3GPP TSG-RAN WG4 Meeting #99-e R4-2108451

Electronic Meeting, 19 May – 27 May 2021

**Agenda item:** 7.1.4, 8.2.5, 8.28.5

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [99-e][326] NR\_R17\_SpectrumWI\_Demod

**Document for:** Information

# Introduction

This email discussion thread discusses the UE/BS demodulation requirements associated with spectrum:

* Introduction of FR2 FWA UE with maximum TRP of 23dBm for n257 and n258 (AI 7.1.4)
* Introduction of NR 47GHz band (AI 8.2.5.1/8.2.5.2)
* Introduction of channel bandwidths 35MHz and 45MHz for NR (AI 8.28.5)

# Topic #1: FR2 FWA UE with maximum TRP of 23dBm for n257 and n258 (AI 7.1.4)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2110639 | Ericsson | CR: Removal of [] from Noc power level for n257/n258 PC5 |

## Open issues summary

Collect comments for CR to finalize the performance part.

## Companies views’ collection for 1st round

### Open issues

Provide the comments for the CR in 1.3.2.

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| R4-2110639 CR(Ericsson) | Company A |
| Company B |
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## Summary for 1st round

### Open issues

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N/A

### CRs/TPs

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See Section 5.

## Discussion on 2nd round (if applicable)

No discussion.

# Topic #2: UE NR 47 GHz band (AI 8.2.5.1)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2109218 | Intel Corporation | **Proposal 1:** Consider 1 dB additional margin for TS 38.101-4 Table 7.2.2.2.1-4 Test 2-6 and TS 38.101-4 Table 7.2.2.2.1-5 Test 3-1 to extend applicable carrier frequency range for 47GHz bands. **Proposal 2:** Consider 1.5 dB additional margin for TS 38.101-4 Table 7.2.2.2.1-3 Test 1-4 to extend applicable carrier frequency range for 47GHz bands. |
| R4-2110551 | Huawei, HiSilicon | **Observation 1:** There is obviously performance degradation considering “Example 2, UE” phase noise model at 47GHz comparing to “Example 2, UE” phase noise model at 29GHz or no phase noise model.**Observation 2:** Except impact of the phase noise, at least 1dB is remained for other impairment factors.**Proposal 1:** Add extra 1dB for the 16QAM rank 2 case with Enhanced Receiver Type 1 case and the 64QAM rank 2 case.**Proposal 2:** Do not test 256QAM at 47GHz. |
| R4-2110645 | Ericsson | **Observation 1:** The existing DL 64QAM CR=0.43 Rank 2 test for FR2 is applicable for n262. **Observation 2:** The existing DL 256QAM CR=0.67 Rank 1 test for FR2 is not applicable for n262. **Proposal:** The existing FR2 UE performance requirements in TS38.101-4 are applicable to the FR2 operating bands defined in with FDL\_high not exceeding 48200 MHz, except the test case of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4). |
| R4-2110765 | Qualcomm Incorporated | **Observation 1:** The SNR degradation in demodulation performance between 47GHz (band n262), 39 GHz, 29 GHz for tests 1-3 and 2-6 in 38.101-4 is marginal and smaller than 0.5dB when using UE Phase Noise model from TR 38.803, Example 2.**Proposal 1:** For FR2 UE Demodulation performance, extend the existing UE performance requirements in 38.101-4 up to 48.2GHz (including n262) up to and including 64QAM (MCS 18) Rank 2. |
| R4-2110646 | Ericsson | draft CR: TS 38.101-4: n262 demodulation requirements |

## Open issues summary

### Sub-topic 2-1: Applicability of FR2 UE demodulation requirements to 47GHz band (n262).

**Issue 2-1: Applicability of 64QAM Rank 2 (TS38.101-1 Table 7.2.2.2.1-4 Test 2-6) for 47GHz band**

* Proposals
	+ Option 1: Applicable with additional 1dB margin
	+ Option 2: Applicable without additional margin
* Recommended WF
	+ Collect companies view

**Issue 2-2: Applicability of 16QAM Rank 1 with Enhanced Receiver Type 1 (TS38.101-4 Table 7.2.2.2.1-5 Test 3-1) for 47GHz band**

* Proposals
	+ Option 1: Applicable with additional 1dB margin
* Recommended WF
	+ Collect companies view if option 1 is agreeable or not.

**Issue 2-3: Applicability of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4) for 47GHz band**

* Proposals
	+ Option 1: Applicable with additional 1.5dB margin
	+ Option 2: This test is not applicable for 47GHz band
* Recommended WF
	+ Collect companies view

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | Sub topic 2-1: Sub topic 2-2:Sub topic 2-3:Others: |
| Huawei | **Issue 2-1: Applicability of 64QAM Rank 2 (TS38.101-1 Table 7.2.2.2.1-4 Test 2-6) for 47GHz band**Based on our evaluation results, we prefer Option 1: Applicable with additional 1dB margin.**Issue 2-2: Applicability of 16QAM Rank 1 with Enhanced Receiver Type 1 (TS38.101-4 Table 7.2.2.2.1-5 Test 3-1) for 47GHz band**Based on our evaluation results, we prefer Option 1.**Issue 2-3: Applicability of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4) for 47GHz band**Based on our evaluation results, extra 3dB margin should be added, and then the 256QAM case will be untestable. So we prefer Option 2: This test is not applicable for 47GHz band. |
| Ericsson | Sub topic 2-1: Option 2. According to the companies evaluation results, the degradation from 28GHz to 47GHz due to PN is in range of less than 0.5dB to 0.7dB. Extra margin of +1.0dB is too much since the existing FR2 requirements were set with large margin. Even if we add an extra margin, at most +0.5dB. Sub topic 2-2: Same comment as sub topic 2-1. Additional margin of 1.0dB is too much considering the margin when RAN4 set the requirements. We prefer to apply the requirement of 16QAM Rank 1 with Enhanced Receiver Type to n262 without extra margin. Even if we add a margin, at most +0.5dB. Sub topic 2-3: Option 2. We also observed a huge degradation from 28GHz to 47GHz. It is not feasible to extend the applicable bands for 256QAM test to n262.  |
| Qualcomm | **Issue 2-1: Applicability of 64QAM Rank 2 (TS38.101-1 Table 7.2.2.2.1-4 Test 2-6) for 47GHz band****Issue 2-2: Applicability of 16QAM Rank 1 with Enhanced Receiver Type 1 (TS38.101-4 Table 7.2.2.2.1-5 Test 3-1) for 47GHz band**For these tests the results presented by companies show degradation on performance of up to 0.7dB, but in our view the PN model used for submission (UE Example 2) can be considered a pessimistic assumption on the impact on performance. So, in our opinion, for these two issues the amount of degradation shown by the UE Example 2 model does not justify a 1dB relaxation, and that the current requirements should be applied to the 47 GHz band, as also supported by the results we submitted in the previous meeting.**Issue 2-3: Applicability of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4) for 47GHz band**The evaluation based on the results obtained with the UE Example 2 phase noise model show a large degradation and would effectively make the SNR not testable. However, considering that the PN model is a pessimistic assumption, we should further discuss whether 256 QAM requirements can be applicable based on less pessimistic phase noise models. |
| Intel | **Issue 2-1: Applicability of 64QAM Rank 2 (TS38.101-1 Table 7.2.2.2.1-4 Test 2-6) for 47GHz band**We support Option 1. We are not sure that companies have added enough margin in Rel-15 to accommodate impairments on 47GHz. We can also compromise to adding 0.7 dB.To Qualcomm, we also observed that example two UE PN model leads to the worse performance. Same time it is official model and we should use it as a reference for minimum performance requirements. **Issue 2-2: Applicability of 16QAM Rank 1 with Enhanced Receiver Type 1 (TS38.101-4 Table 7.2.2.2.1-5 Test 3-1) for 47GHz band**We support Option 1. We are not sure that companies have added enough margin in Rel-15 to accommodate impairments on 47GHz. We can also compromise to adding 0.7 dB.To Qualcomm, we also observed that example two UE PN model leads to the worse performance. Same time it is official model and we should use it as a reference for minimum performance requirements. **Issue 2-3: Applicability of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4) for 47GHz band**Question to companies. Why we are comparing results at 29GHz vs 47GHz. Current requirements are applicable up to 40000 MHz according to TS 38.101-4. Based on our evaluations there is a .4 dB degradation on 47GHz compared to 39GHz. We suggest adding 1.5 dB margin in this case. For possible testability issue with high SNR, we have the following note in TS 38.101-4 clause 4.2:“For radiated minimum requirements specified in the specification, if maximum achievable SNR in the test system for certain test conditions is less than the defined SNR requirement for those tests, those requirements shall not be tested”In this case we believe it is better to allow testing of 256QAM requirements at 47GHz carrier frequency and leave up to TE vendors whether it will be tested or not. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| R4-2110646Draft CR(Ericsson) | Company A |
| Company B |
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## 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.*

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|  | **Status summary**  |
| **Sub-topic#2-1** |  **Issue 2-1: Applicability of 64QAM Rank 2 (TS38.101-1 Table 7.2.2.2.1-4 Test 2-6) for 47GHz band** **Issue 2-2: Applicability of 16QAM Rank 1 with Enhanced Receiver Type 1 (TS38.101-4 Table 7.2.2.2.1-5 Test 3-1) for 47GHz band**Companies have different proposals to apply the existing FR2 demodulation requirements to 47GHz bands based on the simulation results. One company argued the PN model example 2 in TR 38.803 is pessimistic, one company argued the phase noise model referred to in TS 38.803 is still useful to consider. Candidate options:* Option 1: Applicable with additional margin
	+ Option 1a: extra 1dB (Huawei, Intel)
	+ Option 1b: extra 0.7dB (Intel)
	+ Option 1c: at most 0.5dB (Ericsson)
* Option 2: Applicable without additional margin (Ericsson, Qualcomm)

Recommendations for 2nd round:Looking the discussion on Issue 2-3, companies’ simulation assumption is different. The moderators recommend to evaluate the test cases further and the 2nd round discusses the simulation assumption for evaluation especially assumed carrier frequency and phase noise model. * Carrier frequency:
	+ 47GHz vs. 28GHz
	+ 47GHz vs. 39GHz
* Phase noise model
	+ PN model example 2 in TR 38.803 as a baseline
	+ Other PN models are not precluded

**Issue 2-3: Applicability of 256QAM Rank 1 (TS38.101-4 Table 7.2.2.2.1-3 Test 1-4) for 47GHz band**Some company observed it requires more than 3dB extra margin for 47GHz compared with 28GHz. One company questioned why the comparison is done between 29GHz and 47GHz, the comparison should be done between 40GHz and 47GHz. Candidate options:* Option 1: Applicable with additional 1.5dB margin (Intel)
	+ Performance should be compared with 39GHz and 47GHz.
* Option 2: This test is not applicable for 47GHz band (Huawei, Ericsson)
	+ It requires 3dB extra margin, and it is not testable.
* Option 3: Need more evaluation (Qualcomm)
	+ PN model example 2 in TR 38.803 is pessimistic. Consider other phase noise models.

Recommendations for 2nd round:The moderator thinks it is difficult to conclude it. The moderator recommends to evaluate further and discuss the simulation assumption (Same as Issue 2-1/2-2). |

### CRs/TPs

See Section 5.

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## Discussion on 2nd round (if applicable)

Discuss the way forward on the simulation assumption.

# Topic #3: BS NR 47 GHz band (AI 8.2.5.2)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2110592 | Nokia, Nokia Shanghai Bell | CR for 38.141-2: Add AWGN Offset note to FR2 demod noise level |

## Open issues summary

Collect comments for CR to finalize the conformance test part.

## Companies views’ collection for 1st round

### Open issues

Companies are encouraged to provide the comments on CRs in 3.3.2.

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| R4-2110592CR(Nokia, Nokia Shanghai Bell) | Ericsson: The CR is fine, but it is related to the discussion on whether to introduce the change for Rel-15/16, i.e. [318] R15 UE/BS demod maintenance. If agree for Rel-15/16 then the CR should be a category A.  |
| Company B |
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## Summary for 1st round

### Open issues

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N/A

### CRs/TPs

See Section 5.

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## Discussion on 2nd round (if applicable)

No discussion.

# Topic #4: Channel bandwidths 35MHz and 45MHz for NR (AI 8.28.5)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2109219 | Intel Corporation | Simulation results |
| R4-2110547 | Huawei, HiSilicon | **Proposal 1:** Select subband size 32 for both 35MHz and 45MHz bandwidth requirements. |
| R4-2110644 | Ericsson | Simulation results |
| R4-2111167 | Qualcomm Incorporated | Simulation results |
| R4-2110548 | Huawei, HiSilicon | Summary of simulation results for 35MHz and 45MHz channel bandwidth for FR1 FDD |
| R4-2110549 | Huawei, HiSilicon | CR on UE demodulation and CSI reporting for 35MHz and 45MHz channel bandwidth for FR1 FDD (Rel-16) |
| R4-2110550 | Huawei, HiSilicon | CR on UE demodulation and CSI reporting for 35MHz and 45MHz channel bandwidth for FR1 FDD (Rel-17) |

## Open issues summary

### Sub-topic 4-1: Subband size for CA CQI test used for CBW 35MHz and 45MHz

**Issue 4-1: Subband size for CA CQI tests**

* Proposals
	+ Option 1: Set subband size 32 for both 35MHz and 45MHz bandwidth requirements.
* Recommended WF
	+ Agree with Option 1.

### Sub-topic 4-2: Collection of simulation results with 35/45MHz for FR1 FDD

**Issue 4-2: Summary of simulation results**

* Proposals:
	+ Companies are encouraged to collect the simulation results in R4-2110548 to discuss the requirements in the second round.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | Sub topic 4-1: Others: |
| Huawei | **Issue 4-1: Subband size for CA CQI tests**Option 1.**Issue 4-2: Summary of simulation results**Draft summary of simulation results R4-2110548 is uploaded, please check if your results are correctly captured, also impairments results are welcome to provide during this meeting.Well aligned results among companies. If interesting companies can provide impairment results during this meeting, then the SNR requirements with square brackets can be captured in the revised CR R4-2110550. |
| Ericsson | Sub topic 4-1: Support the recommended WF.  |
| Qualcomm | Issue 4-1: Ok with recommended WF. |
| Intel | **Issue 4-1: Subband size for CA CQI tests**Recommended WF is fine. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| R4-2110549CR(Huawei, HiSilicon) | Moderator: This is Rel-17 WI. This CR should be withdrawn. Need to check chair/secretary if R4-2110550 is used instead (but Category need to be changed to Cat-B).  |
| Huawei: Thanks for figuring out this issue for us, this CR can be withdrawn. |
| Company B |
| R4-2110550 Cat-A CR(Huawei, HiSilicon) | Huawei: draft CR is uploaded into the draft folder for your review, and it can be revised to capture the SNR requirements if possible in the 2nd round. |
| Ericsson: It this CR is agreeable, change the CR category to B. Need to check with secretary if it is possible.  |
| Qualcomm: Number of CORESET RBs need to be a multiple of 6. Can you please fix the number of RBs accordingly? |
| Huawei: Revised CR v2 is uploaded: corrected the number of CORESET RBs as comment from QC; SNR requirements with square brackets as per the submitted results are included.CR is changed to Cat B as per offline checking with MCC secretary. |

## 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.*

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|  | **Status summary**  |
| **Sub-topic#4-1** | **Issue 4-1: Subband size for CA CQI tests**All the companies agreed to set subband size 32 for both 35MHz and 45MHz bandwidth requirements. Agreements: * Set subband size 32 for both 35MHz and 45MHz bandwidth requirements.

Recommendations for 2nd round:No discussion is required.  |

### CRs/TPs

See Section 5.

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## Discussion on 2nd round (if applicable)

Discuss the revision of CR.

# Recommendations for Tdocs

## 1st round

**New tdocs**

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| **Title** | **Source** | **Comments** |
| Way forward on UE demodulation on NR 47GHz band | Ericsson | Capture the agreements on Topic #2 (UE NR 47GHz band) |
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**Existing tdocs**

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| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
|  |  |  |  |  |
| R4-2110639 | Removal of [] from Noc power level for n257/n258 PC5 | Ericsson | Agreeable | No comments received in the 1st round. |
| R4-2110646 | draft CR: TS 38.101-4: n262 demodulation requirements | Ericsson | Postponed |  |
| R4-2110592 | CR for 38.141-2: Add AWGN Offset note to FR2 demod noise level | Nokia, Nokia Shanghai Bell | Revised | [99-e][318] Demod\_R15\_Maintenance agreed to submit the CR from Rel-15 (NR\_newRAT) or Rel-16 (TEI16). CR category should be changed to Cat-A.WI code should be changed accordingly. Note the discussion is continued in [318].  |
| R4-2110549 | CR on UE demodulation and CSI repopting for 35MHz and 45MHz channel bandwidth for FR1 FDD (Rel-16) | Huawei, HiSilicon | Not pursued | Since this WF is for Rel-17, this CR should be withdrawn. |
| R4-2110550 | CR on UE demodulation and CSI repopting for 35MHz and 45MHz channel bandwidth for FR1 FDD (Rel-17) | Huawei, HiSilicon | Revised | Capture the simulation results summary: R4-2110548.CR category should be changed from Cat-A to Cat-B.  |

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

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| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | 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