**3GPP TSG RAN WG1 Meeting #110bis-e R1-220xxxx**

**e-Meeting, October 10th – 19th, 2022**

**Agenda item: 7.2**

**Source: Moderator (ZTE)**

**Title: Summary of [110bis-e-NR-R16-03]: Discussion on correction for cancellation of PUSCH repetitions due to DAPS handover**

**Document for:** **Discussion and Decision**

# Introduction

This document provides the summary of the following email discussion on the correction for cancellation of PUSCH repetitions due to DAPS handover proposed by [1].

[110bis-e-NR-R16-03] Discussion on correction for cancellation of PUSCH repetitions due to DAPS handover by Oct 14 – Junfeng (ZTE)

# Discussion

## Issue description

During DAPS handover, a UE transmits only on the target cell, and cancels the transmission to source cell in the following handover cases that have been specified in Clause 15 in TS 38.213[2].

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| For DAPS handover that is not intra-frequency, if  - the UE indicates support of *interFreqUL-TransCancellationDAPS-r16*, and  - UE does not indicate a capability for power sharing between source and target MCG in DAPS handover or the UE is not provided with *uplinkPowerSharingDAPS-Mode*, and  - UE transmissions on the target cell and the source cell are in overlapping time resources,  the UE transmits only on the target cell, and cancels the transmission to source cell.  For intra-frequency DAPS handover, if  - UE transmissions on the target cell and the source cell are in overlapping time resources,  the UE transmits only on the target cell and cancels the transmission on the source cell. |

It means that the PUSCH repetition or PUCCH repetition on the source cell is cancelled in the above cases. The UE behavior on the PUCCH repetition cancellation during DAPS handover has been captured in Clause 9.2.6 in TS38.213.

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| For DAPS operation, if a UE would transmit a PUCCH over C:\Users\10005275\AppData\Local\Temp\ksohtml12728\wps1.jpg slots on the source MCG and the UE does not transmit the PUCCH in a slot from the C:\Users\10005275\AppData\Local\Temp\ksohtml12728\wps2.jpg slots due to overlapping in time with UE transmission on the target MCG in the slot, the UE counts the slot in the number of C:\Users\10005275\AppData\Local\Temp\ksohtml12728\wps3.jpg slots. |

However, the description of cancellation due to DAPS handover is missed for determination of time domain resources for PUSCH repetitions in TS 38.214.

Thus, the following draft CR in [R1-2209465](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Docs/R1-2209465.zip) [1] is provided to add the missing cancellation rule for PUSCH repetitions in clauses 6.1.2.1 and 6.1.2.3.1 in TS38.214 to align the TS38.213.

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| **6.1.2.1 Resource allocation in time domain** **<Unchanged parts are omitted>**  For PUSCH repetition Type A, a PUSCH transmission in a slot of a multi-slot PUSCH transmission is omitted according to the conditions in Clause 9, Clause 11.1, Clause 11.2A and Clause 15 of [6, TS38.213].  For PUSCH repetition Type B, except for PUSCH transmitting CSI report(s) with no transport block, the number of nominal repetitions is given by *numberOfRepetitions*. For the *n*-th nominal repetition, *n* = *0*, …, *numberOfRepetitions* - 1,  - The slot where the nominal repetition starts is given by , and the starting symbol relative to the start of the slot is given by .  - The slot where the nominal repetition ends is given by , and the ending symbol relative to the start of the slot is given by .  Here is the slot where the PUSCH transmission starts, and is the number of symbols per slot as defined in Clause 4.3.2 of [4, TS38.211].  For PUSCH repetition Type B, the UE determines invalid symbol(s) for PUSCH repetition Type B transmission as follows:  - A symbol that is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* is considered as an invalid symbol for PUSCH repetition Type B transmission.  - For operation in unpaired spectrum, symbols indicated by *ssb-PositionsInBurst* in SIB1 or *ssb-PositionsInBurst* in *ServingCellConfigCommon* for reception of SS/PBCH blocks are considered as invalid symbols for PUSCH repetition Type B transmission.  - For operation in unpaired spectrum, symbol(s) indicated by *pdcch-ConfigSIB1* in *MIB* for a CORESET for Type0-PDCCH CSS set are considered as invalid symbol(s) for PUSCH repetition Type B transmission.  - For operation in unpaired spectrum, if *numberOfInvalidSymbolsForDL-UL-Switching* is configured, *numberOfInvalidSymbolsForDL-UL-Switching* symbol(s) after the last symbol that is indicated as downlink in each consecutive set of all symbols that are indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* are considered as invalid symbol(s) for PUSCH repetition Type B transmission. The symbol(s) given by *numberOfInvalidSymbolsForDL-UL-Switching* are defined using the reference SCS configuration *referenceSubcarrierSpacing* provided in *tdd-UL-DL-ConfigurationCommon*.  - The UE may be configured with the higher layer parameter *invalidSymbolPattern*, which provides a symbol level bitmap spanning one or two slots (higher layer parameter *symbols* given by *invalidSymbolPattern*). A bit value equal to 1 in the symbol level bitmap *symbols* indicates that the corresponding symbol is an invalid symbol for PUSCH repetition Type B transmission. The UE may be additionally configured with a time-domain pattern (higher layer parameter *periodicityAndPattern* given by *invalidSymbolPattern*), where each bit of *periodicityAndPattern* corresponds to a unit equal to a duration of the symbol level bitmap *symbols*, and a bit value equal to 1 indicates that the symbol level bitmap *symbols* is present in the unit. The *periodicityAndPattern* can be {1, 2, 4, 5, 8, 10, 20 or 40} units long, but maximum of 40 msec. The first symbol of *periodicityAndPattern* every 40 msec/P periods is a first symbol in frame 𝑛𝑓 mod 4 = 0, where P is the duration of *periodicityAndPattern-r16* in units of msec. When *periodicityAndPattern* is not configured, for a symbol level bitmap spanning two slots, the bits of the first and second slots correspond respectively to even and odd slots of a radio frame, and for a symbol level bitmap spanning one slot, the bits of the slot correspond to every slot of a radio frame. If *invalidSymbolPattern* is configured, when the UE applies the invalid symbol pattern is determined as follows:  - if the PUSCH is scheduled by DCI format 0\_1, or corresponds to a Type 2 configured grant activated by DCI format 0\_1, and if *invalidSymbolPatternIndicatorDCI-0-1* is configured,  - if invalid symbol pattern indicator field is set 1, the UE applies the invalid symbol pattern;  - otherwise, the UE does not apply the invalid symbol pattern;  - if the PUSCH is scheduled by DCI format 0\_2, or corresponds to a Type 2 configured grant activated by DCI format 0\_2, and if *invalidSymbolPatternIndicatorDCI-0-2* is configured,  - if invalid symbol pattern indicator field is set 1, the UE applies the invalid symbol pattern;  - otherwise, the UE does not apply the invalid symbol pattern;  - otherwise, the UE applies the invalid symbol pattern.  - If the UE  - is configured with multiple serving cells within a cell group and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the multiple serving cells, and  - indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and  - is not configured to monitor PDCCH for detection of DCI format 2-0 on any of the multiple serving cells,  - a symbol indicated to the UE for reception of SS/PBCH blocks in a first cell of the multiple serving cells by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon* is considered as an invalid symbol for PUSCH repetition Type B transmission in  - any of the multiple serving cells if the UE is not capable of simultaneous transmission and reception as indicated by *simultaneousRxTxInterBandCA* among the multiple serving cells, and  - any one of the cells corresponding to the same band as the first cell, irrespective of any capability indicated by *simultaneousRxTxInterBandCA*  and  - a symbol is considered as an invalid symbol in another cell among the set of serving cell(s) provided with *directionalCollisionHandling-r16* for PUSCH repetition Type B transmission with Type 1 or Type 2 configured grant except for the first Type 2 PUSCH transmission (including all repetitions) after activation if the symbol is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* on the reference cell as defined in Clause 11.1 of [6, TS 38.213], or the UE is configured by higher layers to receive PDCCH, PDSCH, or CSI-RS on the reference cell in the symbol.  For PUSCH repetition Type B, after determining the invalid symbol(s) for PUSCH repetition type B transmission for each of the *K* nominal repetitions, the remaining symbols are considered as potentially valid symbols for PUSCH repetition Type B transmission. If the number of potentially valid symbols for PUSCH repetition type B transmission is greater than zero for a nominal repetition, the nominal repetition consists of one or more actual repetitions, where each actual repetition consists of a consecutive set of all potentially valid symbols that can be used for PUSCH repetition Type B transmission within a slot. An actual repetition with a single symbol is omitted except for the case of *L*=1. An actual repetition is omitted according to the conditions in Clause 9, Clause 11.1, Clause 11.2A and Clause 15 of [6, TS38.213]. The UE shall repeat the TB across actual repetitions. The redundancy version to be applied on the *n*th actual repetition (with the counting including the actual repetitions that are omitted) is determined according to table 6.1.2.1-2.  For PUSCH repetition Type B, when a UE receives a DCI that schedules aperiodic CSI report(s) or activates semi-persistent CSI report(s) on PUSCH with no transport block by a '*CSI request'* field on a DCI, the number of nominal repetitions is always assumed to be 1, regardless of the value of *numberOfRepetitions*. When the UE is scheduled to transmit a PUSCH repetition Type B with no transport block and with aperiodic or semi-persistent CSI report(s) by a '*CSI request'* field on a DCI, the first nominal repetition is expected to be the same as the first actual repetition. For PUSCH repetition Type B carrying semi-persistent CSI report(s) without a corresponding PDCCH after being activated on PUSCH by a '*CSI request'* field on a DCI, if the first nominal repetition is not the same as the first actual repetition, the first nominal repetition is omitted; otherwise, the first nominal repetition is omitted according to the conditions in Clause 9, Clause 11.1, Clause 11.2A and Clause 15 of [6, TS38.213].  For PUSCH repetition Type B, when a UE is scheduled to transmit a transport block and aperiodic CSI report(s) on PUSCH by a '*CSI request'* field on a DCI, the CSI report(s) is multiplexed only on the first actual repetition. The UE does not expect that the first actual repetition has a single symbol duration.  **<Unchanged parts are omitted>**  6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant  The procedures described in this clause apply to PUSCH transmissions of PUSCH repetition Type A with a Type 1 or Type 2 configured grant.  The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If *cg-RetransmissionTimer* is provided, the redundancy version for uplink transmission with a configured grant is determined by the UE. If the parameter *repK-RV* is not provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, for the *n*th transmission occasion among *K* repetitions, *n*=1, 2, …, *K*, it is associated with *(mod(n-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *startingFromRV0* set to *'off'*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions. Otherwise, the initial transmission of a transport block may start at  - the first transmission occasion of the *K* repetitions if the configured RV sequence is {0,2,3,1},  - any of the transmission occasions of the *K* repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},  - any of the transmission occasions of the *K* repetitions if the configured RV sequence is {0,0,0,0}, except the last transmission occasion when *K≥8*.  For any RV sequence, the repetitions shall be terminated after transmitting *K* repetitions, or at the last transmission occasion among the *K* repetitions within the period *P*, or from the starting symbol of the repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0, 0\_1 or 0\_2, whichever is reached first. In addition, the UE shall terminate the repetition of a transport block in a PUSCH transmission if the UE receives a DCI format 0\_1 with DFI flag provided and set to '1', and if in this DCI the UE detects ACK for the HARQ process corresponding to that transport block.  The UE is not expected to be configured with the time duration for the transmission of *K* repetitions larger than the time duration derived by the periodicity *P*. If the UE determines that, for a transmission occasion, the number of symbols available for the PUSCH transmission in a slot is smaller than transmission duration *L*, the UE does not transmit the PUSCH in the transmission occasion.  For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when *K >* 1*,* the UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters *cg-nrofSlots* and *cg-nrofPUSCH-InSlot*, in which case the UE repeats the TB in the *repK* earliest consecutive transmission occasion candidates within the same configuration. A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Clause 9, Clause 11.1, Clause 11.2A and Clause 15 of [6, TS38.213]. |

## 1st round discussion

**Question 1: Please provide your views on whether the proposed change in R1-2209465 [1] for Rel-16 can be supported. Or any other suggestion?**

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| **Company name** | **Support or not** | **Comments** |
| ZTE | Support |  |
| Samsung |  | It should be included in Rel-16 alignment CR. |
| Qualcomm |  | Agree with Samsung on including the update as part of Rel-16 alignment CR |
| Vivo |  | We share the similar view with Samsung and QC to include the change in Rel-16 alignment CR. |
| Spreadtrum |  | Alignment CR or separate CR is fine for us. |

**Question 2: Please provide your views whether the potential mirror CR for Rel-17 is needed.**

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| **Company name** | **Need or not** | **Comments** |
| ZTE | Yes |  |
| Samsung |  | It should be included in Rel-17 alignment CR. |
| Qualcomm |  | The update should be included in Rel-17 alignment CR. |
| vivo |  | Include the change in Rel-17 alignment CR. |
| Spreadtrum |  | Alignment CR or separate CR is fine for us. |

# Conclusion

TBD

# Reference

1. R1-2209465 Correction on cancellation of PUSCH repetitions due to DAPS handover ZTE
2. TS 38.213 gb0, Physical layer procedures for control