**3GPP TSG RAN WG1 #106bis-e R1-210xxxx**

**e-Meeting, October 11th – 19th, 2021**

**Agenda item:** 8.17.17

**Source:** Moderator (NTT DOCOMO, INC.)

**Title:** [draft] Summary on other UE feature related discussions

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.17.17 including any other UE feature related discussions not directly relevant to 8.17.1 ~ 8.17.16, i.e., not captured in [1] or [2], and captures the following email discussion.

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| [106bis-e-R17-UE-features-Others-01] Email discussion UE features for other remaining issues – Shinya (DOCOMO)* 1st check point: October 14
* Final check point: October 19
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Based on the discussions summarized in Section 2, following is the suggested list of issues to be discussed and priority order considering RAN2 impact especially for capability signaling design, which are tagged and colour coded with High priority, Medium priority, or Low priority.

**FL proposal of list of issues/proposals and priority:**

* **High priority issues (such as a certain FG is necessary or not):**
	+ **Discuss whether to add an FG for indicating supported option for UL Tx switching for 2Tx-2Tx inter-band UL CA whether/how to separate the capability for UE subgroup indication from FG 29-1**
* **Medium priority issues (such as components and type that have capability signaling impacts):**
	+ **None**
* **Low priority issues (such as components that do not have capability signaling impacts)**
	+ **None**

In this round of the discussion, companies are requested to provide comments on the proposals and questions tagged FL3.

# **UE features for UL Tx switching**

In [2], FG 37-x is captured as placeholder for potential RAN1 UE features for Rel-17 UL Tx switching.

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
|  37. [NR\_RF\_FR1\_enh] | 37-x |  |  |  |  |  |  |  |  |  |  |  |  |

Following feedbacks are provided in contributions for the RAN1#106bis-e meeting.

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| [3] | ZTE | In Rel-16, we have the following per-BC UE feature to supported option for UL Tx switching for inter-band UL CA.

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| Features | Index | Feature group | Components |
| 22. NR Others | 22-1 | Indicating supported option for UL Tx switching for inter-band UL CA | Indicating supported option for UL Tx switching for inter-band UL CA* Candidate values set is {option1, option2, both option 1 and option 2}
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Similarly, Rel-17 also specifies two different options for UL Tx switching for inter-band UL CA. From our perspective, it is not appropriate to always require UE to support the same option for Rel-16 UL Tx switching and Rel-17 UL Tx switching for iner-band UL CA. For example, UE may support “both Option1 and Option2” for Rel-16 1Tx-2Tx UL Tx switching, but it may only support “Option1” for Rel-17 UL Tx switching, Rel-17 UL Tx switching is enhanced from two perspectives, 1) from 1Tx-2Tx to 2Tx-2Tx switching; 2) from 2-carrier case to 3-carrier case switching. It may be ok to support the same option for 2-carrier case and 3-carrier case. But different options should be allowed for 1Tx-2Tx switching and 2Tx-2Tx switching. Thus, we propose to introduce the following UE feature for Rel-17 2Tx-2Tx UL Tx switching for both 2-carrier case and 3-carrier case.***Proposal 1****: Introduce the following UE feature for Rel-17 2Tx-2Tx UL Tx switching for inter-band UL CA.*

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| 37. [NR\_RF\_FR1\_enh] | 37-1 | Indicating supported option for UL Tx switching for 2Tx-2Tx inter-band UL CA | Indicating supported option for 2Tx-2Tx UL Tx switching for inter-band UL CA* Candidate values set is {option1, option2, both option 1 and option 2}
 | FFS | Yes | N/A |  | Per BC | N/A | N/A | N/A |  | FFS details |

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## **Discussion**

**[FL1] High priority question 2-1:**

* **Companies are encouraged to provide views on whether to add an FG for indicating supported option for UL Tx switching for 2Tx-2Tx inter-band UL CA**

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| Company | Comment |
| Nokia, NSB | OK to have the FG. As for the details of the FG itself, some simplification can be made by assuming the Rel-16 FG as prerequisite. |
| Intel | We are supportive to the FL proposal  |
| ZTE | Yes, a new FG is needed for UL Tx switching for 2Tx-2Tx inter-band UL CA.If such a new FG is not introduced, it basically means that UE has to support the same option for both Rel-16 1Tx-2Tx UL Tx switching and Rel-17 2Tx-2Tx UL Tx switching. This may unnecessary complicates the UE implementation and delay the commercial launch. For example, UE may support “both Option1 and Option2” for Rel-16 1Tx-2Tx UL Tx switching, but it may only support “Option1” for Rel-17 UL Tx switching. |
| Huawei, HiSilicon | We don’t see a new FG is needed for the following reasons,1. The new FG overlaps with the existing FG 22-1.
2. In Rel-16, for a UE reporting 1Tx-2Tx switching with any option in FG 22-1, the UE must also support 1Tx-1Tx switching with the same option. Therefore, the same rule should be applied to Rel-17, i.e. a UE capable of 2Tx-2Tx switching with any option above, it should be capable of 1Tx-2Tx switching. However, the new FG is not in line with such basic rule, and will cause unnecessary operation issue for gNB. For example, a Rel-17 gNB supports 2Tx-2Tx UL-CA Option 1, but the gNB cannot config 1Tx-2Tx switching Option 1 to a UE capable of 2Tx-2Tx switching Option 1.
3. It is unclear what UE implementation issue could be to retain the basic rule for CA operation.
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| DOCOMO | We are fine to have the proposed FG to allow UE supporting different option for 2Tx-2Tx UL Tx switching from 1Tx-2Tx UL Tx switching if such case (i.e., supporting different options) is practical. |
| FL2 | According to the comments provided so far, companies have different view on whether add an FG for indicating supported option for UL Tx switching for 2Tx-2Tx inter-band UL CATherefore, no additional proposal is made for now, but companies are encouraged to check the comments provided so far and indicate if their position is changed. |
| ZTE2 | Add some response to Huawei’s comments1) & 3) FG22-1 is only for 1Tx-2Tx UL Tx switching, where only 1 antenna can be switched between two carriers. The new FG we are discussing here is for 2Tx-2Tx UL Tx switching, where 2 antennas can be switched between 2(or 3) carriers. It is obvious that they are two different capabilities, it is just that their component values happen to be the same.2) Your argument seems to say, if 2Tx-2Tx supports one option, then 1Tx-2Tx may not support such option. However, our concern is that, if 1Tx-2Tx supports both Option1 and Option2, it requires UE to support both options for 2Tx-2Tx all together, otherwise, they cannot pass the IoDT test. This puts too much implementation restrictions. |
| Huawei, HiSilicon | In response to ZTE’s comments, thank you for your follow-ups, but we are afraid that our concerns listed in the three bullets before have not been addressed by your reply, e.g. whether the proposal precludes a gNB to configure a UE capable of 2Tx-2Tx switching with only 1Tx-2Tx switching for the same option, and what exact UE implementation issue has been identified given the Rel-17 UE behaviour for 2Tx-2Tx is the same as Rel-16 one except for maybe the ambiguous state issue whose solution is only a baseband solution? In our understanding, the proposal seems equivalently changing the existing FG 22-1 from per BC to per feature set, and causes unnecessary troubles for gNBs during network operation |
| Qualcomm | We are supportive to this new FG which could be used to differentiate Rel-17 capable UE with Rel-16 capable UE. Rel-17 allows a new switching case and would increase UE’s implementation complexity to check the target switching case. Without this new FG, Rel-16 capable UE would be required to provide sufficient flexibility to support the switching among 3 cases introduced by Rel-17, which is not realistic. Meanwhile, it would be good if it would be limited to no more than 2 bands being configured with UL. With this limitation, feature per band combination would be acceptable. |
| FL3 | According to the comments provided so far, companies still have different views.Companies are encouraged to keep discussion until the quiet period (Friday 15th October 23:59 UTC). |
| OPPO | We support to the feature. |
| Huawei, HiSilicon | In response to Qualcomm comment, without this new FG, RAN2 has had proper design to differentiate Rel-17 capable UE from Rel-16 capable UE. Not sure if we have fully understood your comments.As commented before, this existing FG 22-1 is per BC which is independent of Tx number, but it is equivalently changed to per FS by the new FG, which causes issues to gNB as explained above. Based on RAN1 discussions, Rel-16 UE behaviours are fully reused to Rel-17. For Option 2 with the additional switching state, the only difference is a simple clarification on the state ambiguity issue. It does not cause any unrealistic UE implementation.We hope proponents could address our concerns and answer our questions asked in previous rounds. |
| ZTE | In response to Huawei, what you mentioned can be summarized by the following: If UE supports Option1 for 2Tx-2Tx, then UE also needs to supports Option1 for 1Tx-2Tx;If UE supports Option 2 for 2Tx-2Tx, then UE also needs to supports Option2 for 1Tx-2Tx;If UE supports {Option1+Option 2} for 2Tx-2Tx, then UE also needs to supports {Option1+Option 2} for 1Tx-2Tx;However, our concern is that, if UE supports {Option1+Option 2} for 1Tx-2Tx, UE should have the flexibility to report Option1 only (or Option2 only) for 2Tx-2Tx. |

# **Conclusions**

TBD

# **References**

[1] R1-2108678 Preliminary RAN1 UE features list for Rel-17 LTE Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2108679 Preliminary RAN1 UE features list for Rel-17 NR Moderators (AT&T, NTT DOCOMO, INC.)

[3] R1-2109140 Discussion on Rel-17 UE features for UL Tx switching ZTE