3GPP TSG-RAN WG4 Meeting # 95-e R4-2008566

Electronic Meeting, 25 May – 5 June, 2020

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **38.133** | **CR** |  **0767** | **rev** | **1** | **Current version:** | **16.3.0** |  |
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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:***  | CR for introduction of Active TCI state switching delay with CCA Requirements for NR-U |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_unlic-Core |  | ***Date:*** | 2020-05-08 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | Introdction of Active TCI state switching delay with CCA Requirements |
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| ***Summary of change:*** | Introdction of Active TCI state switching delay with CCA Requirements in for NR-U based on the discussion of previous meetings. |
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| ***Consequences if not approved:*** | The corresponding requirements of NR-U is incomplete. |
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| ***Clauses affected:*** | 8.10A |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  |  |
| ***affected:*** |  | **x** |  Test specifications |  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |   |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

### <Start of Change 1>

8.10A Active TCI state switching delay with CCA

8.10A.1 Introduction

The requirements in this section apply for a UE configured with one or more TCI state configurations on serving cell in EN-DC with PSCell on a carrier frequency with CCA or SA NR with PCell on a carrier frequency with CCA. UE shall complete the switch of active TCI state within the delay defined in this section.

8.10A.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

- TCI state switch command is received within 1280 ms of the last transmission of the RS resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command

- The TCI state remain detectable during the TCI state switching period

- The SSB associated with the TCI state remain detectable during the TCI switching period

- SNR of the TCI state is ≥ -3dB

Otherwise, the TCI state is unknown.

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

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command 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+ (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 + + (THARQ +TOk\*(Tfirst-SSB+ TSSB\*LMAC,known)) / *NR slot length*.

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 retransmission opportunities, until the time of its successful transmission, as specified in TS 38.213 [3]; no extension of THARQ due to UL LBT 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, where the SSB may not be transmitted subject to CCA;

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

UE shall stay in the old TCI state upon LMAC,known exceeding LMAC,known,max.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command 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+ + (THARQ +(TL1-RSRP+ TSSB/CSI-RS\*L1MAC,unknown)+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+ + (THARQ +(TL1-RSRP+ TSSB\*L1MAC,unknown) +TOuk\*(Tfirst-SSB+ TSSB\*LMAC,unknown)) / *NR slot length*.

Where T L1-RSRP is the time for L1-RSRP measurement for Rx beam refinement, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4A.1,

- with the assumption of M=1

- with TReport = 0

TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4A.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

TSSB/CSI-RS = the periodicity of SSB index or CSI-RS configured for L1-RSRP measurement

L1MAC,unknown≤ L1MAC,unknown,max is the corresponding number of occasions with the signal measured for L1-RSRP not available at the UE.

L2MAC,unknown≤L2MAC,unknown,max is the corresponding number of SSB occasions not available at the UE.

L1MAC,unknown,max = 2 for TSSB/CSI-RS≤40 ms, L1MAC,unknown,max = 1 for TSSB/CSI-RS>40 ms

L2MAC,unknown,max = 2 for TSSB≤40 ms, L2MAC,unknown,max = 1 for TSSB>40 ms

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

UE shall stay in the old TCI state upon L1MAC,unknown exceeding L1MAC,unknown,max or L2MAC,unknown exceeding L2MAC,unknown,max.

8.10A.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled'for the CORESET scheduling the PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.306 [14].

The known condition for TCI state defined in clause 8.10A.2 is applied.

8.10A.5 RRC based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying RRC activation command 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+ (TRRC\_processing  +TOk\*(Tfirst-SSB + TSSB-proc+ TSSB\*LRRC,known)) / *NR slot length*, where TRRC\_processing is the RRC processing delay, Tfirst-SSB, TSSB-proc,TOk, TSSB are as defined in clause 8.10A.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Tfirst-SSB is time to first SSB transmission occasion after RRC processing by the UE, where the SSB may not be transmitted subject to CCA;

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

LRRC,known≤ LRRC,known,max is the corresponding number of SSB occasions not available at the UE.

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

*Editor’s Note: The UE behaviours when LRRC,known exceedsLRRC,known,max is FFS.*

If the target TCI state is unknown, upon receiving PDSCH carrying RRC activation command 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+ (TRRC\_processing  +(TL1-RSRP+ TSSB/CSI-RS\*L1RRC,unknown)+TOuk\*(Tfirst-SSB+ TSSB-proc+TSSB\*L2RRC,unknown) ) / *NR slot length*, where TRRC\_processing is the RRC processing delay, TL1-RSRP, TSSB/CSI-RS, TOuk, TSSB-proc, TSSB are as defined in clause 8.10A.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Tfirst-SSB is time to first SSB transmission occasion after L1-RSRP measurement when TCI state switching involves QCL-TypeD, where the SSB may not be transmitted subject to CCA;

Tfirst-SSB is time to first SSB transmission occasion after RRC processing time at the UE for other QCL types, where the SSB may not be transmitted subject to CCA;

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

L1RRC, unknown≤ L1RRC, unknown,max is the corresponding number of occasions with the signal measured for L1-RSRP not available at the UE.

L2RRC,unknown≤L2RRC,unknown,max is the corresponding number of SSB occasions not available at the UE.

L1RRC, unknown,max = 2 for TSSB/CSI-RS ≤40 ms, L1MAC,unknown,max = 1 for TSSB/CSI-RS>40 ms.

L2RRC,unknown,max = 2 for TSSB ≤40 ms, L2MAC,unknown,max = 1 for TSSB>40 ms.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list.

*Editor’s Note: The UE behaviours when L1RRC,unknown exceedsL1RRC,unknown,max andL2RRC,unknown exceedsL2RRC,unknown,max are FFS.*

8.10A.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE active TCI state list update 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 +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 1>