**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 8.12.5

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [98-bis-e][312] NR\_exto71GHz\_BSRF

**Document for:** Information

# Introduction

This email discussion summary covers BS RF requirements for extending NR operation to 71 GHz. The discussion is split into two major topics, Tx requirements and Rx requirements, within which individual requirements are discussed in various sub-topics. Generally, proposals and requirements having most dependency have been grouped together.

As this is the first meeting to discuss requirements it is highly welcomed to raise open issues around requirements which need to be covered, even though they would have not been covered by the input documents to the meetings.

The main goal of the discussion is to find a baseline on which requirements and which aspects of requirements need further analysis, therefore having a clear guideline on the work towards next meeting.

# Topic #1: Tx requirements

First topic covers Tx requirements

The input documents did not discuss base station classes, but as classes may be very relevant on the details of the requirements, it is encouraged to take possible differences between classes into account in company comments.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2104456**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104456.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1:** The radiated transmitter characteristics requirements apply to the BS type 2-O should be considered as the baseline for NR operation in 52.6 – 71 GHz range.  **Proposal 2:** The radiated transmit power for NR operation in 52.6 – 71 GHz range should be declared by the manufacturer.  **Proposal 3:** The BS output power for NR operation in 52.6 – 71 GHz range should be declared by the manufacturer. Additional regional requirements can be specified to align with regulatory requirements in certain regions.  **Proposal 4:** The current total power dynamic range for BS type 2-O can be used as baseline for NR operation in 52.6 – 71 GHz range, but special consideration should be placed on the wider channel bandwidth with large SCS.  **Proposal 5:** The transmit OFF power for NR operation in 52.6 – 71 GHz range should be calculated with a suitable set of operation parameters at this frequency range. Moreover, the transient period for NR operation in 52.6 – 71 GHz range should be shorter than that for BS type 2-O considering the shorter symbol duration with the larger SCS and the target cell sizes in these frequency ranges.  **Proposal 6:** The frequency error and EVM requirements for BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz range. However, special consideration should be placed on the applicable higher order modulations for NR operation in 52.6 – 71 GHz range due to the higher phase noise expected in this frequency range. Moreover, the CA time alignment error requirements for NR operation in 52.6 – 71 GHz range should be shorter than that for BS type 2-O considering the shorter symbol duration with the larger SCS and the target cell sizes in these frequency ranges.  **Proposal 7:** The ACLR and ACS values from the coexistence studies at 70GHz in the NR study item can be considered as baseline for NR operation in 52.6 – 71 GHz range. Moreover, the out-of-band emissions and unwanted emissions in the spurious domain specified in ETSI EN 303 722 can be considered as baseline for at least unlicensed NR operation in 52.6 – 71 GHz range. Additional regional requirements can be specified to align with regulatory requirements in certain regions. |
| [**R4-2104731**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104731.zip) | CATT | **Observation 1:** If fractional bandwidth of operating band in 52.6-71GHz is less than 6%, the EIRP accuracy (±3.4dB) and the TRP accuracy (±3dB) for FR2 can be reused for 52.6-71GHz.  **Observation 2:** To derive OTA total power dynamic range (dB) by , where is transmission bandwidth configuration for supported numerology/CBW in 52.6 -71 GHz.  **Observation 3:** To take the OFF power -36 dBm/MHz for 52.6 -71GHz.  **Observation 4:** 2 us can be considered as the transient period requirement as the trade-off of the system performance and implementation efforts.  **Observation 5:** Frequency error requirement can be reused from FR2.  **Observation 6:** EVM requirement can be reused from FR2, and need to define EVM window length for supported SCS for 52.6-71GHz.  **Observation 7:** OTA occupied bandwidth can be reused from FR2.  **Observation 8:** For licensed operation, OBUE limits need to be adjusted for 52.6 – 71GHz.  **Proposal 1:** To decide the required ACLR for co-existence for 52.6 – 71GHz by co-existence simulation. |
| [**R4-2106355**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106355.zip) | Ericsson | **Proposal 1:** It is proposed to use parameter sets in Table 2.1-3 if co-existence simulations are considered or if antenna parameters are shared to other groups.  **Proposal 2:** NR in 52.6 to 71 GHz should support modulation orders up to 64QAM.  **Proposal 3:** Due to large carrier bandwidth or large RFBW foreseen for NR in 52.6 GHz, as the unwanted emission levels due to low power spectral density of the signal become lower than unwanted emission limits, RAN4 should study how the unwanted emissions for large carrier bandwidths or RFBW should be handled.  **Proposal 4:** Final evaluation of transient times has to consider not only the general ON/OFF mask at start and end slot, for TDD DL/UL boundaries, used in GP timing, but also other use cases related to UE UL, like SRS time mask and PUSCH-PUCCH and SRS time mask. The cases of SRS time mask and PUSCH-PUCCH and SRS time mask have to be investigated in UE RF session.  **Proposal 5:** Investigate if TAE for MIMO in extension to 71 GHz WI can be based on the AAS method, ie no explicit TAE requirement, instead performance is verified in BS conformance.  **Proposal 6:** Single FFT assumed for intra band contiguous CA as UE architecture.  **Proposal 7:** Once a UE RX architecture is agreed then link simulations and/or analytical calculations and investigations will give the actual requirement for TAE for intra band contiguous CA.  **Proposal 8:** Once a UE RX architecture and deployment cases are agreed then link simulations and/or analytical calculations and investigations will give the actual requirement for TAE for intra band non-contiguous CA and inter band CA. |
| [**R4-2106589**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106589.zip) | ZTE | [Summary by moderator]: There are no observations or proposals explicitly made in the contribution, but it provides an overview with initial views on individual Tx requirements and how to proceed with them. |

## Open issues summary

### Sub-topic 1-1: General and output power requirements

This sub-topic covers output power related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 1-1-1: Using existing BS type 2-O requirements as baseline**

* Proposals
  + Option 1: The radiated transmitter characteristics requirements apply to the BS type 2-O should be considered as the baseline for NR operation in 52.6 – 71 GHz range.
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 1-1-2: EIRP and TRP accuracy and levels**

* Proposals
  + Option 1: EIRP and TRP are declared by manufacturer
  + Option 2: The BS output power for NR operation in 52.6 – 71 GHz range should be declared by the manufacturer. Additional regional requirements can be added to specification to align with regulatory requirements.
  + Option 3: If fractional bandwidth of operating band in 52.6-71GHz is less than 6%, the EIRP accuracy (±3.4dB) and the TRP accuracy (±3dB) for FR2 can be reused for 52.6-71GHz.
* Recommended WF
  + TBA

**Issue 1-1-3: Total power dynamic range**

* Proposals
  + Option 1: The current total power dynamic range for BS type 2-O, based on 10\*log10(Nrb) can be used for NR operation in 52.6 – 71 GHz range.
  + Option 2: TBA
* Recommended WF
  + TBA

### Sub-topic 1-2: Timing and signal quality requirements

This sub-topic covers timing and signal quality related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 1-2-1: Transient time**

* Proposals
  + Option 1: Transient period should be shorter than 3us, considering shorter symbol times
  + Option 2: Final evaluation of transient times has to consider not only the general ON/OFF mask at start and end slot, for TDD DL/UL boundaries, used in GP timing, but also other use cases related to UE UL, like SRS time mask and PUSCH-PUCCH and SRS time mask. The cases of SRS time mask and PUSCH-PUCCH and SRS time mask have to be investigated in UE RF session.
  + Option 3: Consider 2us for transient time to balance implementation effort and system performance
* Recommended WF
  + TBA

**Issue 1-2-2: Tx OFF power**

* Proposals
  + Option 1: To take the OFF power -36 dBm/MHz for 52.6 -71GHz.
  + Option 2: The transmit OFF power for NR operation in 52.6 – 71 GHz range should be calculated with a suitable set of operation parameters at this frequency range.
* Recommended WF
  + TBA

**Issue 1-2-3: Time alignment error**

* Proposals
  + Option 1: CA time alignment error should be smaller than for current BS type 2-O
  + Option 2: Investigate if TAE for MIMO in extension to 71 GHz WI can be based on the AAS method, i.e. no explicit TAE requirement, instead performance is verified in BS conformance.
  + Option 3 Single FFT assumed for intra band contiguous CA as UE architecture.
  + Option 4: Once a UE RX architecture is agreed then link simulations and/or analytical calculations and investigations will give the actual requirement for TAE for intra band contiguous CA.
  + Option 5: Once a UE RX architecture and deployment cases are agreed then link simulations and/or analytical calculations and investigations will give the actual requirement for TAE for intra band non-contiguous CA and inter band CA.
* Recommended WF
  + TBA

**Issue 1-2-4: Frequency error**

* Proposals
  + Option 1: Frequency error requirement can be reused from FR2.
* Recommended WF
  + TBA

**Issue 1-2-5: EVM**

* Proposals
  + Option 1: EVM requirements for BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz range. However, special consideration should be placed on the applicable higher order modulations for NR operation in 52.6 – 71 GHz range due to the higher phase noise expected in this frequency range.
  + Option 2: New EVM window length needs to be defined for new SCS
  + Option 3: Support modulations up to 64 QAM.
* Recommended WF
  + TBA

### Sub-topic 1-3: Emission requirements

This sub-topic covers unwanted emissions related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 1-3-1: Low absolute emission level due to wide carrier BW**

* Proposals
  + Option 1: Due to large carrier bandwidth or large RFBW foreseen for NR in 52.6 GHz, as the unwanted emission levels due to low power spectral density of the signal become lower than unwanted emission limits, RAN4 should study how the unwanted emissions for large carrier bandwidths or RFBW should be handled.
* Recommended WF
  + TBA

**Issue 1-3-2: ACLR and co-existence simulations**

* Proposals
  + Option 1: ACLR is derived by new co-existence simulations
  + Option 2: ACLR can be derived based on 70 GHz co-existence study in 38.803
* Recommended WF
  + TBA

**Issue 1-3-3: OBUE and spurious emissions**

* Proposals
  + Option 1: For licensed operation, OBUE limits need to be adjusted for 52.6 – 71GHz.
  + Option 2: out-of-band emissions and unwanted emissions in the spurious domain specified in ETSI EN 303 722 can be considered as baseline for at least unlicensed NR operation in 52.6 – 71 GHz range.
* Recommended WF
  + TBA

**Issue 1-3-4: Occupied BW**

* Proposals
  + Option 1: OTA occupied bandwidth can be reused from FR2.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub-topic 1-1:

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 1-1-1: Using existing BS type 2-O requirements as baseline**  Option 1 seems ok. Use BS type 2-O for transmitter requirements. Requirement values are determined per band.  **Issue 1-1-2: EIRP and TRP accuracy and levels**  Option 2: is ok, since we need to capture regulatory limits apply for this range. Option 3 is also ok. Both option 2 and option 3 is ok with us.  **Issue 1-1-3: Total power dynamic range**  Option 1 seems reasonable. |
| CATT | **Issue 1-1-1: Using existing BS type 2-O requirements as baseline**  We support the direction of option 1, BS type 2-O methodology can be reused.  **Issue 1-1-2: EIRP and TRP accuracy and levels**  We’re ok with option 2 and option 3.  **Issue 1-1-3: Total power dynamic range**  Ok with option 1. |
| Qualcomm | **Issue 1-1-1: Using existing BS type 2-O requirements as baseline**  We support option 1.  **Issue 1-1-2: EIRP and TRP accuracy and levels**  We support option 2 as it captures the regulatory requirements.  **Issue 1-1-3: Total power dynamic range**  We support option 1 which is based on the uniform PSD assumption. |
| ZTE | **Issue 1-1-1: Using existing BS type 2-O requirements as baseline**  To Agree in high level is fine, however requirement for 60GHz should be still discussed case by case.  **Issue 1-1-2: EIRP and TRP accuracy and levels**  Fine with option 2, for option 3 on fractional channel bandwidth, we need more time to check it.  **Issue 1-1-3: Total power dynamic range**  For licensed band, it’s okay for option 1.  For unlicensed band, this requirement might be not needed. |
| Huawei | Issue 1-1-1: Using existing BS type 2-O requirements as baseline  Option 1 is considered to be common understanding. Maybe we shall clarify that it does not mean that we are going to reuse those, but the analysis starts from the existing FR2 requirements.  Issue 1-1-2: EIRP and TRP accuracy and levels  Actually all options are somehow complementary. Both the EIRP and TRP levels are declared for FR2, so it is ok to assume the same up to 71 GHz. However, more discussion on the accuracy values is required (i.e. option 1 may not be detailed enough). Option 2 is ok. Consideration of the regulatory requirements does not require discussion – RAN4 needs to respect them anyway.  We would like to continue the analysis on the fractional bandwidth aspects.  Issue 1-1-3: Total power dynamic range  Option 1 as starting point. Whether or not uniform PSD is a valid assumption for this range may require some more discussion. |
| Nokia | Issue 1-1-1: Propose option 1.  Issue 1-1-2: Propose option 2. For option 1, for urban and dense urban the parameter sets result in EIRP beyond what is allowed in unlicensed operation and licensed regulation not available -> cannot proceed with coexistence study. For option 3, more analysis may be needed as TRX inaccuracy is likely larger at these frequencies.  Issue 1-1-3: Ok for option 1 in general, but special consideration should be placed on the wider channel bandwidth with large SCS. |

Sub-topic 1-2:

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 1-2-1: Transient time**  We prefer Option 2. Final evaluation of transient times has to consider not only the general ON/OFF mask at start and end slot, for TDD DL/UL boundaries, used in GP timing, but also other use cases related to UE UL TX (“ON->ON”), like SRS time mask and PUSCH-PUCCH and SRS time mask. The cases of SRS time mask and PUSCH-PUCCH and SRS time mask have to be investigated in UE RF session.  **Issue 1-2-2: Tx OFF power**  We prefer option 1, re-use FR2 requirement as base line.  **Issue 1-2-3: Time alignment error**  We prefer Option 2: Investigate if TAE for MIMO in extension to 71 GHz WI can be based on the AAS method, i.e. no explicit TAE requirement, instead performance is verified in BS conformance.  **Issue 1-2-4: Frequency error**  We prefer option 1, to re-use requirement from FR2.  **Issue 1-2-5: EVM**  Based on technology capabilities captured in TR 38.808 for this frequency range we prefer option 3. |
| CATT | **Issue 1-2-1: Transient time**  Agree that UE performance should be considered together. If there’s no opportunity to improve UE performance, BS improvement may need to see if it’s valuable although we propose option 3 for BS.  **Issue 1-2-2: Tx OFF power**  We support option 1 as the starting point.  **Issue 1-2-3: Time alignment error**  FFS  **Issue 1-2-4: Frequency error**  Ok with option 1.  **Issue 1-2-5: EVM**  Agree with option 2 that window length table should be updated and support option 3. |
| Qualcomm | **Issue 1-2-1:Transient time**  We prefer option 2 as UE considerations needs to be accounted for when deriving the transient time requirements.  **Issue 1-2-2:Tx OFF power**  Option 1 seems reasonable as a starting point.  **Issue 1-2-3:Time alignment error**  We support option 5. Once a UE RX architecture and deployment cases are agreed then link simulations and/or analytical calculations and investigations will give the actual requirement for TAE for intra band non-contiguous CA and inter band CA  **Issue 1-2-4:Frequency error**  We support option 1.  **Issue 1-2-5:EVM**  We support option 2. |
| ZTE | **Issue 1-2-1:Transient time**  Option 2 is preferred. In addition, regarding GP overhead, DL-UL periodicity should also been taken into account.  **Issue 1-2-2:Tx OFF power**  Prefer to have more link budget analysis similar as FR2 NR in Rel-15.  **Issue 1-2-3:Time alignment error**  For MIMO related TAE requirement, it need some further link level simulation;  For CA related TAE requirements, it needs some inputs from UE and BS RF architecture both.  **Issue 1-2-4:Frequency error**  We support option 1.  **Issue 1-2-5:EVM**  Start with 64QAM for 60GHz, option 2 could be considered in the later phase. |
| Huawei | Issue 1-2-1: Transient time  Due to the relation to the UE RF discussions, we would prefer to defer the decision on concrete value for transient time. Option 2 can be considered as the starting point – this is seen to be inline with the SI conclusions.  Issue 1-2-2: Tx OFF power  We prefer to have more analysis of the FR2 background, which lead to the derivation of -36 dBm/MHz. Therefore option 2 can be used as the starting point – if not adjustments would be needed, then we end up with the -36 dBm/MHz anyways.  Issue 1-2-3: Time alignment error  FFS. Consider progress on the UE architecture, if any.  Issue 1-2-4: Frequency error  Consider FR2 frequency error as starting point. More analysis may be needed when the BS classes are considered.  Issue 1-2-5: EVM  Due to new SCS, EVM window length needs to be further studied and new window length is expected. This is seen as conformance testing issue – no need to decide it now. Let’s focus on the analysis first.  Ok with option 3. |
| Nokia | Issue 1-2-1: Propose option 1. Option 2 has more relevance to UE requirement, Ok to consider option 3 but it more analysis is needed.  Issue 1-2-2: Propose option 2. For option 1, analysis in R4-2104731 states the requirement could be relaxed by almost 10 dB, why to reuse the old requirement then?  Issue 1-2-3: Propose option 1. For option 2, the background for proposal is unclear as it seems to make a linkage from conducted requirement background to OTA requirement, but we do have explicit OTA EVM requirement specified in TS 37.105 and TS 38.104. Option 3 depends on CA configuration; aggregation of multiple 2 GHz carriers does not likely use single FFT. For MIMO transmission, TAE requirement does not have linkage to UE architecture as TAE can be measured between two polarization is specified in TS 38.141-2.  Issue 1-2-4: Propose option 1.  Issue 1-2-5: Propose option 1, likely not necessary to define 256QAM. Agree with options 2 and 3 on top of option 1. |

Sub-topic 1-3:

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| **Company** | **Comments** |
| Ericsson | **Issue 1-3-1: Low absolute emission level due to wide carrier BW**  Since the power is spread out wider due to larger supported CBW, RAN4 needs to look into how the emission level should be specified.  **Issue 1-3-2: ACLR and co-existence simulations**  We prefer option 2, where the ACLR is based on NR proxy frequency 70 GHz from TR 38.803. In addition, we can also use input from the TR 38.808 which indicates the range.  **Issue 1-3-3: OBUE and spurious emissions**  We prefer Option 1 for licensed operation and Option 2 for unlicenced operation.  **Issue 1-3-4: Occupied BW**  Option 1 to re-use occupied bandwidth from FR2 seems like a reasonable approach. |
| CATT | **Issue 1-3-1: Low absolute emission level due to wide carrier BW**  Support the direction of option 1.  **Issue 1-3-2: ACLR and co-existence simulations**  Support option 1 to do new co-existence simulation.  **Issue 1-3-3: OBUE and spurious emissions**  Support option 1 for licensed band.  **Issue 1-3-4: Occupied BW**  Support option 1. |
| Qualcomm | **Issue 1-3-1: Low absolute emission level due to wide carrier BW**  We support option 1.  **Issue 1-3-2: ACLR and co-existence simulations**  We prefer option 1 to conduct new coexistence simulation to derive the requirements. Input and support can be leveraged from the work done in TR 38.803.  **Issue 1-3-3: OBUE and spurious emissions**  We support option 1 for licensed band.  **Issue 1-3-4: Occupied BW**  We support option 1. |
| ZTE | **Issue 1-3-1: Low absolute emission level due to wide carrier BW**  Fine with option 1.  **Issue 1-3-2: ACLR and co-existence simulations**  Option 2 is more preferable since ACLR requirement is not just coming from coexistence study at the end .  **Issue 1-3-3: OBUE and spurious emissions**  Fine with option 1 for licensed band.  **Issue 1-3-4: Occupied BW**  Support option 1. |
| Huawei | Issue 1-3-1: Low absolute emission level due to wide carrier BW  The observation in option 1 is ok. No need for formal decision on “what RAN4 needs to study to conclude the requirement”. RAN4 study on this aspect needs to continue to conclude.  Issue 1-3-2: ACLR and co-existence simulations  We prefer to have more analysis on this topic before taking decision (more analysis to verify if 38.803 content is sufficient or not – need to verify if additional RAN4 aspects need to be considered; it’s ok to consider it as baseline though). Both options can be further studied and decide next meeting.  Issue 1-3-3: OBUE and spurious emissions  Ok for option 1 for licensed operation. More analysis needed for the unlicensed operation.  Issue 1-3-4: Occupied BW  There was not much technical arguments brought behind the proposal in option 1. Considering related discussion on the max channel bandwidth, we would like to have more study before we agree to reuse the existing FR2 requirement. Number of measurement point to be also analysed for the purpose of avoiding excessive requirements on the test equipment. |
| Nokia | Issue 1-3-1: Ok with option 1, as with no action, we will have issues with testing anyway.  Issue 1-3-2: Propose option 2. For option 1, as expected and shown in R4-2104439 and R4-2104441, the required ACIR values for channel bandwidth wider than 200MHz (which was used in TR 38.803) should be smaller considering the relatively impact of the ACI on the higher noise floor with the wider receive bandwidth, so there should be no issue to use the ACLR and ACS values in TR 38.803 for channel bandwidth wider than 200MHz.  Issue 1-3-3: Propose option 2, additional regional requirements can be specified to align with regulatory requirements in certain regions. Option 1 only consider licensed operation but not unlicensed operation.  Issue 1-3-4: OK with option 1. |

## 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:*  *Candidate options:*  *Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

# Topic #2: Rx requirements

*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** |
| [**R4-2104457**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104457.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1:** The radiated receiver characteristics requirements apply to the BS type 2-O should be considered as the baseline for NR operation in 52.6 – 71 GHz range.  **Proposal 2:** The reference sensitivity level for NR operation in 52.6 – 71 GHz range should be declared by the manufacturer within specified ranges, which should be calculated with a suitable set of operation parameters at this frequency range. Moreover, new FRCs should be defined for the larger SCSs with the wider channel bandwidth for NR operation in 52.6 – 71 GHz range, where the allocated RBs should be scaled according to the target SCSs and channel bandwidth.  **Proposal 3:** The ACLR and ACS values from the coexistence studies at 70GHz in the NR study item can be considered as baseline for NR operation in 52.6 – 71 GHz range. Moreover, the in-band blocking level of BS type 2-O can be used as baseline for NR operation in 52.6 – 71 GHz range, but consideration should be placed to ensure alignment between in-band selectivity and ACS.  **Proposal 4:** The current out-of-band blocking level for BS type 2-O can be used as baseline, but special consideration should be placed on ΔfOOB the expected wider operating bands in 52.6 – 71 GHz range. Moreover, the current 60 GHz upper frequency limit will need to be extended to cover above 71 GHz depending on test system implementation feasibility, while the current measurement step sizes for BS type 2-O can be used as baseline for NR operation in 52.6 – 71 GHz range with special consideration on the testing time impact with the extended upper frequency limit.  **Proposal 5:** The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 can be considered as baseline for at least unlicensed NR operation in 52.6 – 71 GHz range, and additional regional requirements can be specified to align with regulatory requirements in certain regions.  **Proposal 6:** The interferer levels for general receiver intermodulation for NR operation in 52.6 – 71 GHz range can be derived by applying an offset below the in-band blocking levels.  **Proposal 7:** The current ICS value for BS type 2-O can be used as baseline to calculate the wanted and interfering signal levels for NR operation in 52.6 – 71 GHz range, but the value may be adjusted for this higher frequency range. Moreover, new FRCs should be defined for the larger SCSs with the wider channel bandwidth for NR operation in 52.6 – 71 GHz range, where the allocated RBs within the new FRCs should be scaled according to the target SCSs and channel bandwidth. |
| [**R4-2104683**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104683.zip) | Ericsson | **Proposal 1:** For the 120kHz SCS, retain the existing FRC for sensitivity and RX requirements based on 50MHz.  **Proposal 2:** For the 480kHz SCS, define the sensitivity using minimum bandwidth FRC. Consider whether a larger bandwidth FRC should also be defined in order to reduce the amount of testing for the 1600MHz bandwidth.  **Proposal 3:** For the 960kHz SCS, define the sensitivity using 400MHz FRC. Consider an additional larger FRC for larger bandwidths if needed.  **Observation 1:** The ranges for sensitivity declaration in the existing specifications appear to be sufficient.  **Proposal 3:** The ACS requirement can be used as is, except that the interferer bandwidth may need to be adjusted to be the same as the reference sensitivity FRC bandwidth. The interferer level should be set to achieve the correct ACS for the sub-range.  **Proposal 4:** For the frequency range 52 to 71 GHz define the wanted signal power as EISREFSENS\_xxM + 6 dB (The bandwidth for the sensitivity FRC needs further discussion).  **Proposal 5:** For the frequency range 52 to 71 GHz, use the same interferer levels as for FR2.  **Proposal 6:** For the frequency range 52 to 71 GHz, re-use the size of the exclusion zone from FR2.  **Proposal 7:** For the frequency range 52 to 71 GHz, set the upper test limit to 2nd harmonic.  **Proposal 8:** Set the RX intermodulation levels based on RX blocking. |
| [**R4-2104732**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104732.zip) | CATT | **Observation 1:** [13] dB can be considered as NF assumption for 52.6-71GHz for receiver requirement.  **Observation 2:** Antenna gain assumption for 52.6-71GHz can be considered to be increased by 1dB relative to 45GHz.  **Proposal 1:** To decide the required ACS for co-existence by co-existence simulation.  **Proposal 2:** To decide in-band blocking interference level by the simulation.  **Observation 3:** 120 MHz can be considered as measurement step size for interferer signal step size for 800MHz and 1600MHz CBW for OTA in-band blocking and OTA out-of-band blocking.  **Observation 4:** Reusing interfering field strength for FR2 for OTA out-of-band blocking can be considered as starting point.  **Observation 5:** Reusing 8 dB below OTA in-band blocking levels principles for RX IM interferer level for FR2 can be considered as starting point.  **Observation 6**: 14dBc required ICS can be considered to be reused for 52.6-71GHz for all BS type. |
| [**R4-2106590**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106590.zip) | ZTE corporation | [Summary by moderator]: There are no observations or proposals explicitly made in the contribution, but it provides an overview with initial views on individual Rx requirements and how to proceed with them. |

## 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: General and sensitivity related requirements

This sub-topic covers general topics and sensitivity related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 2-1-1: Using existing BS type 2-O requirements as baseline**

* Proposals
  + Option 1: The radiated receiver characteristics requirements apply to the BS type 2-O should be considered as the baseline for NR operation in 52.6 – 71 GHz range.
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 2-1-2: Sensitivity**

* Proposals
  + Option 1: Sensitivity is declared
  + Option 2: Retain existing FRC for 50 MHz channel bandwidth
  + Option 3: Define new FRCs for wide channel bandwidths
  + Option 4: For 480 kHz SCS, use smallest channel bandwidth for FRC
  + Option 5: For 960 kHz SCS, use 400 MHz channel bandwidth for FRC
* Recommended WF
  + TBA

### Sub-topic 2-2: ACS and in-band blocking

This sub-topic covers ACS and in-band blocking related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 2-2-1: Deriving ACS and blocking levels**

* Proposals
  + Option 1: Derive ACS and blocking levels with new simulations
  + Option 2: Derive ACS from co-existence study in 38.803
  + Option 3: Current FR2 requirement can be baseline for in-band blocking, but alignment between ACS and in-band blocking needs to be considered.
* Recommended WF
  + TBA

**Issue 2-2-2: Interferer bandwidth and measurement step size**

* + Option 1: Adjust interferer signal bandwidth to match FRC definition
  + Option 2: 120 MHz can be considered as measurement step size for interferer signal step size for 800MHz and 1600MHz CBW for OTA inband blocking.
* Recommended WF
  + TBA

### Sub-topic 2-3: Out-of-band blocking

This sub-topic covers out-of-band blocking related requirements. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

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

**Issue 2-3-1: Out of band blocking**

* Proposals
  + Option 1: Re-use current FR2 OOB blocker level
  + Option 2: Wanted signal level shall be EISrefsens\_XX MHz + 6 dB, i.e. bandwidth of FRC needs to be discussed
  + Option 3: ΔfOOB needs further consideration taking into account the expected wider operating bands in 52.6 – 71 GHz range
  + Option 4: Re-use the exclusion zone from current FR2
  + Option 5: Test system feasibility needs to be considered together with setting upper frequency limit for blocker
  + Option 6: Consider 2nd harmonic to be the upper frequency limit for blocker
  + Option 7: Current measurement step size can be the starting point, but test time needs to be considering taking into account the extended upper frequency limit
  + Option 8: 120 MHz can be considered as measurement step size for interferer signal step size for 800MHz and 1600MHz CBW for OTA out-of-band blocking.
* Recommended WF
  + TBA

### Sub-topic 2-4: Others

This sub-topic remaining proposal and other Rx requirements not covered before. Throughout the issues the individual options are not exclusive i.e. multiple options can and sometimes need be supported together to create a coherent requirement.

**Issue 2-4-1: Receiver intermodulation interferer level**

* Proposals
  + Option 1: The interferer levels for general receiver intermodulation for NR operation in 52.6 – 71 GHz range can be derived by applying an offset below the in-band blocking levels.
  + Option 2: Reusing 8 dB below OTA in-band blocking levels principles for RX IM interferer level for FR2 can be considered as starting point.
* Recommended WF
  + TBA

**Issue 2-4-2: In channel selectivity**

* Proposals
  + Option 1: 14dBc required ICS can be considered to be reused for 52.6-71GHz for all BS type.
  + Option 2: The current ICS value for BS type 2-O can be used as baseline to calculate the wanted and interfering signal levels for NR operation in 52.6 – 71 GHz range, but the value may be adjusted for this higher frequency range
  + Option 3: New FRCs should be defined for the larger SCSs with the wider channel bandwidth for NR operation in 52.6 – 71 GHz range, where the allocated RBs within the new FRCs should be scaled according to the target SCSs and channel bandwidth.
* Recommended WF
  + TBA

**Issue 2-4-3: Receiver spurious emissions**

* Proposals
  + Option 1: The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 can be considered as baseline for at least unlicensed NR operation in 52.6 – 71 GHz range, and additional regional requirements can be specified to align with regulatory requirements in certain regions.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 2-1-1: Using existing BS type 2-O requirements as baseline**  Agree option 1. The requirements can be based on the existing FR2. In certain places, requirement levels may need to be changed for the new bands.  **Issue 2-1-2: Sensitivity**  Agree option 1. For the FRC, probably minimum bandwidth (50MHz for 120k SCS and as agreed for the others) is OK, but before the final decision we should check on the agreed bandwidths and whether any wider FRCs are needed to reduce measurement times. |
| CATT | **Issue 2-1-1: Using existing BS type 2-O requirements as baseline**  Agree the methodology but the exact level may need some discussion according to the assumption of antenna parameters.  **Issue 2-1-2: Sensitivity**  The details need more discussion when the min. CBW is agreed. Agree that new FRC is needed. |
| Qualcomm | **Issue 2-1-1: Using existing BS type 2-O requirements as baseline**  We support option 1. BS type 2-O should be a baseline and further analysis should be built on that.  **Issue 2-2-2: Sensitivity**  More discussion is required on the impact of the min CBW. For now we support option 3. |
| ZTE | **Issue 2-1-1: Using existing BS type 2-O requirements as baseline**  To agree option 1 in high level should be fine, however these requirement should be updated once system parameter has been decided.  **Issue 2-1-2: Sensitivity**  Option 1 is fine.  In addition, regarding the FRC for 60GHz, this is quite reliable on channel bandwidth discussion, we prefer to postpone the discussion here. |
| Huawei | Issue 2-1-1: Using existing BS type 2-O requirements as baseline  Option 1 is considered to be common understanding. Maybe we shall clarify that it does not mean that we are going to reuse those, but the analysis starts from the existing FR2 requirements.  Issue 2-1-2: Sensitivity  Reusing the FR2 approach is ok: option 1.  Wait for the conclusion on the min/max channel bandwidth before concluding on FRCs. |
| Nokia | Issue 2-1-1: Propose option 1.  Issue 2-1-2: Propose option 1. Options 2, 4 and 5 depend on the final minimum channel bandwidth and maximum channel bandwidth for each SCS. For options 3-5, how are the values in table 2.1-2 in R4-2104683 obtained? |

Sub topic 2-2

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| **Company** | **Comments** |
| Ericsson | **Issue 2-2-1: Deriving ACS and blocking levels**  For ACS, agree option 2; the existing co-existence studies are still valid.    **Issue 2-2-2: Interferer bandwidth and measurement step size**  Option 1 makes sense. |
| CATT | **Issue 2-2-1: Deriving ACS and blocking levels**  Support option 1 to do new co-exit simulation.  **Issue 2-2-2: Interferer bandwidth and measurement step size**  Agree with the direction of option 1, details FFS. |
| Qualcomm | **Issue 2-2-1: Deriving ACS and blocking levels**  We support option 1 to conduct coexistence simulation to derive the ACS and blocking level requirements.  **Issue 2-2-2: Interferer bandwidth and measurement step size**  We support option 1. |
| ZTE | **Issue 2-2-1: Deriving ACS and blocking levels**  Option 2 is more preferred.  **Issue 2-2-2: Interferer bandwidth and measurement step size**  Interference signal bandwidth might not related with FRC discussion, this is related with minimmum channel bandwidth in this band . |
| Huawei | Issue 2-2-1: Deriving ACS and blocking levels  Similar to ACLR discussions, more analysis is preferred.  Issue 2-2-2: Interferer bandwidth and measurement step size  Option 1 seems reasonable approach, but we need to wait for the min/max CHBW conclusions anyway.  Measurement step size is considered as the conformance testing aspect. Clarification is needed if this needs to be decided at such early stage. |
| Nokia | Issue 2-2-1: Propose options 2 and 3. For option 1, as expected and shown in R4-2104439 and R4-2104441, the required ACIR values for channel bandwidth wider than 200MHz (which was used in TR 38.803) should be smaller considering the relatively impact of the ACI on the higher noise floor with the wider receive bandwidth, so there should be no issue to use the ACLR and ACS values in TR 38.803 for channel bandwidth wider than 200MHz.  Issue 2-2-2: OK with option 2. For option 1, it is proposed to have two FRCs for larger bandwidth, so would there also be two ACS interferer bandwidth? |

Sub topic 2-3

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| **Company** | **Comments** |
| Ericsson | **Issue 2-3-1: Out of band blocking**  We agree options 1-7. The requirement can be based on FR2; more discussion is needed on the feasible measurement upper limit. |
| CATT | **Issue 2-3-1: Out of band blocking**  Support the direction of FR2 methodology, details FFS. |
| Qualcomm | **Issue 2-3-1: Out of band blocking**  Needs to be further studied. For now we can adopt FR2 as option 1 suggests. |
| ZTE | **Issue 2-3-1: Out of band blocking**  More discussions are needed. |
| Huawei | Option 1, 2: more study needed  Option 3: agree  Option 4: options 3 and 4 are inter-connected. To clarify: is ΔfOOB understood here as the exclusion zone for the operating band?  Option 5: in principle we agree, but formal agreement on this is not needed (this is conformance testing issue which will have to be concluded before deriving test requirements).  Option 6: it is considered that the 2nd harmonic is the default to be considered. Still, referring to the FR2 discussions, we need to split core and conformance aspects (i.e. practical upper frequency for test). We prefer to have more discussion first.  Option 7: agree  Option 8: Measurement step size is considered as the conformance testing aspect. Clarification is needed if this needs to be decided at such early stage. |
| Nokia | Issue 2-3-1: Propose options 1, 3, 5 and 7. Option 2 depends on agreed FRC bandwidth. Option 4 should also consider the expected wider operating bands in 52.6 – 71 GHz range. Option 6 should consider if TE would be able to handle up to 2x71 GHz OK with option 8. |

Sub topic 2-4

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 2-4-1: Receiver intermodulation interferer level**  Agree option 1 the intermodulation levels can be based on the in-band blocker levels with the same ratio as used for the rest of FR2.    **Issue 2-4-2: In channel selectivity**  Agree options 2 and 3. New FRCs will be needed for the new SCS. The existing ICS levels can be default but some more consideration of scenarios is needed.    **Issue 2-4-3: Receiver spurious emissions**  Option 1 can be a baseline for unlicensed; for licensed the existing FR2 could be a baseline. |
| CATT | **Issue 2-4-1: Receiver intermodulation interferer level**  Agree with direction of option 1 and ok to further discuss the exact values.  **Issue 2-4-2: In channel selectivity**  Ok with option 2 and option 3. The level can be discussed further.  **Issue 2-4-3: Receiver spurious emissions**  FFS |
| Qualcomm | **Issue 2-4-1: Receiver intermodulation interferer level**  We support option 1.  **Issue 2-4-2: In channel selectivity**  We support option 3. More details need to be discussed.  **Issue 2-4-3: Receiver spurious emissions**  More details need to be discussed. |
| ZTE | **Issue 2-4-1: Receiver intermodulation interferer level**  We support option 1, specific value could be further discussed.  **Issue 2-4-2: In channel selectivity**  We support option 3 and option 1.  **Issue 2-4-3: Receiver spurious emissions**  More details need to be discussed. |
| Huawei | Issue 2-4-1: Receiver intermodulation interferer level  Ok to follow the FR2 approach – option 1. More study needed for the offset itself.  Issue 2-4-2: In channel selectivity  Ok with option 2 and option 3. More analysis needed for the ICS value.  Issue 2-4-3: Receiver spurious emissions  Ok to consider the existing FR2 be a baseline for licensed operation. More analysis needed for the unlicensed operation.  Achievable measurement levels to be accounted for the test requirement. |
| Nokia | Issue 2-4-1: Propose option 1, ok with option 2.  Issue 2-4-2: Propose option 2. Option 1 needs further analysis considering this higher frequency range. Option 3 depends on the final minimum channel bandwidth and maximum channel bandwidth for each SCS.  Issue 2-4-3: Propose option 1. |

## 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:* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

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

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

## 2nd round

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

Notes:

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