**3GPP TSG- Meeting # *R4-2408683***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
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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:***  | (NR\_newRAT-Core) CR for Rel-15 TCI state switching requirements - Rel-18 |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | Furthermore, the reference to 38.321 that was introduced in agreed CR R4-2401451 did not cover section 8.10.3A, 8.10A.3, 8.10A.6, 8.10B.3, 8.10B.6, 8.10C.3, 8.10C.6, 8.10D.3 and 8.10D.6. |
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| ***Summary of change:*** | Updating MAC-CE descriptions in sections 8.10.3A, 8.10A.3, 8.10A.6, 8.10B.3, 8.10B.6, 8.10C.3, 8.10C.6, 8.10D.3 and 8.10D.6 to be similar to section 8.10.3 and 8.10.6 (as agreed in R4-2401451). |
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| ***Consequences if not approved:*** | Different sections for TCI state switch are not consistent with each other. |
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| ***Clauses affected:*** | 8.10.3A, 8.10A.3, 8.10A.6, 8.10B.3, 8.10B.6, 8.10C.3, 8.10C.6, 8.10D.3 and 8.10D.6 |
|  |  |
|  | **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:*** | R4-2408683 |

**<< Change 1 >>**

### 8.10.3A MAC-CE based TCI state switch delay in HST FR2 scenarios

For FR2 power class 6 UE*,* if the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the symbol m of the first slot that is after slot n+ THARQ + $3N\_{slot}^{subframe,µ}$ + TOk\*(Tfirst-SSB + TSSB-proc + Trs + Trs-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + $3N\_{slot}^{subframe,µ}$ .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;

- TSSB-proc = 2 ms;

- Trs is time to the first TRS or SSB transmission after the SSB transmission in the definition of Tfirst-SSB is processed by the UE;

- Trs-proc = 2 ms;

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

For FR2 power class 6 UE, if the target TCI state is unknown, the same requirement for unknown target TCI state case specified in clause 8.10.3 applies.

For FR2 power class 6 UE if the UE indicates to support [*highSpeedTCISwitchEnhMAC-CE-FR2-r18*] and [*R18 enhanced MAC-CE indication*] is indicated as ‘0’ for the TCI state switch, the same requirement specified in clause 8.10.3 applies.

**<< End of change 1 >>**

**<< Change 2 >>**

### 8.10A.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+$ 3N\_{slot}^{subframe,µ}$ +(THARQ +TOk\*(Tfirst-SSB + TSSB-proc+TSSB\*LMAC,known)) */NR slot length*. The UE shall be able to receive on the old TCI state until slot n +$ 3N\_{slot}^{subframe,µ}$ + (THARQ +TOk\*(Tfirst-SSB+ TSSB\*LMAC,known)) / *NR slot length*, where

 THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]. In the event of UE not being able to transmit the acknowledgment due to UL CCA failures: THARQ is extended to also include the time to all next HARQ feedback transmissions and retransmission opportunities, until the time of its successful transmission, as specified in TS 38.213 [3]; no extension of THARQ due to UL CCA failures is allowed for Type 2C UL channel access in TS 37.213;

 Tfirst-SSB is time to first SSB transmission occasion after MAC CE command is decoded by the UE, during which some SSB occasions may not be available at the UE due to DL CCA failures;

 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, 0 otherwise;

 TSSB = ssb-periodicityServingCell;

 LMAC,known≤ LMAC,known,max is the corresponding number of SSB occasions not available at the UE;

 LMAC,known,max =2 for TSSB≤40 ms, LMAC,known,max =1 for TSSB>40 ms.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+$ 3N\_{slot}^{subframe,µ}$ + (THARQ+ TL1-RSRP +TOuk\*(Tfirst-SSB+ TSSB-proc+TSSB\*LMAC,unknown)) / *NR slot length*. The UE shall be able to receive on the old TCI state until slot n+$ 3N\_{slot}^{subframe,µ}$ + (THARQ+TOuk\*(Tfirst-SSB+ TSSB\*LMAC,unknown)) / *NR slot length*,

Where:

- LMAC,unknown≤LMAC,unknown,max is the corresponding number of SSB occasions groups not available at the UE;

- LMAC,unknown,max = 2 for TSSB≤40 ms, LMAC,unknown,max = 1 for TSSB>40 ms;

- TOuk = 1.

- T L1-RSRP = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2-2. Otherwise,

- T L1-RSRP is the time for Rx beam refinement in FR2-2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB\_CCA for SSB as specified in clause 9.5A.4.1,

- with the assumption of M=1

- with TReport = 0

- TOuk = 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 change 2 >>**

**<< Change 3 >>**

### 8.10A.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+$ 3N\_{slot}^{subframe,µ}$ + (THARQ +TOk\*(Tfirst-SSB + TSSB-proc+TSSB\*LMAC,known)) / *NR slot length*. Where THARQ, Tfirst-SSB, TSSB-proc , TSSB, LMAC,known and TOk are as defined in clause 8.10A.3.

**<< End of change 3 >>**

**<< Change 4 >>**

### 8.10B.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + $3N\_{slot}^{subframe,µ}$+ TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + $3N\_{slot}^{subframe,µ}$ .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, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ +$3N\_{slot}^{subframe,µ}$ + TL1-RSRP +TOuk\*(Tfirst-SSB+ TSSB-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + $3N\_{slot}^{subframe,µ}$ .

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\_RedCap for SSB as specified in clause 9.5B.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS\_RedCap for CSI-RS as specified in clause 9.5B.4.2

- 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 change 4 >>**

**<< Change 5 >>**

### 8.10B.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ THARQ +$3N\_{slot}^{subframe,µ}$ +TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. Where THARQ, Tfirst-SSB, TSSB-proc and TOk are defined in clause 8.10.3.

**<< End of change 5 >>**

**<< Change 6 >>**

### 8.10C.2 MAC-CE based TCI state switch delay

Upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + $3N\_{slot}^{subframe,µ}$+ TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ + $3N\_{slot}^{subframe,µ}$ .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, 0 otherwise.

**<< End of change 6 >>**

**<< Change 7 >>**

### 8.10C.6 Active TCI state list update delay

Upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ THARQ +$3N\_{slot}^{subframe,µ}$ +TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. Where THARQ, Tfirst-SSB, TSSB-proc and TOk are defined in clause 8.10C.2.

**<< End of change 7 >>**

**<< Change 8 >>**

8.10D.3 MAC-CE based TCI state switch delay

Upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + $3N\_{slot}^{subframe,µ}$+ TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ +$3N\_{slot}^{subframe,µ}$ .

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, 0 otherwise.

**<< End of change 8 >>**

**<< Change 9 >>**

### 8.10D.6 Active TCI state list update delay

Upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ THARQ +$3N\_{slot}^{subframe,µ}$ +TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. Where THARQ, Tfirst-SSB, TSSB-proc and TOk are defined in clause 8.10D.3.

**<< End of change 9 >>**