UE for other

 QCL types.

 - is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS.

- T L1-RSRP is the time for Rx beam refinement in FR2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

- configured with higher layer parameter *repetition* set to ON

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

==========================End of 2nd change =============================