**3GPP TSG-RAN WG4 Meeting # 97-e draft R4-2016971**

**Electronic Meeting, 2 – 13 Nov., 2020**

**Agenda item:** 10.28

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [97e][130] NR\_47GHz\_Band

**Document for:** Information

# Introduction

New work item (RP-201232): introduction of NR 47 GHz band by T-Mobile USA and Dish Network was approved in RAN#88-e. This is the second RAN4 meeting to continue to discuss the work item. See RP-201560 on the latest status of this work item.

UE RF, BS RF, RRM, and Demod requirement as well as some TPs to TR are going to be discussed in this meeting.

# Topic #1: UE RF

UE Link budget and RF requirements are discussed in this topic #1.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014263**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014263.zip)Discussion on PC3 EIRP and EIS in n262 | Qualcomm Incorporated | We presented updated min peak EIRP and REFSENS estimates for n262, based on rel. 15 assumptions:- Min. peak EIRP = 14.8 dBm- REFSENS @ -1dB SNR and 100M = -81.5 dBm |
| [**R4-2015084**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015084.zip)UE RF requirements for NR band n262 | Nokia, Nokia Shanghai Bell | Proposal 1: At least the fallback group 3 (CA\_262G, H, I, J, K, L and M) is specified in Rel-17.Observation 1: The bandwidth of n262 is much smaller than n259 and therefore there is room to optimize the component performance.Proposal 2: For REFSENS analysis, NF=12 dB should be used as this is already communicated to ITU-R WP 5D for IMT parameters.Proposal 3: Other parameters shall be reused from the link budget analysis of n259/n260 as much as possible and the implementation loss shall not be overestimated simply because of higher frequency.Proposal 4: EIRP value is reused from n259 if the beam correspondence tolerance requirement is introduced to PC3.Proposal 5: The existing MPR in TS 38.101-2 is applied to n262.Proposal 6: The existing minimum output power in TS 38.101-2 is applied to n262.Observation 2: No issue specific to n262 is identified regarding UL CA and UL MIMO. |
| [**R4-2015855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015855.zip)Link budget for PC3 for n262 | Sony, Ericsson | Observation 1 A dual-polarized antenna structure with PA for each polarization was assumed when defining the peak EIRP for bands n257  n261.Observation 2 According to our estimate (minimum) peak EIRP is 18 dBm for PC3: n2 Observation 3 The spherical coverage performance (delta between peak and 50% EIRP) depends on many factors, and it cannot be concluded that the n262 band must be worse than, e.g., n259 in terms of spherical coverage.Observation 4 Multi-band relaxation for specification (Table 6.2.2.3-4 in TS 38.101-2 ) for n262 shall be MBP,n=0.5dB and MBS,n=0.4dB.Observation 5 According to our estimate REFSENS for PC3: n262 is -81.5 dBmProposal 1 For PC3: n262 reuse maximum peak EIRP and maximum TRP from PC3: n260Proposal 2 Companies shall provide the reference RF architecture they assumed when deriving the peak EIRP link budget.Proposal 3 Further study the spherical coverage requirement (delta between peak and 50% EIRP) of n262. |
| [**R4-2015888**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015888.zip)PC3 minimum peak EIRP and EIS requirements for band n262 | Intel Corporation | Observation 1: The derived PC3 minimum peak EIRP value for band n262 is 17dBm. Compared to the PC3 requirement for band n259, this represents a reduction of 1.7dB.Proposal 1: Define the PC3 minimum peak EIRP requirement of band n262 as 17dBm.Observation 2: The derived PC3 minimum peak EIS value for band n262 is -83.2dBm. Compared to the PC3 requirement for band n259, the difference is 1.5dB.Proposal 2: Define the PC3 minimum peak EIS requirement of band n262 as -83.2dBm (for 50 MHz bandwidth). |
| [**R4-2016229**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016229.zip)EIRP and EIS evaluation for band n262 | vivo | Proposal 1: Based on the reported link budget, the peak EIRP (minimum value) is 16.25 dBm for band n262.Proposal 2: Based on the reported link budget, the EIS (minimum value) is -78.5 dBm/100MHz for band n262. |
| [**R4-2016296**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016296.zip)Peak EIRP and Peak EIS for band n262 | Apple Inc. | Proposal 1: The single-band minimum peak EIRP requirement for band n262 is 12.7 dBm.Proposal 2: The single-band minimum peak EIS requirement for band n262 is -78.98 dBm/50 MHz, -75.98 dBm/100 MHz, -72.98 dBm/200 MHz, -69.98 dBm/400 MHzObservation 1: Degradation of the radiated energy from the antenna due to poor impedance matching when supporting 39 GHz + 47 GHz wide band antenna is anticipated.Proposal 3: Study of multi-band relaxation requirement shall consider wide-band antenna solution (39 GHz + 47 GHz). |

## Open issues summary

### Sub-topic 1-1 Min Peak EIRP

The link budget analysis for peak EIRP is summarized in the following table. The min peak EIRP range is between 12.7 and -81.5 dBm.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | [**R4-2014263**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014263.zip)Qualcomm | [**R4-2015855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015855.zip)Sony, Ericsson | [**R4-2015888**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015888.zip)Intel | [**R4-2016229**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016229.zip)vivo | [**R4-2016296**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016296.zip)Apple |
| Parameter | Unit | Nominal | tolerance | Nominal | tolerance | Nominal | tolerance | Nominal | tolerance | Nominal | tolerance |
| Frequency range | GHz | 47.2 – 48.2GHz |
| Pout per element | dBm | 8 |  | 10 |  | 11 |  | 10 |  | 9.5 |  |
| # of antennas in an array | 　 | 4 |  | 4 |  | 4 |  | 4 |  | 4 |  |
| Total conducted power per polarization | dBm |  |  | 16 | 0.5 | 17 |  | 16 | -1 | 16 | -2 |
| Avg antenna element gain | dBi | 0.4 |  | 5.5 |  | 4 |  | 4 | -0.5 | 3.75 |  |
| Antenna rolloff loss versus frequency | dB |  |  | 0.5 |  | -2.5 |  | -1.5 | 0 | -1.5 |  |
| Realized antenna array gain | dBi |  |  | 10.5 | 1 | 7.5 |  | 8.5 |  | 8.3 | 0 |
| Polarization gain | dB | 2 chains |  | 2.5 |  | 2.8 |  | 2.5 |  | 2.8 |  |
| Mismatch and transmission line loss including load pull | dB |  |  | 1 | 1 | -3.5 |  | -1 | -0.5 | -2.6 | -0.7 |
| Beam forming loss (phase shifter and amplitude error) | dB |  |  | 1 | 0.5 | -0.5 |  | -0.5 | -0.25 | -2 | -0.6 |
| Finite beam table | dB |  |  | 0 |  | -0.25 |  | -0.25 | 0 |  |  |
| Beam forming loss (one beam table fits all) | dB |  |  | 0 |  | -0.25 |  | -0.25 | 0 |  |  |
| Form factor integration losses | dB |  |  | 4 | 2 | -5.8 |  | -5.5 | -1.5 | -4 | -2 |
| Total implementation loss (nominal) | dB |  |  | 6 |  |  |  | -7.5 |  | -8.6 | -3.3 |
| Total implementation loss (worst case) | dB | 4+4.6 |  | 9.5 |  | -10.3 |  |  | -9.75 |  |  |
| Peak EIRP (Nominal) | dBm |  |  | 23 |  |  |  | 19.5 |  | 18 |  |
| Tolerance (+/-) | dB |  |  | 5 |  |  |  |  | 3.25 |  | -4.3 |
| Peak EIRP (Minimum) | dBm | 14.8 |  | 18 |  | 17.0 |  | 16.25 |  | 12.7 |  |
| Peak EIRP (Maximum) | dBm |  |  |  |  |  |  | 22.75 |  |  |  |

Issue 1-1-1: Is there any issue in link budget parameters provided by each company? Are they reasonable?

Issue 1-1-2: How is RAN4 to decide the mean peak EIRP value?

Issue 1.1-3: What is RAN4 to decide the EIRP spherical coverage? What is the expected EIRP at 50%-tile?

Issue 1.1-4: How to handle other power classes than PC3?

### Sub-topic 1-2 REFSENS

The link budget analysis for REFSENS is summarized in the following table. REFSENS range is between -75.98 dBm and -81.5 dBm for 100 MHz channel bandwidth.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | [**R4-2014263**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014263.zip)Qualcomm | [**R4-2015855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015855.zip)Sony, Ericsson | [**R4-2015888**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015888.zip)Intel | [**R4-2016229**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016229.zip)vivo | [**R4-2016296**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016296.zip)Apple |
| **Parameter** | **Unit** | **Value** |
| Band number |  | n262 |
| Frequency range | GHz | 47.2 – 48.2GHz |
| Modulation |  | QPSK |
| SNR requirement | dB | -1 | 0including 1 dB IM | -1 | -1 | -1 |
| Bandwidth | MHz | 100 | 100 | 50 | 100 | 50 |
| Thermal noise | dBm/Hz |  | -174 | -174 | -174 | -174 |
| Noise Figure | dB | 12.1 | 12.5 | 12 | 16 | 16 |
| Number of antenna in an array |  | 4 | 4 |  | 4 | 4 |
| Array gain | dB | 0.4 | 5.5 | 7.5 (effective) | 8.5 (realized) | 8.3 (realized) |
| Element gain | dBi |  | 4.5 |  | 4 | 3.75 |
| Diversity gain | dB | 2 chains | 0 |  | 0 | 0 |
| Antenna gain roll-off over frequency | dB |  | 0.5 |  | -1.5 | -1.5 |
| Beamforming loss | dB |  | 1 |  | -1 | -2 |
| Total insertion loss | dB |  | 8 |  | -9 | -11.3 |
| [Mismatch and transmission line loss] | dB |  |  |  | -2 | -3.3 |
| [Form factor Integration losses] | dB |  |  |  | -6 | -6 |
| [Implementation loss] | dB | 3 |  | 10.3 |  |  |
| [Packaging loss] | dB | 4.6 |  |  |  |  |
| REFSENS(50 MHz) | dBm |  |  | -83.2 |  | -78.98 |
| REFSENS(100 MHz) | dBm | -81.5  | -81.5 |  | -78.5 | -75.98 |
| REFSENS(200 MHz) | dBm |  |  |  |  | -72.98 |
| REFSENS(400 MHz) | dBm |  |  |  |  | -69.98 |

Issue 1-2-1: Is there any issue in link budget parameters provided by each company? Are they reasonable?

Issue 1-2-2: What is RAN4 to decide the REFSENS value?

Issue 1.2-3: What is RAN4 to decide the EIS spherical coverage? What is the expected EIS at 50%-tile?

Issue 1.2-4: How to handle other power classes than PC3?

### Sub-topic 1-3 Multiband relaxation

Issue 1-3-1: Is the proposal by Sony and Ericsson MBP,n=0.5dB and MBS,n=0.4dB agreeable?

Issue 1-3-2: Is the proposal by Apple, “Study of multi-band relaxation requirement shall consider wide-band antenna solution (39 GHz + 47 GHz),” agreeable?

### Sub-topic 1-4 Beam correspondence

Issue 1-4-1 Is the Nokia proposal “EIRP value is reused from n259 if the beam correspondence tolerance requirement is introduced to PC3” agreeable?

### Sub-topic 1-5 CA configurations

Issue 1-5-1: Is Nokia proposal “At least the fallback group 3 (CA\_262G, H, I, J, K, L and M) is specified in Rel-17.” agreeable?

### Sub-topic 1-6 MPR

Issue 1-5-1: Is Nokia proposal “The existing MPR in TS 38.101-2 is applied to n262” agreeable?

### Sub-topic 1-7 Minimum output power

Issue 1-7-1: Is Nokia proposal “The existing minimum output power in TS 38.101-2 is applied to n262” agreeable?

### Sub-topic 1-8 Others

Issue 1-8-1: Is there any other UE RF issue?

## Companies views’ collection for 1st round

### Open issues

Please leave your 1st round comments here.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Issue 1.1-3: We expect n262 will follow ‘gain drop’ trends set up by existing bands however.Issue 1.1-4: As release independent from Rel-17Issue 1.2-3: We expect n262 will follow ‘gain drop’ trends set up by existing bands however.Issue 1.2-4: As release independent from Rel-17Issue 1-6-1: Is Nokia proposal “The existing MPR in TS 38.101-2 is applied to n262” agreeable? YESIssue 1-7-1: (we are checking and will offer our view during second round or WF discussion) |
| DISH Network | Issue 1.1-1: Quite a bit of deviation both in each specific parameter and in resulting Minimum peak EIRP. This may or may not be a concern, depending of if RAN4 is still able to agree on the Minimum Perak EIRP value.Issue 1.1-2: Obviously it would help if the analysis were closer to each other, but maybe a sort of “averaging” should be eventually used. It would help to have analysis from other manufacturers as well.Issue 1.1-3:Issue 1.1-4: Other PC’s are in the scope of the WI so certainly they need to be specified as well. Companies should provide proposals for PC1/PC2/PC4 values in next meeting. It seems that PC3 would be in relative terms suffering more from the higher frequency than PC1/PC2/PC4 so the delta between n260 and n262 for PC1/PC2/PC4 should be smaller than that for n260 and n262 in PC3.Issue 1.2-1: Quite a bit of deviation both in each specific parameter and in resulting REFSENS. This may or may not be a concern, depending of if RAN4 is still able to agree on the REFSENS valueIssue 1.2-2: Obviously it would help if the analysis were closer to each other, but maybe a sort of “averaging” should be eventually used. It would help to have analysis from other manufacturers as well.Issue 1.2-3:Issue 1.2-4: Other PC’s are in the scope of the WI so certainly they need to be specified as well. Companies should provide proposals for PC1/PC2/PC4 values in next meeting. It seems that PC3 would be in relative terms suffering more from the higher frequency than PC1/PC2/PC4 so the delta between n260 and n262 for PC1/PC2/PC4 should be smaller than that for n260 and n262 in PC3.Issue 1.3-2: It would certainly help to understand what the expected outcome of this would be, if agreed. Some of the EIRP/REFSENS proposals are quite conservative, so having potentially significant Multiband relaxation on top of those is not reasonable. This proposal should be further clarified during this meeting.Issue 1.5-1: Ok as a minimum. We have 1GHz of spectrum in certain markets. RAN4 should consider what is the most effective way (=which channel BW, which fallback group, etc) to support those allocations, that we believe is relevant for some other FR2 bands as well. There was a contribution touching this point in previous meeting (R4-2010300). Should we WID be modified to include Intra-band CA?  |
| vivo  | Issue 1-1-2: we suggest to define requirements based on the inputs from interested companies. Another way is to specify an “offset value” based on the requirements of n259 (43.5GHz).Issue 1.1-4: share same view with QC, this could be release independent from Rel-17. Suggest to focus on PC 3 first, and then other PCs in next steps.Issue 1-2-2 and Issue 1.2-4: same comments with MOP.Issue 1-3-2: we support this proposal. |
| MediaTek | Sub-topic 1-1 Min Peak EIRPIssue 1.1-4: How to handle other power classes than PC3?Define each power class requirement one-by-one for 47GHz band. Of course, reasonable technical leverage is expected.Sub-topic 1-2 REFSENSIssue 1.2-4: How to handle other power classes than PC3?Define each power class requirement one-by-one for 47GHz band. Of course, reasonable technical leverage is expected.Sub-topic 1-3 Multiband relaxationIssue 1-3-1 & Issue 1-3-2: From Rel-16, MBR is “per band MBR”, hence, we shall consider more complete possible cases to define the single one value. In short, we basically prefer to have further study, such as consider possible quite wide band operation requirement (39+47GHz).Sub-topic 1-4 Beam correspondence Issue 1-4-1: Although the proposal is basically made sense. We prefer to define peak EIRP requirement firstly. |
| Samsung | Issue 1-1-2: We would suggest to narrow down the proposed EIRP (or Pout per element at least) as a range for the next meetingIssue 1-2-2: We would suggest to narrow down the proposed EIS (or NF at least) as a range for the next meetingIssue 1-3-2: We support this proposal to see and support n262 with existing FR2 bands  |
| Sony | Issue1.1-3: We think the peak EIRP should be decided before the spherical coverage. Besides, further analysis is needed since Form Factor Integration Loss may decrease spherical coverage performance compared to lower frequencies. Issue 1-2-2: The REFSENS template was a bit incomplete especially form factor integration loss was only shown for EIRP, not REFSENS and base band IM was also missing. Therefore, it was a bit difficult to compare result from the different contributions. Issue1.2-3: After REFSENS is decided EIS spherical coverage can be decided. Further analysis is needed since Form Factor Integration Loss may decrease spherical coverage performance compared to lower frequencies.  |
| Nokia | Issue 1-1-2: Some compromise would be needed to agree the minimum peak EIRP.Issue 1.1-3: EIRP at 50%-tile from the min peak EIRP would need to be aligned with other bands.Issue 1.1-4: Although PC3 is in high priority, other power classes are in the scope of the WI.Issue 1-2-2: Some compromise would be needed to agree the REFSENS value.Issue 1.2-3: EIS would need to be aligned with other bands.Issue 1.2-4: Although PC3 is in high priority, other power classes are in the scope of the WI.Issue 1-3-1: Can be agreed.Issue 1-3-2: The consequence of this assumption; MBR needs to be further discussed unless 1-3-1 is agreed.Issue 1-4-1 Can be agreed.Issue 1-5-1: Can be agreed.Issue 1-5-1: Can be agreed.Issue 1-7-1: Can be agreed. |
| Huawei | Issue 1.1-1: It’s not clear whether UE supporting band n262 will also support other operating bands, if yes, which band(s) should be considered with 47GHz? 28+47GHz or 39+47GHz? According to issue in 1-3-2, wide band antenna is suggested to be considered for 39+47GHz, whether the antenna would be shared among other possible bands? There is no assumption of the front end component, would it be shared as well? Those assumptions are important to derive the following requirements. Issue 1.1-2: Some assumptions in issue 1.1-1 are not clear to derive the min EIRP requirements, some more discussion is needed. Issue 1.1-3: It depends on the bands supported by the UE and the antenna design, which is not clear so far.Issue 1.1-4: Focus on PC3 firstly and other power classes will be decided later. Power classes are also closely related to the application scenarios, which should be made clear before we consider the specific power class.Issue 1-2-1: Similar to issue 1.1-1, some basic assumptions are not clear.Issue 1-2-2: Based on the clear information of implementation, we can have a better view how to define the EIS requirements. Issue 1.2-4: similar comments as 1.1-4.Issue 1-3-1 & Issue 1-3-2: Depends on which bands should be considered by the UE implantation. Open to have study of wide-band antenna solution (39 GHz + 47 GHz), but is it the only architecture to be considered? How about the 28+47GHz? Whether some study is needed to have a conclusion of feasible or not?Issue 1-6-1: Further study is needed on the possibility of reusing the existing MPR.Issue 1-7-1: (we are checking and will offer our view during second round or WF discussion) |
| T-Mobile USA | Issue 1-2-1: It is difficult to compare the numbers from different companies. Why is the array gain so much lower (5-8 dB) in the Qualcomm budget than others? Why 4 dB difference in Noise figure between 3 proposals and two others?Are Mismatch and transmission line loss plus form factor integration losses the same as Implementation loss plus packaging loss? |
| Intel | Sub-topic 1-1 Min Peak EIRPIssue 1.1-2: How is RAN4 to decide the mean peak EIRP value?Since this is the first meeting discussing the value, we anticipate more discussions and alignment are needed. As usual, we can start by discussing the average for all proposals and specific value options as potential compromises.Issue 1.1-3: What is RAN4 to decide the EIRP spherical coverage? What is the expected EIRP at 50%-tile?We should first discuss and decide the min peak EIRP value before diving into the EIRP spherical coverage requirement.Issue 1.1-4: How to handle other power classes than PC3?As we have previously done, we should have dedicated link budget discussions for each power class. Sub-topic 1-2 REFSENSIssue 1-2-2: What is RAN4 to decide the REFSENS value?Same as Issue 1.1-2. Issue 1.2-3: What is RAN4 to decide the EIS spherical coverage? What is the expected EIS at 50%-tile?We should first discuss and decide the min peak EIS value before diving into the EIS spherical coverage requirement.Issue 1.2-4: How to handle other power classes than PC3?Have dedicated budget discussions for each power class Sub-topic 1-3 Multiband relaxationIssue 1-3-1: Is the proposal by Sony and Ericsson MBP,n=0.5dB and MBS,n=0.4dB agreeable?Further study is neededIssue 1-3-2: Is the proposal by Apple, “Study of multi-band relaxation requirement shall consider wide-band antenna solution (39 GHz + 47 GHz),” agreeable?We have to consider all supported cases and account for wide-band coverage impact in the multi-band relaxation study. |
| Apple | Subtopic 1.2.1: Min Peak EIRP* Isssue 1-1-1: It is reasonable to consider a degradation compared to n259/n260 on the total conducted power for PA supporting n262, as well as, an increase in the total insertion loss.
* Isssue 1-1-2: In the work plan for n262 was agreed that we have to finalize by this meeting the band specific requirements such as EIRP/EIS. Therefore, we propose to take an average of the companies proposed values to define peak EIRP for n262.
* Issue 1-1-3: We expect a degradation on the EIRP spherical coverage, and we support that companies provide technical analysis the upcoming meeting. For this we need to have an agreement for the peak EIRP, since it is required for the analysis of EIRP spherical coverage.
* Issue 1-1-4: First we should concentrate in the definition of min EIRP for PC3, before discussing about the other power classes.

Subtopic 1.2.2: REFSENS* Isssue 1-1-1: It is reasonable to consider a degradation compared to n259/n260 due to the increase in NF, which is one of the key parameters for the estimation of REFSENS.
* Isssue 1-1-2: In the work plan for n262 was agreed that we have to finalize by this meeting the band specific requirements such as EIRP/EIS. Therefore, we propose to take an average of the companies proposed values to define peak EIS for n262.
* Issue 1-1-3: We support that companies provide technical analysis the upcoming meeting. For this we need to have an agreement for the peak EIS, since it is required for the analysis of EIS spherical coverage.
* Issue 1-1-4: First we should concentrate in the definition of min EIRP for PC3, before discussing about the other power classes.

Subtopic 1.2.3: Multi-band Relaxation* Isssue 1-3-1: No
* Issue 1-1-3: In our contribution we have shared that for the study of the multi-band relaxation for n262, we need to consider the antenna array performance when evaluating the antenna integration of 39 GHz and 47 GHz.

Subtopic 1.2.4: Beam Correspondence* Issue 1-4-1: No, we cannot agree at this stage to re-use the number from n259 without previous analysis.

Subtopic 1.2.6: MPR* Issue 1-5-1: We need to introduce UL PTRS in the reference measurement channel configuration for n262, in order to keep the same MPR for n262. Otherwise, the MPR will have to be adjusted.

Subtopic 1.2.7: Minimum Output Power* Issue 1-7-1: We will provide our comments in the 2nd round
 |

### CRs/TPs comments collection

*N/A*

## 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 1-1 Min Peak EIRP** | * PC3 min peak EIRP

Some companies commented some averaging or compromise are needed to agree the value. To be further treated in a WF#1 to have consensus.* PC3 EIRP Spherical coverage

There are different views whether EIRP can be reused from existing bands or not. To be further treated in a WF for further study.* Power class

There are contributions only on PC3. In the first round, several companies proposed focus on PC3. Some companies proposed to treat other power classes in release independent manner.To be discussed in a second round, if such approach is acceptable. |
| **Sub-topic 1-2 REFSENS** | * PC3 REFSENS

Some companies commented some averaging or compromise are needed to agree the value. To be further treated in a WF#1 to have consensus.* PC3 EIRP Spherical coverage

There are different views whether EIS can be reused from existing bands or not. To be further treated in a WF for further study.* Power class

There are contributions only on PC3. In the first round, several companies proposed focus on PC3. Some companies proposed to treat other power classes in release independent manner.To be discussed in a second-round topic, if such approach is acceptable. |
| **Sub-topic 1-3 Multiband relaxation** | There are questions which multi-band combinations are considered and what wideband antenna should be assumed. Majority view seem to be to clarify the scenarios and corresponding architectures and discuss associated relaxations.WF#2 is assigned for further discussion about multi-band aspects. |
| **Sub-topic 1-4 Beam correspondence** | A few companies commented that this needs to be checked further.To be included in a WF#1 for further study. |
| **Sub-topic 1-5 CA configurations** | Tentative agreementProposal 1: At least the fallback group 3 (CA\_262G, H, I, J, K, L and M) is specified in Rel-17.Additional configurations, if needed, can be further discussed next meeting.To be captured in WF#1 |
| **Sub-topic 1-6 MPR** | There are different views.* Existing MPR can be used: Nokia, Qualcomm
* UL PTRS or higher MPR is needed: Apple
* Further study is needed: Huawei

To be included in a WF#1 for further study. |
| **Sub-topic 1-7 Minimum output power** | Qualcomm, Huawei and Apple commented they would provide views in the second round. It is included in the second-round topic. If something is agreed in the second-round discussion, it is captured in a WF.To be included in WF#1. |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 R4-2016879 | WF on UE RF requirement of n262 | Qualcomm |
| #2R4-2016880 | WF on multi-band relaxation of n262 | Apple |

### CRs/TPs

*N/A*

## Discussion on 2nd round (if applicable)

### Sub-topic 1-7 Minimum output power

Issue 1-7-1: Is Nokia proposal “The existing minimum output power in TS 38.101-2 is applied to n262” agreeable?

As some companies are ready to provide their views, further discussion takes place here.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-7:  |

### Sub-topic 1-9 Power class

Issue 1-9-1: Can we agree to focus on PC3 for EIRP/EIS requirement and other power classes are treated in release independent manner?

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-9: |

### Sub-topic 1-10 WF on UE RF requirement of n262

This is just to collect general comments on the assigned WF.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-10: |

### Sub-topic 1-11 WF on multi-band relaxation of n262

This is just to collect general comments on the assigned WF.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-11: |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| R4-2016879 | It looks agreeable but is treated in main session due to limited review time in the 2nd round. |
| R4-2016880 | It looks agreeable but is treated in main session due to limited review time in the 2nd round. |

# Topic #2: BS RF (including TP on regulations/system parameter)

BS RF core requirement as well as conformance requirement is discussed in Topic#2.

TR template, and TPs to TR is also covered in this agenda (as .

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2015902**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015902.zip)TR 38.847 Introduction of NR Band 262 (47Ghz band) | Ericsson | A revised TR template with the assigned TR number is provided. |
| [**R4-2015903**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015903.zip)Draft CR to TS 38.104 - n262 introduction | Ericsson | BS RF requirements for band n262 is specified. |
| [**R4-2015904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015904.zip)BS RF requirements and system parameters - TP to TR 38.847 | Ericsson | A TP is provided with regulatory background, system parameters and BS RF requirements. |
| [**R4-2016155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016155.zip)47GHz band TT for NR BS RF requirement | Keysight Technologies UK Ltd | This document proposes, “Estimated MU” values which calculated by extrapolation method for setting TT values. |
| [**R4-2016191**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016191.zip)TP to TR 38.847: BS RF requirements | Nokia, Nokia Shanghai Bell | This contribution provides the text proposal on summary of expected changes to 38.104 and 38.141-2. It is proposed to agree on this text proposal. |
| [**R4-2015083**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015083.zip)TP to TR 38.847 on regulatory background and system parameters | Nokia, Nokia Shanghai Bell | A TP is provided with regulatory background and system parameters. |

## Open issues summary

### Sub-topic 2-1 MU budget

Proposed MU values are summarized in the following table. Different extrapolation schemes result in slightly different MU budgets. Nokia proposes +0.2 dB MU for 47GHz (from 40 GHz) except absolute ACLR and OBUE, while Keysight proposes larger MU.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tx test | TS 38.141-224.25 ~ 29.5GHz | TS 38.141-237 ~ 40GHz | Estimated MU47.2~48.2GHzKeysight[**R4-2016155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016155.zip) | Estimated MU47.2~48.2GHzNokia[**R4-2016191**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016191.zip) |
| EIRP | 1.7 | 2 | 2.2 | 2.2 |
| EIRP extreme | 3.1 | 3.3 | 3.5 | 3.5 |
| Output Power | 2.1 | 2.4 | 2.6 | 2.6 |
| Tx Off power | 2.9 | 3.3 | 3.6 | 3.5 |
| Relative ACLR | 2.3 | 2.6 | 2.8 | 2.8 |
| Absolute ACLR | 2.7 | 2.7 | 2.9 | 2.7 |
| OBUE (close) | 2.7 | 2.7 | 2.9 | 2.7 |

Issue 2-1-1: Should MU for Tx off power is 3.5 or 3.6 dB?

Issue 2-1-2: Should MU for Absolute ACLR be 2.7 or 2.9 dB?

Issue 2-1-3: Should MU for OBUE be 2.7 or 2.9 dB?

Issue 2-1-4: Should we accept MU for EIRP/output power/Relative ACLR that are the same between two companies?

## Companies views’ collection for 1st round

### Open issues

Moderator: Please add comments on MU budgets here.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Keysight | Sub topic 2-1: Keysight: a couple of point;1. This is to set TT, so that TT table (in 38.141-2 Annex) should be considered not for MU table in Section 4 because no study conducted for MU analysis. This also is reason why we are proposing “Estimated MU” for setting TT and “estimate MU is for purpose of setting TT.
2. As R4-2016191 pointing out, Rx TT/MU needs to be set as well, because current value is from study up to 40GHz but erroneously upper freq shows FR2 max.
3. For Rx TT by “Estimated MU” we propose following values (we missed this in our tdoc)

Rx TT/MU is more difficult for 47GHz band because No Vector Signal Generator covers up to this much of frequency. So that use of Mixer should be assumed for frequency up conversion to have 47GHz range of modulated signal for both wanted and interferer. Proposal is calculated with following;* Adding mixer uncertainty term (2.25) used in Tx Spurs MU calculation into existing value
* Add 0.2dB as other factor’s potential increase

For EIS Estimated MU for setting TT of EIS (47.2G ~ 48.2GHz)

|  |  |  |
| --- | --- | --- |
| from agreed EIS 37<f<40G value | 1.22449 | Note, agreed value 2.4/1.96 |
| Mixer uncertainty (Note) | 2.25 |  |
| combined uncertainty 1sigma | 2.561616 |  |
| Expanded uncertainty 1.96 | 5.020767 |  |
| add 0.2dB for additional estimated mergin | 5.220767 |  |
| Proposed MU EIS (2digit) | 5.2 |  |

(note, this mixer uncertainty is from TR37.941 table 12.2.3.3.-1, term A2-20)For Rx In-channel selectivity, using above value and then mixer uncertainty for interferer and add 0.2dB makes following (table is from TR37.941 table 10.5.4-3)

|  |  |  |
| --- | --- | --- |
| MU-EIS (value from above) | 2.561616 | Note, this value from above 1sigma |
| MU Test equipment(Note) | 2.423324 |  |
| MU PA (taken from TR doc) | 0.2 |  |
| ACLR-effect (taken from TR doc) | 0.4 |  |
| combined unceratinty 1sigma | 3.554487 |  |
| Expanded uncertainty 1.96 | 6.966794 |  |
| add 0.2dB for additional | 7.166794 |  |
| Proposed MU EIS (2digit) | 7.2 |  |

In summary, Rx TT to propose for 47.2G<f<48.2GHz with “estimated MU”EIS reference sensitivity: 5.2dBIn-channel selectivity: 7.2dBOther Rx TT values are all TT=0 as already shownKeysigh3: Additional Rx Estimated MU for other Rx test cases;For ACS/IBB are the same as In-channel selectivityFor Rx IM here is table based from TR37.971 table 10.6.4-2 with mixer uncertainty and CW interferer uncertainty for this frequency range;

|  |  |  |
| --- | --- | --- |
| MU-EIS (value from above) | 2.561616 | Note, this value from above 1sigma |
| MU Test equipment(Note) | 2.423324 |  |
| MU CWint (CW SG) | 1.28 | Value from R4-1807130 |
| MU PA (taken from TR doc) | 0.2 |  |
| ACLR-effect (taken from TR doc) | 0.4 |  |
| combined unceratinty 1sigma | 3.777933 |  |
| Expanded uncertainty 1.96 | 7.404748 |  |
| add 0.2dB for additional | 7.604748 |  |
| Proposed MU EIS (2digit) | 7.6 |  |

 |
| Ericsson | We don’t think we could use a linear interpolation approach to specify the MU, there is no technical rationale for such method. Nevertheless, looking at the relatively small delta, we could agree on considering adding 2-3 tenth of dB MU for 47 GHz. As we don’t think the linear interpolation approach is justified we would prefer the following valuesIssue 2-1-1: 3.5dB.Issue 2-1-2: 2.7dBIssue 2-1-3: 2.7dBIssue 2-1-4: okFor the Rx MU just proposed by Keysight, we need more analysis and propose to come back next meeting. |
| R&S | R&S: Sub topic 2-1:  43G MU can’t be reused – higher losses, performance of equipment degrades a bit with frequency.As far as extrapolation goes -– it’s an estimate. We can use MU numbers for ballpark estimation but not a value to rely for max test system uncertainty. Individual MU contributors have complex and different dependencies on the frequency. We expect it probably to be higher of 2.7 in vicinity of 3dBWe are in process of obtaining measured values – can it wait until at least next meeting with numbers proposed by the KS as a holder [2.9dB]? |
| Nokia | Issue 2-1-1: 3.5dBIssue 2-1-2: 2.7dBIssue 2-1-3: 2.7dBIssue 2-1-4: YesFor Rx MU, we are fine to conclude in the next meeting. However, it should be noted maximum OTA system uncertainty for Rx requirements (except for OTA receiver spurious emissions) is the same in 24.25-29.5GHz and 37-43.5GHz frequency range. |
| Keysight2 | To Nokia, what is reason of 0.2dB and 0dB addition on top of existing value to have 47G band? It’s not explained?For us, again, this is to set TT value.(not MU yet); 2-1-1: 3.62-1-2: 2.92-1-3: 2.92-1-4: yesHowever, also proposes to do this further towards next meeting. At least, for some of value, all agreeing to increase value for some amount. |
| Huawei | Issue 2-1-1: 3.6dB.Issue 2-1-2: 2.9dBIssue 2-1-3: 2.9dBIssue 2-1-4: ok with the proposalAlso prefer to have more inputs in next meeting to have a final decision. |

### CRs/TPs comments collection

Moderator: Please add review comments to the draft CR and TPs here.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2015902**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015902.zip)TR 38.847 Introduction of NR Band 262 (47Ghz band) | Company ACompany B |
| [**R4-2015903**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015903.zip)Draft CR to TS 38.104 - n262  | Nokia: change in Table 9.7.5.3.2.3-2 might be not needed at this time since the focus for this Band is for region where Cat B requirements do not apply.Company B |
| [**R4-2015904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015904.zip)BS RF requirements and system parameters - TP to TR 38.847 | Nokia: Nokia has two text proposals which overlap with this TP. We suggest to merge them, for BS part documents can be divided on core and performance part. |
| [**R4-2016191**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016191.zip)TP to TR 38.847: BS RF requirements | Keysight: it is good to see this TP pointing out that Rx TT/MU also needs to be considered while last meeting discussion was pointing out Tx only. Rx TT/MU also needs to be considered and added comment on topic 2-1 (but disagree with proposed value and which table to update)Ericsson: We have similar TP on the BS requirements, we should probably work on a merged version in the 2nd round and then include the TT/MU if they are agreed in the 1st round.Huawei: Further discussion on TT/MU is needed. |
| [**R4-2015083**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015083.zip)TP to TR 38.847 on regulatory background and system parameters | Ericsson: We have similar TP on the Regulatory background, we should probably work on a merged version in the 2nd round, no major issue is expected. |

## Summary for 1st round

### Open issues

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #3R4-2016881 | WF on BS MU/TT for n262 | Nokia |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2015902**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015902.zip) | Tentatively agreed. |
| [**R4-2015903**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015903.zip) | To be revised to R4-2016882. |
| [**R4-2015904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015904.zip) | To be revised to R4-2016883.Merge with R4-2015083The conformance part is included in R4-2016191. The clause structure may need to be aligned. |
| [**R4-2016191**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016191.zip) | To be revised to R4-2016884. |
| [**R4-2015083**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015083.zip) | To be noted. |

## Discussion on 2nd round (if applicable)

The revised documents and WF#3 are for discussion.

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| **R4-2016881** | Tentatively agreed. |
| **R4-2016882** | Tentatively agreed. |
| **R4-2016883** | Tentatively agreed. |
| **R4-2016884** | Tentatively agreed. |

# Topic #3: RRM

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2016179**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016179.zip)Analysis of RRM requirements for 47 GHz band | Ericsson | Observation 1: For FR2 bands band group which is part of core requirements, depend on REFSENS and UE power class.Proposal 1: Band group for n62 in clause 3.5, TS 38.133 will be defined after RF group has agreed the REFSENS values for corresponding UE power classes for band n62. Observation 1: The main impact is defining the minimum signal levels (e.g. min SSB-RP), which depends on the antenna gain and REFSENS, which in turn depend on the UE power class.Proposal 2: Minimum signal levels (e.g. SSB\_RP) in the conditions in clauses B.1-B.2, TS 38.133 will be defiend after RF group has agreed the REFSENS values for corresponding UE power classes for band n62.Proposal 3: Impact of minimum signals (e.g. min SSB\_RP level) on the existing RRM measurement accuracy tests can be assessed once conditions on the minimum levels is finalzed.Moderator comment: n62 should be changed to n262. |

## Open issues summary

### Sub-topic 3-1 RRM requirement for n262

Issue 3-1-1: Can each observation and proposal in R4-2016179 agreeable?

Issue 3-1-2: Is there any other open issue to be further discussed?

## Companies views’ collection for 1st round

### Open issues

Moderator: Please add your 1st round comments on RRM here.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Sub topic 3-1: RRM requirement for n262: OK with the proposals. |

### CRs/TPs comments collection

*N/A*

## 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:* |
| **Sub-topic 3-1****RRM requirement for n262** | *Tentative agreements:*Proposal 1: Band group for n262 in clause 3.5, TS 38.133 will be defined after RF group has agreed the REFSENS values for corresponding UE power classes for band n262. Proposal 2: Minimum signal levels (e.g. SSB\_RP) in the conditions in clauses B.1-B.2, TS 38.133 will be defined after RF group has agreed the REFSENS values for corresponding UE power classes for band n262.Proposal 3: Impact of minimum signals (e.g. min SSB\_RP level) on the existing RRM measurement accuracy tests can be assessed once conditions on the minimum levels is finalized. |

### CRs/TPs

*N/A*

## Discussion on 2nd round (if applicable)

*N/A*

## Summary on 2nd round (if applicable)

*N/A*

# Topic #4: Others (WID and UE/BS Demod)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2016461**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016461.zip)Revised WID: introduction of NR 47 GHz band | T-Mobile USA, Dish Network | A revised WID draft including the assigned TR number is provided. |
| [**R4-2016096**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016096.zip)Simulation results on UE demodulation performance impact by the introduction of NR 47GHz band | Ericsson | In this paper, we provide with our simulation results as input to the discussions on UE demodulation performance aspect of this WI. |
| [**R4-2016097**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016097.zip)On demodulation requirements for the new 47GHz band | Ericsson | Proposal 1: Re-use existing UE and BS demodulation requirements. No need for any new demodulation requirements in this WI.Proposal 2: Check and confirm the BS link budget for the next meeting, considering in particular the assumption for the RX sensitivity and the likely available PA output power in the test set-up.Proposal 3: Check and confirm the link budget for the next meeting |

## Open issues summary

### Sub-topic 4-1 WID revision

If there is any comment to the draft WID revision R4-2016461, please leave comments for Sub-topic 4-1 so that the WI proponent can take them into account.

The moderator intention is to note the WID. The WID revision is expected next RAN Plenary.

### Sub-topic 4-2 UE Demod

Issue 4-2-1: Is analysis in R4-2016096 agreeable?

Issue 4-2-2: Are proposals on UE demod in R4-2016097 agreeable?

### Sub-topic 4-3 BS Demod

Issue 4-3-1: Are proposals on BS demod in R4-2016097 agreeable?

## Companies views’ collection for 1st round

### Open issues

Moderator: Please add your 1st round comments here!

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Sub topic 4-1: WID revision : OK with the revision.Sub topic 4-2: UE Demod OK with the proposals. Simulation analysis (R4-2016096) can be noted a usual.Sub topic 4-3: BS Demod: OK with the proposals. |

### CRs/TPs comments collection

*N/A*

## 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 4-1WID revision | R4-2016461 is to be noted.To be submitted to RAN Plenary for approval. |
| Sub topic 4-2 and 4-3 | R4-2016096 is to be noted.R4-2016097 is tentatively agreed. |

### CRs/TPs

*N/A*

## Discussion on 2nd round (if applicable)

*N/A*

## Summary on 2nd round (if applicable)

*N/A*