3GPP TSG RAN WG1 #102 DRAFT R1-20xxxx

e-Meeting, August 17th – 28th, 2020

**Agenda item: 7.2.10**

**Source: Moderator (Nokia)**

**Title: FL summary on aperiodic CSI-RS triggering with different numerology between CSI-RS and triggering PDCCH**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is a pre-meeting summary of the documents submitted for the AI7.2.10 that discussed the aperiodic CSI-RS triggering with different numerology between CSI-RS and triggering PDCCH. One document was identified with proposals related to the functionality [1].

# 2 Proposal 3, section 2.2 [1]

Section 2.2 of [1] makes the following point:

The following agreement was achieved last meeting. A new RRC parameter was added to control the newly defined beam switching behavior in Rel-16.

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| Agreements:* Introduce a new capability signaling for aperiodic CSI-RS triggering with beam switching timing (FG14-7 in UE features list)
	+ Followings are clarified for FG14-7 (beamSwitchTiming-r16) in the UE features list
		- Candidate values of beamSwitchTiming-r16 include {224, 336}
* An RRC configuration parameter is added to indicate the UE behavior for AP-CSI-RS beam switching in Rel-16
	+ When provided, the UE behavior agreed in Rel-16 TEI is performed, with beamSwitchTiming-r16 as input
	+ Otherwise, the UE behavior specified in Rel-15 is performed, with beamSwitchTiming as input
* Adopt following TP to TS38.214
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However, above behavior is only clarified for the same numerology case. For X-numerology CSI-RS triggering the related UE behavior should also be updated based on the latest agreement.

Moreover, the RRC parameter used in current TS 38.213 (*aperiodicTriggeringOffsetExt-r16*) is not aligned with that defined in TS 38.331: *aperiodicTriggeringOffset-r16*, which is updated together in the following TP.

[detailed TP to TS38.214 provided in [1] copied in the Annex]

*Proposal 3:* *Agree the TP above for clarification on default beam switching behavior and alignement with RRC spec.*

# 3 FL proposal on the scope of the RAN1#102

**Feature lead proposal:** Consider section 2.2 and proposal 3 of [1] and the relatd TP to TS38.214

Comments on the FL proposal

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| **Company** | **Comments** |
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# References

1. R1-2005360 Remaining issues on MR-DC, vivo

# Annex – TP to TS38.214, section 2.2 of [1]

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| 5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology<Unchanged part ommited>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 *~~aperiodicTriggeringOffsetExt-r16~~ 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 'QCL-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.<Unchanged part ommited>5.2.1.5.1a Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have different numerologiesWhen 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-r16*is not provided,, or is smaller than 48+ $d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbolswhen the reported value of *beamSwitchTiming-r16* is one of the values of {224, 336} and *enableBeamSwitchTiming-r16* is provided, 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 'QCL-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], 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*enableBeamSwitchTiming-r16*is not provided, aperiodic CSI-RS scheduled with offset larger than or equal to 48+ $d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming-r16* is provided, periodic CSI-RS, semi-persistent CSI-RS;- 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 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-r16*is not provided,or is equal to or greater than 48+$d∙2^{μ\_{CSIRS}}/2^{μ\_{PDCCH}}$ in CSI-RS symbols when the reported value of *beamSwitchTiming-r16* is one of the values of {224, 336} and *enableBeamSwitchTiming-r16* is provided 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 *~~aperiodicTriggeringOffsetExt-r16~~ aperiodicTriggeringOffset-r16,* including the case that the UE is not configured with *minimumSchedulingOffsetK0-r16* for any DL or UL BWP and all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'QCL-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 *~~aperiodicTriggeringOffsetExt-r16~~ 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

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

<Unchanged part ommited> |