**3GPP TSG RAN WG1 #119 R1-240xxxx**

**Orlando, US, November 18th – 22nd, 2024**

**Source: Moderator (CATT)**

**Title:** **Summary on UE capability of SRS antenna switching**

**Agenda Item:** **7**

**Document for:** **Decision**

# Introduction

In RAN1#119, the following contribution is submitted on UE capability of SRS antenna switching to provide a TP revising TS38.306 [1]:

R1-2409919 Discussion on UE capability for SRS antenna switching CATT

This moderator summary aims at collecting the comments from companies regarding the issue in the above contribution.

# Discussion

In 38.306, the following UE capability parameters are used to indicating whether the UE supports SRS antenna switching for more than 4 Rx.

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| ***srs-AntennaSwitchingBeyond4RX-r17***  Indicates whether the UE supports SRS Antenna switching for more than 4 Rx. The capability signalling comprises the following parameters:  *-* *supportedSRS-TxPortSwitchBeyond4Rx-r17* indicates a combination of supported xTyRs. It includes 11-bit bitmap, where starting from the leading / leftmost bit (bit 0), each bit corresponds to {t1r1, t2r2, t1r2, t4r4, t2r4, t1r4, t2r6, t1r6, t4r8, t2r8, t1r8}. For any indicated value, x shall be equal to or smaller than the one associated with the largest y.  *-* *entryNumberAffectBeyond4Rx-r17* indicates the lowest band entry number of the UL group (see *entryNumberSwitchBeyond4Rx-r17*) that impacts the DL of this band entry;  *-* *entryNumberSwitchBeyond4Rx-r17* indicates the lowest band entry of the UL group, which is defined as band entries with UL (see NOTE 1) that impact each other's UL (i.e. SRS TX port switching on any of the cells in the group will impact UL on all the cells in the group). This parameter is absent if an UL group contains only one band entry.  The UE indicating support of this shall indicate support of *srs-TxSwitch.*  For *entryNumberAffectBeyond4Rx-r17* and *entryNumberSwitchBeyond4Rx-r17*, value 1 means first entry, value 2 means second entry and so on. The UE may include *entryNumberAffectBeyond4Rx-r17/entryNumberSwitchBeyond4Rx-r17* for a band entry even if all of the bits in the *supportedSRS-TxPortSwitchBeyond4Rx-r17* are set to 0 for that band entry. All DL and UL that switch together indicate the same entry number.  The entry number is the band entry number in a band combination. The UE is restricted not to include fallback band combinations for the purpose of indicating different SRS antenna switching capabilities.  NOTE 1: The band with UL includes a band associated with *FeatureSetUplinkId* set to 0 corresponding to the support of *SRS-SwitchingTimeNR*.  NOTE 2: If reported for the same values of xTyR in *supportedSRS-TxPortSwitchBeyond4Rx-r17* as reported with *supportedSRS-TxPortSwitch*/*supportedSRS-TxPortSwitch-v1610*, the reported values for *entryNumberAffectBeyond4Rx-r17* and *entryNumberSwitchBeyond4Rx-r17* are not valid. |

It can be seen that *supportedSRS-TxPortSwitchBeyond4Rx-r17* includes 11-bit bitmap, and each bit corresponds to {t1r1, t2r2, t1r2, t4r4, t2r4, t1r4, t2r6, t1r6, t4r8, t2r8, t1r8} respectively. To avoid unnecessary flexibility on indicating the combinations of xTyRs, a restriction is specified in 38.306 that for any indicated value of the 11-bit bitmap, x shall be equal to or smaller than the one associated with the largest y.

The restriction is ambiguous when the largest y is associated with more than one x values. For example, for a UE indicates both t2r8 and t1r8, it is unclear whether ‘the one associated with the largest y’ should be interpreted as 2 or 1:

* if ‘the one associated with the largest y’ is interpreted as 2, one or more of {t2r2, t2r4, t2r6} can be indicated by the UE;
* if ‘the one associated with the largest y’ is interpreted as 1, none of {t2r2, t2r4, t2r6} can be indicated by the UE.

Similar as UE capabilities reporting on downgrading configuration of SRS Tx port switching patterns for no more than 4Rx and 8T8R, UE indicates the SRS Tx port switching patterns with x no more than the largest x associated with the largest y as downgrading configuration of SRS Tx port switching patterns should be supported for SRS antenna switching beyond 4Rx. Since the interpretation should be clarified in 38.306. In this case, a LS should be sent to RAN2 to ask for the change. The corresponding TP for 38.306 (v17.10.0) can be as follows:

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| --- | --- | --- | --- | --- | --- |
| 4.2.7.1 *BandCombinationList* parameters <Unrelated parts are omitted>   | ***srs-AntennaSwitchingBeyond4RX-r17***  Indicates whether the UE supports SRS Antenna switching for more than 4 Rx. The capability signalling comprises the following parameters:  *-* *supportedSRS-TxPortSwitchBeyond4Rx-r17* indicates a combination of supported xTyRs. It includes 11-bit bitmap, where starting from the leading / leftmost bit (bit 0), each bit corresponds to {t1r1, t2r2, t1r2, t4r4, t2r4, t1r4, t2r6, t1r6, t4r8, t2r8, t1r8}. For any indicated value, x shall be equal to or smaller than the largest one associated with the largest y.  *-* *entryNumberAffectBeyond4Rx-r17* indicates the lowest band entry number of the UL group (see *entryNumberSwitchBeyond4Rx-r17*) that impacts the DL of this band entry;  *-* *entryNumberSwitchBeyond4Rx-r17* indicates the lowest band entry of the UL group, which is defined as band entries with UL (see NOTE 1) that impact each other's UL (i.e. SRS TX port switching on any of the cells in the group will impact UL on all the cells in the group). This parameter is absent if an UL group contains only one band entry.  The UE indicating support of this shall indicate support of *srs-TxSwitch.*  For *entryNumberAffectBeyond4Rx-r17* and *entryNumberSwitchBeyond4Rx-r17*, value 1 means first entry, value 2 means second entry and so on. The UE may include *entryNumberAffectBeyond4Rx-r17/entryNumberSwitchBeyond4Rx-r17* for a band entry even if all of the bits in the *supportedSRS-TxPortSwitchBeyond4Rx-r17* are set to 0 for that band entry. All DL and UL that switch together indicate the same entry number.  The entry number is the band entry number in a band combination. The UE is restricted not to include fallback band combinations for the purpose of indicating different SRS antenna switching capabilities.  NOTE 1: The band with UL includes a band associated with *FeatureSetUplinkId* set to 0 corresponding to the support of *SRS-SwitchingTimeNR*.  NOTE 2: If reported for the same values of xTyR in *supportedSRS-TxPortSwitchBeyond4Rx-r17* as reported with *supportedSRS-TxPortSwitch*/*supportedSRS-TxPortSwitch-v1610*, the reported values for *entryNumberAffectBeyond4Rx-r17* and *entryNumberSwitchBeyond4Rx-r17* are not valid. | BC | No | N/A | N/A | | --- | --- | --- | --- | --- |   <Unrelated parts are omitted> |

As the issue is about to have the consensus among RAN1 group and revise RAN2 spec, two proposals are provided based on the above arguments:

Proposal 1: On UE indicating supported downgrading configuration of SRS Tx port switching patterns for SRS antenna switching beyond 4Rx, only the SRS Tx port switching patterns with x no more than the largest one associated with the largest y can be indicated.

Proposal 2: Send a LS to RAN2 to ask for clarifying in the description for *supportedSRS-TxPortSwitchBeyond4Rx-r17* in 38.306 that only the SRS Tx port switching patterns with x no more than the largest one associated with the largest y can be indicated, with the draft TP mentioned for 38.306 (v17.10.0).

In this case, two questions are raised as follows:

## Q1: Do you agree that the issue raised in the contribution is valid? If yes, do you agree with proposal 1?

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| **Company** | **Agree or Not Agree** | **Comments** |
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## Q2: Do you agree to send a LS to RAN2? If yes, do you agree with the TP drafted in proposal 2？

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| **Company** | **Agree or Not Agree** | **Comments** |
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# Proposal for online discussion

TBD.

# Reference

1. R1-2409919 Discussion on UE capability for SRS antenna switching CATT