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

**Contacts**

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| --- | --- | --- |
| **Company** | **Delegate** | **Email address** |
| **Prefix** | **(at)** | **Domain** |
| Nokia | Karri Ranta-aho | Karri.Ranta-aho | (at) | Nokia.com |
| NTT DOCOMO | Hiroki Harada | hiroki.harada | (at) | docomo-lab.com |
| Qualcomm | Yiqing Cao | yiqingc | (at) | qti.qualcomm.com |
| Huawei, HiSilicon | Frank Yi LONG | frank.longyi | (at) | huawei.com |
| Apple | Ankit Bhamri | a.bhamri | (at) | apple.com |
| ZTE | Xingguang WEI | wei.xingguang | (at) | zte.com.cn |
| Samsung | Marian Rudolf | m.rudolf | (at) | partner.samsung.com |
| Intel | Gary Xiong | Gang.xiong | (at) | Intel.com |
| vivo | Can LI | can.li | (at) | vivo.com |
| China Telecom | Jianchi Zhu | zhujc | (at) | chinatelecom.cn |
| LG Electronics | Seunghwan Choi | seunghwan.choi | (at) | lge.com |

# 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

### 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**

|  |  |
| --- | --- |
| **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**

|  |  |
| --- | --- |
| **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.

|  |  |  |
| --- | --- | --- |
|   | 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) |

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| 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.
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| 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.
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| 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”. |