3GPP TSG RAN WG1 #102-e R1-200xxxx

**e-Meeting, August 17th – 28th, 2020**

**Agenda item: 5.1**

**Source: Moderator (China Telecom)**

**Title: [102-e-LS-TxSwitching-01] Email discussion/approval on maintenance of uplink Tx switching thread #1**

**Document for: Discussion and Decision**

# Introduction

In [1], maintenance issues are summarized for uplink Tx switching. As per the guidance of Chairman, following issues are identified for email discussion/approval during RAN1 #102 e-meeting:

[102-e-LS-TxSwitching-01]: Email discussion/approval of the following aspects:

* Align IE names with RAN2 specification (R1-2005996, R1-2006933)
* Align the units of N2 and Tswitch on SRS triggering (R1-2006661)
* Clarification on the ambiguity issue on SCS (R1-2006333)
* Clarification on switching mechanism for EN-DC option 2 (R1-2006333)
* Clarification on the term “operation state” for EN-DC (R1-2006933)
* Clarification on Tmuxproc,CSI (R1-2006933)
* Clarification on 1-port transmission of PRACH for EN-DC option 2 (R1-2006333)

by 8/21, followed by CR(s) if any by 8/26 – Jianchi (CT)

[102-e-LS-TxSwitching-02]: Email discussion/approval of the following aspects:

* Location of the switching period (R1-2006333, R1-2006760, R1-2006933)
* 1-port transmission via DCI format 0\_1 for UL CA option 2 (R1-2006333, R1-2006661, R1-2006760)
* UE behaviour related to *simultaneousTxSUL-NonSUL* for SUL with Tx switching (R1-2006333)
* Uplink Tx switching + intra-band contiguous CA (R1-2006760)

by 8/21, followed by CR(s) if any by 8/26 – Jianchi (CT)

This Email discussion/approval on maintenance of uplink Tx switching thread #1.

# Discussion

## Issue #1: Align IE names with RAN2 specification (R1-2005996, R1-2006933)

* **Proposed TP1 to TS 38.214**

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| **< unchanged text omitted>**  6.1.6 Uplink switching  The UE may omit uplink transmission during the uplink switching gap if the conditions defined in this sub-clause are met and the UE is configured with *uplinkTxSwitching-r16*. The switching gap is indicated by UE capability *uplinkTxSwitchingPeriod-r16*:  - If a UE indicated a capability for uplink switching with *uplinkTxSwitchRequested-r16* for a band combination, and if it is for that band combination  - Configured with a MCG using E-UTRA radio access and with a SCG using NR radio access (EN-DC), or  - Configured with uplink carrier aggregation, or  - Configured in a serving cell with two uplink carriers with higher layer parameter *supplementaryUplink*.  the conditions under which the switching gap may be present and the location of the switching gap are defined for each of the cases in sections 6.1.6.1, 6.1.6.2, and 6.1.6.3 respectively.  If an uplink switching is triggered for an uplink transmission starting at *T0*, after *T0-Toffset*, the UE is not expected to cancel the uplink switching, or to trigger any other new uplink switching occurring before *T0* for any other uplink transmission that is scheduled after *T0-Toffset*, where *Toffset* is the UE processing procedure time defined for the uplink transmission triggering the switch given in subclause 5.3, subclause 5.4, subclause 6.2.1, subclause 6.4 and in subclause 9 of [6, TS 38.213].  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the uplink transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the uplink transmitted after the switching gap.  6.1.6.1 Uplink switching for EN-DC  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* for a band combination, and if it is for that band combination configured with a MCG using E-UTRA radio access and with a SCG using NR radio access (EN-DC), if the UE is configured with uplink switching with parameter *uplinkTxSwitching-r16*,   * for the UE configured with *switchedUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s): * when the UE is to transmit an NR uplink that takes place after an E-UTRA uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * when the UE is to transmit an E-UTRA uplink that takes place after an NR uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * the UE is not expected to transmit simultaneously on the NR uplink and the E-UTRA uplink. If the UE is scheduled or configured to transmit any NR uplink transmission overlapping with an E-UTRA uplink transmission, the NR uplink transmission is dropped, * for the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16,* when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s): * when the UE is to transmit an NR two-port uplink that takes place after an E-UTRA uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. . * when the UE is to transmit an E-UTRA uplink that takes place after an NR two-port uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * the UE is not expected to transmit simultaneously a two- port transmission on the NR uplink and the E-UTRA uplink.   - in all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  - when the UE is configured with *tdm-PatternConfig-r15* or by *tdm-PatternConfig-r16*  - for the E-UTRA subframes designated as uplink by the configuration, the UE assumes the operation state in which one-port E-UTRA uplink can be transmitted.  - for the E-UTRA subframes other than the ones designated as uplink by the configuration, the UE assumes the operation state in which two-port NR uplink can be transmitted.  6.1.6.2 Uplink switching for Carrier Aggregation  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* 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-r16*, when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s):  - When the UE is to transmit a 2-port transmission on one uplink carrier and if the preceding uplink transmission is a 1-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - When the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission is a 2-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *switchedUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 2-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on the same uplink carrier and the UE is under the operation state in which 2-port transmission cannot be supported in the same uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on another uplink carrier and the UE is under the operation state in which 2-port transmission can be supported on the same uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - 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.  - In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  6.1.6.3 Uplink switching for Supplementary Uplink  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* 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-r16*,  - If the UE is to transmit any uplink channel or signal on a different uplink from the preceding transmission occasion based on DCI(s) received before or based on a higher layer configuration(s), then the UE assumes that an uplink switching is triggered in a duration of switching gap , where is the start time of the first symbol of the transmission occasion of the uplink channel or signal and is the preparation procedure time of the transmission occasion of the uplink channel or signal given in subclause 5.3, subclause 5.4, subclause 6.2.1, subclause 6.4 and in subclause 9 of [6, TS 38.213], respectively. During the switching gap , the UE is not expected to transmit on any of the two uplinks.  - In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  **< unchanged text omitted>**  **< unchanged text omitted>**  6.4 UE PUSCH preparation procedure time  If the first uplink symbol in the PUSCH allocation for a transport block, including the DM-RS, as defined by the slot offset *K2* and the start and length indicator *SLIV* 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 transport block.  *- N2* is based on *µ* of Table 6.4-1 and Table 6.4-2 for UE processing capability 1 and 2 respectively, where *µ* corresponds to the one of (*µDL*, *µUL*) resulting with the largest *Tproc,2*, where the *µDL* corresponds to the subcarrier spacing of the downlink with which the PDCCH carrying the DCI scheduling the PUSCH was transmitted and *µUL* corresponds to the subcarrier spacing of the uplink channel with which the PUSCH is to be transmitted, and *κ* is defined in clause 4.1 of [4, TS 38.211].  - If the first symbol of the PUSCH allocation consists of DM-RS only, then *d2,1* = 0*,* otherwise *d2,1* = 1.  - If the UE is configured with multiple active component carriers, the first uplink symbol in the PUSCH allocation further includes the effect of timing difference between component carriers as given in [11, TS 38.133].  - If the scheduling DCI triggered a switch of BWP, *d2,2* equals to the switching time as defined in [11, TS 38.133], otherwise *d2,2*=0.  - For a UE that supports capability 2 on a given cell, the processing time according to UE processing capability 2 is applied if the high layer parameter *processingType2Enabled* in *PUSCH-ServingCellConfig* is configured for the cell and set to *enable*,  - If the PUSCH indicated by the DCI is overlapping with one or more PUCCH channels, then the transport block is multiplexed following the procedure in clause 9.2.5 of [6, TS 38.213], otherwise the transport block is transmitted on the PUSCH indicated by the DCI.  - If uplink switching gap is triggered as defined in subclause 6.1.6,  equals to the switching gap duration and for the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16* *µUL*=min(*µUL,carrier1, µUL,carrier2*), otherwise .  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP1.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Support but with the following suggested modifications. As presented in out tdoc [6], we prefer to follow the 3GPP practice to get rid of the “-r16” suffix for the IE name of UE capabilities. Because RAN2 may be going to introduce extension with different suffix for UE capabilities due to correction or enhancement in the future release, e.g. more switching periods are introduced as *uplinkTxSwitchingPeriod-v1630 or uplinkTxSwitchingPeriod-r17*. However, RRC configuration for triggering an operation mode is usually much stable, thus the “-r16” suffix for such RRC configuration could be either removed or reserved. Therefore, we suggest to further update the following IE names for the above TP:  1. modify “*uplinkTxSwitchingPeriod-r16*” to “*uplinkTxSwitchingPeriod*”  2. modify “*BandCombination-UplinkTxSwitch-r16*” to “*BandCombination-UplinkTxSwitch*” |
| Qualcomm | We are ok with the proposal in general.  The following part is unclear  - For the UE configured with dualUL by the parameter uplinkTxSwitchingOption-r16, when the UE is to transmit a 2-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on the same uplink carrier and the UE is under the operation state in which 2-port transmission cannot be supported in the same uplink carrier, then the UE is not expected to transmit for the duration of N\_"Tx1-Tx2" on any of the two carriers.  - For the UE configured with dualUL by the parameter uplinkTxSwitchingOption-r16, when the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on another uplink carrier and the UE is under the operation state in which 2-port transmission can be supported on the same uplink carrier, then the UE is not expected to transmit for the duration of N\_"Tx1-Tx2" on any of the two carriers.  However, this is unrelated to the current change proposals. |
| Ericsson | We prefer to keep the suffix ‘-r16’ for now (it is used in lot of places in RAN1 spec). Suffix issue can be addressed by the editor uniformly for all the places. |
| OPPO | Support  Reply to Huawei: The suffix “-r16” has been widely used in 38.211/212/213/214 |
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## Issue #2: Align the units of N2 and Tswitch on SRS triggering (R1-2006661)

* **Proposed TP2 to TS 38.214**

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| 6.2.1 UE sounding procedure  **< unchanged text omitted>**  If the UE has an active semi-persistent SRS resource configuration and has not received a deactivation command, the semi-persistent SRS configuration is considered to be active in the UL BWP which is active, otherwise it is considered suspended.  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-r16* 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* symbolsand 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 and an additional time duration *Tswitch*. The minimal time interval unit of OFDM symbol is counted based on the minimum subcarrier spacing given by  where  is given by when the UE configured with *uplinkTxSwitchingOption2 and by* otherwise.  *µSRS* and *µPDCCH* are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively.  - *Tswitch*, and  are defined in clause 6.4.  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP2.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Support the first change to sum of N2 and T\_switching. Please note two spaces are missing for “N2 symbols and” as shown in the screen copy below. “symbols” seems missing after “N2+14”.  For the second change, what we see have unreadable characters and many typos as this screen copy below |
| ZTE | We are open to clarify this issue. However, it seems that the following agreements is only applicable to T\_proc,2. If we want to extend the following agreements to SRS timeline, maybe it is better to have an explicit agreements first.  Agreements:   * For SUL, EN-DC and inter-band UL CA Option 1 with UL Tx switching,      * Where T\_switch is the switching period reported by the UE. * For inter-band UL CA Option 2 with UL Tx switching,   *µUL* = min (*µUL, CC1*, *µUL, CC2*)     * Where T\_switch is the switching period reported by the UE. * A mix of Cap#1 and Cap#2 across CC1 and CC2 is not supported for UL Tx switching. |
| Qualcomm | Supporting the proposal.  However, parameter name alignment, similar to TP1 would be needed. |
| **Ericsson** | On whether a separate agreement or not – we don’t have a strong view, but spec update is needed for correctness. Below is an updated TP to address the editorial comments above.  **Updated TP1 to 38.214 g20– subclause 6.2.1**  ---------------------------------- start updated TP1 to TS 38.214 vg20 sub-clause 6.2.1-----------------------------  6.2.1 UE sounding procedure  < unchanged text omitted>  If the UE has an active semi-persistent SRS resource configuration and has not received a deactivation command, the semi-persistent SRS configuration is considered to be active in the UL BWP which is active, otherwise it is considered suspended.  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-r16* 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 *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, 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 text omitted>  ---------------------------------- end TP1 ------------------------------------------------------------------------ |
| OPPO | Fine with the above TP from Ericsson |
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## Issue #3: Clarification on the ambiguity issue on SCS (R1-2006333)

* **Proposed TP3 to TS 38.214**

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| 6.1.6 Uplink switching  **< unchanged text omitted>**  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of one uplink carrier and the *µUL,carrier2* corresponds to the subcarrier spacing of the other uplink carrier.  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP3.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Don’t feel an issue for PRACH transmission as R1-2006333 claimed. The SCS is of an uplink rather than an uplink transmission so that the current spec is correct for PRACH transmission. Furthermore, the text changes introduce ambiguity for the uplinks. Therefore, we suggest the following changes:  S6.1.6 of TS 38.214  “  The UE does not expect to perform more than one uplink switching in a slot with *µUL*, where the *µUL* is the maximum subcarrier spacing of all configured uplink BWPs on all the uplinks configured with *uplinkTxSwitching-r16*..  “  S6.4 of TS 38.214  “If uplink switching gap is triggered as defined in subclause 6.1.6, equals to the switching gap duration and for the UE configured with *uplinkTxSwitchingOption2* *µUL*=min(*µUL,carrier1, µUL,carrier2*), otherwise , where the *µUL,carrier1* corresponds to the subcarrier spacing of the uplink transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the uplink transmitted after the switching gap.”  For the following reasons:   * SCS is the parameter of active BWP on an uplink, instead of parameter of an uplink, as the excerpt of 38.213 below. * In case of multiple BWPs configured with different SCS on an uplink, only one SCS should represent the SCS of the uplink. * The definitions of *µUL,carrier1* and *µUL,carrier2* are still used in S6.4 of TS38.214 and referred by S6.2.1. They should be kept.   TS 38.213 |
| ZTE | We don’t understand Huawei’s arguments above. Besides, the updated TP provided by Huawei above is not in line with previous agreements.  Agreements:   * + For inter-band UL CA, SUL and EN-DC, a UE does not expect to perform more than one UL Tx switching in a slot with larger SCS between two uplink carriers.   First of all, when discussing the above agreements, companies understanding was that the “SCS” means the “PUCCH/PUSCH SCS”. PUCCH/PUSCH SCS is the same as SCS of the active UL BWP. In the current specification, “subcarrier spacing of the uplink transmitted …” is not clear which SCS it is referring. It gives reader the impression that it is referring to the SCS of the UL transmission as there is a word “transmitted” followed by the “subcarrier spacing of the uplink”. To make it clear, we shoudl further clarify that the “SCS” here means the SCS of the active UL BWP in the specification.  Besides, the “subcarrier spacing of the uplink transmitted before the switching gap” and “subcarrier spacing of the uplink transmitted after the switching gap” are ambiguous in case when there are UL transmissions in both carriers, especially when the subcarrier spacings of the uplink transmitted in these two carriers are different.  With that, we propose the following updated TP for 6.1.6 of 38.214.  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the active UL BWP of one carrier and the *µUL,carrier2* corresponds to the subcarrier spacing of the active UL BWP of the other uplink. |
| Qualcomm | In principle, we are supportive of the proposal.  However, depending on the outcome of the following topic: “Location of the switching period (R1-2006333, R1-2006760, R1-2006933)”, it may be necessary to change the restriction from ‘**once per slot**’ to ‘**once in any consecutive 14-symbol period**’. The current proposal would apply equally in any case.  We would have a concern if the maximum SCS is taken over all active and inactive BWPs, so prefer to determine SCS based on the active BWP only. |
| OPPO | Fine with the TP |
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## Issue #4: Clarification on switching mechanism for EN-DC option 2 (R1-2006333)

* **Proposed TP4 to TS 38.214**

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| 6.1.6.1 Uplink switching for EN-DC  **< unchanged text omitted>**   * for the UE configured with *option2* by the parameter *uplinkTxSwitchingOption,* when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s): * when the UE is to transmit an NR two-port uplink that takes place after an E-UTRA uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * when the UE is to transmit an E-UTRA uplink that takes place after an NR two-port uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * when the UE is to transmit an E-UTRA uplink that takes place after an NR one-port uplink on anther uplink carrier and the UE is under the operation state in which 2-port transmission can be supported on the same uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers * when the UE is to transmit an NR two-port uplink that takes place after an NR one-port uplink on the same carrier and the UE is under the operation state in which 2-port transmission cannot be supported, then the UE is not expected to transmit for the duration of on any of the two carriers * the UE is not expected to transmit simultaneously a two- port transmission on the NR uplink and the E-UTRA uplink.   **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP4.

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| **Companies** | **Comments** |
| **Huawei, HiSilicon** | Thanks for the TP. But we don’t feel its motivation is clear enough. EN-DC involves inter-RAT processing for UL Tx switching, which is different from UL-CA. To simplify BS scheduler, the TP proponent proposed semi-static state of Tx chains (operation state) and tied it to the tdm-pattern configuration. However, the TP seems to go the opposite way because the introduction of dynamic operation state in the TP may require both the EN-DC UE and BSs to track back multiple previous transmissions, which increases the complexity.  For the same reason of complexity reduction, it was agreed that only the last transmission is used for EN-DC to determine whether UL Tx switching is triggered. Therefore, we prefer not to introduce such additional operation state, and would like to hear more clarification on its motivation. |
| ZTE | From specification point of view, both tdm-pattern based solution and CA like solution (dynamical scheduling based solution) are supported for EN-DC with Tx switching. However, the CA like solution is not completed in the current specification. It seems we have already clarified the motivation in our tdoc. Not sure why companies doubt the necessity of completing the specification.  While, if all companies think the CA like solution is not needed for EN-DC with Tx switching, then we are also ok to not introduce the TP. |
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## Issue #5: Clarification on the term “operation state” for EN-DC (R1-2006933)

* **Proposed TP5 to TS 38.214**

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| 6.1.6.1 Uplink switching for EN-DC  **< unchanged text omitted>**  - when the UE is configured with *tdm-PatternConfig-r15* or by *tdm-PatternConfig-r16*  - for the E-UTRA subframes designated as uplink by the configuration, the UE assumes preceding uplink transmission is one-port E-UTRA transmission for the determination of uplink switching triggering.  - for the E-UTRA subframes other than the ones designated as uplink by the configuration, the UE assumes the preceding uplink transmission is two-port NR transmission for the determination of uplink switching triggering.  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP5.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Support. Note that the purpose of the term “operation state” (or “the state of Tx chain”) is to provide the direct essential information for the determination of UL switching for one certain transmission. However, the term has never been used in the current specification text of thereof determination for EN-DC, resulting in big ambiguity by lack of connection. Therefore, a clearer description to associate two parts of texts each other should be used here. |
| ZTE | The TP is not needed. The “operation state” has already been used in the specification for CA with Tx switching. The wording in the current specification is consistent between EN-DC and CA.  Secondly, the TP would complicates the current specification description. It is not clear when the “preceding uplink transmission” happens, e.g., whether it starts before the TDM U or later the TDM U?  Thus, we don’t see the need of this TP. |
| Qualcomm | The term “operation state” seems to be clear enough, doesn’t seem there is a need to change it.  Changing current state to preceding state would be a functional change that we don’t agree with. If the actual preceding UL transmission was different than what the UE is required to assume under this proposal, there will be assignment conflicts. |
| OPPO | The current spec is clear. Thus the change is not needed. |
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## Issue #6: Clarification on (R1-2006933)

* **Proposed TP6 to TS 38.213**

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| 9.2.5 UE procedure for reporting multiple UCI types  **< unchanged text omitted>**  - , , , , , and are defined in [6, TS 38.214], is applied only if of table 5.4-1 in [6, TS 38.214] is applied to the determination of Z, and and are defined in [4, TS 38.211].  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposed TP6.

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| **Companies** | **Comments** |
| Huawei, Hisilicon | Support. Note that there are two defined in TS 38.214. The non-zero in above TP should corresponds to the one for the determination of instead of the one for the determination of T\_proc,2. In other words, the current description in TS 38.213 above is not clear enough, it is applied only if of table 5.4-1 in TS 38.214 is applied for the determination of . |
| ZTE | Ok to clarify this issue. |
| Qualcomm | Would be beneficial to clarify the details.  For example, we believe that the procedures described in 9.2.5. of 38.213 do not apply to the case when Z1 according to Table 5.4-1 applies. |
| OPPO | Support |
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## Issue #7: Clarification on 1-port transmission of PRACH for EN-DC option 2 (R1-2006333)

**Proposal**: Clarify the RAN1#101e agreements as below.

Note: No specification update is needed as the current spec doesn’t preclude PRACH in this case.

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| **Agreements**   * For EN-DC, if UE reports via capability signaling to support uplink Tx switching, UE further reports via per BC capability signaling which one (Option 1, or Option 2, [or Option 1+Opiton 2]) is supported.           When the UE is configured with Option 1: UE is not expected to transmit on both NR and LTE UL simultaneously. If there is any NR UL transmission overlapping with a LTE UL transmission, the NR UL transmission is dropped.          When the UE is configured with Option 2: UE is expected to be able to simultaneously transmit in LTE and NR, if NR carrier is scheduled or configured with 1 port PUSCH/PUCCH/SRS/PRACH transmission. |

Companies are invited to provide views on the above proposal.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | OK for the proposal with the note. |
| ZTE | Support to clarify this issue. |
| Qualcomm | Supporting the proposal |
| OPPO | Support |
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# Summary

**Proposal 1:**

* Adopt the following TP to TS 38.214.

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| **< unchanged text omitted>**  6.1.6 Uplink switching  The UE may omit uplink transmission during the uplink switching gap if the conditions defined in this sub-clause are met and the UE is configured with *uplinkTxSwitching-r16*. The switching gap is indicated by UE capability *uplinkTxSwitchingPeriod-r16*:  - If a UE indicated a capability for uplink switching with *uplinkTxSwitchRequested-r16* for a band combination, and if it is for that band combination  - Configured with a MCG using E-UTRA radio access and with a SCG using NR radio access (EN-DC), or  - Configured with uplink carrier aggregation, or  - Configured in a serving cell with two uplink carriers with higher layer parameter *supplementaryUplink*.  the conditions under which the switching gap may be present and the location of the switching gap are defined for each of the cases in sections 6.1.6.1, 6.1.6.2, and 6.1.6.3 respectively.  If an uplink switching is triggered for an uplink transmission starting at *T0*, after *T0-Toffset*, the UE is not expected to cancel the uplink switching, or to trigger any other new uplink switching occurring before *T0* for any other uplink transmission that is scheduled after *T0-Toffset*, where *Toffset* is the UE processing procedure time defined for the uplink transmission triggering the switch given in subclause 5.3, subclause 5.4, subclause 6.2.1, subclause 6.4 and in subclause 9 of [6, TS 38.213].  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the uplink transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the uplink transmitted after the switching gap.  6.1.6.1 Uplink switching for EN-DC  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* for a band combination, and if it is for that band combination configured with a MCG using E-UTRA radio access and with a SCG using NR radio access (EN-DC), if the UE is configured with uplink switching with parameter *uplinkTxSwitching-r16*,   * for the UE configured with *switchedUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s): * when the UE is to transmit an NR uplink that takes place after an E-UTRA uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * when the UE is to transmit an E-UTRA uplink that takes place after an NR uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * the UE is not expected to transmit simultaneously on the NR uplink and the E-UTRA uplink. If the UE is scheduled or configured to transmit any NR uplink transmission overlapping with an E-UTRA uplink transmission, the NR uplink transmission is dropped, * for the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16,* when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s): * when the UE is to transmit an NR two-port uplink that takes place after an E-UTRA uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. . * when the UE is to transmit an E-UTRA uplink that takes place after an NR two-port uplink on another uplink carrier then the UE is not expected to transmit for the duration of on any of the two carriers. * the UE is not expected to transmit simultaneously a two- port transmission on the NR uplink and the E-UTRA uplink.   - in all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  - when the UE is configured with *tdm-PatternConfig-r15* or by *tdm-PatternConfig-r16*  - for the E-UTRA subframes designated as uplink by the configuration, the UE assumes the operation state in which one-port E-UTRA uplink can be transmitted.  - for the E-UTRA subframes other than the ones designated as uplink by the configuration, the UE assumes the operation state in which two-port NR uplink can be transmitted.  6.1.6.2 Uplink switching for Carrier Aggregation  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* 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-r16*, when the UE is to transmit in the uplink based on DCI(s) received before or based on a higher layer configuration(s):  - When the UE is to transmit a 2-port transmission on one uplink carrier and if the preceding uplink transmission is a 1-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - When the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission is a 2-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *switchedUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on another uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 2-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on the same uplink carrier and the UE is under the operation state in which 2-port transmission cannot be supported in the same uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - For the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, when the UE is to transmit a 1-port transmission on one uplink carrier and if the preceding uplink transmission was a 1-port transmission on another uplink carrier and the UE is under the operation state in which 2-port transmission can be supported on the same uplink carrier, then the UE is not expected to transmit for the duration of on any of the two carriers.  - 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.  - In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  6.1.6.3 Uplink switching for Supplementary Uplink  For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch-r16* 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-r16*,  - If the UE is to transmit any uplink channel or signal on a different uplink from the preceding transmission occasion based on DCI(s) received before or based on a higher layer configuration(s), then the UE assumes that an uplink switching is triggered in a duration of switching gap , where is the start time of the first symbol of the transmission occasion of the uplink channel or signal and is the preparation procedure time of the transmission occasion of the uplink channel or signal given in subclause 5.3, subclause 5.4, subclause 6.2.1, subclause 6.4 and in subclause 9 of [6, TS 38.213], respectively. During the switching gap , the UE is not expected to transmit on any of the two uplinks.  - In all other cases the UE is expected to transmit normally all uplink transmissions without interruptions.  **< unchanged text omitted>**  **< unchanged text omitted>**  6.4 UE PUSCH preparation procedure time  If the first uplink symbol in the PUSCH allocation for a transport block, including the DM-RS, as defined by the slot offset *K2* and the start and length indicator *SLIV* 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 transport block.  *- N2* is based on *µ* of Table 6.4-1 and Table 6.4-2 for UE processing capability 1 and 2 respectively, where *µ* corresponds to the one of (*µDL*, *µUL*) resulting with the largest *Tproc,2*, where the *µDL* corresponds to the subcarrier spacing of the downlink with which the PDCCH carrying the DCI scheduling the PUSCH was transmitted and *µUL* corresponds to the subcarrier spacing of the uplink channel with which the PUSCH is to be transmitted, and *κ* is defined in clause 4.1 of [4, TS 38.211].  - If the first symbol of the PUSCH allocation consists of DM-RS only, then *d2,1* = 0*,* otherwise *d2,1* = 1.  - If the UE is configured with multiple active component carriers, the first uplink symbol in the PUSCH allocation further includes the effect of timing difference between component carriers as given in [11, TS 38.133].  - If the scheduling DCI triggered a switch of BWP, *d2,2* equals to the switching time as defined in [11, TS 38.133], otherwise *d2,2*=0.  - For a UE that supports capability 2 on a given cell, the processing time according to UE processing capability 2 is applied if the high layer parameter *processingType2Enabled* in *PUSCH-ServingCellConfig* is configured for the cell and set to *enable*,  - If the PUSCH indicated by the DCI is overlapping with one or more PUCCH channels, then the transport block is multiplexed following the procedure in clause 9.2.5 of [6, TS 38.213], otherwise the transport block is transmitted on the PUSCH indicated by the DCI.  - If uplink switching gap is triggered as defined in subclause 6.1.6,  equals to the switching gap duration and for the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16* *µUL*=min(*µUL,carrier1, µUL,carrier2*), otherwise .  **< unchanged text omitted>** |

It seems only 1 company has concerns, any further comments?

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Not our preference but OK  Additionally, similar comments as to issue#2, please make it clear that EN-DC is not included.  S6.4 of TS38.214  “for the UE configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16* for uplink carrier aggregation *µUL*=min(*µUL,carrier1, µUL,carrier2*),” |
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**Proposed 2:**

* Adopt the following TP to TS 38.214.

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| 6.2.1 UE sounding procedure  **< unchanged text omitted>**  If the UE has an active semi-persistent SRS resource configuration and has not received a deactivation command, the semi-persistent SRS configuration is considered to be active in the UL BWP which is active, otherwise it is considered suspended.  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-r16* 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 *dualUL* by the parameter *uplinkTxSwitchingOption-r16*, 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 text omitted>** |

Companies are invited to provide views on the above proposal.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Thanks for the updates. In RAN1 agreement, min(*µUL,carrier1, µUL,carrier2*) is only applicable to inter-band UL CA. But now dualUL can be configured to EN-DC, so we suggest a small change,  “when the UE is configured with *dualUL* by the parameter *uplinkTxSwitchingOption-r16* for uplink carrier aggregation”  The remaining parts are fine for us. |
| Huawei, HiSilicon | The comment about adding “for uplink carrier aggregation” is also needed for S6.4 of TS 38.214, it can be added in issue#1, or a new separate TP is needed. |
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**Proposed 3:**

* Adopt the following TP to TS 38.214.

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| 6.1.6 Uplink switching  **< unchanged text omitted>**  The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the active UL BWP of one carrier and the *µUL,carrier2* corresponds to the subcarrier spacing of the active UL BWP of the other uplink.  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposal.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | Not OK. As commented before, it does not address the following concerns.   * In case of multiple BWPs configured with different SCS on an uplink, only one SCS should represent the SCS of the uplink. * The definitions of *µUL,carrier1* and *µUL,carrier2* are still used in S6.4 of TS38.214 and referred by S6.2.1. They should be kept.   In other words, without this change, it is clear in spec what *µUL* is in case of multiple configured BWP with different SCS and dynamic BWP switching. But with the change, it is unclear which active UL BWP is in this case.  If companies don’t prefer the semi-static determination of *µUL* in my previous proposal, then, we propose to minimize the change as  “The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the active UL BWP transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the active UL BWP transmitted after the switching gap.  ” |
| ZTE | We support the FL proposal.  Response to Huawei’s comments.  For your first concern, the SCS of the active UL BWP will be used to represent the SCS of the uplink. It seems this is in line with what you are proposing in your proposal above.  For your second concern, the definitions of *µUL,carrier1* and *µUL,carrier2* are still there in our TP, I am not sure why are saying the definitions are gone.  With you proposed TP, it is still not clear which SCS should be used if there are concurrent transmissions in both carriers. Can you clarify when there are 1P+1P transmissions, whether the “subcarrier spacing of the active UL BWP transmitted before the switching gap” refers to the SCS of the active UL BWP on carrier 1 or the SCS of the active UL BWP on carrier 2? |
| Huawei, HiSilicon | In response to ZTE’s comments, our first proposal with semi-static determination resolved the issue you brought up, but our second one seems not. Let’s try the third one as follows,  “The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the active UL BWP of the uplink transmitted before the switching gap and the *µUL,carrier2* corresponds to the subcarrier spacing of the active UL BWP of the other uplink transmitted after the switching gap.  ” |
| Qualcomm | We don’t agree with the current proposal and its alternatives.  We could agree with the following:  “After an uplink switching, the UE does not expect to perform another uplink switching for a 14-symbol period starting at the end of the switch, where the symbol duration is according to *µUL* = max(*µUL,carrier1, µUL,carrier2*), where the *µUL,carrier1* corresponds to the subcarrier spacing of the active UL BWP of one carrier and the *µUL,carrier2* corresponds to the subcarrier spacing of the active UL BWP of the other carrier .” |
| Huawei, HiSilicon | We don’t feel Qualcomm’s proposal is in line with the agreement, i.e. floating 14-symbol period is not equal to a slot with clear slot boundary. Qualcomm’s proposal seems to be motivated by the other issue being discussed in thread#2. We hope they are not coupled here and the proposal is just to stick to the agreement we have. If needed, Qualcomm’s proposal is suggested to be proposed in thread#2.  Agreements:   * + For inter-band UL CA, SUL and EN-DC, a UE does not expect to perform more than one UL Tx switching in a slot with larger SCS between two uplink carriers. |

**Proposed 4:**

* Adopt the following TP to TS 38.213.

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| 9.2.5 UE procedure for reporting multiple UCI types  **< unchanged text omitted>**  - , , , , , and are defined in [6, TS 38.214], is applied only if of table 5.4-1 in [6, TS 38.214] is applied to the determination of Z, and and are defined in [4, TS 38.211].  **< unchanged text omitted>** |

Companies are invited to provide views on the above proposal.

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| **Companies** | **Comments** |
| Huawei, HiSilicon | OK |
| Qualcomm | We don’t agree with the proposal.  The procedures described in 9.2.5. of 38.213 do not apply to the case when Z1 according to Table 5.4-1 applies. Therefore Proposal 4 is not needed. |
| Huawei, HiSilicon | In response to Qualcomm, the proposal corresponds to the following agreement and applies to the excerpt of TS 38.213 below where T\_switch is only applied to Z\_1. Please note that the proposal is for instead of .  @ Qualcomm, do you mean T\_switch should not be added to in 9.2.5 of TS 38.213 for your comment “the procedures described in 9.2.5. of 38.213 do not apply to the case when Z1 according to Table 5.4-1 applies”?  Agreements:  **C**onfirm the following work assumption:  **Working assumption:**   * If uplink Tx switching is triggered, the additional time is needed and it equals to the length of UL switching period for the followings cases:   + Tmuxproc, 2   + Aperiodic SRS transmission   + PDCCH order triggered PRACH transmission   + *Tproc, CSI* in case of CSI triggered with Z1 of Table 5.4-1 of TS 38.214   TS38.213 |

**Proposal 5**: Clarify the RAN1#101e agreements as below.

Note: No specification update is needed as the current spec doesn’t preclude PRACH in this case.

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| **Agreements**   * For EN-DC, if UE reports via capability signaling to support uplink Tx switching, UE further reports via per BC capability signaling which one (Option 1, or Option 2, [or Option 1+Opiton 2]) is supported.           When the UE is configured with Option 1: UE is not expected to transmit on both NR and LTE UL simultaneously. If there is any NR UL transmission overlapping with a LTE UL transmission, the NR UL transmission is dropped.          When the UE is configured with Option 2: UE is expected to be able to simultaneously transmit in LTE and NR, if NR carrier is scheduled or configured with 1 port PUSCH/PUCCH/SRS/PRACH transmission. |

It seems we have achieved consensus on proposal 5.

# References

1. R1-2006978, Summary#2 of uplink Tx switching, Moderator (China Telecom), RAN1#102e, August 17th – 28th, 2020.
2. R1-2005996, Discussion on Tx Switching between Two Uplink Carriers, OPPO, RAN1#102e, August 17th – 28th, 2020.
3. R1-2006333, Remaining Maintenance Issues of UL Tx Switching, ZTE, RAN1#102e, August 17th – 28th, 2020.
4. R1-2006661, Maintenance for UL Tx Switching, Ericsson, RAN1#102e, August 17th – 28th, 2020.
5. R1-2006760, Remaining issues for 1Tx-2Tx switching, Qualcomm Incorporated, RAN1#102e, August 17th – 28th, 2020.
6. R1-2006933, Discussion on the remaining problems of supporting Tx switching between two uplink carriers, Huawei, HiSilicon, RAN1#102e, August 17th – 28th, 2020.