**3GPP TSG RAN WG1 #105-e R1-210xxxx**

**e-Meeting, May 10th – 27th, 2021**

**Agenda item:** 7.2.12

**Source:** Moderator (NTT DOCOMO, INC.)

**Title:** Summary on [105-e-NR-TEI16-01]

**Document for:** Discussion and Decision

1. Introduction

This contribution summarizes the following email discussion.

[105-e-NR-TEI16-01] Email discussion/approval on Rel-16 NR TEI related issues, till 5/24 – Hiroki (DoCoMo)

* Discuss following proposal and corresponding specification impact
	+ The DL/UL collision handling should be supported by a UE capable of such handling for each band within a band combination where the UE supports inter-band simultaneous transmission and reception.
1. Discussion on Rel-16 NR TEI related issues
	1. Half-duplex operation in CA with unpaired spectrum

Following proposal is made in a contribution.

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| [6] | According to the previous agreements, UE can report the DL/UL collision handling capability for a band or band combination (BC) not supporting simultaneous transmission and reception (simul-RxTx for short) on two carriers within one band or on different bands, and the base station can configure the UE for such collision handling. From UE implementation point of view, although no explicit UE capability, it is naturally understood that even if a UE can support simul-RxTx between bands, the UE cannot support simul-RxTx within each band of that BC respectively.Thus, for a band combination (BC), according to current specifications, a UE * Case a) may, or Case b) may not, support simul-RxTx for inter-band BC, based on *simultaneousRxTxInterBandCA*, and
* When the UE does not report/support *simultaneousRxTxInterBandCA* (Case b), the UE may or may not support collision handling based on *half-DuplexTDD-CA-SameSCS-r16* for the inter-band BC
	+ The UE may also support/report *half-DuplexTDD-CA-SameSCS-r16* for a BC that is intra-band only (i.e. if one of the bands is also an intra-band only BC), according to the recent agreements

As can be seen, it is not clear what is the intended UE reporting for Case a) when a UE supports *simultaneousRxTxInterBandCA* for a BC, and can support *half-DuplexTDD-CA-SameSCS-r16* for each single band only (rather than for inter-band BC which is an advanced UE capability), given that a UE cannot report DL/UL collision handling capability for the BC in this scenario. On the other hand, if the intra band combination is a subset of the above inter-band combination, the UE may be able to report/support DL/UL collision handling then it is not clear whether gNB has correct/same understanding in order for a proper configuration.One example assumes a CA scenario of two bands, with one carrier in band A and two carriers in band B. The UE reports supporting simul-RxTx across band A and B, and the UE doesn’t support simul-RxTx on the two carriers in band B. RAN1 needs to clarify whether the UE can support DL/UL collision handling for the two carriers in band B, especially when the UE can report DL/UL collision handling capability for band B. From our understanding, the UE should be able to handle the DL/UL collision for the carriers in band B in the above example, however the current specification does not seem to allow this. Corresponding specification impact needs to be further discussed after that. ***Proposal:*** *The DL/UL collision handling should be supported by a UE capable of such handling for each band within a band combination where the UE supports inter-band simultaneous transmission and reception.*  |

Based on the above proposal, following point can be discussed in RAN1#105-e meeting.

### **FL proposal #1**

* **Discuss following proposal and corresponding specification impact**
	+ **The DL/UL collision handling should be supported by a UE capable of such handling for each band within a band combination where the UE supports inter-band simultaneous transmission and reception.**

Companies are encouraged to check above FL proposal and to provide feedback if any in below.

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| Company | Comment |
| Huawei | Y as our proposal…The spec impact in RAN1 may be to clarify the definition of reference cell is determined among a cell group within a band or within a BC. Potential spec impact e.g. on RAN2 could be left to RAN2 to decide, if any. |
| ZTE | It seems the issue only exists when UE supports *simultaneousRxTxInterBandCA* for a band combination but doesn’t support simultaneous Tx and Rx within one certain band.If the proposal is agreed, then the reference cell determination is divided into two cases,1. If UE doesn’t indicate *simultaneousRxTxInterBandCA*, the reference cell is determined based on all serving cells configured with *half-duplex-behavior* within this cell group. 2. If UE indicates *simultaneousRxTxInterBandCA*, the reference cell is determined based on all serving cells configured with *half-duplex-behavior* within this band.The second case seems to have huge spec impac with potential NBC issue. It seems better if we can also update the corresponding UE feature for this the second case by updating the existing FG or defiing new FG for it. |
| ZTE2 | Add some more comments…According to the RAN4 spec, it seems the same TDD pattern is required for intra-band CA case. It seems that UE doesn’t need to perform half-duplex collision handling purly for the intra-band CA case. If this is the case, then it seems the proposal is not needed. |
| Huawei | We just agreed last meeting that half duplex operation is possible for intra-band only case, and even if the pattern is the same, collision may happen on flexible symbols.Spec impact can be discussed – right now in our assessment it is minor: only clarify the definition of reference cell once in the text is fine. |
| Ericsson | We are fine with the proposal. But my feeling is UE side of companies need to comment on this thread also. |
| Moderator (NTT DOCOMO) | Thank you very much for the feedbacks!Although there have been only three companies commenting, we should move forward considering the deadline.As I commented, it seems better to see the spec impact (i.e., TP) based on the proposal from Huawei so that concern on spec impact from ZTE can be potentially addressed.So, I’d like to ask Huawei to prepare TP based on the proposal/assessment. |
| Huawei | Please see the TP in the appendix. Please note the TP v1 is based on the latest spec without incorporating the agreed CR from last meeting. |
| Qualcomm | Unclear to us what the motivation of the proposal is. The current proposal would mean that the UE must apply directional conflict resolution including FDD cells, which was never even discussed per our understanding. We think the proposal should not be agreed. Of course, it is possible that we just misunderstood the purpose, in which case some clarification could help and would be appreciated. Was the proposal meant to cover only the intra-band part of inter- plus intra-band CA combinations? But then what issue the UE would need to resolve in intra-band FDD? We do not think that the definitions actually work with considering FDD cells, even though RAN4 seem to have allowed half duplex capability limitation across FDD-TDD cells as well. The TP itself seems unrelated to the proposal. Would be ideal to stop having continued diusussion on this feature at every meeting. This was a TEI that was supposed to be finished in one quarter. Don’t even remember when, three years ago? With every text proposal it is less clear what the feature is used for. As we have explained, the feature is fundamentally broken because it describes resolving directional conflicts with assuming zero timing advance while the actual conflict occurs between DL and UL with actual timing advance. So the decisions made by the algorithm are often erroneous. |
| Moderator (NTT DOCOMO) | Thank you very much for the checking and feedback!Regarding Qualcomm’s comment/concern on the applicability to FDD cells, I think the following capability definition could solve the concern. In my understanding, the intension of Huawei’s proposal is to cover the case of directional collision handling on flexible symbols between TDD cells within a band. Further clarification/explanation from Huawei would be helpful.

| ***half-DuplexTDD-CA-SameSCS-r16***Indicates whether the UE supports directional collision handling between reference and other cell(s) for half-duplex operation in TDD CA with same SCS. The UE can include this field, only if *simultaneousRxTxInterBandCA* is not present. | BC | No | TDD only | N/A |
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Actually I share similar concern with Peter since we had CR discussion for this feature almost every meeting.I really hope this discussion could be the last one. |

1. Conclusion

TBD

Reference

[1] R1-2104325 Remaining Issues of Rel-16 UL Tx Switching ZTE

[2] R1-2104653 Remaining issues for 1Tx-2Tx switching Qualcomm Incorporated

[3] R1-2104730 Enhancement on uplink power control for M-TRP OPPO

[4] R1-2104731 Text Proposals for Tx Switching between Two Uplink Carriers OPPO

[5] R1-2104858 Summary of Rel-16 uplink Tx switching Moderator (China Telecom)

[6] R1-2105524 Discussion on half duplex operation for TDD CA Huawei, HiSilicon

[7] R1-2105925 Discussion on the remaining problems of supporting Tx switching between two uplink carriers Huawei, HiSilicon

Appendix

TP version 1

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| 11.1 Slot configuration<Omitted>If a UE - is configured with multiple serving cells and is provided *half-duplex-behavior* = 'enable', and- is not capable of simultaneous transmission and reception on any of the multiple serving cells, and- indicates support of capability for half-duplex operation in CA with unpaired spectrum, and - is not configured to monitor PDCCH for detection of DCI format 2\_0 on any of the multiple serving cells,for a set of symbols of a slot that are indicated to the UE for reception of SS/PBCH blocks in a first cell ~~any~~ of the multiple serving cells by *ssb-PositionsInBurst* in *SystemInformationBlockType1* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, when provided to the UE, the UE does not transmit PUSCH, PUCCH, or PRACH in the slot if a transmission would overlap with any symbol from the set of symbols, and the UE does not transmit SRS in the set of symbols of the slot in- any one of the cells corresponding to the same band as the first cell if the UE is capable of simultaneous transmission and reception by *simultaneousRxTxInterBandCA* among the multiple serving cells, or- any of the multiple serving cells otherwise.For a set of symbols of a slot corresponding to a valid PRACH occasion and  symbols before the valid PRACH occasion, as described in Clause 8.1, the UE does not receive PDCCH, PDSCH, or CSI-RS in the slot if a reception would overlap with any symbol from the set of symbols. The UE does not expect the set of symbols of the slot to be indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated*. For a set of symbols of a slot indicated to a UE by *pdcch-ConfigSIB1* in *MIB* for a CORESET for Type0-PDCCH CSS set, the UE does not expect the set of symbols to be indicated as uplink by *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated*.If a UE is scheduled by a DCI format to receive PDSCH over multiple slots, and if *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated*, indicate that, for a slot from the multiple slots, at least one symbol from a set of symbols where the UE is scheduled PDSCH reception in the slot is an uplink symbol, the UE does not receive the PDSCH in the slot. If a UE is scheduled by a DCI format to transmit PUSCH over multiple slots, and if *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated*, indicates that, for a slot from the multiple slots, at least one symbol from a set of symbols where the UE is scheduled PUSCH transmission in the slot is a downlink symbol, the UE does not transmit the PUSCH in the slot.If a UE- is configured with multiple serving cells and is provided *half-duplex-behavior* = 'enable', and- is not capable of simultaneous transmission and reception on any of the multiple serving cells, and- indicates support of capability for half-duplex operation in CA with unpaired spectrum, and - is not configured to monitor PDCCH for detection of DCI format 2-0 on any of the multiple serving cells, the UE determines a reference cell for a symbol as an active cell with the smallest cell index among - the cells of each band respectively if the UE is capable of simultaneous transmission and reception by *simultaneousRxTxInterBandCA* for the configured multiple serving cells, or- the configured multiple serving cells otherwise,where the symbol is configured as- downlink, or uplink, as indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated*- uplink, if the symbol is flexible and the UE is configured to transmit SRS, PUCCH, PUSCH, or PRACH on the symbol- downlink, if the symbol is flexible and the UE is configured to receive PDCCH, PDSCH or CSI-RS on the symbol <Omitted> |