3GPP TSG RAN WG1 #106-e R1-21xxxxx

**e-Meeting, August 16th – 27th, 2021**

**Agenda item: 7.2.12**

**Source: Moderator (China Telecom)**

**Title: [106-e-NR-Maintenance-Others-02] Remaining issues on Rel-16 uplink Tx switching**

**Document for: Discussion and Decision**

# Introduction

In [1], maintenance issues are summarized for Rel-16 uplink Tx switching. This contribution is the summary of the following email discussion.

[106-e-NR-Maintenance-Others-02] Remaining issues on Rel-16 uplink Tx switching (CA based SRS carrier switching) by August 20 – Jianchi (China Telecom)

# Email discussion (1st round)

## Issue: CA based SRS carrier switching

SRS carrier switching was intensively discussed in RAN1 #104e, RAN1 #104b-e and RAN1 #105e. Companies acknowledged that some clarification is needed, but no consensus has been achieved.

R1-2106501 proposed TPs for both uplink suspension and prioritization rules of SRS carrier switching. R1-2107322 proposed to conclude that the combination of SRS carrier switching and UL Tx switching is not supported in R16 and suggested solving the issues in R17 for the combined feature of SRS carrier switching and UL Tx switching.

Based on the discussion in RAN1 #105e, it seems the following proposal on suspension can be accepted by the majority.

**Proposal 1:**

* Adopt the following TP to TS 38.214.

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| **<Unchanged parts are omitted – 38.214>**A UE can be configured with SRS resource(s) on a carrier *c1* with slot formats comprised of DL and UL symbols and not configured for PUSCH/PUCCH transmission. For carrier *c1*, the UE is configured with higher layer parameter *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier* the switching from carrier *c2* which is configured for PUSCH/PUCCH transmission. During SRS transmission on carrier *c1* (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR*), the UE temporarily suspends the uplink transmission on carrier *c2*, and also the uplink transmission on carrier *c3* if the UE is configured with *uplinkTxSwitching-r16* for uplink switching between uplink carrier *c2* and *c3*.**<Unchanged parts are omitted – 38.214>** |

Companies are encouraged to provide views on the above proposal.

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| **Company** | **Comments** |
| CATT | For proposal 1, it is better to add below description because similar topic will be discussed in [106-e-NR-7.1CRs-02].“Subject to the prerequisite of retaining the “suspending” function as an outcome from [106-e-NR-7.1CRs-02] discussion, for a UE configured with both UL Tx switching and SRS carrier switching, if a SRS transmission is triggered by SRS carrier switching and its “switch-from” uplink carrier is configured with uplinkTxSwitching-r16, then the UE also temporarily suspend the UL transmission on the other uplink carrier configured with uplinkTxSwitching-r16. “ |
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R1-2106501 proposed TP for prioritization rules of SRS carrier switching.

**Proposal 2:**

* Adopt the following TP to TS 38.214.

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| **<Unchanged parts are omitted – 38.214>**6.2.1.3 UE sounding procedure between component carriersFor a carrier of a serving cell *d* with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission, denote as $s\_{0}(d)$ the corresponding carrier of a serving cell whose UL transmissions are temporarily suspended as signalled by higher layer parameter *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier*. Define the set $S\left(d\right)=\{s\_{0}\left(d\right)…s\_{N-1}(d)\}$ as the set of carriers of serving cells that each carrier meets one of the following conditions:- $s\_{i}(d)$ is in the same band as $s\_{0}(d)$, or $s\_{0}(d)$ and $s\_{i}(d)$ are both configured with *uplinkTxSwitching-r16*.- $s\_{i}(d)$ is in the same TAG as $s\_{0}(d)$.where $1\leq i\leq N-1$.**<Unchanged parts are omitted – 38.214>**For an SRS transmission starting in symbol $N\_{\_{}}$ of carrier $d$$\_{}$ and a conflicting transmission in carrier $\_{}$ starting in symbol$ N\_{\_{}}$, where $1\leq i\leq N-1$, the UE shall apply the prioritization / dropping rules in the remainder of this clause taking into account:- DCI(s) for which the time interval between the last symbol of PDCCH and $\_{}\_{\_{}}$ is at least$ N\_{2} $symbols and an additional time duration $T\_{SRS\_{CS}}$, and the time interval between the last symbol of PDCCH and $\_{\_{}}\_{\_{}}$ is at least$ N\_{2}$ symbols*;* and- semi-persistent CSI reports or SRS considered active at least $N\_{2}$ symbols and an additional time duration $T\_{SRS\_{CS}}$ before $N\_{\_{}}$, and considered active at least $N\_{2}$ symbols before $N\_{\_{}\_{}}$.where $T\_{SRS\_{CS}}=max⁡\{switchingTimeUL,switchingTimeDL\}$, and the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across $\_{}, \_{}\_{}$ and their corresponding scheduling cells.The following prioritization rules shall be applied in case of collision between a transmission of SRS over carrier and transmission of a physical signal/channel over a carrier of a serving cell in set $S\left(d\right)$:- the UE shall not transmit SRS whenever SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell $d$ and PUSCH/PUCCH transmission carrying HARQ-ACK/positive SR/RI/CRI/SSBRI and/or PRACH on a carrier of a serving cell in set $S\left(d\right)$ happen to overlap in the same symbol and that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in [13, TS 38.306].- the UE shall not transmit a periodic/semi-persistent SRS whenever periodic/semi-persistent SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell $d$ and PUSCH transmission carrying aperiodic CSI on a carrier of a serving cell in set $S\left(d\right)$ happen to overlap in the same symbol and that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in [13, TS 38.306].- the UE shall drop PUCCH/PUSCH transmission carrying periodic/semi-persistent CSI comprising only CQI/PMI/L1-RSRP/L1-SINR, and/or SRS transmission on a carrier of a serving cell in set $S\left(d\right)$ configured for PUSCH/PUCCH transmission whenever the transmission and SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell$ d$ happen to overlap in the same symbol and that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in [13, TS 38.306].- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR on a carrier of a serving cell in the set$ S\left(d\right)$ whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell$ d$ happen to overlap in the same symbol and that can result in uplink transmissions beyond the UE's indicated uplink carrier aggregation capability included in [13, TS 38.306].**<Unchanged parts are omitted – 38.214>** |

Companies are encouraged to provide views on the above proposal.

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| **Company** | **Comments** |
| CATT | We want to clarify whether this issue on prioritization rules of SRS carrier switching will be handled in this email thread or [106-e-NR-7.1CRs-02] because some contribution on similar topic will be handled in [106-e-NR-7.1CRs-02]. |
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# References

1. R1-2107136, Summary of Rel-16 uplink Tx switching, Moderator (China Telecom), August 16th – 27th, 2021.
2. R1-2106501, Discussion on the remaining problems of supporting Tx switching between two uplink, Huawei, HiSilicon, RAN1 #106-e, August 16th – 27th, 2021.
3. R1-2107322, Remaining issues for 1Tx-2Tx switching, Qualcomm Incorporated, RAN1 #106-e, August 16th – 27th, 2021.