3GPP TSG RAN WG1 #110-e R1-22abcde

e-Meeting, October 10 – 19, 2022

**Agenda item: 7.2**

**Source: Moderator (Nokia)**

**Title: [110bis-e-NR-R16-11] UE type “SwitchedUL” and simultaneous transmission on two UL bands – Moderator Summary**

**WI: NR\_RF\_FR1**

**Release: Rel-16**

**Document for: Discussion and Decision**

# 1 Introduction

This document is a summary of the discussion related to the RAN1#110bis Release-16 maintenance (agenda item 7.2) issue #11 on UL Tx Switching, handled in the following email thread:

[110bis-e-NR-R16-11] Discussion on correction to UE type “SwitchedUL” and simultaneous transmission on two UL bands by Oct 17 – Karri (Nokia)

Relevant tdocs:

* [R1-2210190](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Docs/R1-2210190.zip) Correction to UE type “SwitchedUL” and simultaneous transmission on two UL bands Nokia, Nokia Shanghai Bell

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# 2 Summary of the issue raised in the Tdoc

Problem description of R1-2210190

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| For CA-based UL Tx Switching with SwitchedUL (Option 1) the specifications do not correctly capture the RAN1 agreement that the UE is not supposed to be able to transmit on carrier 2 when it is transitting 1-port transmission on carrier 1.**Agreements:*** For inter-band UL CA, if UE reports via capability signaling to support uplink Tx switching, UE further reports via capability signaling which option (between Option 1 and Option 2) is supported.
	+ Option 1: If uplink Tx switching is configured, UE is not expected to be scheduled or configured with UL transmission on carrier 2 for case 1.

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| --- | --- | --- |
|  | Number of **Tx chains** in WID (carrier 1 + carrier 2) | Number of **antenna ports** for UL transmission (carrier 1 + carrier 2) |
| Case 1 | 1T+1T | 1P+0P |
| Case 2 | 0T+2T | 0P+2P, 0P+1P  |

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Proposed specification change in R1-22010190 to TS38.214 subclause 6.1.6.2 *Uplink switching for carrier aggregation*

- The UE configured with *uplinkTxSwitchingOption* set to 'switchedUL' is not expected to simultaneously transmit on the two uplink carriers.

# 3 Discussion

# 3.1 Round 1 - CLOSED

### Question 1

* **Do you agree with the problem statement, yes/no? If no, please explain.**
* *For CA-based UL Tx Switching with SwitchedUL (Option 1) the specifications do not correctly capture the RAN1 agreement that the UE is not supposed to be able to transmit on carrier 2 when it is transmitting 1-port transmission on carrier 1.*

**Please provide company comments to the table below**

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| **Company**  | **Comment** |
| Nokia | As the proponent, we agree with the problem statement. We haven’t identified the specification restriction limiting the “SwitchedUL” UE type transmissions to one UL carrier only at a time. |
| NTT DOCOMO | We agree with the problem statement. |
| Qualcomm | We understand the motivation, even though we don’t see any ambiguity on understanding current specification. We are ok to update the spec if majority prefers. |
| Huawei, HiSilicon | OK to capture the definition of Option 1 into specification if it has not been captured in RAN2 or RAN4 specification. However, we prefer to stick to the exact wording in the agreement as much as possible rather than the one from the proponent so that we don’t have to spend time in debating it again. |
| Apple | Although we think that there is no ambiguity that switchedUL doesn’t support simultaneous transmission on multiple carriers, but we are okay to update the specifications if preferred by majority of the companies |
| ZTE | Similar view as Qualcomm and Apple, we prefer not to update the spec but can be ok if majority prefers to have. Meanwhile, we think the same statement can also be added for SUL for clarity since NUL and SUL are not allowed to perform simultaneous reception, which is similar to *switchedUL*. |
| Samsung | We agree with the problem statement and support a CR. We do not see much potential or risk for possible misinterpretation of the Rel-16 specs during implementation. Expected UE behaviour with ‘switchedUL” and no concurrent UL transmissions should be pretty clear from context and feature support (at least for Rel-16). Looking at the proposed CR, it appears almost more important to clarify the Rel-17 2 intra-band CC case.  |
| Intel | We do not see strong need to capture this in the spec as this is very clear from the beginning that switchUL means there is no concurrent uplink transmission. We are also fine to capture this if majority supports.  |
| Spreadtrum | We support to make the spec clear to capture the CR. |
| vivo | We agree with the problem statement. |
| China Telecom | Similar with other companies, we don’t see any ambiguity in the current specification. We can accept the majority views. |
| LG Electronics | We share the similar view as other companies. We don't think there is any difficulty in understanding 'switched' in the current spec, therefore, we prefer not to update the spec. But, we can accept the majority views if the spec can be clearer with the correct CR.  |

### Question 2

* **Please provide your comments on the specification change proposal**
* The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ is not expected to simultaneously transmit on the two uplink carriers.

**Please provide company comments to the table below**

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| **Company**  | **Comment** |
| NTT DOCOMO | We are fine with the proposed change for Rel-16.On the other hand, if same change will be applied to Rel-17, “not expected to simultaneously transmit on the two uplink carriers” would not be correct since intra-band contiguous aggregated two carriers can be simultaneously used for UL transmission even with ‘switchedUL’ according to the following agreements. So, some wording modification may be necessary for Rel-17 if same change will be applied. Agreements:For Rel-17 1Tx-2Tx switching between 1 carrier on Band A and 2 contiguous carriers on Band B, the mapping between UL transmission ports and Tx chain for SUL and UL CA Option 1 is defined as follows.

|  |  |  |
| --- | --- | --- |
|   | Number of **Tx chains** in WID (band A + band B) | Number of **antenna ports** for UL transmission (band A (carrier 1) + band B (carrier 2 + carrier 3)) |
| Case 1 | 1T+1T | 1P+(0P+0P) |
| Case 2 | 0T+2T | 0P+(2P+0P), 0P+(0P+2P), 0P+(2P+2P), 0P+(1P+0P), 0P+(0P+1P), 0P+(1P+1P), 0P+(1P+2P), 0P+(2P+1P)  |

Agreements:For Rel-17 2Tx-2Tx switching between 1 carrier on Band A and 2 contiguous carriers on Band B, the mapping between UL transmission ports and Tx chain for SUL and UL CA Option 1 is defined as follows.

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| --- | --- | --- |
|   | Number of **Tx chains** in WID (band A + band B) | Number of **antenna ports** for UL transmission (band A (carrier 1) + band B (carrier 2 + carrier 3)) |
| Case 2 | 0T+2T | 0P+(2P+0P), 0P+(0P+2P), 0P+(2P+2P), 0P+(1P+0P), 0P+(0P+1P), 0P+(1P+1P), 0P+(1P+2P), 0P+(2P+1P) |
| Case 3 | 2T+0T | 2P+(0P+0P), 1P+(0P+0P) |

 |
| Qualcomm | if majority prefers to update the spec to explicitly reveal the agreement, we are open to discuss.However, we are not ok with the above proposal as it’s not aligned with agreement ”If uplink Tx switching is configured, UE is not expected to be scheduled or configured with UL transmission on carrier 2 for case 1.” We propose following wording * The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ is not expected to be scheduled or configured with simultaneously transmission on the two uplink carriers.
 |
| Huawei, HiSilicon | As commented before, the wording in the agreement is better. So we propose,”*If a UE is configured with uplinkTxSwitchingOption set to ’switchedUL’, the UE is not expected to be scheduled or configured with simultaneous UL transmissions on both the uplink carriers*.” Regarding the intra-band cases introduced in Rel-17, the wording ”carriers” should be kept in Rel-16 CR, while it can be replaced by bands in Rel-17 mirror CR. |
| Apple | We support the updated wording by Qualcomm, if CR is to be agreed |
| ZTE  | Two comments from our side.1. As mentioned by NTT DOCOMO, the mirror CR in Rel-17 should consider the intra-band CA case. Some wording update can be ”*.....on the uplink carriers on both bands*”

- The UE configured with *uplinkTxSwitchingOption* set to ‘*switchedUL*’ is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on uplink carriers on both bands.1. Similar statement can be added for SUL for clarity.

|  |
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| For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch* for a band combination, and if it is for that band combination configured in a serving cell with two uplink carriers with higher layer parameter *supplementaryUplink*:- If the UE is configured with uplink switching with parameter *uplinkTxSwitching*,- If the UE is to transmit any uplink channel or signal on a different uplink on a different band from the preceding transmission occasion based on DCI(s) received before C:\Users\10240317\AppData\Local\Temp\ksohtml7492\wps1.jpgor based on a higher layer configuration(s), then the UE assumes that an uplink switching is triggered in a duration of switching gap C:\Users\10240317\AppData\Local\Temp\ksohtml7492\wps2.jpg, where C:\Users\10240317\AppData\Local\Temp\ksohtml7492\wps3.jpg is the start time of the first symbol of the transmission occasion of the uplink channel or signal and C:\Users\10240317\AppData\Local\Temp\ksohtml7492\wps4.jpg is the preparation procedure time of the transmission occasion of the uplink channel or signal given in clause 5.3, clause 5.4, clause 6.2.1, clause 6.4 and in clause 9 of [6, TS 38.213], respectively. During the switching gap C:\Users\10240317\AppData\Local\Temp\ksohtml7492\wps5.jpg, the UE is not expected to transmit on any of the two uplinks.- The UE is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on both uplinks.- In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions. |

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| Samsung | For the Rel-16 CR, we prefer the Qualcomm proposed wording which is in line with how the EN-DC case is specified.For Rel-17, this would again be ambiguous. Also the ZTE proposed version reads mis-leadin. It is not clear if the 2 intra-band carrier case or 2 carriers with 1 carrier in each band are meant. What about the following text?* The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ s not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on one uplink carrier on one band and any transmission on another uplink carrier on another band.
 |
| Intel | If introduced, we are fine with the wording from Qualcomm to align with the agreements for Rel-16 CR. For Rel-17 CR, we share similar view as Huawei that ”carriers replaced by bands” should address the issue.  |
| Spreadtrum | We support the words from QC. |
| vivo | We support the words from ZTE. |
| China Telecom | If CR is necessary, we agree with the majority that the wording ”the UE is not expected to be scheduled or configured” should be added. Also agree with Huawei that the wording ”carriers” should be kept in Rel-16 CR, while it can be replaced by bands in Rel-17 mirror CR. |
| LG Electronics | We are fine with either wording suggested by companies for Rel-16 CR, but slightly prefer the wording from Qualcomm based on the wording of previous agreement. For Rel-17 mirror CR, only change should be the use of ”band” instead of ”carrier”. |

### Summary of Round 1

#### On question 1: Do you agree with the problem statement, yes/no?

* 6 companies support clarifying the specification
* 6 companies don’t see the ambiguity but are OK to clarify the text if so preferred by the majority

**Moderator’s thoughts**: The companies who say they don’t see the ambiguity mention that it is clear from the context but do not refer to any specification text, while the 6 companies supporting the specification clarification indicate that the discussed restriction is not mentioned in the spec.

**Additional points noted:**

* the same statement can also be added for SUL for clarity since NUL and SUL are not allowed to perform simultaneous reception, which is similar to switchedUL.

**Moderator’s thoughts**: The Rel-15 SUL/NUL combination not allowed to transmit simultaneously is specified for SUL/NUL in Rel-15 and thus that should be already covered in the basic SUL case. If this is not clear in Rel-15, then it would seem this is a Rel-15 SUL problem.

**Moderator proposal:**

* **Proceed with drafting the specification text in RAN1#110bis-e**
* **Discuss if the same statement should be added for SUL**

#### On question 2: Please provide your comments on the specification change proposal

Several comments were made on the original proposal not being aligned with the wording of the RAN1 agreement. Also several comments were pointing out that the Rel-17 compatibility may require the mirror CR wording to be somewhat different.

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| --- | --- |
| **Company**  | **Proposal** |
| QCOM | The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ is not expected to be scheduled or configured with simultaneously transmission on the two uplink carriers. |
| ZTE | The UE configured with *uplinkTxSwitchingOption* set to ‘*switchedUL*’ is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on uplink carriers on both bands.And for SUL- The UE is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on both uplinks. |
| Samsung | The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ s not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on one uplink carrier on one band and any transmission on another uplink carrier on another band.  |

The Samsung proposal would seem to answer to all concerns wrt. the Rel-16 wording and be directly compatible with Rel-17 Tx Switching operation.

The same text could be carried forward to the SUL branch of UL Tx Switching as well.

**Moderator Proposal:**

* **Adopt the following (Samsung) text for both Rel-16 and Rel-17 for the UL CA Tx Switching**
	+ The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ s not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on one uplink carrier on one band and any transmission on another uplink carrier on another band.
* **Adopt the following (ZTE) text to the SUL Tx Switching**
	+ The UE is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on both uplinks.

# 3.2 Round 2

### Question 1 – closed

### Question 2

**Moderator Proposal:**

* **Adopt the following (Samsung) text for both Rel-16 and Rel-17 for the UL CA Tx Switching**
	+ The UE configured with *uplinkTxSwitchingOption* set to ‘switchedUL’ s not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on one uplink carrier on one band and any transmission on another uplink carrier on another band.
* **Adopt the following (ZTE) text to the SUL Tx Switching**
	+ The UE is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on both uplinks.

**Please provide company comments to the table below**

|  |  |
| --- | --- |
| **Company**  | **Comment** |
| Samsung | We support the moderator proposal as is. |
| Qualcomm | No strong concern on Samsung proposal, but just want to kindly remind that the Rel-16 spec doesn’t use “one band” or “another band” in Section 6.1.6.2 of TS38.214. We suggest removing “one band” and “another band” on Rel-16 CR to keep the wording alignment with rest of paragraph. For Rel-17 CR which might be beyond current discussion, we are ok with above proposal. On SUL proposal from ZTE, nothing wrong about the content. If majority agrees we are also ok with this.  |
| ZTE | We support to adopt the two TPs above shared by moderator.Regarding Qualcomm’s comment, it is true we don’t use “one band” or “another band” in Rel-16. But either way is fine for us. |
| Nokia, NSB | We are OK with the current proposal (with or without the SUL addition). We are also OK with the Qualcomm suggestion and potentially using the “band” phraseology in the Rel-17 shadow CR. |
| Huawei, HiSilicon | The text for SUL should be formed in the similar way as UL-CA Option 1. Not sure why they are proposed with difference.The text is needed only for the case of intra-band uplink CA. For the case of single serving cell configured with SUL, as moderator commented, it has been specified well since Rel-15.Therefore, we propose to add the following text to Rel-176.1.6.3 Uplink switching for supplementary uplinkFor a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch* for a band combination, and if it is for that band combination configured in a serving cell with two uplink carriers with higher layer parameter *supplementaryUplink*:- If the UE is configured with uplink switching with parameter *uplinkTxSwitching*,- If the UE is to transmit any uplink channel or signal on a different uplink on a different band from the preceding transmission occasion based on DCI(s) received before $T\_{0}-T\_{offset}$or based on a higher layer configuration(s), then the UE assumes that an uplink switching is triggered in a duration of switching gap $N\_{Tx1-Tx2}$, where $T\_{0}$ is the start time of the first symbol of the transmission occasion of the uplink channel or signal and $T\_{offset}$ is the preparation procedure time of the transmission occasion of the uplink channel or signal given in clause 5.3, clause 5.4, clause 6.2.1, clause 6.4 and in clause 9 of [6, TS 38.213], respectively. During the switching gap $N\_{Tx1-Tx2}$, the UE is not expected to transmit on any of the two uplinks.- The UE configured with another serving cell for intra-band uplink carrier aggregation is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on one uplink carrier on one band and any transmission on another uplink carrier on another band.- In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.Regarding the Rel-16 text for UL-CA Option 1, there is very similar text in Rel-16 spec without the term of band, as copied below. The proposed text is supposed to be added after it with similar wording. Additionally, as usual, Rel-17 mirror CR don’t have to get the exact same text as Rel-16 CR if necessary. Therefore, we prefer not to add the word “band” in the Rel-16 CR.“The UE is not expected to be scheduled or configured with uplink transmissions that result in simultaneous transmission on two antenna ports on one uplink carrier, and any transmission on another uplink carrier.”  |
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