**3GPP TSG RAN WG1 Meeting #104b-e R1-** **210xxxx**

**e-Meeting, 12th – 20th April 2021**

**Title: [104b-e-NR-UE\_Pow\_Sav-01] NR UE Power Saving**

**Agenda item: 7.2.7**

**Source: CATT**

**Document for: Discussion**

# Final Summary of Email Discussions and Agreements

# Email Discussion [104b-e-NR\_UE\_Pow\_Sav-01]

* **Issue 1: A-CSI-RS triggering offset for cross-slot scheduling [1]**

**Proposal Hardcode A-CSI-RS triggering offset to K0min when A-CSI-RS is triggered by SRS request field in non-codebook-based UL transmission.**

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| **Company** | **Support the issue and draft CR** | **Comments** |
| Huawei,HiSilicon | Support to discuss the issue. Based on Apple’s CR, revised CR is provided as following:5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology======skipped text======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 K0min. When the minimum scheduling offset restriction is applied, aperiodic CSI-RS triggering offset is set to the currently applicable K0min, when triggered by SRS request indicated by the value of the SRS request field is not '00' as in Table 7.3.1.1.2-24 of [5, TS 38.212] and if the scheduling DCI is not used for cross carrier or cross bandwidth part scheduling.6.1.1.2 Non-Codebook based UL transmission======skipped text======If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, the presence of the associated CSI-RS is indicated by the SRS request field if the value of the SRS request field is not '00' as in Table 7.3.1.1.2-24 of [5, TS 38.212] and if the scheduling DCI is not used for cross carrier or cross bandwidth part scheduling. The CSI-RS is located in the same slot as the SRS request field if the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP or *minimumSchedulingOffsetK2* for any UL BWP ~~currently applicable minimum scheduling offset restriction K~~~~0min~~~~=0~~. When the minimum scheduling offset restriction is applied, CSI-RS triggering offset is set to the currently applicable K0min. If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, any of the TCI states configured in the scheduled CC shall not be configured with *qcl-Type* set to 'typeD'. | The issue is valid and needs to be resolved in our view. If it is not corrected, for Non-codebook transmission, even if cross slot scheduling is configured, UE need to still buffer symbols after PDCCH for potential CSI-RS associated with SRS resource, which violates the power saving benefit of the introduction of K0min. Regarding the detailed change, we made some revisions to align with the description regarding the minimum K0 and minimum K2 in current specifications.  |
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* **Issue 2:** **Including TC-RNTI for the RNTI not supporting cross-slot scheduling [2]**

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| **Company** | **Support the issue and draft CR** | **Comments** |
| Huawei, HiSilicon | Need further clarification | The cross-slot scheduling based power saving scheme is only applied for connected mode UE. For a connected mode UE, RA-RNTI is used to schedule Msg2 PDSCH and C-RNTI is used to schedule Msg4 PDSCH for contention based RACH. So, it seems there is no case for gNB to use TC-RNTI to schedule PDSCH during RACH procedure for connected mode UE. |
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* **Issue 3:** **Clarification of Dormancy group indication by higher layer parameter** ***dormancyGroupOutsideActiveTime* [3]**

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| **Company** | **Support the issue and draft CR** | **Comments** |
| Huawei, HiSilicon | Support the issue and draft CR in [3] |  |
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# Email Discussion during Preparation[104b-e-Prep\_NR\_UE\_Pow\_Sav]

## Summary of Preparation

Issues 1, 2, 3 raised in R1-2103086, R1-2103602, and R1-2103748 resepctively are discussed.

## Feedback from Preparation

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| **Company** | **Supporting Issues and draft CR** | **Comments** |
| Huawei, HiSilicon | Issue 1, Issue 2, Issue 3 | 1. Issue1 is a valid issue that needs to be resolved. The detailed change needs to be further discussed;
2. We are open to discuss issue2. However, it seems for connected mode UE, C-RNTI shall be used to schedule PDSCH rather than TC-RNTI during RACH procedure.
3. Issue3 should be discussed to align RAN1 and RAN2 specification.
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| ZTE,Sanechips | Issue 2, Issue 3 | 1) Issue 1: The purpose of associating A-CSI-RS with A-SRS for UL non-codebook transmission is to measure the A-CSI-RS to assist the derivation of the precoding information for A-SRS in the case of channel reciprocity. If the transmission of A-CSI-RS is delayed due to the restriction of minK0, it will defeat the purpose above.2) Issue 2: to align with the previous agreements3) Issue 3: open to discuss it if needed |
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# Summary of Open Issues

* **Issue 1: A-CSI-RS triggering offset for cross-slot scheduling [1]**
* **Proposal Hardcode A-CSI-RS triggering offset to K0min when A-CSI-RS is triggered by SRS request field in non-codebook-based UL transmission.**

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

======skipped text======

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 K0min. When the minimum scheduling offset restriction is applied, aperiodic CSI-RS triggering offset is set to K0min, when triggered by SRS request indicated by the value of the SRS request field is not '00' as in Table 7.3.1.1.2-24 of [5, TS 38.212] and if the scheduling DCI is not used for cross carrier or cross bandwidth part scheduling.

6.1.1.2 Non-Codebook based UL transmission

======skipped text======

If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, the presence of the associated CSI-RS is indicated by the SRS request field if the value of the SRS request field is not '00' as in Table 7.3.1.1.2-24 of [5, TS 38.212] and if the scheduling DCI is not used for cross carrier or cross bandwidth part scheduling. The CSI-RS is located in the same slot as the SRS request field if currently applicable minimum scheduling offset restriction K0min=0. When the minimum scheduling offset restriction is applied, CSI-RS triggering offset is set to K0min. If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, any of the TCI states configured in the scheduled CC shall not be configured with *qcl-Type* set to 'typeD'.

* **Issue 2:** **Including TC-RNTI for the RNTI not supporting cross-slot scheduling [2]**

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| ----------------------------------------------- Start of TP of TS 38.214 --------------------------------------------------------5.1.2.1 Resource allocation in time domain**\*\*\* Unchanged text is omitted \*\*\***When the UE is configured with *minimumSchedulingOffsetK0* in an active DL BWP it applies a minimum scheduling offset restriction indicated by the 'Minimum applicable scheduling offset indicator'field in DCI format 1\_1 or DCI format 0\_1 if the same field is available. When the UE is configured with *minimumSchedulingOffsetK0* in an active DL BWP and it has not received 'Minimum applicable scheduling offset indicator' field in DCI format 0\_1 or 1\_1, the UE shall apply a minimum scheduling offset restriction indicated based on 'Minimum applicable scheduling offset indicator' value '0'. When the minimum scheduling offset restriction is applied the UE is not expected to be scheduled with a DCI in slot *n* to receive a PDSCH scheduled with C-RNTI, CS-RNTI or MCS-C-RNTI with *K*0 smaller than $ \left⌈K\_{0min}⋅\frac{2^{μ^{'}}}{2^{μ}}\right⌉$, where *K*0minand $μ$ are the applied minimum scheduling offset restriction and the numerology of the active DL BWP of the scheduled cell when receiving the DCI in slot *n,* respectively, and $μ^{'}$ is the numerology of the new active DL BWP in case of active DL BWP change in the scheduled cell and is equal to $μ$, otherwise. The minimum scheduling offset restriction is not applied when PDSCH transmission is scheduled with C-RNTI, CS-RNTI or MCS-C-RNTI in common search space associated with CORESET0 and default PDSCH time domain resource allocation is used, in the search space set provided by *recoverySearchSpaceId* when monitoring PDCCH as described in [6, TS 38.213] or when PDSCH transmission is scheduled with SI-RNTI, MSGB-RNTI, ~~or~~ RA-RNTI or TC-RNTI. The application delay of the change of the minimum scheduling offset restriction is determined in Clause 5.3.1.**\*\*\* Unchanged text is omitted \*\*\***----------------------------------------------- End of TP of TS 38.214 -------------------------------------------------------- |

* **Issue 3:** **Clarification of Dormancy group indication by higher layer parameter** ***dormancyGroupOutsideActiveTime* [3]**

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| **10.3 PDCCH monitoring indication and dormancy/non-dormancy behaviour for SCells**======skipped part=======- a bitmap, when the UE is provided a number of groups of configured SCells by high layer parameter(s) *dormancyGroupOutsideActiveTime*, where - the bitmap location is immediately after the Wake-up indication bit location- the bitmap size is equal to the number of groups of configured SCells where each bit of the bitmap corresponds to a group of configured SCells from the number of groups of configured SCells- a '0' value for a bit of the bitmap indicates an active DL BWP, provided by *dormantBWP-Id*, for the UE [11, TS38.321] for each activated SCell in the corresponding group of configured SCells- a '1' value for a bit of the bitmap indicates - an active DL BWP, provided by *firstOutsideActiveTimeBWP-Id*, for the UE for each activated SCell in the corresponding group of configured SCells, if a current active DL BWP is the dormant DL BWP- a current active DL BWP, for the UE for each activated SCell in the corresponding group of configured SCells, if the current active DL BWP is not the dormant DL BWP- the UE sets the active DL BWP to the indicated active DL BWP======skipped part=======If a UE is provided search space sets to monitor PDCCH for detection of DCI format 0\_1 and DCI format 1\_1 and if one or both of DCI format 0\_1 and DCI format 1\_1 include a SCell dormancy indication field, - the SCell dormancy indication field is a bitmap with size equal to a number of groups of configured SCells, ~~provided by~~  according to high layer parameter(s) *dormancyGroupWithinActiveTime*, - each bit of the bitmap corresponds to a group of configured SCells from the number of groups of configured Scells- if the UE detects a DCI format 0\_1 or a DCI format 1\_1 that does not include a carrier indicator field, or detects a DCI format 0\_1 or DCI format 1\_1 that includes a carrier indicator field with value equal to 0 - a '0' value for a bit of the bitmap indicates an active DL BWP, provided by *dormantBWP-Id*, for the UE for each activated SCell in the corresponding group of configured SCells- a '1' value for a bit of the bitmap indicates - an active DL BWP, provided by *firstWithinActiveTimeBWP-Id*, for the UE for each activated SCell in the corresponding group of configured SCells, if a current active DL BWP is the dormant DL BWP- a current active DL BWP, for the UE for each activated SCell in the corresponding group of configured SCells, if the current active DL BWP is not the dormant DL BWP- the UE sets the active DL BWP to the indicated active DL BWP |

# Contributions summary and proposals

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| Apple [1] |  Proposal 1: Hardcode A-CSI-RS triggering offset to K0min when A-CSI-RS is triggered by SRS request field in non-codebook-based UL transmission.  |
| ZTE, Sanechips [2] | Including TC-RNTI for the RNTI not supporting cross-slot scheduling |
| Huawei, HiSilicon [3] | Clarification of Dormancy group indication by higher layer parameter *dormancyGroupOutsideActiveTime* |

# Reference

1. R1-2103086 Maintenance of UE power saving for NR Apple
2. R1-2103602 Remaining issues of Rel-16 power saving ZTE,Sanechips
3. R1-2103748 Remaining issues for Rel-16 UE power saving Huawei, HiSilicon