**3GPP TSG-RAN WG1 Meeting #105-eR1-210**

**E-meeting, May 10-27, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.214** | **CR** |  | **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 unaligned frame boundary CA with A-CSI-RS transmission and CSI reference resource definition | | | | | | | | | |
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| ***Source to WG:*** | Moderator (Nokia), MediaTek | | | | | | | | | |
| ***Source to TSG:*** | RAN1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_NR\_DC\_CA\_enh-Core | | | | |  | ***Date:*** | | | 2021-05-27 |
|  |  | | | |  | |  | | |  |
| ***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 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | The formula for Ksin 5.2.1.5.1 is not correct for example under the case below:    where DCI is received in CC3, ACSI-RS is triggered in CC2, n=0, X=0, =3, =0, we have Ks = 0 + 0 + 3 – 0 = 3, which is wrong due to the reason that the SCS of (120kHz) and (120kHz) is different from the SCS of CC2 (30kHz), although CC3 and CC2 have the same SCS.  For the formula of *n* in 5.2.2.5, the *ca-SlotOffset* between the DL carrier and UL carrier is not taken into consideration. | | | | | | | | |
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| ***Summary of change:*** | | Corrected the formula in 5.2.1.5.1 to work also in the abovementioned case and introduced the *ca-SlotOffset* to the *n* calculation in 5.2.2.5 | | | | | | | | |
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| ***Consequences if not approved:*** | | Cross-carrier A-CSI triggering when the carriers have a different SCS and the slot offset between the carriers is configured lead to erroneous timing | | | | | | | | |
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| ***Clauses affected:*** | | 5.2.1.5.1, 5.2.2.5 | | | | | | | | |
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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:*** | |  | | | | | | | | |

#### 5.2.1.5 Triggering/activation of CSI Reports and CSI-RS

##### 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 per slot. 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. 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,

- the last symbol of the PDCCH span of the DCI carrying the BWP switching shall be no later than the last symbol of the PDCCH span of the DCI carrying the CSI trigger, irrespective of whether they are in the same carrier of a serving cell or not and irrespective of whether they are in the same SCS or not;

- the UE is not expected to have any other BWP switching in that carrier after the last symbol of the PDCCH span covering the DCI carrying the CSI trigger and before the first symbol of the triggered NZP CSI-RS or CSI-IM.

A trigger state is initiated using the *CSI request* field in DCI.

- When all the bits of *CSI request* field in DCI are set to zero, no CSI is requested.

- When the number of configured CSI triggering states in *CSI-AperiodicTriggerStateList* is greater than , where  is the number of bits in the DCI *CSI request* field, the UE receives a subselection indication, as described in clause 6.1.3.13 of [10, TS 38.321], used to map up to  trigger states to the codepoints of the *CSI request* field in DCI.  is configured by the higher layer parameter *reportTriggerSize* where . When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the subselection indication, the corresponding action in [10, TS 38.321] and UE assumption on the mapping of the selected CSI trigger state(s) to the codepoint(s) of DCI CSI request field shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH.

- When the number of CSI triggering states in *CSI-AperiodicTriggerStateList* is less than or equal to , the *CSI request* field in DCI directly indicates the triggering state.

- For each aperiodic CSI-RS resource in a CSI-RS resource set associated with each CSI triggering state, the UE is indicated the quasi co-location configuration of quasi co-location RS source(s) and quasi co-location type(s), as described in Clause 5.1.5, through higher layer signaling of *qcl-info* which contains a list of references to *TCI-State's* for the aperiodic CSI-RS resources associated with the CSI triggering state. If a *State* referred toin the list is configured with a reference to an RS configured with *qcl-Type* set to 'typeD', that RS may be an SS/PBCH block located in the same or different CC/DL BWP or a CSI-RS resource configured as periodic or semi-persistent located in the same or different CC/DL BWP.

- 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,* 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 when the UE provides *beamSwitchTiming-r16*, *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,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on'.

- If a UE is configured with *enableDefaultTCIStatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*

- 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 by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS;

- else, the UE applies the QCL parameter(s) of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS, in the latest slot in which one or more CORESETs are associated with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS

- else if a UE is configured with *enableTwoDefaultTCIStates* and at least one TCI codepoint is mapped to two TCI states

- 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], aperiodic CSI-RS scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS. If there is a PDSCH indicated with two TCI states in the same symbols as the CSI-RS, the UE applies the first TCI state of the two TCI states when receiving the aperiodic CSI-RS.

- else, the UE applies the first one of two TCI states corresponding to the lowest TCI codepoint among those mapped to two TCI states and applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received when receiving the aperiodic CSI-RS.

- else 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 in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* 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 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' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided;

- else if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is 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* and 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* 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* 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 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,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on', 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.

- The UE is not expected to receive aperiodic CSI-RS and PDSCH/aperiodic CSI-RS associated with different values of *coresetPoolIndex* in overlapped symbol(s). The UE is not expected to receive aperiodic CSI-RS and semi-persistent/periodic CSI-RS with different 'QCL-type D' in overlapped symbol(s).

- A non-zero codepoint of the CSI request field in the DCI is mapped to a CSI triggering state according to the order of the associated positions of the up to trigger states in *CSI-AperiodicTriggerStateList* with codepoint '1' mapped to the triggering state in the first position.

For a UE configured with the higher layer parameter *CSI-AperiodicTriggerStateList*, if a Resource Setting linked to a *CSI-ReportConfig* has multiple aperiodic resource sets, only one of the aperiodic CSI-RS resource sets from the Resource Setting is associated with the trigger state, and the UE is higher layer configured per trigger state per Resource Setting to select the one CSI-IM/NZP CSI-RS resource set from the Resource Setting.

When aperiodic CSI-RS is used with aperiodic reporting, the CSI-RS offset is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16*. The CSI-RS triggering offset has the values of {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} slots. If the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP or *minimumSchedulingOffsetK2* for any UL BWP and if 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 is fixed to zero. The aperiodic triggering offset of the CSI-IM follows offset of the associated NZP CSI-RS for channel measurement. 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 in slot , otherwise, and where

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

*-*  and are the and the which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH, and are the and the 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.

The UE does not expect that aperiodic CSI-RS is transmitted before the OFDM symbol(s) carrying its triggering DCI. When the minimum scheduling offset restriction is applied, UE is not expected to be triggered by CSI triggering state indicated by the CSI request field in DCI in which CSI-RS triggering offset is smaller than the currently applicable minimum scheduling offset restriction *K*0min.

If interference measurement is performed on aperiodic NZP CSI-RS, a UE is not expected to be configured with a different aperiodic triggering offset of the NZP CSI-RS for interference measurement from the associated NZP CSI-RS for channel measurement.

If the UE is configured with a single carrier for uplink, the UE is not expected to transmit more than one aperiodic CSI report triggered by different DCIs on overlapping OFDM symbols.

\*\*\*\*\*\*\*\*\*\*\* UNCHANGED PART OMITTED \*\*\*\*\*\*\*\*\*\*\*

5.2.2.5 CSI reference resource definition

The CSI reference resource for a serving cell is defined as follows:

- In the frequency domain, the CSI reference resource is defined by the group of downlink physical resource blocks corresponding to the band to which the derived CSI relates.

- In the time domain, the CSI reference resource for a CSI reporting in uplink slot *n'* is defined by a single downlink slot *n*-*nCSI\_ref*,

- where  and and  are the subcarrier spacing configurations for DL and UL, respectively, and the and the are determined by higher-layer configured *ca-SlotOffset* for the cells transmitting the uplink and downlink, as defined in clause 4.5 of [4, TS 38.211]

- where for periodic and semi-persistent CSI reporting

- if a single CSI-RS/SSB resource is configured for channel measurement *nCSI\_ref* is the smallest value greater than or equal to , such that it corresponds to a valid downlink slot, or

- if multiple CSI-RS/SSB resources are configured for channel measurement *nCSI\_ref* is the smallest value greater than or equal to , such that it corresponds to a valid downlink slot.

- where for aperiodic CSI reporting, if the UE is indicated by the DCI to report CSI in the same slot as the CSI request, *nCSI\_ref* is such that the reference resource is in the same valid downlink slot as the corresponding CSI request, otherwise *nCSI\_ref* is the smallest value greater than or equal to , such that slot *n*- *nCSI\_ref* corresponds to a valid downlink slot, where *Z'* corresponds to the delay requirement as defined in Clause 5.4.

- when periodic or semi-persistent CSI-RS/CSI-IM or SSB is used for channel/interference measurements, the UE is not expected to measure channel/interference on the CSI-RS/CSI-IM/SSB whose last OFDM symbol is received up to *Z'* symbols before transmission time of the first OFDM symbol of the aperiodic CSI reporting.

\*\*\*\*\*\*\*\*\*\*\* UNCHANGED PART OMITTED \*\*\*\*\*\*\*\*\*\*\*