3GPP TSG RAN WG1 Meeting #122 R1-250xxxx

**Bengaluru, India, 25th – 29th August, 2025**

**Title: Reply LS on UL Tx switching for TEI19**

**Response to: R4-2505221**

**Release: Rel-19**

**Work Item: TEI-19**

**Source: RAN1**

**To: RAN4, RAN2**

**Cc:**

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**Attachments:**

# Overall description

RAN1 would like to thank RAN4 for their LS in R4-2505221. RAN1 would like to inform RAN4 and RAN2 that RAN1 reached the following agreement to introduce the functionalities for Scenario#1 in RAN1 specifications:

**Agreement:**

* A UE capable of Scenario#1 is mandated to support max 2 layers of UL-MIMO on carriers of both bands.
* For a UE capable of Scenario#1, the number of ports of UL-MIMO can be configured as either 1-port or 2-port on any UL carriers as usual. If 1-port is configured on all the carriers of any band, then the UE behaviour follows the normal UL-CA.
* Inform RAN2/RAN4 with the following:
  1. The following RRC parameters are used to configure 3Tx Scenario#1;
     + *uplinkTxSwitching*: existing RRC parameter in R16/R17 UL Tx switching.
     + [*uplinkTxSwitching3TxScenario1*]: new RRC parameter to configure the UE with 3Tx Scenario#1.
  2. The following RRC parameters are not applicable when the UE is configured with [*uplinkTxSwitching3TxScenario1*];
     + *uplinkTxSwitchingOption*
     + *uplinkTxSwitching-2T-Mode*
     + *uplinkTxSwitching-DualUL-TxState*
  3. Note: the following UE capability is assumed to be introduced by RAN4:
     + [*uplinkTxSwitchingPeriod3TxScenario1*]*:* UE capability to report the support of 3Tx Scenario#1 and the switching period required for 3Tx Scenario#1
* Adopt the following TP to TS38.214.

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| < Unchanged parts are omitted >  6.1.6 Uplink switching  The UE may omit uplink transmission during the uplink switching gap if the conditions defined in this clause are met and the UE is configured with *uplinkTxSwitching* or *uplinkTxSwitchingMoreBands*. The switching gap is indicated by UE capability *uplinkTxSwitchingPeriod2T2T* if *uplinkTxSwitching-2T-Mode* is configured, [*uplinkTxSwitchingPeriod3TxScenario1*] if [*uplinkTxSwitching3TxScenario1*]is configured, and *uplinkTxSwitchingPeriod* otherwise in clauses 6.1.6.1, 6.1.6.2.0, 6.1.6.3, and is determined based on higher layer parameter *switchingPeriodConfigForBandPair* in clause 6.1.6.2.2 for uplink switching configured with 2, 3 or 4 uplink bands if *uplinkTxSwitchingMoreBands* is configured:  < Unchanged parts are omitted >  6.1.6.2 Uplink switching for carrier aggregation  6.1.6.2.0 Uplink switching with two uplink bands  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch*, ~~or~~ *uplinkTxSwitchingPeriod2T2T*, or [*uplinkTxSwitchingPeriod3TxScenario1*] for a band combination, and if it is for that band combination configured with uplink carrier aggregation:  - If the UE is configured with uplink switching with parameter *uplinkTxSwitching*, when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s):  - If [*uplinkTxSwitching3TxScenario1*] is not configured, when the UE is to transmit a 2-port transmission on one uplink carrier on one band and if the preceding uplink transmission is a 1-port transmission on another uplink carrier on another band, then the UE is not expected to transmit for the duration of on any of the carriers.  - If [*uplinkTxSwitching3TxScenario1*] is not configured, when the UE is to transmit a 1-port transmission on one uplink carrier on one band and if the preceding uplink transmission is a 2-port transmission on another uplink carrier on another band, then the UE is not expected to transmit for the duration of on any of the carriers.  - For the UE configured with *uplinkTxSwitchingOption* set to 'switchedUL', when the UE is to transmit a 1-port transmission on one uplink carrier on one band and if the preceding uplink transmission was a 1-port transmission on another uplink carrier on another band, then the UE is not expected to transmit for the duration of on any of the carriers.  - For the UE configured with *uplinkTxSwitchingOption* set to 'dualUL' or with [*uplinkTxSwitching3TxScenario1*], when the UE is to transmit a 2-port transmission on one uplink carrier on one band and if the preceding uplink transmission was a 1-port transmission on a carrier on the same band and the UE is under the operation state in which 2-port transmission cannot be supported in the same band, then the UE is not expected to transmit for the duration of on any of the carriers.  - For the UE configured with *uplinkTxSwitchingOption* set to 'dualUL', when the UE is to transmit a 1-port transmission on one uplink carrier on one band and if the preceding uplink transmission was a 1-port transmission on another uplink carrier on another band and the UE is under the operation state in which 2-port transmission can be supported in the same band, then the UE is not expected to transmit for the duration of on any of the carriers.  - For the UE configured with *uplinkTxSwitchingOption* set to 'dualUL', if the UE is configured with *uplinkTxSwitching-DualUL-TxState* set to 'oneT', when the UE is under the operation state in which 2-port transmission can be supported on one carrier on one band followed by no transmission on any carrier on the same band and 1-port transmission on the other carrier on another band the UE shall consider this as if 1-port transmission was transmitted on both uplinks, otherwise the UE shall consider this as if 2-port transmission took place on the transmitting carrier.  - If *uplinkTxSwitching-2T-Mode* or [*uplinkTxSwitching3TxScenario1*] is configured, when the UE is to transmit a 2-port transmission on one uplink carrier on one band and if the preceding uplink transmission is a 2-port transmission on another uplink carrier on another band, then the UE is not expected to transmit for the duration of on any of the carriers.  - If [*uplinkTxSwitching3TxScenario1*] is configured, when the UE is to transmit a 2-port transmission on one uplink carrier on one band and if the preceding uplink transmission was a 1-port transmission on another uplink carrier on another band and the UE is under the operation state in which 2-port transmission can be supported on the same band, then the UE is not expected to transmit for the duration of on any of the carriers.  - If [*uplinkTxSwitching3TxScenario1*] is not configured, 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 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.  < Unchanged parts are omitted > 6.2.1 UE sounding procedure < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'aperiodic':  - the UE receives a configuration of SRS resource sets,  - the UE receives a downlink DCI, a group common DCI, or an uplink DCI based command where a codepoint of the DCI may trigger one or more SRS resource set(s). For SRS in a resource set with usage set to 'codebook' or 'antennaSwitching', the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2* symbols and an additional time duration *Tswitch*. Otherwise, the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2* +14 symbols and an additional time duration *Tswitch*. The minimal time interval unit of OFDM symbol is counted based on the minimum subcarrier spacing given by min(*µPDCCH, µUL*) where *µUL* is given by min(*µUL,carrier1, µUL,carrier2, µSRS*) when the UE is configured with the higher layer parameter *uplinkTxSwitchingOption* set to 'dualUL' or configured with [*uplinkTxSwitching3TxScenario1*] for uplink carrier aggregation, and by *µSRS*otherwise. *µSRS* and *µPDCCH*are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively.  - *Tswitch*, *µUL,carrier1* and *µUL,carrier2* are defined in clause 6.4.  < Unchanged parts are omitted >  6.4 UE PUSCH preparation procedure time  If the first uplink symbol in the PUSCH allocation for up to two transport blocks, including the DM-RS, as defined by the slot offset *K2* and Koffset, if configured, and the start *S* and length *L* of the PUSCH allocation indicated by '*Time domain resource assignment*' of the scheduling DCI and including the effect of the timing advance, is no earlier than at symbol *L2*, where *L2* is defined as the next uplink symbol with its CP starting  after the end of the reception of the last symbol of the PDCCH carrying the DCI scheduling the PUSCH, then the UE shall transmit the PUSCH. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the last symbol of the PDCCH carrying the DCI scheduling the PUSCH, the PDCCH candidate that ends later in time is used.  < Unchanged parts are omitted >  - If uplink switching gap is triggered as defined in clause 6.1.6,  equals to the switching gap duration and for the UE configured with higher layer parameter *uplinkTxSwitchingOption* set to 'dualUL' or configured with [*uplinkTxSwitching3TxScenario1*] for uplink carrier aggregation *µUL*=min(*µUL,carrier1, µUL,carrier2*), otherwise .  < Unchanged parts are omitted > |

# Actions

RAN1 respectfully asks RAN4 and RAN2 to take the above agreement into consideration for introducing 3Tx UL switching Scenario#1 in TEI-19.

# Dates of next TSG RAN WG1 meetings

TSG RAN WG1 Meeting #122-bis October 13 – 17, 2025 Prague, CZ

TSG RAN WG1 Meeting #123 November 17 – 21, 2025 Dallas, US