**3GPP TSG-RAN WG1 Meeting #104bis-eR1-2104037**

**E-meeting, April 12-20, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.214** | **CR** | **0180** | **rev** | **-** | **Current version:** | **16.5.0** |  |
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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 | **X** | Core Network |  |

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| ***Title:***  | 38.214 CR on CSI request constraint per slot |
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| ***Source to WG:*** | Moderator (Nokia), vivo, MediaTek |
| ***Source to TSG:*** | RAN1 |
|  |  |
| ***Work item code:*** | LTE\_NR\_DC\_CA\_enh-Core  |  | ***Date:*** | 2021-04-19 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | A UE is not expected to receive more than one DCI with non-zero CSI request per slot; a UE is not expected to receive more than one aperiodic CSI report request for transmission in a given slot. However, the definition of a ‘slot’ is not clear for DC/CA cases with different numerology. |
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| ***Summary of change:*** | Clarify that the CSI request constraint and CSI reporting constraint are across CC in a cell group. Within a cell group, a UE is not expected to receive DCI for CSI triggering in a slot overlapping with any slot receiving DCI for CSI triggering. In addition, a UE is also not expected to receive an aperiodic CSI report request for transmission in a slot overlapping with any slot having an aperiodic CSI report transmission in the same cell group. The slot length is taken from the lowest SCS carrier when the DCI, the CSI-RS and the PUSCH are not having all the same SCS.Removal of square brackets around a value in Table 5.2.1.5.1a |
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| ***Consequences if not approved:*** | gNB and UE may have different understanding on the constraints for A-CSI request/reporting. |
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| ***Clauses affected:*** | 5.2.1.5.1, 5.2.1.5.1a |
|  |  |
|  | **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 is a Rel-16 variant of the RAN1#104-agreed Rel-15 38214CR0174 ([R1-2102178)](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2102178.zip) that is extended to work with cross-carrier scheduling of different numeroligies in subclause 5.2.1.5.1a. The change to 5.2.1.5.1 is a shadow of the CR0174, while the change to 5.1.2.1.5.1a is new and unique to cross-carrier scheduling with different SCS. |
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| ***This CR's revision history:*** |  |

5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology

For CSI-RS resource sets associated with Resource Settings configured with the higher layer parameter *resourceType* set to 'aperiodic', 'periodic', or 'semi-persistent', trigger states for Reporting Setting(s) (configured with the higher layer parameter *reportConfigType* set to 'aperiodic') and/or Resource Setting for channel and/or interference measurement on one or more component carriers are configured using the higher layer parameter *CSI-AperiodicTriggerStateList*. For aperiodic CSI report triggering, a single set of CSI triggering states are higher layer configured, wherein the CSI triggering states can be associated with any candidate DL BWP. A UE is not expected to receive more than one DCI with non-zero *CSI request* field per slot per cell. A UE is not expected to receive DCI with non-zero *CSI request* field within a cell group in a slot overlapping with any slot receiving DCI with non-zero *CSI request* field in the same cell group. A UE is not expected to be configured with different *TCI-StateId*'s for the same aperiodic CSI-RS resource ID configured in multiple aperiodic CSI-RS resource sets with the same triggering offset in the same aperiodic trigger state. A UE is not expected to receive more than one aperiodic CSI report request for transmission in a given slot per cell. A UE is not expected to receive an aperiodic CSI report request for transmission in a slot overlapping with any slot having an aperiodic CSI report transmission in the same cell group. If a UE does not indicate its capability of *CSItriggerStateContainingNonactiveBWP* the UE is not expected to be triggered with a CSI report for a non-active DL BWP. Otherwise, when a UE is triggered with a CSI report for a DL BWP that is non-active when expecting to receive the most recent occasion, no later than the CSI reference resource, of the associated NZP CSI-RS, the UE is not expected to report the CSI for the non-active DL BWP and the CSI report associated with that BWP is omitted. When a UE is triggered with aperiodic NZP CSI-RS in a DL BWP that is non-active when expecting to receive the NZP CSI-RS, the UE is not expected to measure the aperiodic CSI-RS. In the carrier of the serving cell expecting to receive that associated NZP CSI-RS, if the active DL BWP when receiving the NZP CSI-RS is different from the active DL BWP when receiving the triggering DCI,

< Unchanged parts are omitted >

5.2.1.5.1a Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have different numerologies

When the triggering PDCCH and the triggered aperiodic CSI-RS are of different numerologies, the behavior defined in 5.2.1.5.1 for the case where the numerologies are the same applies with the following exceptions:

Beam switch timing:

- If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* is smaller than the UE reported threshold *beamSwitchTiming* + *d* $∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols*,* as defined in [13, TS 38.306], when the reported value is one of the values of {14, 28, 48} and *enableBeamSwitchTiming* is not provided, or is smaller than 48+ $d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbolswhen the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameter *repetition,* or is smaller than the UE reported threshold *beamSwitchTiming-r16 +* $d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols*,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on', where if the µPDCCH < µCSIRS, the beam switching timing delay *d* is defined in Table 5.2.1.5.1a-1, else *d* is zero

- if one of the associated trigger states has the higher layer parameter *qcl-Type* set to 'typeD',

- if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* + *d* $∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the reported value is one of the values {14,28,48} and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info*, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48+ $d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'on' and scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* + *d* $∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$in CSI-RS symbols when *enableBeamSwitchTiming* is provided;

- else,

- if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is to be received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored.

- else if the UE is configured with *enableDefaultBeamForCCS*, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption of the lowest-ID activated TCI state applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received.

- If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* is equal to or greater than the UE reported threshold *beamSwitchTiming* + *d* $∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols, when the reported value is one of the values of {14,28,48} and *enableBeamSwitchTiming* is not provided and the *NZP-CSI-RS-ResourceSet* is not configured with higher layer parameter *trs-Info*, or is equal to or greater than the UE reported threshold *beamSwitchTiming* + *d* $∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the reported value is one of the values of {14,28,48} and the *NZP-CSI-RS-ResourceSet* is configured with higher layer parameter *trs-Info*, or is equal to or greater than 48+$d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info*, or is equal to or greater than the UE reported threshold *beamSwitchTiming-r16* + *d* $2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$in CSI-RS symbolswhen *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on', where if the µPDCCH < µCSIRS, the beam switching timing delay *d* is defined in Table 5.2.1.5.1a-1, else *d* is zero, the UE is expected to apply the QCL assumptions in the indicated TCI states for the aperiodic CSI-RS resources in the CSI triggering state indicated by the CSI trigger field in DCI.

**Table 5.2.1.5.1a-1: Additional beam switching timing delay *d***

|  |  |
| --- | --- |
| ***µPDCCH*** | ***d* [PDCCH symbols]** |
| 0 | 8 |
| 1 | 8 |
| 2 | 14 |

Aperiodic CSI-RS timing:

- When the aperiodic CSI-RS is used with aperiodic CSI reporting, the CSI-RS triggering offset *X* is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16,* including the case that the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP or *minimumSchedulingOffsetK2* for any UL BWP and all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'typeD' in the corresponding TCI states. The CSI-RS triggering offset has the values of {0, 1, …, 31} slots when the µPDCCH < µCSIRS and {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} when the µPDCCH > µCSIRS.. The aperiodic CSI-RS is transmitted in a slot , if UE is configured with *ca-SlotOffset* for at least one of the triggered and triggering cell, and *Ks* = , otherwise, and where

*- n* is the slot containing the triggering DCI, *X* is the CSI-RS triggering offset in the numerology of CSI-RS according to the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16*,

- $μ\_{CSIRS}$ and $μ\_{PDCCH}$ are the subcarrier spacing configurations for CSI-RS and PDCCH, respectively,

- $N\_{slot, offset, PDCCH}^{CA}$ and $μ\_{offset,PDCCH}$are the$ N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH respectively, $N\_{slot, offset, CSIRS}^{CA} $and  $μ\_{offset,CSIRS}$ are the$ N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured *ca-SlotOffset* for the cell transmitting the CSI-RS respectively, as defined in [4, TS 38.211] clause 4.5

- If the µPDCCH < µCSIRS, the UE is expected to be able to measure the aperiodic CSI RS, if the CSI-RS starts no earlier than the first symbol of the CSI-RS carrier's slot that starts at least *Ncsirs* PDCCH symbols after the end of the PDCCH triggering the aperiodic CSI-RS.

- If the µPDCCH > µCSIRS, the UE is expected to be able to measure the aperiodic CSI RS, if the CSI-RS starts no earlier than at least *Ncsirs* PDCCH symbols after the end of the PDCCH triggering the aperiodic CSI-RS.

**Table 5.2.1.5.1a: *Ncsirs* as a function of the subcarrier spacing of the triggering PDCCH**

|  |  |
| --- | --- |
| ***µPDCCH*** | ***Ncsirs* [symbols]** |
| 0 | 4 |
| 1 | 5 |
| 2 | 10 |
| 3 | 14 |

When the triggering PDCCH and the triggered aperiodic CSI-RS are of different numerologies, the CSI request constraint and CSI reporting constraint defined in 5.2.1.5.1 for the case where the numerologies are the same applies with the following additions:

- CSI request constraints:

- A UE is not expected to receive more than one CSI request per reference slot length across all CCs in a cell group, where the SCS of the reference slot is the minimum of SCS of the PDCCH with which the DCI was transmitted, the SCS of the PUSCH with which the CSI report is to be transmitted, and the SCS of the minimum SCS of the CSI-RS associated to the CSI reports triggered by the DCI. The beginning of a slot length is defined according the PDCCH cell with which the DCI carrying the CSI request is transmitted.

- CSI reporting constraints:

- A UE is not expected to receive more than one CSI request for transmission in a given reference slot length across all CCs in a cell group, where the SCS of the reference slot is the minimum of SCS of the PDCCH with which the DCI was transmitted, the SCS of the PUSCH with which the CSI report is to be transmitted, and the SCS of the minimum SCS of the CSI-RS associated to the CSI reports triggered by the DCI. The beginning of a slot length is defined according the PUSCH cell with which the CSI report is transmitted.

5.2.1.5.2 Semi-persistent CSI/Semi-persistent CSI-RS

< Unchanged parts are omitted >