3GPP TSG RAN WG1 Meeting #104-e R1-21xxxxx

e-Meeting, January 25th – February 5th, 2021

Agenda Item: 7.1

Source: Moderator (MediaTek)

Title: Summary for [104-e-NR-7.1CRs-11] Clarification on CSI request constraint per slot

**Document for: Discussion and decision**

# Introduction

In RAN1 #103-e meeting, the following email discussion is assigned by Chairman to discuss “[104-e-NR-7.1CRs-11] Clarification on CSI request constraint per slot”. The email thread is triggered by Issue #17 of [1] and originates from the draft CR in [2].

[R1-2101136](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2101136.zip) Draft 38.214 CR on CSI request constraint per slot MediaTek Inc.

[104-e-NR-7.1CRs-11] Draft 38.214 CR on CSI request constraint per slot – Yi-Ju (MediaTek) by Jan 29

# Discussion

## Background

In TS 38.214, the following constraints on receiving multiple A-CSI requests within a slot are provided:

* 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 especially when different numerologies are involved in CA/DC cases. For example, there are two cells configured in CA case as shown in Figure 1 and 2. One has SCS 15 kHz, and the other has SCS 30 kHz. The following lists some examples for determining the slot constraint:

**Case 1:** the slot is defined based on the smallest SCS of two cells. As shown in Figure 1, if UE receives one DCI with non-zero CSI request in Slot #0 of Cell #1, then UE does not expect to receive DCI with non-zero CSI request in red region.

**Case 2:** the slot is defined according to the largest SCS of two cells. As shown in Figure 2, if UE receives on DCI with non-zero CSI request in Slot #0 of Cell #1, the UE is possible to receive another DCI with non-zero CSI request in Slot #1 of Cell #1. **But it needs to clarify whether UE can receive DCI with non-zero CSI request in red region of Cell #0.**

**Case 3:** the slot is defined according to the PDCCH numerology for triggering the A-CSI report. In this example, the behaviour is the same as in Case 2.

The draft TP in R1-2101136 is provided in Appendix for reference.



**Figure 1. Case 1 – slot constraint is defined based on the smallest SCS**



**Figure 2. Case 2/3 – slot constraint is defined based on the largest SCS/PDCCH numerology**

## Company views

The draft CR in [2] addresses two issues as follows. Please provide company’s view in the table below.

**Issue #1:** for a UE not expected to receive more than one DCI with non-zero CSI request per slot, the proposed change in [2] is provided as follows. Note that ‘in a cell group’ means in MCG or SCG.

A UE is not expected to receive more than one DCI with non-zero CSI request per slot within a cell group; the slot is defined according to the smallest SCS of all configured DL BWPs in a cell group*.*

**Q1: Do you agree with the proposed changes above?**

|  |  |  |
| --- | --- | --- |
| Company | Agree or not | Comments |
| ZTE | No | We think the restriction is about UE processing capability of processing PDCCH. Hence it should make more sense to interpret the slot based on PDCCH numerology. |
| Intel | Agree |  |
| Ericsson | No | The restriction would make it impossible to trigger aperiodic CSI-RS in two consecutive 0.125ms slots in an FR1-FR2 CA scenario, whereas such triggering is possible without CA.Using consecutive slots for ap-CSI-RS is necessary due to restrictions in how many CSI-RS resources that can be triggered in one slot. |
| Apple | Agree |  |
| CATT | No | The change is not needed in our view. The slot refers to a slot within a cell. For any cell, UE is not expected to receive more than one DCI with non-zero CSI request in a slot. That is, it has nothing to do with whether there is already a DCI with non-zero CSI request in another cell. In the examples given in Figure 1/2, gNB could trigger aperiodic CSI in slot#0 of cell#0. |
| OPPO | No | We share similar view as CATT. The principle of CR is more suitable for the UE capability restriction among multiple carriers/bands. However, the current spec is to make restriction for each carrier, which does not affect the other carriers.  |
| vivo | Agree | The original intention from Rel-15 limitation is for single cell case. For UE simultaneously receiving PDCCH from multiple cells, there are no corresponding limitation. We are supportive of the most conservative limitation. To open the discussion, we would be fine to add a Rel-16 UE capability for more aggressive counting of numerology. |
| Qualcomm | Ok, but prefer a better solution | Regarding CATT’s comment, we have different understanding. The constraints, as they stand, should apply to multiple CCs. If same numerology, no matter two CSI requests are transmitted on same or different CCs, they can not lie in same slot. The ambiguity is the numerology if two CCs have different numerologies.We think the issue needs to be discussed, and we should strive to reach a consensus otherwise it is unclear how cross-numerology CSI request can work. |
| Samsung | No | We think that only active BWPs should be considered for CSI. Additionally, we should consider this issue conservatively because it is related to Rel-15. In this manner, we suggest to make the conclusion instead of changing the current specification:ConclusionFor the restriction on a DCI reception with non-zero CSI request per slot, the slot is defined according to the smallest SCS of all active DL BWPs in a cell group.  |

**Q2: Which option do you support if you don’t agree with the proposed change?**

* Option 1: the smallest SCS of all active DL BWPs in a cell group
* Option 2: the largest SCS of all configured DL BWPs in a cell group
* Option 3: the largest SCS of all active DL BWPs in a cell group
* Option 4: The SCS of received PDCCH with non-zero CSI request in a cell group
* Note: ‘in a cell group’ means in MCG or SCG

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| --- | --- | --- |
| Company | Supporting option | Comments |
| ZTE | Option 4 |  |
| Intel | Option 2 | Back to back triggering should be allowed |
| Ericsson | Option 4 |  |
| CATT |  | One question regarding Option 4: What if there is PDCCH with non-zero CSI request in both of the cells? Which SCS shall be used to determine whether it is a valid case? |
| Vivo | Option | Option5.  |
| Qualcomm | Option 6 | Option 1 (either of configured BWP or active BWP) is implementation-friendly, but we also understand network concern that back-to-back trigger becomes impossible. As illustrated in the figure below, even self-triggering on CC1 is avoided. In our view, it is ok to allow self-triggering because it is allowable in single CC case. Option 4 allows back-to-back trigger, but also allows following case which seems challenging in implementation due to cross-numerology triggering. So, it is preferred to be avoided. If network want to trigger CSI of CC1 and CC2, network could put the two CSI reports into same trigger state.Considering scheduling flexibility and reasonable UE complexity, we think it is suitable to use the minimum SCS of PDCCH and the triggered CSIRS and PUSCH (similar to the SCS of CSI timeline) to determine the SCS of “the slot”.Option 6: lowest SCS of PDCCH carrying the CSI request, CSI-RS associated to the triggered CSI reports, and the PUSCH that carries the CSI reports.@vivo, we are not sure what option 5 is. |
| Samsung | Option 1 but conclusion | We don’t need to change the current specification. We can make the conclusion for this CR.  |

**Issue #2:** for a UE not expected to receive more than one aperiodic CSI report request for transmission in a given slot, the proposed change in [2] is provided below. Note that ‘in a cell group’ means in MCG or SCG.

A UE is not expected to receive more than one aperiodic CSI report request for transmission in each reference slot, which is defined according to the smallest SCS of all configured UL BWPs in a cell group.

**Q3: Do you agree with the proposed changes above?**

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| --- | --- | --- |
| Company | Agree or not | Comments |
| ZTE | No | If a BWP is not active, UE will not report or process the aperiodic CSI in this BWP. Hence UE does not need to reserve the capability for non-active BWPs. Hence we think to the interpretation based on smallest SCS of all active BWPs is sufficient. |
| Intel | Agree |  |
| Ericsson | No | Same reason as for Q1 |
| Apple | Agree |  |
| CATT | No | The CR is not needed. The original text is clear that UE will not transmit CSI for more than one aperiodic CSI report request in one slot. It has nothing to do with the numerologies of another cell. That is, UE may be triggered to transmit aperiodic CSI at the same time in another CC.  |
| OPPO | No | Same comment as for Q1 |
| vivo | Agree | Same comment as for Q1. |
| Samsung | No | Same comment as for Q1 |
| Qualcomm | Ok, but prefer better solution | Same comment as for Q1. |

**Q4: Which option do you support if you don’t agree with the proposed change?**

* Option 1: the smallest SCS of all active UL BWPs in a cell group
* Option 2: the largest SCS of all configured UL BWPs in a cell group
* Option 3: the largest SCS of all active UL BWPs in a cell group
* Option 4: the SCS of the UL BWP where the UCI is transmitted
* Note: ‘in a cell group’ means in MCG or SCG

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| --- | --- | --- |
| Company | Supporting option | Comments |
| ZTE | Option 1 |  |
| Intel | Option 2 |  |
| Ericsson | Option 4 |  |
| Samsung | Option 1 but conclusion |  |
| Qualcomm | Option 6 in Q2, also fine with option 4. | Similarly to Q2, option 1 is restrictive in back-to-back trigger, the proposed option 6 can achieve the balance in back-to-back trigger and UE complexity. Option 4 is ok if it is the UL BWP where PUSCH carrying CSI is transmitted. |

**Q5: Any other issue? Please provide your comments if any in the following table.**

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| --- | --- |
| Company | Comments |
|  |  |
|  |  |

# Conclusion

To be added after discussion.

# Reference

1. R1-2101768, “RAN1#104-e preparation phase initial summary on NR Rel-15 CRs”, Ad-hoc Chair (Samsung)
2. R1-2101136, “Draft 38.214 CR on CSI request constraint per slot”, MediaTek Inc.

# Appendix

------------------------------------------------------------- Start of the TP ----------------------------------------------------------------

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

##### 5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS

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 within a cell group; the slot is defined according to the smallest SCS of all configured DL BWPs in a 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 each reference slot, which is defined according to the smallest SCS of all configured UL BWPs in a cell group. A UE is not expected to be triggered with a CSI report for a non-active DL BWP. A trigger state is initiated using the *CSI request* field in DCI.

< Unchanged parts are omitted >

-------------------------------------------------------------- End of the TP ----------------------------------------------------------------