**3GPP TSG RAN WG1 #110 R1-2207708**

**Toulouse, France, August 22nd – 26th, 2022**

**Agenda item:** 8.16.5

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

**Title:** Summary on UE features for TEI17

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.16.5 regarding UE features for TEI17 and captures company views based on the announcement in the following email thread.

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| [110-R17-UE\_features\_1] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc – Hiroki (DOCOMO)   * eIIoT & URLLC, RedCap, UE power saving, coverage enhancement, NB-IoT & eMTC, sidelink, MBS, 5G terrestrial broadcast, UL TX switching, SDT |

Based on the latest RAN1 UE features list in [1] and contributions in AI 8.16.5 discussing UE features for TEI17, the issues to be discussed are tagged and colour coded with High priority or Low priority based on potential RAN2 spec impact (including description update in TS38.306).

# **Discussion**

## **2.1 39-3-1: Stay on the target CC for SRS carrier switching, and 39-3-2: Affected bands for inter-band CA during SRS carrier switching**

In [1], FG 39-3-1/2 are captured as below.

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| 39. TEI17 | 39-3-1 | Stay on the target CC for SRS carrier switching | Stay on the target CC when remaining SRS resource set(s) for SRS carrier switching exists | 2-56 | Yes | n/a |  | Per BC | n/a | n/a | n/a | Note1: When UE supports this capability, if the time period between the SRS resource sets is smaller than the total required RF switching time to the source CC and back to the target CC and a higher priority UL transmission and/or DL reception is not scheduled on the source CC in the time period between the two SRS resources sets, the UE stays in the target CC in the period between the SRS resource sets; otherwise, the UE switches back to the source CC after transmitting each SRS resource set  Note2: If the UE does not indicate this capability, the UE falls back to Rel-15 behavior, that is UE switches back to source CC between the SRS resource sets  This is a working assumption. | Optional with capability signaling |
| 39. TEI17 | 39-3-2 | Affected bands for inter-band CA during SRS carrier switching | 1. Indicate which other bands in the band combination are affected by the SRS switch.  2. The dropping rules / timelines apply to the indicated bands when SRS carrier switching on target CC and other UL on source CC are overlapped in the same symbol. | 2-56 | Yes | n/a |  | Per BC | n/a | n/a | n/a | Note: If this new indication is missing, the UE defaults to Rel-15 behavior.  For each “source-target” pair (as indicated by srs-SwitchingTimesListNR), the UE can indicate which other bands in the band combination are affected by the SRS switch.  This is a working assumption. | Optional with capability signaling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [3] | NTT DOCOMO, INC. | In our understanding, the capabilities above are the results of the lengthy discussion in RAN1 on SRS carrier switching. The only remaining issue would be whether to consider another Tx switching case here. From our perspective, it could be ok to go with above for SRS carrier switching only to conclude the lengthy RAN1 discussion.  **Proposal 6: Support FG39-3-1/2 for SRS carrier switching (i.e., remove [This is a working assumption])** |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-1:**

* **Confirm Working assumption to define FG39-3-1 and FG39-3-2**

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| Company | Comment |
| Moderator (NTT DOCOMO) | Some contributions in AI 7.1 also discuss on FG39-3-1/2. Therefore, based on the coordination with RAN1 chair, whether to confirm the working assumption is discussed in AI 7.1.  **SRS carrier switching (to be moderated by Keyvan – Huawei)**  [R1-2205765](file:///C:\\Users\\younsun\\Documents\\3GPP%20documents\\RAN1%20tdocs\\TSGR1_110\\Docs\\R1-2205765.zip)        Discussion on SRS carrier switching            Huawei, HiSilicon  [R1-2206531](file:///C:\\Users\\younsun\\Documents\\3GPP%20documents\\RAN1%20tdocs\\TSGR1_110\\Docs\\R1-2206531.zip)        Discussion on SRS carrier switching            Intel Corporation  [R1-2207171](file:///C:\\Users\\younsun\\Documents\\3GPP%20documents\\RAN1%20tdocs\\TSGR1_110\\Docs\\R1-2207171.zip)        Remaining issues for SRS carrier switching Qualcomm Incorporated |
| Intel | Agree with Moderator’s suggestion. |
| ZTE | Agree with Moderator’s suggestion. |

## **2.2 new FG: Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA**

In [1], FG 39-1/2 are captured as below.

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| 39. TEI17 | 39-1 | Parallel SRS and PUCCH/PUSCH transmission across CCs in intra-band non-contiguous CA | Parallel SRS and PUCCH/PUSCH transmission across CCs in intra-band non-contiguous CA |  | Yes | n/a | UE cannot transmit parallel SRS and PUCCH/PUSCH transmission across CCs in intra-band non-contiguous CA | Per BC | No | Yes | n/a | This feature is the same as parallelTxSRS-PUCCH-PUSCH, but for intra-band non-contiguous CA | Optional with capability signaling |
| 39. TEI17 | 39-2 | Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA |  | Yes | n/a | UE cannot transmit parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Per BC | No | Yes | n/a | This feature is the same as parallelTxPRACH-SRS-PUCCH-PUSCH, but for intra-band non-contiguous CA. This feature is enabled by a new UE-specific RRC parameter *intraBandNC-PRACH-simulTx-r17* | Optional with capability signaling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | ZTE | However, although the Rel-16 UE capability *parallelTxMsgA-SRS-PUCCH-PUSCH-r16* also follows the same logic that intra-band non-contiguous CA is a similar case as inter-band CA, this case hasn’t been extended to a new Rel-17 UE feature similar as FG 39-1 and 39-2.  The existing Rel-16 UE feature FG 9-3 for parallel transmission of MsgA and other channels for inter-band CA is shown as below.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Features | Index | Feature group | Components | Prerequisite feature groups | Field name in TS 38.331 [2] | Parent IE in TS 38.331 [2] | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Note | Mandatory/Optional | | 9. NR\_2step\_RACH | 9-3 | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA with msgA in PCell/PScell | 4-26, 9-1 | parallelTxMsgA-SRS-PUCCH-PUSCH-r16 | CA-ParametersNR-v1610 | n/a | n/a |  | Optional with capability signalling |   Following the same logic, it’s reasonable to also extend parallel transmission of MsgA and other channels from inter-band CA to intra-band non-contiguous CA. As for the specific solution, it can also follow the same handling method, i.e. introduce a new Rel-17 UE feature for parallel transmission of MsgA and other channels for intra-band non-contiguous CA.  ***Proposal 4:*** *Introduce a new Rel-17 UE feature FG 39-X for support of parallel transmission between MsgA and other channels in intra-band non-contiguous CA as described below:*   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | 9-3 | *Yes* | n/a | UE cannot transmit parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Per BC | No | Yes | n/a | This feature is the same as parallelTxMsgA-SRS-PUCCH-PUSCH-r16  , but for intra-band non-contiguous CA. | Optional with capability signaling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-2:**

* **Introduce a new FG for Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA as below**

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| 39. TEI17 | 39-X | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | 9-3 | Yes | n/a | UE cannot transmit parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA | Per BC | No | Yes | n/a | This feature is the same as *parallelTxMsgA-SRS-PUCCH-PUSCH-r16*, but for intra-band non-contiguous CA. | Optional with capability signaling |

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| Company | Comment |
| Intel | There was similar discussion in AI 7.2.1. We suggest to wait the progress before we make the decision for UE capability. |
| ZTE | We support the proposal.  Regarding Intel’s comment to wait for 7.2.1 discussion, it’s not needed, because the discussion in 7.2.1 is focusing on whether and how to capture the UE’s behavior in Rel-16 TS 38.214 spec based on existing Rel-16 UE feature, and this proposal is to introduce new Rel-17 UE feature for intra-band non-contiguous CA, these are separate issues without any dependencies. In addition, if this Rel-17 UE feature is introduced, we can further discuss how to capture the impact of this Rel-17 UE feature on Rel-17 spec TS 38.214. |
| Nokia, NSB | Unclear why this new FG would be needed. |
| Moderator (NTT DOCOMO) | Based on the feedbacks, further explanation on why the proposed new FG is needed should be provided, otherwise there may be no consensus to introduce the proposed new FG. |
| ZTE | Please find ZTE’s explanation below:  In Rel-15/16, we have 3 FGs regarding the parallel transmission for SRS and other channels, PRACH and other channels, MsgA and other channels respectively as shown below, and these FGs are for inter-band CA case.  FG 4-25 Parallel SRS and PUCCH/PUSCH transmission across CCs in inter-band CA  FG 4-26 Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA  FG 9-3 Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA  While in last meeting, after discussion in AI 7.1, it’s observed that intra-band non-contiguous CA case is similar as inter band CA case, so the first 2 FGs are extended from inter-band CA to intra-band non-contiguous CA by introducing 2 new Rel-17 FGs as shown below. However, the third FG happens to be missing from such extension although FG 9-3 is a similar case as FG 4-25 and FG 4-26.  FG 4-25 Parallel SRS and PUCCH/PUSCH transmission across CCs in inter-band CA ---> FG 39-1 Parallel SRS and PUCCH/PUSCH transmission across CCs in intra-band non-contiguous CA  FG 4-26 Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA ---> FG 39-2 Parallel PRACH and SRS/PUCCH/PUSCH transmissions across CCs in intra-band non-contiguous CA  FG 9-3 Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA ---> ???  Therefore, it’s obvious that the parallel transmission of MsgA and other channels should also be extended from inter-band CA to intra-band non-contiguous CA by introducing a new Rel-17 FG 39-x as in the proposal, otherwise, there would be imbalance for these 3 parallel transmission FGs, i.e. only parallel transmission of MsgA and other channel doesn’t support intra-band non-contiguous CA. |

# **Conclusions**

TBD

# **References**

[1] R1-2205608 Updated RAN1 UE features list for Rel-17 NR after RAN1 #109-e including remaining RAN1 issues Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2205914 Discussion on some remaining issues of Rel-17 UE features ZTE

[3] R1-2207392 Discussion on remaining issues in RAN1 UE features list for Rel-17 NR NTT DOCOMO, INC.