**3GPP TSG-RAN WG4 Meeting # 104-bis-e DRAFT R4-2216981**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item:** 9.2

**Source:** Moderator (AT&T)

**Title:** Email discussion summary for [104-bis-e][145] RAN\_task\_UERF\_part1

**Document for:** Information

# Introduction

This document captures the email discussion for contributions submitted under agenda item 9.2 for the RAN task concerning the study of a possible 2Rx exception for 6GHz as well as the necessary CR to consider 4Rx as baseline for band n104.

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: Discussion and potential approval of CR in R4-2216244 to consider 4Rx as baseline for band n104. Discussion and potential proposed way forward on a possible 2Rx exception for 6GHz.
* 2nd round: Further discussion, if necessary, on any revised CR for R4-2216244. Approval of way forward on a possible 2Rx exception for 6GHz.

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: 4Rx Baseline CR and 2Rx Exception Study

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2215374 | Skyworks Solutions Inc. | Proposal 1:   * If the UE declares 2Rx support for n96 it is also allowed to declare 2Rx support for n104 in RCC countries * FFS if regions or countries beyond RCC should be added * Details of the signalling can be left to RAN2.   Observation 1: Since the 2RX and 4Rx features are already defines for n104 there is no impact on the 38.101-1 specification other than possibly a note describing the solution for 4Rx baseline with 2Rx exception.  Observation 2:   * Until sufficient market is available for n104, UEs that support n96 with 2Rx should be allowed to declare support for n104 with 2Rx rather than n104 not supported * Since n96 is not supported in the same region as n104 and support of n102 does not guarantee that the n104 frequency range is supported, some specific signalling might be required. * Valid power classes for NRU are PC5 (default) and PC3 while it PC3 (default) and PC2 for NR |
| R4-2215645 | Apple | Proposal 1a: Existing 2RX and 4RX requirements for the unlicensed band n96/n102 remain as they are.  Proposal 1b: There is no impact to TS 38.101-1 in terms of performance requirements.  Proposal 2a: The simplest signalling solution is to leverage existing IE maxNumberMIMO-LayersPDSCH indicating number of RX chains supported by the UE.  Proposal 2b: We might need a clarification in TS 38.101-1 indicating that a UE supporting band n104 may have 2RX antenna ports. |

## Open issues summary

### Sub-topic 1-1

**Issue 1-1: 2Rx and 4Rx Requirements for n96/n102**

* Proposals
  + Option 1: 2Rx and 4Rx requirements for n96/n102 remain as is.
  + Option 2: Other (indicate detailed proposal)
* Recommended WF
  + Option 1

### Sub-topic 1-2

**Issue 1-2:** **2Rx and 4Rx Requirements for n104**

* Proposals
  + Option 1: No impact on 38.101-1 in terms of performance requirements
  + Option 2: Other (indicate detailed proposal)
* Recommended WF
  + Option 1

### Sub-topic 1-3

**Issue 1-3:** **2Rx Support in Band n104**

* Proposals
  + Option 1: If the UE declares 2Rx support for band n96, it is also allowed to declare 2Rx support for band n104 in RCC countries. FFS if regions or countries beyond RCC should be added.
  + Option 2: Add clarification in TS 38.101-1 indicating that a UE supporting band n104 may have 2Rx antenna ports
  + Option 3: No allowance for 2Rx support for band n104
  + Option 4: Other (indicate detailed proposal)
* Recommended WF
  + TBA

### Sub-topic 1-4

**Issue 1-4: Signalling Solutions to Indicate 2Rx Support in Band n104**

* Proposals
  + Option 1: Leave details of signalling solutions to RAN2
  + Option 2: Leverage existing IE maxNumberMIMO-LayersPDSCH to differentiate between 2RX and 4RX UEs for band n104
  + Other (indicate detailed proposal)
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 1-1: 2Rx and 4Rx Requirements for n96/n102**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1. Existing requirements for 2/4RX remain as they are |
| Huawei | Option 1 |
| Vodafone | Option 1. |
| Charter Comm, Inc | Option 1 |
| CHTTL | Option 1. |
| Telstra | Option 1. |
| Meta | Option 1 |
| OPPO | Option 1 |
| CATT | Option 1 |
| TIM | Option 1 |
| Xiaomi | Option 1 |
| vivo | Option 1 |
| Skyworks | Option 1 |
| Nokia | Option 1 |
| Ericsson | Option 1. |

**Sub-topic 1-2: 2Rx and 4Rx Requirements for n104**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1. Existing requirements for 2/4RX remain as they are. |
| Huawei | 2Rx and 4Rx requirements are already defined |
| Vodafone | Option 1. |
| Charter Comm Inc | Option 1 |
| CHTTL | We share the same understanding as Huawei, |
| Telstra | Option 1 |
| Meta | Option 1 |
| OPPO | Option 1 |
| CATT | Option 1 |
| TIM | Option 1 |
| Xiaomi | Option 1 |
| vivo | Option 1. Quite clear |
| Skyworks | Agree that 2Rx and 4Rx are already defined and stay as they are. |
| Nokia | Why is only performance requirements mentioned here, as compared to Issue 1-1. All existing requirements should in principle remain as they are, and we do not support changing these without justification.  Why is 2Rx and 4Rx bundled in these proposed options?  Per RAN agreement RAN4 is tasked to study if allowing 2Rx exception for n104 would have any impact on requirements. For now, we can agree that there shall be no requirement impact for 4Rx and we shall first conduct the study for 2Rx before agreeing that. That said, if all other companies are ready now to agree that there shall be no requirement impact for 2Rx we are fine with that, but that is not entirely what we understand with option 1 since only performance requirements are mentioned here. |
| Ericsson | Option 1. We shall still capture that 4Rx is the baseline (Huawei’s CR). |

**Sub-topic 1-3: 2Rx Support in Band n104**

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| --- | --- |
| **Company** | **Comments** |
| Apple | Our general preference is Option 2, but Option 1 and 2 are very close. In fact, Option 1 can be viewed as a more detailed version of Option 2 with explicit conditions when 2RX exception is allowed. We are open to discuss further whether we just allow 2RX exception (Option 2) or whether we want to capture more specific conditions (similar to Option 1). |
| Huawei | Option 3  Among the listed options, we can only support option 3.  Regarding Option 1, we do not understand its’ dependency upon the support of another unlicensed band. Licensed spectrum operation is quite different from local usage in unlicensed operation. The motivation to consider 4Rx as baseline is that 2Rx severely impact the network performance. n96 has more relaxed REFSENS than n104, with 2Rx would degrade the network performance further.  And Option 2 put 2Rx exception very general which make 4Rx baseline meaningless, so it is also not acceptable. |
| China Telecom | For the current options listed here, we can only support option 3.  Option 1 and option 2 will make the baseline of 4Rx for n104 not implemented in many cases.  We are open to further discuss other possible options if any. |
| Vodafone | Option 3.  As indicated by Huawei, options 1 and 2 have the potential to undermine the 4 Rx baseline agreement. We also do not understand the need for introducing a dependency on an unlicensed band as proposed in option 1. |
| Charter Communications Inc | We agree with Apple and our preference is option 2 as well. We also agree that further discussion should take place to clearly state the conditions by which 2 RX exceptions can be allowed. Furthermore, we should stay away from considering 4 RX mandatory. |
| CHTTL | Support Option 3 only.  We also share the similar view that Option 1/2 is not fully aligned with the 4Rx baseline agreement made in last RAN meeting. Regarding option 1, in our understanding, the spec does not define the number of supported Rx for a given band to be dependent on another band. Option 2 is proposing 2Rx in very generic way which is not aligned with the 4Rx baseline agreement. |
| Spark NZ | We support option 3 and agree with the views of Vodafone on options 1 and 2 1 and 2 will undermine the 4Rx baseline agreement. |
| CMCC | We prefer option 3. 4Rx is the baseline and it seems option 1 and option 2 will undermine previous agreement. |
| China Unicom | We support option 3 only.  We also share the similar view that Option 1/2 is not fully aligned with the 4Rx baseline agreement. |
| Telstra | We continue to find a lack of any justification, in terms of addressing spectrum efficiency and path loss, to allow any exception to the long-held requirement that for licensed bands >2.6 GHz, four RX antenna are mandated in the UE. This mandate was motivated to improve link budgets and compensate for path losses at these frequencies and at 6GHz, these effects are greater. The reduction from 4 RX to 2 RX has significant impacts to the spectrum efficiency, MIMO capability on top of link budget.  There needs to be justification to permit such a degradation in the efficiency of this licensed band. The vehicle industry argued that in their case, the use of more expensive externally mounted vehicle antennas can help to overcome the loss of two receivers in these bands.  No such justification has been presented for n104. As such, Option 3 can be the only option. |
| Meta | We also agree with Apple comments. we prefer to support both 2Rx and 4Rx.do not need to define baseline and defaults for supporting number of antenna. |
| OPPO | In RAN#97e, the conclusion was made that 4Rx is baseline and study whether 2Rx exception is possible similar as exception for automotive UE. In our view, it opens a door as the compromise for future apply if there is special case shown later on.  Therefore, in our view Option 2 is more aligned with the RAN guidance but probably it is too open, people may consider any UE can apply 2Rx. Probably we can say 4Rx as baseline but keep the possibility of 2Rx case in the future. How to capture in the spec can be further discussed. |
| CATT | Option 3 if option 1 and option 2 are the exceptions. |
| TIM | We support Option 3. Option 1 and Option 2 are not in line with the baseline agreement. |
| Xiaomi | Option 2 seems more close to the conclusion in RAN plenary. |
| vivo | We agree with Apple comments. We also prefer Option 2.  On top of making 4RX as baseline, allowing 2Rx for this band is the best compromise we can see. |
| Skyworks | RAN has tasked RAN4 to find a solution for 2Rx option for n104. In our proposal to link to n96 is because n96 is supported by some smartphones in conjunction with WiFi6E. These only support 2Rx and could support n104 with minimum added cost while with an uncertain market for n104 today, there is little incentive to implement 4Rx. Our proposal is then tied to the RCC case which is today the only one for n104. Once n104 is applicable in higher volumes and markets, 4Rx may be justified. Sticking to 4Rx only in not in accordance to RAN guidance and as is is only postponing the implementation of n104 in phones. We suggest that option 1 or 2 are given more thoughts by operators and network vendors (is there any from RCC countries?) if their intention is to have phones supporting n104 as early as it makes sense from an HW impact on the UE. |
| Nokia | To our understanding the RAN agreement is:  “*Define band n104 requirements with 4Rx as baseline. RAN4 to perform a study on any possible 2Rx exception (as done for 2Rx exception for automotive) and, if confirmed, identify the necessary specification impact (e.g. requirements, signalling) for the 2Rx exception to be used.*”.  From that it is clear that 4Rx shall be the baseline. However, it is also clear that a potential exception with 2Rx could be allowed given certain constrains. If we in Issue 1-2 agree that there shall be no impact to the existing specification/requirements for 4Rx for n104. Then we can further investigate, if possible and if so, what constrains a 2Rx exception shall have.  From this reasoning we do not think any of the options fully capture the RAN guidance. Option 3 could be a starting point since this is the RAN agreed baseline, but perhaps it is too soon to firmly rule out 2Rx at current stage. |
| Ericsson | Option 3, but we could accept exception if justified (e.g. for RedCap devices?).  We don’t think option 1 would really be an exception as 4Rx is not mandatory for n96. When supporting WiFi 6, are the antennas only supporting that frequency range or are they multi-bands antennas, supporting also mid-bands? If dedicated antennas, what would be the expected antenna area increase and how much that would impact UE design/final cost when supporting 4Rx? The option 2 doesn’t define any criteria to mandate or not 4Rx, it’s just left up to UE manufacturer. |

**Sub-topic 1-4: Signalling Solutions to Indicate 2Rx Support in Band n104**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2. Our view is that existing signaling suffices, which does not require further actions from other 3GPP WGs. We are of course open to discuss whether additional signaling is needed; then we can decide which WGs will be impacted. |
| Huawei | In general we support Option 1, but it comes after we conclude Sub-topic 1-3. |
| Vodafone | Same view as Huawei. |
| Charter Communications Inc | Option 2, using capability signaling to differentiate between 2 Rx and 4 RX in n104 should be the correct path. |
| CHTTL | Other, based on the agreed RAN guidance, the 2RX exception need to be first identified and confirmed, then discuss the necessary specification impact including signaling later on, so this should not be discussed at this stage. |
| Spark NZ | We support Huawei |
| Telstra | Other: Response to this sub-topic is premature until resolving sub-topic 1-3 |
| Meta | We support to use the existing IE maxNumberMIMO-LayersPDSCH to support 2Rx or 4Rx. But we also fine with option 1. |
| OPPO | Option 2 is enough. |
| CATT | Option 1. |
| TIM | Supporting Huawei. |
| vivo | Option 2. |
| Skyworks | Even if we believe the signaling aspect should be left to RAN2 once we have settled on a RAN4 solution for 2Rx, we are fine to reuse existing IE if it is suited. |
| Nokia | Let’s conclude issue 1-3 first but in general we think this issue should be handled by RAN2. |
| Ericsson | Option 1 |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2216244 | This CR is a starting point for capturing agreements. We need to find a proper way to capture the 2RX exception. Maybe a simple NOTE will be sufficient, but the actual wording will depend on the outcome of issue 1-3, i.e. whether we just capture that “a UE may have 2RX exception in band n104” or we add more specific conditions. |
| Meta: RNA4 need to support both 2Rx and 4Rx in n104. So we prefer to add simple NOTE based on Apple comment. |
|  |
| vivo: a new modified note should be used for this band, to show 2Rx is allowed. |
| Skyworks: we can’t agree to the CR until there is a clear path to enable 2Rx option. In our view it is not the same case than the previous 4Rx mandatory bands. |
| Nokia: This CR can form a starting point. However, dependent on the outcome of the discussion this CR may be needed revised |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents