3GPP TSG RAN WG1 #112 R1-23xxxxx

**Athens, Greece, February 27th – March 3rd, 2023**

**Agenda item: 8.17**

**Source: Moderator (China Telecom)**

**Title: FL summary of discussion on Rel-17 UL Tx switching**

**Document for: Discussion**

# Introduction

This contribution is a summary of maintenance issues for Rel-17 UL Tx switching.

# Initial discussion

## Issue: Clarification on SCS of the two intra-band carriers

[1] points out that it needs clarification that the numerologies should be the same for the active UL BWPs of the two intra-band carriers in any band involved in Release 17 Tx switching, otherwise when the SCSs for the two intra-band carriers are different, the UE behaviour is unclear.

[1] proposes the following TP to TS 38.214.

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| 6.1.6 Uplink switching < Unchanged parts are omitted >  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL, 1, µUL, 2*), where the *µUL, 1* corresponds to the subcarrier spacing of the active UL BWP of one uplink carrier before the switching gap and the *µUL, 2* corresponds to the subcarrier spacing of the active UL BWP of the other uplink carrier after the switching gap. If there are two carriers on the band of the uplink transmission before or after the switching gap, UE does not expect that the active UL BWPs of the two carriers on the band are of different numerologies.  < Unchanged parts are omitted > |

**Companies are encouraged to provide comments on the above TP.**

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| **Company** | **Comments** |
| vivo | Support.  In Rel-17, the TX switching is enhanced to support additional scenarios where one of the involved bands have **two** consecutive intra-band carriers and it is not clear from the spec if both carriers are always assumed to have same numerology. If not, it is also ambiguous how *µUL* is derived. Thus, clarification is needed.  Additionally, in the last meeting, RAN1 achieved an agreement for Rel-18 TX switching that if there are two consecutive intra-band carriers in one of the involved bands, µUL, 1 = max(µUL, 1-1, µUL, 1-2), where µUL, 1-1 and µUL, 1-2 are SCSs of active UL bandwidth parts of the two carriers in the band, is used to determine *µUL*. This agreement considered the case where the two consecutive intra-band carriers on a band are of different numerologies. As the scenarios supported in Rel-17 (e.g. switching between a band pair) are also supported in Rel-18, it is better to clarify whether UE also needs to consider the mixed SCS case in Rel-17 TX switching.  Considering that the consecutive intra-band carriers on the same band are typically deployed with same numerology, and we are at the very late stage Rel-17 for maintenance, it is suggested to conclude or reflect in the Rel-17 spec that UE expects same SCS for the two consecutive carriers in Rel-17 TX switching.  **Agreement**  Following restrictions are applied for Rel-18 UL Tx switching across 3 or 4 bands.   * The UE does not expect to perform more than one uplink switching within a reference slot based on µUL = max(µUL, 1, µUL, 2, µUL, 3) in case of 3 bands, µUL = max(µUL, 1, µUL, 2, µUL, 3, µUL, 4) in case of 4 bands, where µUL, 1, µUL, 2, µUL, 3, µUL, 4 are SCSs of active UL bandwidth parts of the bands in the band combination   + If there are two consecutive intra-band carriers in one band, µUL, 1 = max(µUL, 1-1, µUL, 1-2), where µUL, 1-1 and µUL, 1-2 are SCSs of active UL bandwidth parts of the carriers in the band * (working assumption) If two uplink switching are triggered and result in UL transmissions on more than 2 bands within any two consecutive reference slots, then the time duration between the end of all transmission(s) prior to the first uplink switching and the start of all transmission(s) after the second uplink switching within the two reference slots is expected to be not less than a minimum separation time   + The minimum separation time is a sum of X us and the switching gap required for the second uplink switching.   + X us is subject to UE capability with a value set of {0us, 500us} |
| Qualcomm | We share similar views that the same numerology is usually adopted for contiguous carriers within one band to avoid interference and scheduling complexity. Given this consideration, we are ok to clarify this consensus in RAN1.  On the Rel-17 CR, we slightly prefer a conclusion without specification changes.  We support applying same principle for Rel-18. |
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# References

1. R1-2300433, Correction on SCS of the reference slot restriction of Rel-17 TX switching, vivo, RAN1#112, February 27th – March 3rd, 2023.