3GPP TSG RAN WG1 #103-e R1-20xxxxx

e-Meeting, October 26th – November 13th, 2020

**Agenda item: 5.1**

**Source: Moderator (China Telecom)**

**Title: [103-e-NR-LS-TxSwitching-02] Email discussion/approval on maintenance of uplink Tx switching thread #1**

**Document for: Discussion and Decision**

# Introduction

In [1], maintenance issues are summarized for uplink Tx switching. As per the guidance of Chairman, following issues are identified for email discussion/approval during RAN1 #103 e-meeting:

[103-e-NR-LS-TxSwitching-01] Email discussion/approval a potential CR till 10/30 – Jianchi (CT)

* Clarification on T^mux\_{proc,CSI} (R1-2007603, R1-2007725, R1-2008564)
* Clarification on the ambiguity issue on SCS and align the description on carrier1 and carrier2 with TS 38.331 (R1-2007725, R1-2008229)

[103-e-NR-LS-TxSwitching-02] Email discussion/approval a potential CR till 10/30 – Jianchi (CT)

* Back to back switching caused by SRS transmission (R1-2008596)
  + Note 1: no discussion on location of switching period.
  + Note 2: the previous agreements should not be overturned.
* Maximum data rate (R1-2008596)

This contribution is the summary of email discussion/approval on maintenance of uplink Tx switching thread #2.

# Discussion

## Issue #1: Back to back switching caused by SRS transmission (R1-2008596)

R1-2008596 mentioned back to back switching could happen due to SRS transmission, and proposed not to support it as it consumes too many symbols as switching gaps illustrated in the following figure.

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| symbol # | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| CC2 | U | U | U | U | U | U | U | U | U | U | U | G | G |  | G | G | U | U | U | U | U | U | U | U | U | G | G |  |
| CC1 |  |  |  |  |  |  |  |  |  |  |  |  |  | S |  |  |  |  |  |  |  |  |  |  |  |  |  | S |

Q: If UL Tx switching is configured, whether back to back switching caused by SRS transmission could be supported?

Companies are invited to answer the above question.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Yes, it has been supported. Such back to back switching is useful in practical network and has been supported by SRS carrier switching. We don’t see a need to preclude such useful switching. |
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R1-2008596 presented two solutions to avoid back to back switching caused by SRS transmission.

* Option 1: The switching period can only be placed at the slot boundary.
* Option 2: No more than 1 switching in consecutive 14 symbols.

According to the notes in [1], there is no discussion on location of switching period and the previous agreements should not be overturned, we focus on the discussion on option 2.

* Proposed TP to TS 38.214

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| 6.1.6 Uplink switching  **< unchanged text omitted>**  After an uplink switching, the UE does not expect to perform more than one uplink switching in a slot for a 14-symbol period starting at the end of the switch, where the symbol duration is according to with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the uplink transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the uplink transmitted after the switching gap.  **< unchanged text omitted>** |

Companies are invited to provide views on the above TP.

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| **Companies** | **Comments** |
| ZTE | The above TP is too restrictive. We would like to enable case1 to case2 switch for a periodic SRS transmission under case2 and then immediately switch back to case1 for PUSCH transmission after the SRS transmission. So, we propose the following alternatives in our tdoc R1-2007725.  *Alternative#1: The UE does not expect to perform an uplink switching if the gap between the start of this uplink switching and the end of the previous uplink switching is smaller than 1 symbol based on numerology µUL*  *Alternative#2: The switching gap can only be placed at the slot boundary or the switching point for S slot.*  We slightly prefer Alternative#2 but Alternative#1 is also acceptable if companies are reluctant to discuss about the location of switching gap. Alternative#1 should be sufficient to avoid back-to-back switching. |
| Huawei, HiSilicon | The TP is not agreeable because it is not in line with previous agreement by adding a restriction to ALL uplink transmissions and is out of the scope of this email discussion as described in the chairman’s note.  Additionally, as commented above, such restriction is too much and preclude a very useful use case.  When we made a decision in the agreement whether the SCS of the slot is the larger one or the smaller one in case of two different SCS, the concerned SRS switching had been considered and allowed. As a result, the larger SCS was agreed. Therefore, we should not reopen the discussion and the TP is not necessary.  Regarding ZTE’s alternative#1, it has been reflected by current specification as explained in FL preparation summary. The concern seems to be resolved.  Regarding ZTE’s alternative#2, it is not an option as the note for the scope of this email discussion. |
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## Issue #2: Maximum data rate (R1-2008596)

* Proposed TP to TS 38.306

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| 4.1.2 Supported max data rate **< unchanged text omitted>**  NOTE 1: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL.  NOTE 2:  When the UE is configured with UL Tx switching, only the supported MIMO layer combination that results in the highest combined data rate is counted for the cells.  NOTE 3:  When the UE is configured with UL Tx switching, and the supported MIMO layer combination with the highest combined data results in switching gaps in either DL or UL then the maximum data rate is correspondingly reduced in the DL or UL, respectively.  **< unchanged text omitted>** |

Companies are invited to provide views on the above TP.

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| **Companies** | **Comments** |
| ZTE | It may not be clear what MIMO layer “combination” means here. From our understanding, NOTE 2 is to avoid invalid assumption of MIMO layer combination across the carriers involving UL Tx switching when supported max data rate is calculated. We can make it clearer. NOTE 3 does not seem necessary. Otherwise, all other time gaps/overhead defined in the specs should be taken into account. |
| Huawei, HiSilicon | There is overlaps between NOTE 2 and NOTE 1 in case of SUL. It is unclear why the redefinition with “MIMO layer combination” is necessary or better. A clarification is suggested. |
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# References

1. R1-2008814, Summary of uplink Tx switching, Moderator (China Telecom), RAN1#103e, October 26th – November 13th, 2020.
2. R1-2007603, Discussion on the remaining problems of supporting Tx switching between two uplink carriers, Huawei, HiSilicon, October 26th – November 13th, 2020.
3. R1-2007725, Remaining Maintenance Issues of UL Tx Switching, ZTE, October 26th – November 13th, 2020.
4. R1-2008229, Text Proposals for Tx Switching between Two Uplink Carriers, OPPO, October 26th – November 13th, 2020.
5. R1-2008564, Draft CR to 38.213 on corrections for UL Tx switching, Ericsson, October 26th – November 13th, 2020.
6. R1-2008596, Remaining issues for 1Tx-2Tx switching, Qualcomm Incorporated, October 26th – November 13th, 2020.

# Appendix

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| **Companies** | **Views** |
| **ZTE**  **(R1-2007725)** | ***Proposal 2****: Consider the following two alternatives to address the back-to-back switching issue.*  *Alternative#1: The UE does not expect to perform an uplink switching if the gap between the start of this uplink switching and the end of the previous uplink switching is smaller than 1 symbol based on numerology µUL*  *Alternative#2: The switching gap can only be placed at the slot boundary or the switching point for S slot.* |
| **Qualcomm**  **(R1-2008596)** | Proposal 1: In the prioritization for SRS switching considers the state of carriers configured with UL Tx switching jointly. As an example, if SRS switching is configured between CC2 and CC3 then in the prioritization the state of CC1 also needs to be considered if CC1 and CC2 are configured with UL Tx switching.  Proposal 2: Define requirements allowing dropping transmissions on a CC due to SRS transmission on another CC, even if this CC is not configured with SRS switching, as long as the CC is configured with UL Tx switching.  Proposal 3: Choose one of the following options:   * During the SRS transmission on CC3 and the interruption time caused by RF tuning, UE is not expected to be scheduled or configured with other transmission requiring UL Tx switching * Define rules on the order in which the UE state vs. dropping decisions are being made   Proposal 4: conclude NOT to support switching caused by SRS transmission or other reasons.  Proposal 5: to avoid the back-to-back SRS switching, adopt one of the following proposals   * Option 1 * The switch location should be always at a slot boundary in the CC with higher SCS * Placing transient always in CC1 (FDD) should be default * Relative placement of transient is RRC configured * Option 2 * Adopt the text proposal in section 3.2   Proposal 6: adopt the following notes for the maximum data rate  NOTE 2:  When the UE is configured with UL Tx switching, only the supported MIMO layer combination that results in the highest combined data rate is counted for the cells.  NOTE 3:  When the UE is configured with UL Tx switching, and the supported MIMO layer combination with the highest combined data results in switching gaps in either DL or UL then the maximum data rate is correspondingly reduced in the DL or UL, respectively. |