3GPP TSG RAN WG1 #101 DRAFT R1-2004641

e-Meeting, May 25th – June 5th, 2020

**Agenda item: 7.2.10.6**

**Source: Moderator (Nokia)**

**Title: FL summary #2 on cross-carrier scheduling with different numerology**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is the RAN1#101 meeting discussion summary.

# 2 Issue to be addressed in RAN1#101-e

Codebook for more than 1 DCI per monitoring occasion, three solution options can be identified in the submitted documents:

1. If the maximum number of unicast DCIs per MO per scheduled cell is increased to larger than one, the PDSCH starting time in addition to the existing MO and Cell index is introduced to order the HARQ-ACK feedback. [1]
2. CCE index is introduced to further determine the Type-2 HARQ-ACK codebook and PUCCH resource. [3], [7]
3. Assuming X>1 DL DCIs scheduling unicast PDSCHs per scheduled cell can be transmitted in a PDCCH MO, C-DAI is used as a third dimension of HARQ-ACK bits ordering in Type2 HARQ-ACK CB [6].

**Q1:** Please provide your company views on the three options

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| **Proposal**  **Company** | **Option 1) [1]** | **Option 2) [3], [7]** | **Option 3) [6]** |
| CATT | None. The current specification works well and nothing is needed. If more than two DCIs per MO is configured, the HARQ-ACK bits can be transmitted in different codebooks.  It should be noted more than one DCIs per MO is not a new issue and has been discussed in Rel-15. The relevant conclusion is quoted below:  **Conclusion**:   * In Rel-15, a UE is not expected to detect two (or more) DCI formats (same or different) in PDCCHs received with a same first symbol in a slot and scheduling PDSCH reception(s) or SPS PDSCH release on a same cell and indicating a same slot for corresponding HARQ-ACK transmission.   + No CR is necessary   The same mechanism can be (actually it should be) applied to the case wherein up to 4 DCIs are transmitted in a same MO. | | |
| ZTE | We support Option 1).  From our perspective, Option 1) is an implementation friendly solution as UE expects to process the HARQ-ACK bits by the order of the receiving time of the corresponding PDSCHs. | The MO is determined via the starting time when UE needs to monitor the PDCCH candidates. If two CORESETs are within the same MO, then CCE index is not applicable to this case as the CCE index in the two CORESETs may be the same. | If the maximum number of DCIs per MO is >= 4, then C-DAI cannot be applied to order the HARQ-ACK. |
| Qualcomm | Our view is none of option 1, 2 or 3 is needed which is aligned with CATT’s views.  We also do not see it necessary to have more than one DCIs per PMO because one slot scheduling multiple slots can be supported based on Case 2 PDCCH monitoring.  Both option 1 to 3 and multiple DCIs per PMO are optimizations that result in unncessary new UE implementation for Rel-16. | | |
| MTK | We think Option 1 is viable. | We think Option 2 is the most straight forward and easy way to order the codebook. However, we expect proponents of Option 2 [3][7] can clarify how to handle the issue mentioned by ZTE (two CORSETs with the same CCE (say 0) mapping to the same PDCCH MO). | We also see the issue as ZTE pointed out. Proponent of Option 3 [6] can clarify how to handle the mentioned scenario (number of DCIs per MO is >= 4). |
| vivo | None of the option is needed.  The proposed option increases the UE complexity (i.e., counting the PDSCH starting time). Moreover each option may have its issue. For example, by option-2 the content of DCI (i.e., DAI) will depend on the mapping location of DCI (i.e., CCE index) which is determined after the generating the coded symbol of DCI. Such kind of change should be avoid. | | |
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# 3 Conclusion on the scope of the RAN1#101

To be written

# References

1. R1-2003328, Remaining Issues on Cross-carrier Scheduling with Mixed Numerologies, ZTE
2. R1-2003414, Remaining issues on cross-carrier scheduling with mix numerologies, vivo
3. R1-2003508, Remaing issues on cross-carrier scheduling with different numerology, Huawei, HiSilicon
4. R1-2003602, Discussion on HARQ-ACK feedback for SPS PDSCH release with cross-carrier scheduling, CATT
5. R1-2003675, Remaining issues on cross-carrier scheduling with different numerology, MediaTek Inc.
6. R1-2003751, Remaining issues on cross-carrier scheduling with different numerology, Intel Corporation
7. R1-2004037, Remaining issue on cross-carrier scheduling with different numerology, LG Electronics
8. R1-2004366, Remaining issues for cross-carrier scheduling with different numerologies, Ericsson
9. R1-2004639, FL summary on cross-carrier scheduling with different numerology, Moderator (Nokia)