**3GPP TSG-RAN Meeting #90-e RP-20xxxx**

**Electronic Meeting, December 7th – 11th 2020**

**Agenda item:** 9.2.1

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Moderator’s summary for email discussion [90E][18][RAN4\_NR-U\_Leftovers]

**Document for:** Discussion/Decision

# Introduction

This document summarizes the email discussion on handling of RAN4 NR-U leftover work as documented in [1] and [2].

# Proposals

From [1], the proposals are

* Proposal 1: RAN#90e to endorse RAN4 WF in R4 2017835 for the continuation of RAN4 requirements not completed in Rel 16 in Rel 17 timeframe, i.e.,
  + For CA and DC band combinations including n46 or n96, RAN4 recommends to cover these within the existing Rel 17 band combination basket work items
  + For the introduction of 100MHz channel BW for n46 and/or n96, RAN4 recommends to cover this within the existing Rel 17 “adding BW to existing bands work item” (NR\_bands\_R17\_BWs)
  + For NR U power class 3, RAN4 recommends to postpone the work until Rel 16 NR TxDiv work in TEI16 is completed.
* Proposal 2: RAN#90e to discuss and decide how to handle the following items in Rel 17
  + NR-U power class 3
  + UL intra-band contiguous CA

From [2], the proposals are

Proposal 1a: NR-U PC3 should leverage outcome of the NR TxD technical discussion.

Proposal 1b: Timeline for NR-U PC3 should be (re-)discussed when the NR TxD discussion is completed (whereupon it can be also discussed to which WI we add it).

Proposal 2a: Due to the sheer number of NR-U specific issues it is preferrable to handle 100MHz channel as a dedicated work package not mixing it with existing basket WIs.

Proposal 2b: TSG RAN should discuss further timeline for adding the 100MHz channel.

## Initial round discussion

Handling CA band DC band combinations within Rel-17 band combination basket work items

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| **Company** | **Comments** |
| Charter Communications, Inc | * + We agree with proposal 1, *“For CA and DC band combinations including n46 or n96, RAN4 recommends to cover these within the existing Rel 17 band combination basket work items”* |
| Qualcomm Incorporated | Agree |
| Intel | Agree |
| MTK | Agree |
| Ericsson | Agree |
| ZTE | Agree |
| Skyworks | Agree |
| AT&T | Agree |
| CHTTL | Note that some related combinations are already included in the Rel.17 baskets during the email approval of last RAN4 meeting, targeting approval in this meeting, not sure whether we need to confirm this proposal again, but anyway we are ok. |
| Nokia | Agree with proposal 1 from [1] |

If/how to introduce 100 MHz channel bandwidth

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| **Company** | **Comments** |
| Charter Communications, Inc | We agree with proposal 1pending clarification below, *“For the introduction of 100MHz channel BW for n46 and/or n96, RAN4 recommends to cover this within the existing Rel 17 “adding BW to existing bands work item” (NR\_bands\_R17\_BWs)”*  Question for clarification. During NR-U discussion for introduction of 100 MHz channel BW, there were some channel rasters proposed that would cause potential interference with other technologies. Will this be discussed in the existing Rel 17 adding BW to existing bands work item? If so, then we agree with proposal 1. If not, we do not agree with proposal 1 |
| Qualcomm Incorporated | Agree to cover this within the NR\_bands\_R17\_BWs and also agree with Charter that issues related to coexistence and channel rasters for Band n46 and n96 should also be handled in that context. |
| Intel | Agree with the proposal. Coex and other requirements should be discussed together. |
| MTK | Coexistence and raster design should be considered with other requirements in the same package. |
| Ericsson | We don’t have strong view. It can either be in basket WI for BW (NR\_bands\_R17\_BWs) or separate item. |
| Apple | Issues related to co-existence and raster design shall be of course discussed for the 100MHz channel. However, accounting for the fact that there will be quite specific NR-U related topics, we could not help but wonder whether an existing basket is a right place for this kind of work. We would prefer having better traceability of the corresponding discussions and agreements. Somewhat referring forward to the UL CA feedback, it is not clear why we treat differently 100MHz and UL CA because both topics might require some NR-U specific input. |
| ZTE | Fine to add NR-U 100MHz into NR\_bands\_R17\_BWs, however no further TU should be requested considering this work should be quite similar as NR-U 80MHz. For the coexistence issue raised for NR-U carrier placement is applied for all BWs including 20MHz,40MHz,60MHz, 80MHz, at the end , it was agreed to leave up to the BS implementation, therefore we think the same principle should be applied for 100MHz |
| Skyworks | A pre-requisite to 100MHz MPR/AMPR /REFSENS study for wideband operation is an agreement on the related spaectrum mask. It may not be feasible to cover this within the WI for new BW, but once available this should be similar work than for NR bands. |
| Nokia | We agree this should be covered within NR\_bands\_R17\_BWs. |
| Huawei | If following the procedure, the WI adding BW to existing bands work item is a basket work item. It is designed to add the additional channel bandwidth which is fully specified to a certain band. And the basket work item is following the block approval procedure. So from procedure wise, we see some challenging to put 100MHz into the existing basket work item. We wonder if the topic can be merged into lower 6GHz WI and they may share the same issue and if so the work could be well organized. |

Power class 3 and dependency on TxDiv

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| **Company** | **Comments** |
| Charter Communications, Inc | We are ok to discuss PC3 after Rel 16 NR TxDiv work in TEI16 is completed. But we have a question for clarification. Under RAN4\_non-spectrum\_scoping thread [09], in the RAN4 TU allocation spreadsheet, it looks like there are no TU allocation for TEI discussion. Is this correct understanding? If so, what is the timing for REL 16 NR TXDiv work closure? |
| Qualcomm Incorporated | It makes sense to wait for the conclusion of TxDiv discussion so that NR-U PC3 can benefit from whatever agreements are made. However, there is also the possibility of NR-U PC3 with a single PA. That would not have any dependency on TxDiv. |
| Intel | Agree that PC3 with 2 PA can be impacted by the ongoing TxD discussion and it makes sense to wait upon outcome. However, PC3 with 1 PA can be discussed independently. However, we would like to further clarify in which WI it is planned to be handled. |
| MTK | Same question as Intel. We want to know in which WI we plan to discuss in Rel-17 or TEI-16. Note that TxDiv is already handled in TEI-16. |
| Ericsson | Agree with the proposal in the WF in R4 2017835. |
| Apple | If we recall right the RAN4 discussion, companies were not able to agree whether NR-U PC3 should be modelled as 1 or 2 PA. That was the time when companies were also contemplating whether it can be completely transparent, but this is exactly what the NR TxD discussion is now aiming at. In that sense outcome of the NR TxD discussion could be beneficial input for NR-U. |
| ZTE | No strong opinions on that, however whether two PAs or single PA architecture for NR-U PC3, it should be discussed together. |
| Skyworks | For PC3, our preference is to use 2 PA as this is consistent with some WiFi implementations and thus hardware reuse is an option. Thus we believe that TxDiv aspects should be settled first |
| Nokia | We support starting work on PC3 as soon as possible, but are OK to wait until the TEI16 TxD work is complete. |
| Huawei | It is OK to wait for conclusion of TxDiv. Regarding how to capture the objective, one alternative way is to consider Rel-17 lower 6GHz work item. |

Uplink intra-band contiguous CA

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| **Company** | **Comments** |
| Charter Communications, Inc. | Can Uplink intra-band contiguous CA be covered under “Rel-17 NR intra band Carrier Aggregation for xCC DL/yCC UL including contiguous and non-contiguous spectrum (x>=y)”? |
| Qualcomm Incorporated | Assigning UL CA to a basket is one possibility. However, we would like to ensure that the discussion for NR-U UL CA is not subject to bulk approval since there are new topics that might not get adequate attention. |
| Intel | We would like to further clarify in which WI it is planned to be handled? |
| MTK | We share the same view as QC that handling the requirement in basket WI may not be a good approach. |
| Ericsson | We prefer this to be part of UL CA basket WI. Second preference is to put this in R17 RF enhancement in FR1 in case there are issues which cannot be easily addressed in basket WI. Third option is to treated UL intra-band CA together with 100 MHz channel BW in a separate item (TEI or whatever) if the latter is not in NR\_bands\_R17\_BWs. |
| Apple | For the sake of better transparency and traceability, it would be better to put NR-U related topics into a separate "basket" item that could embrace all outstanding channel and band combination issues. The amount of work we will have to do will be the same irrespective of the fact whether we use an existing WI code or add a new one. |
| ZTE | Share similar views as QC and MTK, basket WID is not appropriate agenda to discuss general RF requirements. |
| Skyworks | We believe that intra-band UL CA work is not the same than other band combination work and especially there is a need for discussion papers and alignment so block approval cannot be assumed at least. We should also make sure that the rapporteur agrees with the additional work and a 2 week meeting scope. |
| CHTTL | Share similar views as QC and MTK. |
| Nokia | We consider this lower priority than PC3. |
| Huawei | From procedure wise, the common requirement should be treated in a general work item rather basket work item. In basket work item, everything moves fast. |

## Initial round summary

On the handling of new CA and DC combinations related to NR-U, companies were agreeable to include these into the existing Rel-17 CA and DC baskets.

Agreement: RAN to endorse the RAN4 recommendation ”For CA and DC band combinations including n46 or n96, RAN4 recommends to cover these within the existing Rel 17 band combination basket work items”

On 100 MHz channel bandwidth, most companies were agreeable to include in existing work item *NR\_bands\_R17\_BWs* with the understanding that issues related to coexistence and channel raster are within scope of discussion. However, a few companies raised a concern that there are unique attributes of the NR-U channel that might not be well-suited for inclusion in a basket (i.e., *NR\_bands\_R17\_BW*). One suggestion from the moderator is that the 100 MHz CBW is added to the *NR\_bands\_R17\_BW* work item, but that a separate objective is listed for NR-U 100 MHz. Papers submitted for this objective would not be handled by block approval. Recommend discussion of this (or other) alternative for tracing the unique attributes of NR-U in the intermediate round.

On PC3, companies were agreeable to defer discussion until the conclusion of NR TxDiv. Moreover, it was suggested that the entire discussion of PC3 including PA architecture (1PA vs. 2PA) should be handled together; therefore, starting discussion early on 1PA specs was not recommended. Another question brought up is under which WI PC3 should be treated. On suggestion from the moderator is that PC3 could be handled under the 6 GHz European band new WID proposal NR\_6GHz\_unlic\_EU. The PC3 would be general, not limited to the new band of course. Recommend discussion on which work item NR-U PC3 could be handled under, with the understanding that discussion will not commence until the conclusion of NR TxDiv.

On uplink intra-band contiguous CA, there were mixed views on whether this could be treated in a existing intra-band CA basket work tiem. The concern was that the unique aspects of NR-U would be lost within the basket work item. The moderator suggests that the same approach as for 100 MHz channel bandwidth could be adopted here as well. That is, NR-U UL CA is taken as a separate objective in the intra-band CA basket WID and papers submitted for this objective would not be handled by block approval. Recommend discussion of this (or other) alternative for tracing the unique attributes of NR-U in the intermediate round.

# Intermediate round discussion

How to handle the unique attributes of NR-U for 100 MHz channel bandwidth and uplink intra-band contiguous CA if these are included in basket work items. One suggestion is to identify NR-U as an distinct objective within the basket and papers submitted against this objective would not be block approved. Other suggestions are also welcomed.

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| **Company** | **Comments** |
| Charter Communications, Inc. | With regards to the moderator’s suggestion, “100 MHz CBW is added to the *NR\_bands\_R17\_BW* work item, but that a separate objective is listed for NR-U 100 MHz”, we don’t have a strong opinion but we will like to understand further the mechanism of presenting the work item with a separate objective specific to 100 MHz channel bandwidth.  Regarding the uplink intra-band contiguous CA work item, our preference is to treat it in the existing intra-band work item (“Rel-17 NR intra band Carrier Aggregation for xCC DL/yCC UL including contiguous and non-contiguous spectrum (x>=y)”) but we do not believe a separate objective is warranted and this can be handled by block approval since in our opinion there are no specific NR-U attributes related to uplink intra-band CA. |
| Intel | We support the suggestion proposed by the moderator but have a question for clarification. The suggestion says “… and papers submitted against this objective would not be block approved” and we wonder how we distinguish the papers for NR-U from the other excessive block approval papers? |
| Huawei | The proposal for 100MHz from moderator is acceptable. For uplink intra-band contiguous CA, there will be common requirements for intra-band contiguous CA. From procedure wise, the common requirements should be treated under a general WI. |
| Skyworks | For the 100MHz CH BW we are OK with moderator suggestion that it is handled in the NR\_bands\_R17\_BW WI under a specific agenda, provided that this is OK with the rapporteur. This agenda should then cover the derivation of the 100MHz masks for single CC and WB operation  For the PC3 aspects one option is that this is added to the UL MIMO basket if agreed, I assume that once TxDiv is agreed and since there is an agreement in RAN4 that MPR is the same for UL MIMO and TxDiv, TxDiv would be automatically covered  For intra band UL CA, it would be OK to be covered in the intra-band basket if the rapporteur if OK to cover this as a discussion topic that covers the entire meeting. Here again some preliminary work is needed to agree on the specific scenarios: Are both CCs the same BW? Same allocation (full/interlace)? How are interlace aligned within each CC…. |
| Apple | We would like to understand better the approach when 100MHz and UL CA are added into one of the existing WIs but is treated differently. Our general view is that it is not very efficient to introduce new handling rules for already overloaded baskets, especially if the NR-U topics will need dedicated discussions. Will we ask for the online session time for the basket WI just to discuss purely NR-U specific aspects? And the NR-U delegates will have to follow different AIs, which is not productive either. So before proceeding with this option we need to have a clear picture and alignment with existing basket rapporteurs that we know how the rules could look like. |
| ZTE | For NR-U 100MHz, we are also fine with moderator’s suggestion.  For intra-band UL contiguous CA, no strong opinions on that, however it’s better to put together with NR-U 100MHz for better focus. |
| Nokia | The moderator’s proposal is OK with us, with or without a separate objective. If a separate objective is introduced, we can trust the RAN4 chairman to handle it appropriately and we don’t need to define further procedural details here. |
| MTK | For 100MHz, moderator’s suggestion is fine to us.  For intra-band UL CCA, we need a mechanism to explicitly highlight or distinguish NR-U papers from other non NR-U papers. |

Which work item should PC3 work be handled under, with the understanding that such work would not commence until after the conclusion of NR TxDiv discussions? One suggestion is to include this in a new band work item, but some modifications would be needed to ensure that the new power class is not limited to this band. Other suggestions are welcomed.

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| **Company** | **Comments** |
| Intel | We are okay to wait PC3 discussion, i.e., both 1PA and 2PA, until TxD completion, if this is majority view. |
| Huawei | We are OK with wait for PC3 conclusion and then discuss PC3 under other 6GHz WI. |
| Apple | The main question is not in which WI the PC3 discussion will take place but when we can start it. As commented by a number of companies, we need to conclude first NR TxD discussion, after which we can decide which (existing or a new) WI can host the NR-U PC3 discussion. Based on that we suggest deferring this decision until the situation with NR TxD becomes clearer. |
| ZTE | Fine to wait for PC3 conclusion and then further discuss NR-U PC3. |
| Nokia | It would be fine to include PC3 in an update of NR\_6GHz\_unlic\_EU, but the decision can also be taken at a later RAN plenary when TxD is complete. |
| MTK | Since we anyway need to wait for the conclusion of TxD, it seem no urgent to make decision at this meeting. |

Any other topics? i.e., should there be prioritization of any/all of the NR-U leftovers?

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| **Company** | **Comments** |
| Charter Communications, Inc. | With regards to handling PC3 introduction for NR-U under the 6 GHz European band new WID proposal, we support this suggestion but we will like to see the wid revised to capture this objective and clearly articulate that it is retroactive to n96, US band.  We are okay to wait PC3 discussion, i.e., both 1PA and 2PA, until TxD completion. |

## Intermediate round summary

On the introduction of 100 MHz channel bandwidth, most companies were agreeable with the suggestion from the moderator to treat this under the existing *NR\_bands\_R17\_BW* WID so long as papers and discussion related to NR-U 100 MHz are not treated by block approval.

For NR PC3, all companies agreed to wait for the conclusion of NR TxDiv before starting the work. Companies seemed generally agreeable that the 6 GHz new band work item could be one possibility to include the NR PC3 work, but it was pointed out that the specific work item could be decided after conclusion on NR TxDiv.

For intra-band contiguous UL CA, it was agreeable to treat this in the existing *NR\_CA\_R17\_Intra* work item, but papers and discussion related to NR-U intra-band contiguous UL CA shall not be treated by block approval.

# Conclusion

Based on the above discussion, the following agreements were made

RAN endorses the RAN4 recommendations in R4-2017835 with the following additional details

* For the introduction of 100 MHz channel BW
  + The *NR\_bands\_R17\_BWs* WID should be modified to add this new objective
  + Papers and discussion related to 100 MHz NR-U shall not be treated by block approval within this work item
* For NR-U power class 3
  + Work on NR-U PC3 shall not begin until NR TxDiv work is completed.
  + Once the NR TXDiv work is completed, TSG RAN will decide in which WI the corresponding technical work will be conducted.
* For intra-band contiguous UL CA
  + This work shall be handled in *NR\_CA\_R17\_Intra* WID. This WID should be modified to add this new objective
  + Papers and discussion related to NR-U intra-band contiguous UL CA shall not be treated by block approval within this work item

# Reference

1. RP-202752, “Addressing leftover RAN4 requirements for NR-U,” Qualcomm Incorporated
2. RP-202579, “Views on further enhancements for NR-U,” Apple Inc.