**3GPP TSG RAN WG1 #103-e R1-200xxxx**

**E-Meeting, October 26th – 13th, 2020**

**Agenda Item: 7.1**

**Source: Moderator (Huawei)**

**Title: Summary of Correction on supplementary uplink in 38.213**

**Document for: Discussion and Decision**

# Introduction

As per guidance of the chairman, an email discussion for the Rel-15 CR R1-2008777 [1] was kicked off below.

[103-e-NR-7.1CRs-03] Correction on supplementary uplink in 38.213 (Rel-15) – Huawei

* Discussion and decision by 10/27, TPs by 10/29

 It is a clarification for functionalities as summarized below.

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| **Summary of change:** | 1. Clarify the determination of valid slots for PUCCH repetiton for supplementary uplink. |

# Discussions

Based on the discussions till October 28th, a main concern is raised about how to handle the Rel-16 mirror CR which can resolve potential cross-link interference in case of UL sharing with TDD UEs in the same bandwidth of SUL carrier.

Cross-link interference here means an inter-UE interference where a UL transmission power of a SUL UE may interfere the DL reception of  the other TDD UE that has been configured with overlapping bandwidth. As discussed above, there are three scenarios

* No other FDD nor TDD UEs are configured with the bandwidth overlapping with the SUL UE, regardless Rel-15 or Rel-16
* Some FDD UEs are configured with the bandwidth overlapping with the SUL UE
* Some TDD UEs are configured with the bandwidth overlapping with the SUL UE

In the first two scenarios, there is no cross-link interference as companies replied. Only the last scenario is concerned with cross-link interference. However, such cross-link interference is not caused by the CR R1-2008777 but the fact of lack of tdd-UL-DL-ConfigurationCommon/ tdd-UL-DL-ConfigurationDedicated for SUL carrier.

To handle the Rel-16 CR, three options are provided below,

* **Option A**: Agree the Rel-15 CR and its Rel-16 mirror CR, and the introduction of tdd-UL-DL-ConfigurationCommon/tdd-UL-DL-ConfigurationDedicated is a separate issue and not done by this thread but can be discussed by further CR. Please note that Option A is compatible with future correction like Option B and Option C, i.e. Option A can be taken this meeting, and Option B and C are able to be introduced after any concerns on ASN.1 change are resolved. The CRs are as drafted in <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/7.1/%5B103-e-NR-7.1CRs-03%5D/draft%20R1-2008777-Option%20A.zip>
* **Option B**: Agree the Rel-15 CR. For Rel-16, agree the introduction of tdd-UL-DL-ConfigurationCommon/tdd-UL-DL-ConfigurationDedicated and its associated text for PUCCH repetition as drafted in <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/7.1/%5B103-e-NR-7.1CRs-03%5D/draft%20R1-2008777-Option%20B.zip>
* **Option C**: For both Rel-15 and Rel-16, agree the introduction of tdd-UL-DL-ConfigurationCommon/tdd-UL-DL-ConfigurationDedicated and its associated text for PUCCH repetition as drafted in <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/7.1/%5B103-e-NR-7.1CRs-03%5D/draft%20R1-2008777-Option%20C.zip>

For your convenience, the text changes are copied below,

============================= Option A =========================

**Option A:**

**The same text change for both Rel-15 CR and Rel-16 mirror CR:**

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| **<Unchanged parts are omitted>**9.2.6 PUCCH repetition procedure**<Unchanged parts are omitted>**For unpaired spectrum, the UE determines the  slots for a PUCCH transmission starting from a slot indicated to the UE as described in Clause 9.2.3 and having- an UL symbol, as described in Clause 11.1, or flexible symbol that is not SS/PBCH block symbol provided by *startingSymbolIndex* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4* as a first symbol, and- consecutive UL symbols, as described in Clause 11.1, or flexible symbols that are not SS/PBCH block symbols, starting from the first symbol, equal to or larger than a number of symbols provided by *nrofsymbols* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4*For paired spectrum or supplementary uplink band, the UE determines the  slots for a PUCCH transmission as the  consecutive slots starting from a slot indicated to the UE as described in Clause 9.2.3. **<Unchanged parts are omitted>** |

============================= Option B =========================

**Option B:**

**Rel-15 CR:** the same text change as the Rel-15 CR of Option A

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| **<Unchanged parts are omitted>**9.2.6 PUCCH repetition procedure**<Unchanged parts are omitted>**For unpaired spectrum, the UE determines the  slots for a PUCCH transmission starting from a slot indicated to the UE as described in Clause 9.2.3 and having- an UL symbol, as described in Clause 11.1, or flexible symbol that is not SS/PBCH block symbol provided by *startingSymbolIndex* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4* as a first symbol, and- consecutive UL symbols, as described in Clause 11.1, or flexible symbols that are not SS/PBCH block symbols, starting from the first symbol, equal to or larger than a number of symbols provided by *nrofsymbols* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4*For paired spectrum or supplementary uplink band, the UE determines the  slots for a PUCCH transmission as the  consecutive slots starting from a slot indicated to the UE as described in Clause 9.2.3. **<Unchanged parts are omitted>** |

**Rel-16 CR**: Agree to add *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* on SUL carrier for Rel-16, additionally the configuration is used to differentiate the branches of UE behaviors, compared to Option A.

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| **<Unchanged parts are omitted>**9.2.6 PUCCH repetition procedure**<Unchanged parts are omitted>**For unpaired spectrum or supplementary uplink band where the UE is provided with *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, the UE determines the $N\_{PUCCH}^{repeat}$ slots for a PUCCH transmission starting from a slot indicated to the UE as described in Clause 9.2.3 for HARQ-ACK reporting, or a slot determined as described in Clause 9.2.4 for SR reporting or in Clause 5.2.1.4 of [6, TS 38.214] for CSI reporting and having- an UL symbol, as described in Clause 11.1, or flexible symbol that is not SS/PBCH block symbol provided by *startingSymbolIndex* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4* as a first symbol, and- consecutive UL symbols, as described in Clause 11.1, or flexible symbols that are not SS/PBCH block symbols, starting from the first symbol, equal to or larger than a number of symbols provided by *nrofsymbols* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4*For paired spectrum or supplementary uplink band where the UE is not provided with *tdd-UL-DL-ConfigurationCommon* nor *tdd*-*UL-DL-ConfigurationDedicated*, the UE determines the $N\_{PUCCH}^{repeat}$ slots for a PUCCH transmission as the $N\_{PUCCH}^{repeat}$ consecutive slots starting from a slot indicated to the UE as described in Clause 9.2.3 for HARQ-ACK reporting, or a slot determined as described in Clause 9.2.4 for SR reporting or in Clause 5.2.1.4 of [6, TS 38.214] for CSI reporting. **<Unchanged parts are omitted>** |

============================= Option C =========================

**Rel-15 CR:** the same handling as the Rel-16 CR of Option B, agree to add tdd-UL-DL-ConfigurationCommon and tdd-UL-DL-ConfigurationDedicated on SUL carrier for Rel-15

**Rel-16 CR:** the same handling as the Rel-16 CR of Option B, agree to add tdd-UL-DL-ConfigurationCommon and tdd-UL-DL-ConfigurationDedicated on SUL carrier for Rel-16

The same text changes for both Rel-15 and Rel-16,

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| **<Unchanged parts are omitted>**9.2.6 PUCCH repetition procedure**<Unchanged parts are omitted>**For unpaired spectrum or supplementary uplink band where the UE is provided with *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, the UE determines the  slots for a PUCCH transmission starting from a slot indicated to the UE as described in Clause 9.2.3 and having- an UL symbol, as described in Clause 11.1, or flexible symbol that is not SS/PBCH block symbol provided by *startingSymbolIndex* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4* as a first symbol, and- consecutive UL symbols, as described in Clause 11.1, or flexible symbols that are not SS/PBCH block symbols, starting from the first symbol, equal to or larger than a number of symbols provided by *nrofsymbols* in *PUCCH-format1*, or in *PUCCH-format3*, or in *PUCCH-format4*For paired spectrum or supplementary uplink band where the UE is not provided with *tdd-UL-DL-ConfigurationCommon* nor *tdd*-*UL-DL-ConfigurationDedicated*, the UE determines the  slots for a PUCCH transmission as the  consecutive slots starting from a slot indicated to the UE as described in Clause 9.2.3. **<Unchanged parts are omitted>** |

## Q1: Without digging into detailed wording of CRs, which Option above should be the best way to go?

Companies’ views are very welcome.

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| *Company* | *Option A/B/C* | *View* |
| QualComm |  | Thanks a lot for your effort.We don’t think it is realistic to introduce (or to promise to introduce) *tdd-UL-DL-ConfigurationCommon* as part of SUL configuration in this CR discussion. According to ASN.1, *tdd-UL-DL-ConfigurationCommon* is a serving cell-specific parameter under *ServingCellConfigCommon* (or *ServingCellConfigCommonSIB*) and is parallel with *uplinkConfigCommon* and *supplementaryUplinkConfig*.ServingCellConfigCommon ::=         SEQUENCE {[...]    uplinkConfigCommon                  UplinkConfigCommon                                                  OPTIONAL,   -- Need M    supplementaryUplinkConfig           UplinkConfigCommon                                                  OPTIONAL,   -- Need S[...]    tdd-UL-DL-ConfigurationCommon       TDD-UL-DL-ConfigCommon                                              OPTIONAL, -- Cond TDD[...]}Option B and Option C have the above problem. Option A does not resolve the concern on interference issue. The only way to enable PUCCH repetition on SUL is to find a way to limit it on FDD bands, at least in this thread. |
| Moderator |  | @Qualcomm, In Option B, it is only Rel-16 that tdd-UL-DL-ConfigurationCommon is introduced to, we feel it is feasible at this stage. It is an optional IE on condition of SUL bands similar to what we have for TDD now. Therefore, it has no impact on uplinkConfigCommon regardless of its location under ServingCellConfigCommon or supplementaryUplinkConfig. Option C may also be feasible as well because there are precedents like SRS carrier switching which had ASN.1 change for Rel-15 two meetings ago. Option A has no ASN.1 issue, but it does not requires to limit it on some SUL bands (potential overlapping with FDD bands or TDD bands) because it is up to network to handle the interference issue if any. Please note that only one out of three scenarios listed in the introduction has potential interference rather than all scenarios. Also Option A is compatible with future correction like Option B and Option C, i.e. Option A can be taken this meeting, and Option B and C are able to be introduced after any concerns on ASN.1 change are resolved  |
| vivo |  | We appreciate the effort from moderator to provide different options and the draft CR, which makes the whole picture clearer. In general we think both Option A and Option B are considerable. Regarding the draft CR, we are wondering if *tdd*-*UL-DL-ConfigurationDedicated* is needed in addition to *tdd-UL-DL-ConfigurationCommon?* If the only intention for the introduction of TDD configuration for SUL on TDD band is for the cross-link interference handling for adjacent carriers, only *tdd-UL-DL-ConfigurationCommon* seems sufficient.  |
| Samsung |  | Thank you for the effort. It looks very difficult to conclude something for now. First of all, we would like to know what is the companies’ understanding on PUCCH transmission for SUL when this CR is rejected between* A. the UE behavior is not defined and therefore PUCCH repetition is not support for SUL.
* B. it is assumed as FDD operation and therefore PUCCH repetition can be supported for SUL.

If A, we do not need to agree with this CR for Rel-15 since this is not essential correction. If B, we need to further discuss whether/how to clarify it for SUL operation for Rel-15/16.From our view, we think the proposed CR makes sense at least for Rel-15. Our first preference is to introduce this CR only for Rel-15 and keep FFS for Rel-16 operation. Although our preference is not perfectly aligned with Option A, we can be compromise to it for further progress.Please note that, if we apply this CR for both Rel-15 and Rel-16 without any decision on configuring *tdd-UL-DLConfiguration* for SUL band, it is just up to gNB implementation how to handle the cross-link interference.We cannot accept neither Option B nor Option C for now. |
| ZTE | OptionC | First of all, we prefer to have a complete solution for both Rel-15 and Rel-16. From this perspective, Option A is not preferable because it doesn’t address the cross-link interference at all and then RAN1 needs to come back to this issue again in future meetings.Then between Option B and Option C, it seems the only difference is whether we need to introduce RRC parameter for Rel-15 as well. As also commented by other companies, the SUL bands overlapping with TDD band are **release-independent**, which means that these bands can also apply to Rel-15 networks. To address this issue for both Rel-15 and Rel-16 networks, we prefer Option C. Furthermore, if Option C is to be introduced, then a Rel-15 UE capability is also needed to avoid potential NBC issue. Once companies reach consensus on which option to go, then we can try to discuss and finalize the detailed design for the chosen option. At least for now, it seems all the CRs are not complete yet at least for the following reasons.1. As also commented by vivo, it is not clear whether we need *tdd*-*UL-DL-ConfigurationDedicated*.2. I guess we may also need to add something in Section 11.1 of 38.213 if TDD pattern is introduced because currently Section 11.1 of 38.213 is trying to describe TDD pattern for a Cell instead of a carrier.3. If TDD pattern is introduced, it seems we may also need to come back to the RACH issue for SUL that was discussed in last meeting. |
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## Q2: For the chosen Option, any suggestion for the detailed wording of the CR

Companies’ views are very welcome.

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| *Company* | *Option A/B/C* | *View* |
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In case of any other important feedback, they are welcome below.

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| *Company* | *View* |
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# Conclusions

[The following agreements are achieved:]

# References

1. R1-2008777 Correction on supplementary uplink in 38.213, Huawei, HiSilicon, Oct. 26th – Nov. 13th, 2020, RAN1#103-e

# Appendix

# UE capability

The UE capability for PUCCH repetition is a per-UE capability without FDD/TDD differentiation, which means a UE supports both FDD and TDD branches of UE behaviors of PUCCH repetition in TS 38.213 if the UE reports a support of such capability.