**3GPP TSG-RAN WG4 Meeting # 97-e R4-200XXXX**

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

**Agenda item:** 13.2.2, 13.2.3, 13.2.4

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [97e][141] FS\_52\_to\_71GHz\_Part\_2

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion and provide some guidelines for email discussion if necessary.*

The following agenda items will be discussed during email discussion:

* Topic #1 (Agenda 13.2.2): BS aspect
	+ R4-2015948 will be discussed under this agenda.
* Topic #2 (agenda 13.2.3): UE aspect
* Topic #3 (agenda 13.2.4): Others
	+ R4-2015948 moved to topic #1

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

* 1st round: TBA
* 2nd round: TBA

# Topic #1: BS aspect

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014401 | CATT | Observation 1: The BS antenna gain for 52.6-71GHz may need to be larger than gain for 45 GHz considering the large path loss and the larger noise figure (NF), details can be discussed in WI phase.Observation 2:- The noise figure for 52.6-71GHz is expected [2] dB larger than 45 GHz.- The same NF assumption can be used for all BS classes.Observation 3: The BS architecture for existing FR2 is applicable for 52.6 – 71 GHz.Observation 4: FR2 and BS type 2-O terms can be reused by the 52.6-71 GHz frequencies.Observation 5: The BS classes defined in TS 38.104 for AAS BS are applicable for BS in 52.6-71 GHz.Proposal 1: It is proposed to agree on the corresponding text proposal for TR 38.808[4] in the annex. |
| R4-2014977 | Ericsson | Observation 2.2-1:As expected, the PA trend analysis show that both achievable output power and PAE degrades over frequency and for 52 to- 71 GHz will be worse compared to existing FR2 bands. This makes the thermal aspects more challenging for 52 to 71 GHz compared to FR2 bands as the area for radiating elements also will be smaller.Observation 2.2-2:Initial analysis of PA dependencies indicates a feasible ACLR range of 20 to 25 dB for 52 to 71 GHz considering reasonable power efficiency needed to handle the thermal aspects. As we expect larger bandwidths for 52 to 71 GHz, the bandwidth aspects should also be weighted in.Observation 2.3-1:Since the array antenna model parameters are dependent parameters must be selected carefully to maintain composite array antenna gain normalization. |
| R4-2015200 | Nokia, NSB | Observation 1: 40 dBm EIRP can be expected to be met with 4x8 array whereas 60 dBm EIRP requires an 16x16 array.Observation 2: The antenna array sizes do not significantly differ from current FR2 operation and therefore also beamwidths are similar.Observation 3: Co-existence study for this frequency range has already been documented in TR 38.803Observation 4: As co-existence study is already done, justification is needed to start more detailed antenna modelling exercise.Proposal 1: Use the above array sizes as baseline for RAN4 evaluations, when needed.Proposal 2: Extract the ACLR and ACS requirements from TR 38.803Proposal 3: If ACLR value is adjusted compared to current FR2 operating bands, also other related emission requirements, like OBUE and absolute ACLR, should be re-evaluated and adjusted if there is a need. Regulatory requirements need to be respected.Proposal 4: Evaluate if transient times can be improved.Proposal 5: Using wider measurement bandwidths should be considered for NR operation above 52.6 GHz.Proposal 6: Agree the TP to 38.808 to reflect the antenna configurations, co-existence study status and phase noise performance. |
| R4-2015947 | Huawei | TP to TR 38.808 on BS architecture and BS classes for 52 – 71 GHz was provided. |
| R4-2015948 | Huawei | TP to TR 38.808 on PA trends and noise figure |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1

*Sub-topic description: Antenna array size*

*Open issues and candidate options before e-meeting:*

**Issue 1-1: Antenna array size**

* Proposals
	+ Option 1: No significant difference from FR2 (Nokia; R4-2015200)
* Recommended WF
	+ Agree on the option 1

### Sub-topic 1-2

*Sub-topic description: Noise figure medication in the new frequency range from FR2 assumption*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: Noise figure assumption**

* Proposals
	+ Option 1: NF 52 – 71 GHz is [2] dB larger than 45 GHz (CATT; R4-2014401)
	+ Option 2: BS NF 7 dB; UE NF 10 dB (13 dB optionally) (Huawei; R4-2015948)
* Recommended WF
	+ Based on TR 38.803, the option 1 seems to be aligned with the previous RAN4 reply to WP5D. CATT needs to further clarify this aspect. In the meantime, companies are encouraged to share views during 1st round discussion.

### Sub-topic 1-3

*Sub-topic description: ACLR in 52.6 – 71 GHz*

*Open issues and candidate options before e-meeting:*

**Issue 1-3: ACLR**

* Proposals
	+ Option 1: ACLR 20 – 25 dB (Ericsson; R4-2014977)
	+ Option 2: Extract ACLR and ACS from TR 38.803 (Nokia; R4-2015200)
		- If ACLR is adjusted from the existing FR2, other related emission requirements, like OBUE and absolute ACLR, should be re-evaluated and adjusted if necessary. Regulatory requirement needs to be respected.
* Recommended WF
	+ Encourage companies to share views during 1st round discussion

### Sub-topic 1-4

*Sub-topic description: Transient period*

*Open issues and candidate options before e-meeting:*

**Issue 1-4: Transient period**

* Proposals
	+ Option 1: Evaluate if transient period can be improved (Nokia; R4-2015200)
	+ Option 2: Keep the same as FR2 requirement
* Recommended WF
	+ Agree on the option 1

### Sub-topic 1-5

*Sub-topic description: Measurement bandwidth medication in 52.6 – 71 GHz*

*Open issues and candidate options before e-meeting:*

**Issue 1-5: Measurement bandwidth**

* Proposals
	+ Option 1: Wider measurement bandwidth should be considered in 52.6 – 71 GHz (Nokia; R4-2015200)
	+ Option 2: Keep the same as FR2 assumption
* Recommended WF
	+ Agree on the option 1

### Sub-topic 1-6

*Sub-topic description : TP for TR 38.808*

*Open issues and candidate options before e-meeting:*

**Issue 1-6: TP for TR 38.808**

* Proposals
	+ Option 1: TP in R4-2014401 (CATT)
	+ Option 2: TP in R4-2014977 (Ericsson)
	+ Option 3: TP in R4-2015200 (Nokia)
	+ Option 4: TP in R4-2015947 and R4-2015948 (Huawei)
* Recommended WF
	+ Companies are encouraged to share views during the 1st round disucssion

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Charter Communications, Inc. | **Issue 1-2: Noise figure assumption**Option 1: NF 52 – 71 GHz is [2] dB larger than 45 GHz (CATT; R4-2014401)**Issue 1-3: ACLR**Option 2: Extract ACLR and ACS from TR 38.803 (Nokia; R4-2015200)**Issue 1-5: Measurement bandwidth**Option 1: Wider measurement bandwidth should be considered in 52.6 – 71 GHz**Issue 1-6: TP for TR 38.808**Option 3: TP in R4-2015200  |
| Ericsson | Sub topic 1-1: We have a different proposal including different sizes for different deployment scenarios. For this specific frequency range, it is essential to enlarge the antennas to compensate for degraded RF performance in terms of output power and noise figure. Therefore, larger antennas need to be studied. We propose complete sets for larger antennas in R4-2014977. Also, the FR2 antenna parameters can not be re-used directly, parameters need to be adjusted to captured correct absolute gain. Sub topic 1-2: For the noise figure it is essential to collect technical information on trends to RAN4 can conclude on relevant noise figure values and relevant implementation margins. Just using information from TR38.803 may not be the correct way here. We should use information from ETSI in combination with a noise figure trend analysis. Sub topic 1-3: For this range we can not use information from TR 38.803, since it’s not relevant and obsolete. Instead new information is collected for the specific frequency range. Based on that we propose a relevant range to consider in the SI. Option 1 gives the range to consider 20 to 25 dB. This range is an indication a more thorough study is needed for relevant CBW.Sub topic 1-4: For this specific frequency range we suggest to stay with transient times used for FR2. We prefer option 2.Sub topic 1-5: For the study we can use FR2 measurement bandwidths as a starting point. Later in conformance testing we may need to consider other more wider bandwidths due to poor testability reasons. Sub topic 1-6: For TR 38.808, we now need to collect as much information relevant for this frequency range. We need to find a proper structure for the TR, which we propose in R4-2014980. Then we need to merge information together to avoid collisions. See comments below. |
| CATT | **Issue 1-1: Antenna array size**Considering the larger path loss in 52-71 GHz compared with 45 GHz, we think BS antenna array size may be larger. It’s too early to say no change with current FR2 in SI stage.**Issue 1-2: Noise figure assumption**Our views referred TR 38.803, certainly the final decision needs more views and more study.**Issue 1-3: ACLR**We’re not sure if this decision can be made in SI phase. We prefer to do co-existence simulation if the antenna configuration will be changed.**Issue 1-4: Transient period**It should be defined in WI phase considering both system request and implementation capability. The system request is related to the numerology which is not decided yet.**Issue 1-5: Measurement bandwidth**We tentatively agree the direction but we would like to discuss it after the SCS and CBW are concluded. |
| Intel | **Issue 1-2:** Option 1**Issue 1-3**: Prefer Option 2 which is within the range of the proposal 1.**Issue 1-4:** Option 1**Issue 1-5:** We understand the motivation and tend to agree with option 1. Final decision might be depending on CBWs.**Issue 1-6:** We prefer R4-2015200 (Nokia) as a baseline and revise based on the discussion. |
| ZTE | **Issue 1-1: Antenna array size**Firstly, we need to consider the deployment scenarios and use case, secondly, we could also see the possbility to have larger antenna array for wide area deployment.**Issue 1-2: Noise figure assumption**We think we could use TR 38.803 as baseline for further discussion and final decision should be made at the WI phase instead of SI phase.**Issue 1-3: ACLR**Similar Issue 1-1, if antenna array size could be updated for 52.6-71GHz and deployment scenarios could also vary, therefore we think more discussions are needed, it’s premature to draw the conclusion.**Issue 1-4: Transient period**Transient period should be based on the hardware capability discussion, we think PA ramping time, PLL stablization time and turn on the RF chain time should be further discussed for 52.6-71GHz, we cannot directly reuse the existing FR2 requirements**Issue 1-5: Measurement bandwidth**We are open to further discuss this issue whether larger measurement bandwidth could be allowed considering relative larger channel bandwidth. |
| Nokia, Nokia Shanghai Bell  | **Sub-topic 1-1:**This was actually an observation in the Tdoc but perhaps good to discuss as it has relevance towards the proposed TPs. Naturally antenna array size used in RAN4 analysis should not preclude implementation options but realism need to be maintained. Array configurations presented in R4-2014977 going up to 32-by-64 elements and above 80 dBm EIRP are not realistic. **Sub-topic 1-2:**It seems to option 2 does not correctly present the associated contribution. The contribution captures typical noise figures ranging from 10 dB to 13 dB in the TP. The same source of information was used also for 7-24 GHz study and can be applied also here.  **Sub-topic 1-3:**Option 2. This should apply for both UE and BS but it appears the corresponding proposal is missing from the UE section. Option 2 will results in ACLR which is within the range of option 1. **Sub-topic 1-4:**option 1 **Sub-topic 1-5:**option 1 **Sub-topic 1-6:**combination of option 3 and R4-2015948. PA study and noise figure are captured very clearly in R4-2015498.  |
| Huawei | Issue 1-1: Antenna array size FR2 reference can be used as baseline but not to be used as the conclusion of this SI (it was proposed in Nokia tdoc to use singe 70GHz antenna array example for RAN4 evaluations). Set of considered use cases for FR2 and 52-71GHz range is not the same. We suggest to extend the list of the example antenna arrays during this meeting. Issue 1-2: Noise figure assumptionWe should collect the available information – this is also as per WF agreed last meeting (which mentioned the ETSI TR source). If the NF from TR 38.803 is used as source and expanded by [2] then we end up with 14 dB. On the other hand, the ETSI sourced NF values are in range of 10-13 dB (+3-4 dB industrial margin).What is the source for the [2] offset and would it be valid for the whole 52-71 range?Issue 1-3: ACLRMore study needed during WI in order to account for RF impairments. Decision on requirements is outside SI. Issue 1-4: Transient periodObservation on the timing issues may be cultured in the “timing” TP in topic [140]. The requirement itself is not to be decided in SI. We share CATT view that this is related to SCS, which is not decided. Issue 1-5: Measurement bandwidthSimplification/speedup of testing would be welcome. Still, measurement bandwidth is considered to belong to the Performance part of the future WI, i.e. this is way too early to decide. Also, TE vendors inputs may be required here. MB values were adjusted for NR in FR2, and can be seen as the starting point. Issue 1-6: TP for TR 38.808One suggestion: We shall not decide on the listed options as those TP cover various mixes of topics – we shall rather split the technical topic areas (e.g. BS classes, PA trends, NF values, RF requirements, etc.) and to apply the worksplit among the contributing companies. Of course this is to be decided by moderator.  |
| Qualcomm | Issue 1-1: Antenna array size It seems reasonable to start with FR2 as a starting point, however discussion an analysis should be allowed to diverge based on company inputs.Issue 1-2: Noise figure assumptionWe agree NF will be higher in FR2x than FR2. The amount should be determined in the WI phase.Issue 1-3: ACLRSome interference study and feasibility should be considered before values are chosenIssue 1-4: Transient periodCompanies should bring some more analysis during the WI phase to determine what is achievable and acceptable.Issue 1-6: TP for TR 38.808I think the moderator should create round 2 thread to discuss these and try to come up with a consolidated TP that we can agree on during this meeting. |

### 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** |
| R4-2014401 | Ericsson: for the SI we need to collect information on reasonable antenna parameters. We can probably merge and consolidate data from other contribution and find relevant parameters sets. Regarding gain values for OTA sensitivity and BS classes, we think that is for the WI to decide on. The SI TR focus is to collect information capturing technology aspects. |
| CATT: Our analysis is the preliminary thinking and some of them are overlapped with other contributions. We’re happy to provide the TP for BS transmitters and receivers, if a new TP can be assigned and the contents are agreeable by companies.. |
| Nokia, Nokia Shanghai Bell: The TP captures many aspects as needing further study or not being sure about them. Rather than writing down for each requirement that they are just FFS, we should detail out the actions needed to guide future contributions. We don’t really see the added value of the individual requirement analysis how it is stated now, and disagree with some specific points like requiring a new study for ACLR/ACS. |
| HuaweiNF: as per WF last meeting, more inputs on the NF are provided in TP in R4-2015947.BS classes, BS architecture: this topic was part of the WF last meeting so some observations of envisioned BS classes shall be captured in the TR. There is also BS classes TP in R4-2015947. BS TX/RX characteristics: we see some bene fits of looking into specific requirements and capturing selected observations (but no decisions as such) on the RF requirements and topics to be studied in WI. On the other hand, there was not much inputs, nor time for companies to do proper analysis. Maybe this RF Tx/Rx part of the TP can be simplified to remove controversial parts. Based on the above, moderator driven worksplit for TP revisions seems to be needed. |
| R4-2014977 | Ericsson: Technical background information relevant for this frequency range. |
| CATT: For the antenna characteristics clause, we generally agree the antenna size would be larger. But some clarification is needed. For the two sets of BS antenna array parameters in Table 4.2.6.2.2-1, are they for different deployment scenarios? We would like to take them as a starting point but not an agreement in SI stage. |
| Nokia, Nokia Shanghai Bell: The PA study is captured better in R4-2015948, that TP is preferred. Antenna model is very generic but it is unclear how to antenna model is intended to be used during the SI and WI. Further clarifications on this aspect are needed before agreeing the model. The chosen parameters for the antenna model are not realistic. Especially the antenna array sizes and beamsteering ranges are too large. We should keep the example antenna array sizes roughly similar as used in RAN1 study. |
| Huawei: PA analyses: as per WF and referring to the approach in TR38.820, we suggest merging inputs from this TP and from TP in R4-2015948, where the latest PA survey was used for multiple RF technologies (not just GaAs and GaN). For the BS array parameters and models: this TP is to RAN1 TR 38.808, which already include BS antenna model used by RAN1 for the performance evaluations in Annex A. It is unclear what would be the purpose of adding this array info into RAN4 part. we can come back to the array modeling if needed in RAN4 in WI. For the output power vs. ACLR: it shall be clarified in text and figures that this is just one example realization – it shall not limit be perceived as any sort of limitation for future WI.This TP also includes indications on the ACLR – it needs to align with the Issue 1-3. |
| R4-2015200 | Ericsson: Subclause 4.2.1, we cant agree with. It’s a decision for the WI. Subclause 4.2.2, we need to update to also include information from other vendors. Also, there is an error in the plots. Subclause 4.2.3, needs to also include information on larger antennas. In the table we have a lot of new information not really considered before. E.g. the loss is just captured as one value attached to the element, here coupling aspects are included. There is no technical background why the antenna modelling approach is changed. Is it really needed? |
| CATT: As commented in 1.2. We’re not ready to agree the co-exist and BS antenna array observations in this TP. |
| HuaweiCo-existance: referring to previous 45GHz and 70GHz co-ex work is ok to be considered as the background information, but we would suggest not to draw conclusions from that work, e.g. we may need to revisit certain assumptions for the followup WI to account to the 52-71 specific use cases. For instance, ACLR and ACS modelling in TR 38.803 was assuming omni antenna at UE – whether this assumption shall be kept for 52-71GHz is FFS for RF requirements derivation.Phase noise part of the TP needs sync with the discussion in topic [140] – it would be more efficient extract the PN part as separate TP.ACS/ACLR: we would suggest to treat TR 38.803 information as background, but not to decide in SI that ACS/ACLR levels are to be extracted from TR 38.803. BS aspects also covered in the TP in R4-2015947 and other TPs. Proposal 1: there is one example of antenna array (for 70GHz) proposed to be used for RAN4 evaluations. We propose to extend the list of example arrays with more example arrays. Whether 70GHz or 60GHz proxy (as used in other contributions of this SI) shall be used can be also debated. List of example arrays probably may contain both to depict diversity in the achievable EIRP values.Transient time: it would be ok to capture some observations on timing aspects – this can be done in the “timing” TP in topic [140]. Measurement BW: This is valid observation, related to the testing simplification already applied for FR2. Still, this is related to the Performance part of the WI. Inputs from TE vendors may also be needed. |
| QualcommCoexistance: We can start with 38.803 however we need to discuss how much we can re-use and where there are differences. Phase noise: Some of this information is useful for the TR. It may be premature to say other LO architectures do not need to be considered.Antenna arrays: It is premature to say antennas do not have to be evaluated. Some more technical discussion is needed too determine whether this is true. |
| R4-2015947 | Ericsson: In this contribution I can’t really see any information relevant for the SI. Its more suitable for the coming WI TR. |
| CATT: Some clarification is needed for the non-AAS architecture for 52.6-71GHz. |
| Nokia, Nokia Shanghai Bell: For potential further study of low cost indoor deployment BS products we should not limit to considering inputs only from operators taking into account that such deployment may be targeted also for for unlicensed operation. It is unclear for us what is meant by the antenna array performance evaluation in follow-up WI. This sentenced can be removed but naturally companies can bring contributions on topics where they see further work is needed. There is also a minor typo in the last paragraph, the start point of the frequency range should be 52.6 GHz.  |
| Huawei: inputs in this TP are based on the BS WF agreements from previous meeting - findings are 52-71GHz oriented, including 52-71 specific deployment scenarios considerations.If needed we can address the “non-AAS” clarification in section 4.2.3.1 in the revision (CATT concern to be clarified first).The “antenna array performance evaluation” was meant to address examples arrays with RF impairments considered towards derivation of realistic EIRP values (as exemplified is some other contributions this meeting). |
| QualcommI agree the BS array study should continue in the WI |
| R4-2015948 | Ericsson: Regarding the PA trends, we prefer the figures in R4-2014977 based on the same data. The reason is that they better show the trend, that power goes down at high frequencies. Also, we don’t need to list the peak sat power, since that can be miss leading. The plots also have not relevant data, like oscillator and multipliers. The noise figure information is on to include after some small corrections. E.g. the table can be narrowed down to focus of 52 to 71 GHz only. |
| CATT: The noise figure information seems too optimistic, we would like to keep it open until WI. |
| Huawei: as per WF and referring to the approach in TR38.820, we suggest merging inputs from this TP and from TP in R4-2015948, where the latest PA survey was used for multiple RF technologies (not just GaAs and GaN). For the NF: it shall be clarified that the IM values shall be also accounted based on ETSI TR inputs. In our opinion we are not deciding the NF values in this TP – probably this is something that shall be clarified for the whole RAN4 part of this TR. |
| Qualcomm: The PA data summary is interesting but the reason that is in the TP is unclear. What is missing is a description of how this data will be helpful in the WI or implementation. I see maximum Psat, however if I look at CMOS at 22 dBm, there is no way a UE could use PAs like that in an array as the power consumption would be way to high. If the reason for the PA data is described it may or may not be helpful in the TR |
| R4-2014980 | Huawei: due to multiple TPs addressing various mixes of BS topics, it seems that we need to apply worksplit among companies and to divide technical areas – we can arrange the sections structure while revising those TPs. This “skeleton” does not seems to be necessary. This is to be decided by moderator/rapporteur.  |

## 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#1** | *Tentative agreements:** *Issue 1-4: Evaluating improved transient period seems to be agreeable. This can be part of evaluation of SCS feasibility. Companies are encouraged to provide input during SI phase but final decision will be made during WI phase.*
* *Issue 1-5: It seems companies agree with the motivation. However, it is too early to decide at the moment without agreeing applicable CBWs. Suggest to postpone the decision in WI phase.*

*Tentative agreement: Interested companies are encouraged to provide technical input and/or evaluation during SI phase, if any. Final decision will be made after CBWs decision.**Candidate options:**Recommendations for 2nd round:** Issue 1-1: Antenna array size

Views are diverged and more technical discussion is required during the 2nd round discussion.* Issue 1-2: Noise figure

Continue the discussion in the 2nd round.* Issue 1-3: ACLR

Continue the discussion in the 2nd round. It was already agreed the feasible ACLR is 20 – 25 dB in the WF (R4-2011837). Option 2 is in the range of option 1 and it seems two options are not that far and does not conflict. Companies are encouraged to share views.* Issue 1-5: MBW

Companies are encouraged to share views any technical issue or benefit during the 2nd round discussion and potentially in the next meeting. The final decision will be made once CBWs are decided.* Issue 1-6: TP for TR 38.808

Continue the discussion in the 2nd round. Suggest R4-2015200 (Nokia) as a baseline and companies are encouraged to participate the discussion to come up with a single TP. Moderator might ask one to lead this effort. |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| **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)

* Issue 1-1: Antenna array size

Views are diverged and more technical discussion is required during the 2nd round discussion.

* Issue 1-2: Noise figure

Continue the discussion in the 2nd round.

* Issue 1-3: ACLR

Continue the discussion in the 2nd round. It was already agreed the feasible ACLR is 20 – 25 dB in the WF (R4-2011837). Option 2 is in the range of option 1 and it seems two options are not that far and does not conflict. Companies are encouraged to share views.

* Issue 1-5: MBW

Companies are encouraged to share views any technical issue or benefit during the 2nd round discussion and potentially in the next meeting. The final decision will be made once CBWs are decided.

* Issue 1-6: TP for TR 38.808

Continue the discussion in the 2nd round. Suggest R4-2015200 (Nokia) as a baseline and companies are encouraged to participate the discussion to come up with a single TP. Moderator asked Nokia to lead this effort.

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| **Company** | **Comments** |
| Ericsson | * Issue 1-1: Antenna array size: We need to add model and parameters relevant for this frequency range, to avoid confusion in RAN4 WI and by other users of the information. Also, multiple sets of antenna parameters are required to facilitate different types of implementations for different types of deployment scenarios.
* Issue 1-2: Noise figure. Some information is captured, eventually we can add with some published information to make the analysis complete.
* Issue 1-3: ACLR: We need to capture technical background information on how typical ACLR characteristics can look like for this range. The input will then be used in the WI when requirement levels are determined.
* Issue 1-5: MBW: Lets first decide on the CBW support.
* Issue 1-6: TP for TR 38.808: Some information is captured, still some information is not captured (e.g. ACLR input and antenna parameter and model input)
 |
| Huawei | * Issue 1-1: Antenna array size: there are various use cases and the considered frequency range is wide. Therefore consideration of values array sizes and resulting EIRP values (this does not have to be limited by specific regulatory limits, which will be regional) is reasonable.
* Issue 1-2: Noise figure: inputs to TR were considered already, but ok to provide more inputs.
* Issue 1-3: ACLR: focus on observations – requirements itself is obviously for WI phase
* Issue 1-5: MBW: comments provided already to the WF text. Ok to capture some observations in the TR. MBW itself may require inputs from TE vendors.
* Issue 1-6: TP for TR 38.808: some agreements from WF may be worth to be captured in TP (next meeting?)
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## 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*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: UE aspect

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014975 | vivo | Initial MPR results for B52.6G was provided based on CMOS PA models. |
| R4-2015444 | Nokia, NSB | Observation 1: Based on our MPR (Maximum power reduction) simulations modulation quality (EVM) is often the limiting for the achievable maximum transmit for NR from 52.6 GHz to 71 GHz Observation 2: Implementation losses need special attention to guarantee high EIRP output and therefore good UL link budget. Observation 3: Multi-cluster allocations increase the PAPR of the signal, and in some cases causes narrow spectral peaks which easily clash with emission limits, resulting in need of higher MPR.Observation 4: Co-existence study for this frequency range has already been documented in TR 38.803Proposal 1: RAN4 strives to keep UE implementation loss budget reasonably small for NR operation above 52.6 GHz to ensure good UL link budget.Proposal 2: RAN4 to consider whether multi-cluster UL allocations are useful for above 52.6 GHz frequency range or whether contiguous allocations are sufficient.Proposal 3: Almost contiguous allocations shall be specified for above 52.6 GHz operation as the MPR impact is smaller than for multi-cluster allocations.Proposal 4: Evaluate and update On-Off transient times for NR operation above 52.6 GHz.Proposal 5: RAN4 to evaluate what are reasonable measurement bandwidths to be used above 52.6 GHz.Proposal 6: Extract the ACLR and ACS requirements from TR 38.803 |
| R4-2016371 | Huawei | Proposal 1: To include memory effect in the PA models, let’s consider one of the three models: MP, Hammerstein or Wiener. Proposal 2: Among different estimation methods let’s consider least square error algorithm, as it is simple enough to apply with a reasonable performance. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: PA model for memory effect**

* Proposals
	+ Option 1: Consider one of three modes: MP, Hammerstein, or Wiener (Huawei; R4-2016371)
* Recommended WF
	+ The option 1 seems a contradict to the WF (R4-2011840) in RAN4#96e where there is no common PA model in RAN4 and each company could have their own model including measurement based one. While Huawei further clarify the motivation, companies are encouraged to share views during the 1st round discussion.

### Sub-topic 2-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: Multi-cluster allocation vs contiguous allocation for above 52.6 GHz**

* Proposals
	+ Option 1: Consider whether multi-cluster UL allocations are useful for above 52.6 GHz frequency range or whether contiguous allocations are sufficient (Nokia; R4-2015444)
* Recommended WF
	+ Companies are encouraged to share views during the 1st round discussion

### Sub-topic 2-3

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-3: Almost contiguous allocation**

* Proposals
	+ Option 1: Specify almost contiguous allocation in 52.6 – 71 GHz (Nokia; R4-2015444)
* Recommended WF
	+ Companies are encouraged to share views during the 1st round discussion

### Sub-topic 2-4

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-4: On-off transient period**

* Proposals
	+ Option 1: Evaluate and update On-Off transient times for NR operation above 52.6 GHz (Nokia; R4-2015444)
	+ Option 2: Keep the existing FR2 requirement
* Recommended WF
	+ Companies are encouraged to share views during the 1st round discussion

### Sub-topic 2-5

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-5: Measurement bandwidth**

* Proposals
	+ Option 1: evaluate what are reasonable measurement bandwidths to be used above 52.6 GHz (R4-2015444)
* Recommended WF
	+ Agree on the option 1

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications, Inc. | **Issue 2-2: Multi-cluster allocation vs contiguous allocation for above 52.6 GHz*** + Option 1: Consider whether multi-cluster UL allocations are useful for above 52.6 GHz frequency range or whether contiguous allocations are sufficient (Nokia; R4-2015444)

**Issue 2-3: Almost contiguous allocation*** + Option 1: Specify almost contiguous allocation in 52.6 – 71 GHz (Nokia; R4-2015444)

**Issue 2-5: Measurement bandwidth** * + Option 1: evaluate what are reasonable measurement bandwidths to be used above 52.6 GHz (R4-2015444)
 |
| Ericsson | Sub topic 2-1: We have discussed PA models many time for different purposes and never agreed. Maybe we shall follow the WF from last meeting. Sub topic 2-2:Sub topic 2-3:Sub topic 2-4: We prefer option 2. Actually, what is dimensioning for Guard Period is min(BS\_transients, UE\_transients) and BS\_transients = 3 µs and UE\_transients = 5 µs.Sub topic 2-5:  |
| Intel | Issue 2-1: We want to keep the WF (R4-2011840) where no common PA model in RAN4.Issue 2-2: We would like to understand overall benefit of multi-cluster allocation in 52.6 – 71 GHz.Issue 2-3: We would like to understand the motivation of almost contiguous allocation in 52.6 – 71 GHz as almost contiguous allocation has been specified in only FR1 and not FR2.Issue 2-4: Option 1.Issue 2-5: Option 1. At least evaluation of reasonable MBW is necessary. Final decision should be made after CBW decision. |
| Nokia, Nokia Shanghai Bell  | **Sub-topic 2-1:**We don’t think RAN4 should embark on common modeling journey. However, companies are allowed to present simulation results which include memory effects. We welcome Huawei to present such results to demonstrate the relevance of the model. **Sub-topic 2-2:**It appears the contribution has a misalignment with the body text and the conclusion section. The proposal is stated more clearly in the body: **Proposal 2: Requirements for multi-cluster UL allocations are not specified for NR operation above 52.6 GHz.**Clearly we do not see multi-cluster useful for this frequency range.**Sub-topic 2-3:**Option 1  **Sub-topic 2-4:**Option 1**:**Too long UE Tx Off-On transient impacts negatively on BS demodulation performance in the field and improvements should be strived for.  **Sub-topic 2-5:**Option 1.   |
| Huawei | Issue 2-1: PA model for memory effect Our intention was not to force a common PA model in RAN4. Instead, we encourage the incorporation of memory effect into PA models, given the large CBWs to be used in this frequency range. Which memory model to be used is up to individual company.Some more comments in relation to PA model in R4-2015444: It’s important to discuss the EVM budget for different impairments such as PN, PA nonlinearity, image, etc. If PN is not modelled in the simulations (as mentioned in this tdoc), the corresponding EVM budget should be deducted from the overall EVM target. As a result, even larger MPR may be required. Furthermore, regarding MPR: little MPR difference observed between 400 MHz and 2160 MHz BW is probably due to the fact that a memoryless PA model was used. If a memory based model is used the MPR difference would be higher because the more the BW, the more the memory effect and the more signal spectral imbalance happens.**Issue 2-2: Multi-cluster allocation vs contiguous allocation for above 52.6 GHz**Clarification question: is the proposed exclusion of multi-cluster operation applicable to the licensed operation in single CC? More clarification would be needed. Was the assumed transmission for interlaced or contiguous RB allocation (in reference to the figure 1 in R4-2015444)?For NR-U, it is possible to support multi-cluster allocation meet the regulation requirement.**Issue 2-3: Almost contiguous allocation**Need further study, it depends on PUCCH design.**Issue 2-4: On-off transient period** Prefer option 2 currently.**Issue 2-5: Measurement bandwidth** Should wait for CBM conclusion. |
| Qualcomm | **Issue 2-1: PA model for memory effect*** **Companies need to use their own models.**

**Issue 2-2: Multi-cluster allocation vs contiguous allocation for above 52.6 GHz*** **The motivation for MC is unclear. This discuss should occur in the WI**

**Issue 2-3: Almost contiguous allocation*** **I don’t understand why this would be needed.**

**Issue 2-4: On-off transient period** **This is an important topic and companies should bring in data in the WID** |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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:** *Issue 2-2: Multi-cluster allocation vs. contiguous allocation for above 52.6 GHz*

*Tentative agreement: Not specify multi-cluster allocation in 52.6 – 71 GHz** *Issue 2-4: On-off transient period*

*At least evaluation of improved on-off transient period in 52.6 – 71 GHz seems to be necessary.**Tentative agreement: Agree on evaluation of improved ON-OFF transient period in 52.6 – 71 GHz.** *Issue 2-5: Measurement bandwidth*

*It seems companies agree with the motivation. However, it is too early to decide at the moment without agreeing on applicable CBWs. Suggest to postpone the discussion in WI phase.**Tentative agreement:* Companies are encouraged to share views any technical issue or benefit during the 2nd round discussion and potentially in the next meeting. The final decision will be made once CBWs are decided.*Candidate options:**Recommendations for 2nd round:** *Issue 2-1: PA model for memory effect*

*It is unlikely to agree on a common PA model in RAN4 and suggested to stay with the previous WF (R4-2011840) where companies are free to use any model with a valid calibration. However, given one company wanted to further clarify the motivation, interested companies are encouraged to provide input in the 2nd round discussion.* * Issue 2-3: *Almost contiguous allocation*

*RAN4 needs further discussion on benefit of almost contiguous allocation in 52.6 – 71 GHz. Interested companies are encouraged to provide input in the 2nd round discussion and possibly in the next meeting.* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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**  |
| 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)

* *Issue 2-1: PA model for memory effect*

*It is unlikely to agree on a common PA model in RAN4 and suggested to stay with the previous WF (R4-2011840) where companies are free to use any model with a valid calibration. However, given one company wanted to further clarify the motivation, interested companies are encouraged to provide input in the 2nd round discussion.*

* Issue 2-3: *Almost contiguous allocation*

*RAN4 needs further discussion on benefit of almost contiguous allocation in 52.6 – 71 GHz. Interested companies are encouraged to provide input in the 2nd round discussion and possibly in the next meeting.*

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | * *Issue 2-1: PA model for memory effect: the intention of Huawei contribution was not to mandate any specific PA model, not to reopen discussion on common PA model in RAN4. The intention was to capture companies’ views on consideration of PA memory effect in the PA modelling. Huawei suggests to add Issue 2-1 to the [141] WF to encourage companies to provide more inputs on the PA memory effect for next meeting.*
* Issue 2-3: *Almost contiguous allocation: more study needed for next meeting*
 |

## 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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Others

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014894 | Apple | Proposal: Capture the latest 60GHz regulatory status in the ongoing SI. |
| R4-2015728 | Ericsson | Observation 1 Effective mitigation of ICI caused by phase noise for OFDM can be performed using the existing Rel-15 NR distributed PT-RS structure.Observation 2 A clustered PT-RS structure does not offer any performance advantage over the existing Rel-15 NR distributed PT-RS structure.Proposal 1 Retain the same Rel-15 distributed PT-RS structure for OFDM for NR operation in 52.6 to 71 GHz. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1

*Sub-topic description: Capturing the recent 60 GHz regulatory update in a technical report.*

*Open issues and candidate options before e-meeting:*

**Issue 3-1: Regulatory status update**

* Proposals
	+ Option 1: Capture the latest 60 GHz regulatory status in the TR 38.808
	+ Option 2: Do not capture
* Recommended WF
	+ Companies are encouraged to share views during the 1st round discussion.

### Sub-topic 3-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 3-2: PTRS**

* Proposals
	+ Option 1: Retain the same Rel-15 distributed PT-RS structure for OFDM for NR operation in 52.6 to 71 GHz.
	+ Option 2: No RAN4 responsibility
* Recommended WF
	+ As RAN4 agreed in the last meeting, PTRS decision is out of RAN4 scope, and RAN1 is responsible for PTRS discussion and there is ongoing discussion in RAN1. Companies are encouraged to share views during the 1st round discussion.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications, Inc. | **Issue 2-1: Regulatory status update*** + Option 1: Capture the latest 60 GHz regulatory status in the TR 38.808

**Issue 2-2: PTRS** * + Option 1: Retain the same Rel-15 distributed PT-RS structure for OFDM for NR operation in 52.6 to 71 GHz.
 |
| Ericsson | Sub topic 2-1: It’s probably a good thing to capture an overview of the regulatory status. We need to check the status is different region to be sure that correct information is captured. Sub topic 2-2: We agree to Option 1 and Option 2.  |
| CableLabs | Sub-topic 2-1: we support option 1: Capture the latest 60 GHz regulatory status |
| Intel | Issue 3-1: We think TR 38.807 is better place to capture the regulatory status where comprehensive regulartory survery performed. The regulartory status is not final decision and only for EU. Also the current SID does not require regulatory status.Issue 3-2: Option 2.  |
| Nokia, Nokia Shanghai Bell  | **Sub-topic 3-1:**We should not capture the regulatory status at this point of time as the discussions in Europe are still actively on-going and the conclusions are not confirmed by ECC plenary.   **Sub-topic 3-2:**PT-RS is also discussed in thread**[140].**In previous meeting there was a WF agreed that PT-RS enhancements may be useful and this should be communicated also to RAN1. We should act according to the WF. The LS is also part of thread [140].    |
| Apple | **Sub-topic 3-1:**@Intel: We do not have any particular preference where the regulatory status can be captured, and it can be TR 38.807 if it is agreeable to everybody. The reason why we did not propose to capture it in TR 38.807 is because usually we do not update TR of the closed SIs.@Nokia: This is a common practice to update the regulatory status including ongoing discussions. Our input is based on the decisions that already have been made and we will be Ok to remove those parts, which contain information regarding ongoing discussions if companies have concerns with that. @all: The reason why Apple input is somewhat EU centric is that because we did not identify any big regulatory related decisions/discussions made in other regions after we completed TR 38.807. We are also checking now other regions and input from all companies is more than welcome, of course.  |
| Huawei | Issue 3-1: Regulatory status updateWe share the concern captured by the moderator. Still, in our opinion the updated regulatory overview is needed for the followup WI, as it may have impact e.g. on the output power/emissions requirements for certain regions. One potential WF may be to simply mention in TR 38.808 that RAN4 consider updated regulatory status as valid information for the RF requirements discussions during the follow up WI. Then we can come back to this in WI.Please note that TR 38.808 includes placeholder in section 5.1: *Identification of regulatory aspects for consideration*Issue 3-2: PTRSPTRS covered in [140] already, where the feedback was provided. R4-2015728 shall be removed from [141]. |
| Qualcomm | PTRS is being discussed in [140] |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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:** Issue 3-1: Continue discussion in the 2nd round discussion on the issue 3-1 whether ongoing regulatory status is needed to be captured. If so, where is the right place, i.e., TR 38.807 or 38.808.
* Issue 3-2: For PTRS, thread 140 also treats the discussion and thread 140 is better place to discuss. No further discussion in this thread 141.
 |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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**  |
| 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)

* Issue 3-1: Continue discussion in the 2nd round discussion on the issue 3-1 whether ongoing regulatory status is needed to be captured. If so, where is the right place, i.e., TR 38.807 or 38.808.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| xxx | * Issue 3-1: Continue discussion in the 2nd round discussion on the issue 3-1 whether ongoing regulatory status is needed to be captured. If so, where is the right place, i.e., TR 38.807 or 38.808.
 |
| Apple | Issue 3-1: We have a preference of capturing the regulatory status update to facilitate further technical discussions during the normative phase. TR 38.808 would be a better option because we can provide the corresponding technical input during RAN WG4 meetings, whereas TR 38.807 is the closed SI, updates to which require TSG RAN contributions.  |
| Intel | Issue 3-1: The discussion is not final and continent specific as of now. The SID does not require regulatory status. Considering TR 38.807 addressed regulatory situation comprehensively, we think it is better place to capture the ongoing status, if necessary. It was closed but it can be updated always with correct information.  |
| Huawei | Issue 3-1: the regulatory status was not ready when the NR was standardized. So up-to-date regulatory information is seen as valid information in general and shall be collected and captured for the WI phase. Where to place it: it would be good to clarify if RAN4 TR is expected to be generated or not (external, or internal?). TR 38.808 or the to-be-created RAN4 WI TR for 52-71 GHz NR operation.  |

## 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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |