**3GPP TSG RAN WG1 Meeting #110bis-e R1-22xxxxx**

**e-Meeting, October 10 – 19, 2022**

**Agenda Item: 7.1**

**Source: Moderator (Huawei)**

**Title: Summary of [110bis-e-NR-R15-07] Discussion on** **parallel transmission of PRACH and SRS/PUCCH/PUSCH**

**Document for: Discussion and Decision**

# Introduction

This document is created to collect company views on R1-2209849 [1] and R1-2209836 [2]. Both papers try to address issues related to parallel transmission of PRACH and SRS/PUCCH/PUSCH.

# Background

## Issue#1: R1-2209849

In RAN1#109-e, it was agreed to introduce a new feature group X-2 and a new Rel-17 RRC parameter for parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in **intra-band non-contiguous CA**.

Agreement

Introduce feature groups X-1 and X-2 as described below.

* Introduce a new Rel-17 RRC parameter (UE-specific) to enable the UE behavior under X-2.

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| X. TEI | X-2 | Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA |  | *Yes* | n/a | UE cannot transmit parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Per BC | No | Yes | n/a | This feature is the same as parallelTxPRACH-SRS-PUCCH-PUSCH, but for intra-band non-contiguous CA. This feature is enabled by a new UE-specific RRC parameter *intraBandNC-PRACH-simulTx-r17* | Optional with capability signaling |

According to [1], the above agreement has already been reflected in TS38.214 V17.3.0 but it has not been captured in TS38.213 V17.3.0. Based on current specification in TS 38.213, the UE can not transmit PRACH and PUSCH/PUCCH/SRS simultaneously in intra-band non-contiguous CA. Hence, the following changes was proposed in [1]

## 8.1 Random access preamble

========================= Unchanged parts =========================

For single cell operation or for operation with contiguous carrier aggregation in a same frequency band or for operation with non-contiguous carrier aggregation in a same frequency band if the UE is not configured with higher layer parameter *intraBandNC-PRACH-simulTx-r17*, a UE does not transmit PRACH and PUSCH/PUCCH/SRS in a same slot or when a gap between the first or last symbol of a PRACH transmission in a first slot is separated by less than $N$ symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission in a second slot where $N=2$ for $μ=0$ or $μ=$1, $N=4$ for $μ=2$ or $μ=3$, $N=16$ for $μ=5$, $N=32$ for $μ=6$, and $μ$ is the SCS configuration for the active UL BWP. For a PUSCH transmission with repetition Type B, this applies to each actual repetition for PUSCH transmission [6, TS 38.214].

**Q1: Do you agree with the analysis in [1] that based on current specification in TS 38.213, a UE cannot transmit PRACH and PUSCH/PUCCH/SRS simultaneously in intra-band non-contiguous CA? If not, why?**

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| **Company** | **Agree or not** | **Comment** |
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**Q2: If the answer to Q1 is “yes”, do you agree with the change proposed in [1]?**

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| **Company** | **Agree or not** | **Comment** |
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## Issue#2: R1-2209836

For intra-band CA, a UE does not transmit PRACH and PUSCH/PUCCH/SRS in a same slot or when the gap between PRACH and PUSCH/PUCCH/SRS is less than N symbols. The value of N is dependent on the SCS. The corresponding specification is copied below:

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| **TS38.213-ff0**For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not transmit PRACH and PUSCH/PUCCH/SRS in a same slot or when a gap between the first or last symbol of a PRACH transmission in a first slot is separated by less than  symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission in a second slot where  for  or ,  for  or , and  is the SCS configuration for the active UL BWP. |

For intra-band CA with different SCS, it is not clear which SCS should be used to determine the duration of the slot. For example, for CC1 with 15kHz SCS and CC2 with 30kHz SCS as shown in Figure 1, if 15kHz is used, the UE would not transmit the PRACH and PUCCH/PUSCH/SRS as they are in the same 15kHz slot. But if 30kHz SCS is used, the UE would transmit the PRACH and PUCCH/PUSCH/SRS as they are in the different 30kHz slot.



Figure 1: It is not clear whether the PRACH in CC1 and PUCCH/PUSCH/SRS in CC2 are in the same slot or not. The UE would not transmit both if they are in the same slot. Otherwise, the UE would transmit both.

Besides, it is also not clear whether the N (N=2 in the above example) symbols are based on 15kHz SCS or 30kHz SCS as shown in Figure 2. If the N symbols are N 15kHz symbols, then PUSCH/PUCCH/SRS in CC2 should be later than 4th symbol of slot 2 in CC2. If the N symbols are N 30kHz symbols, then PUSCH/PUCCH/SRS in CC2 should be later than 2nd symbol of slot 2 in CC2.



Figure 2: It is not clear whether N (e.g. N=2) symbols gap between PRACH and PUCCH/PUSCH/SRS in the spec is N 15kHz symbols or N 30kHz symbols.

To resolve the above ambiguity, it was proposed to use the smallest SCS among the multiple CCs to determine the duration of the slot and the N symbols in [2], i.e. the UE would not transmit the PRACH and PUCCH/PUSCH/SRS in Figure 1 as they are in the same 15kHz slot. If 30kHz SCS is used, the UE would be required to transmit both PRACH and PUCCH/PUSCH/SRS. However, the timing advance are different between PRACH and PUCCH/PUSCH/SRS, then the UE may need to apply different timing advance in a 15kHz slot. And the symbol boundary among these two CCs in this case will not be aligned. This would complicate the UE implementation. Based on the above analysis, the following TP is proposed

--------------------------------------------------------Start of the TP------------------------------------------------

## 8.1 Random access preamble

================================= Unchanged parts =============================

For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not transmit PRACH and PUSCH/PUCCH/SRS in a same slot with respect to the smallest SCS configuration for the active UL BWP(s) or when a gap between the first or last symbol of a PRACH transmission in a first slot is separated by less than $N$ symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission in a second slot where $N=2$ for $μ=0$ or $μ=$1, $N=4$ for $μ=2$ or $μ=3$, $N=16$ for $μ=5$, $N=32$ for $μ=6$, and $μ$ is the smallest SCS configuration for the active UL BWP(s).

--------------------------------------------------------End of the TP--------------------------------------------------

**Q1: Do you agree with the analysis in [2] that it is not clear which SCS is used to determine “the duration of the slot” and “N symbols gap” according to the current specification? If not, why?**

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| **Company** | **Agree or not** | **Comment** |
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**Q2: Which SCS do you think should be used to determine “the duration of the slot” and “N symbols gap”?**

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| **Company** | **Agree or not** | **Comment** |
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**Q3: Do you agree with the change proposed in [2]?**

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| **Company** | **Agree or not** | **Comment** |
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# Conclusions

To be updated based on the discussion

# References

1. R1-2209849, “Correction on parallel transmission of PRACH and SRS/PUCCH/PUSCH”, Huawei, HiSilicon
2. R1-2209836, “On parallel transmission of PRACH and SRS/PUCCH/PUSCH”, Huawei, HiSilicon