**3GPP TSG-RAN WG4 Meeting # 99-e R4-2108440**

**Electronic Meeting, 19th – 27th May, 2021**

**Agenda item:** 9.15.5

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [99-e][315] 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.

# Topic #1: Tx requirements

First topic covers Tx requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2109114 | CATT | **Proposal 1: The existing FR2 EIRP accuracy (±3.4dB) and the TRP accuracy (±3dB) for FR2 can be reused for 52.6-71GHz.****Proposal 2: The existing FR2 OFF power requirement -36dBm/MHz is valid for 52.6-71 GHz.** |
| R4-2109384 | Nokia, Nokia Shanghai Bell | **Proposal 1: Two rated carrier EIRP may be declared by manufacturer for operating bands in 52.6 – 71 GHz range where the supported fractional bandwidth (FBW) is larger than 6%.****Proposal 2: Whether to allow two rated carrier TRP declarations depending on the supported fractional bandwidth could be separately considered for each operating band or band combination in 52.6 – 71 GHz range, based on technical justification of implementation complexity.****Proposal 3: The total power dynamic range requirement for NR operation in 52.6 – 71 GHz range should be based on 10\*log10(Nrb) for all specified channel bandwidth and SCS combinations.****Proposal 4: 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.****Proposal 5: The transient period for BS operating in 52.6 – 71 GHz range should be considered together with the target transmit OFF power, as well as the transient period for UE operating in 52.6 – 71 GHz range.****Proposal 6: The EVM requirements for BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz range. Moreover, the EVM window length for NR operation in 52.6 – 71 GHz range should be defined as 50% of the normal CP length.****Proposal 7: The MIMO time alignment error requirement for BS type 1-O and BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz 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 8: The issue of low emission PSD is handled by specifying an absolute requirement level for each relative emission requirement considering both adjacent channel protection and implementation feasibility of test equipment.****Proposal 9: A larger measurement step size** **for the OTA occupied bandwidth requirement, e.g. 400kHz, can be considered for NR operation in 52.6 – 71 GHz range with wider channel bandwidth.****Proposal 10: The middle ACLR and ACS values between the values at 50GHz and 70GHz in TR 38.803 can be adopted for NR operation in 52.6 – 71 GHz range.** |
| R4-2109870 | Ericsson | **Proposal 1:** Re-use FR2 radiated transmit power (EIRP) requirement for the frequency range 52.6 to 71 GHz.**Proposal 2:** Re-use FR2 OTA base station output power (TRP) requirement for the frequency range 52.6 to 71 GHz.**Proposal 3:** Define TDD OFF power level of -36 dBm/MHz up to 71 GHz.**Observation 1:** The analysis in TR38.803 considering needed ACLR for 70 GHz proxy frequency very well match the outcome of feasibility analysis during SI.**Proposal 4:** Taking to account both co-existence studies in TR 38.803, existing emission masks and feasibility analysis of power amplifiers, the BS ACLR shall be set to 21 dB.**Proposal 5:** Due to diverse emission mask requirements applicable in different regions and the flexibility in terms of both supported SCS and carrier bandwidths for NR in 52.6 to 71 GHz, further discussions and analysis is needed in RAN4 before defining the OBUE/transmitter emission masks.**Proposal 6:** For licensed operation supporting higher EIRP levels, RAN4 should re-use the FR2 approach and adapt the FR2 OBUE/emission mask for NR in 52.6 to 71 GHz and make adaptations taking to account larger carrier bandwidths.**Proposal 7:** For licensed operation and unlicensed operation, RAN4 should re-use the FR2 approach and use FR2 spurious emission requirements for NR in 52.6 to 71 GHz and make adaptations with respect Fstep,X taking to account larger carrier bandwidths.**Observation 2:** Existing NR MIMO TAE = 65 ns requirement has just been copied over into LTE and NR FR1 and NR FR2 without any technical analysis.**Observation 3:** AAS BS for radiated requirements do not have TAE requirements inside a transceiver group. Instead the BS conformance EIRP and EVM verify actual performance. This is a concept that could be used for the extension of NR to 52.6 - 71 GHz WI as well. Applying similar calibration schemes all over the array implies good coherency between transceiver groups and thus the TAE requirement become obsolete, in particular for higher frequencies.**Observation 4:** To meet EIRP and EVM requirements, in BS conformance any significant time misalignment would affect the beam and introduce beam widening, loss of gain in main lobes and increased sidelobes. This effect is generic and not strongly connected to any particular feature, like MIMO.**Proposal 8:** Remove TAE requirements for MIMO for extension to 71 GHz WI.**Proposal 9:** Assume colocation for contiguous intra band CA and non-contiguous intra band CA for extension to 71 GHz WI. **Proposal 10:** Remove TAE requirements for contiguous intra band CA and non-contiguous intra band CA for extension to 71 GHz WI. **Proposal 11:** Keep TAE = 3 µs for inter band CA for extension to 71 GHz WI. |
| R4-2110601 | ZTE Corporation | **Proposal 1:** to reuse the existing FR2 TRP/EIRP accuracy requirements for 60GHz BS regardless of unlicensed or unlicensed operation.Observation 1: if the output power for 60GHz is on the same level of that for the existing FR2 and same PA manufacturing material (e.g. GaAs, Si), then similar ramping up time and ramping down time could be expected for 60GHz. Observation 2: to reduce the GP overhead for 480kHz and 960kHz of 60GHz, alternatives could be extend the TDD periodicity.**Proposal 2:** to reuse -36dBm/MHz for 60GHz BS regardless of licensed operation or unlicensed operation.**Proposal 3**: to discuss the simulation assumptions to further evaluate acceptable TAE requirements for 60GHz 480kHz and 960kHz SCS. **Proposal 4:** to agree ACLR 24dBc for 60GHz. **Proposal 5:** to agree OBUE limit in Table 3 for 60GHz. Table 3: OBUE limits applicable in the frequency range 52.6 GHz-71 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 39 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. |

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## 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: Power accuracy**

* Proposals (multiple can be selected)
	+ Option 1: The existing FR2 EIRP accuracy (±3.4dB) and the TRP accuracy (±3dB) for FR2 can be reused for 52.6-71GHz, both for licensed and unlicensed operation
	+ Option 2: Two rated carrier EIRP may be declared by manufacturer for operating bands in 52.6 – 71 GHz range where the supported fractional bandwidth (FBW) is larger than 6%.
	+ Option 3: Whether to allow two rated carrier TRP declarations depending on the supported fractional bandwidth could be separately considered for each operating band or band combination in 52.6 – 71 GHz range, based on technical justification of implementation complexity.
* Recommended WF
	+ TBA

**Issue 1-1-2: Off power**

There are proposals in the contributions proposing either to calculate Off power with suitable set of parameters or to re-use the current FR2 off power requirement. Analysis in R4-2109114 results in -27 dBm/MHz.

* Proposals
	+ Option 1: The existing FR2 OFF power requirement -36dBm/MHz is valid for 52.6-71 GHz.
	+ 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
	+ Option 1

**Issue 1-1-3: Transient period**

* Proposals
	+ Option 1: The transient period for BS operating in 52.6 – 71 GHz range should be considered together with the target transmit OFF power, as well as the transient period for UE operating in 52.6 – 71 GHz range.
	+ Option 2: TBA
* Recommended WF
	+ Option 1

**Issue 1-1-4: Total power dynamic range**

* Proposals
	+ Option 1: The total power dynamic range requirement for NR operation in 52.6 – 71 GHz range should be based on 10\*log10(Nrb) for all specified channel bandwidth and SCS combinations.
	+ Option 2: TBA
* Recommended WF
	+ Option 1

### Sub-topic 1-2: Signal quality related requirements

This sub-topic covers 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: MIMO TAE**

* Proposals
	+ Option 1: The MIMO time alignment error requirement for BS type 1-O and BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz range
	+ Option 2: Remove TAE requirements for MIMO for extension to 71 GHz WI.
	+ Option 3: discuss the simulation assumptions to further evaluate acceptable TAE requirements for 60GHz 480kHz and 960kHz SCS.
* Recommended WF
	+ TBA

**Issue 1-2-2: CA TAE**

* Proposals (multiple can be selected)
	+ Option 1: CA time alignment error requirements for NR operation in 52.6 – 71 GHz range should be shorter than that for BS type 2-O
	+ Option 2: Assume colocation for contiguous intra band CA and non-contiguous intra band CA for extension to 71 GHz WI.
	+ Option 3: Remove TAE requirements for contiguous intra band CA and non-contiguous intra band CA for extension to 71 GHz WI.
	+ Option 4: Keep TAE = 3 µs for inter band CA for extension to 71 GHz WI
	+ Option 5: discuss the simulation assumptions to further evaluate acceptable TAE requirements for 60GHz 480kHz and 960kHz SCS.
* Recommended WF
	+ TBA

**Issue 1-2-3: EVM**

* Proposals
	+ Option 1: The EVM requirements for BS type 2-O should be applicable for NR operation in 52.6 – 71 GHz range. Moreover, the EVM window length for NR operation in 52.6 – 71 GHz range should be defined as 50% of the normal CP length.
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 1-3: Unwanted emissions related requirements

This sub-topic covers unwanted emissions related requirements.

**Issue 1-3-1: Low emission PSD**

* Proposals
	+ Option 1: The issue of low emission PSD is handled by specifying an absolute requirement level for each relative emission requirement considering both adjacent channel protection and implementation feasibility of test equipment.
	+ Option 2:
* Recommended WF
	+ TBA

**Issue 1-3-2: ACLR**

Summary of ACLR/ACS results from TR 38.803:

|  |  |  |  |
| --- | --- | --- | --- |
| BS | 30 GHz | 45 GHz | 70 GHz |
| ACLR | 27.5 | 25.5 | 23.5 |
| ACS | 23.5 | 22.5 | 21.5 |

|  |  |  |  |
| --- | --- | --- | --- |
| UE | 30 GHz | 45 GHz | 70 GHz |
| ACLR | 17 | 16 | 15 |
| ACS | 22.5 | 21.5 | 20.5 |

|  |  |  |  |
| --- | --- | --- | --- |
| ACIR | 30 GHz | 45 GHz | 70 GHz |
| DL: BS ACLR / UE ACS | 21.3 | 20.0 | 18.7 |
| UL: UE ACLR / BS ACS | 16.1 | 15.1 | 14.1 |

* Proposals
	+ Option 1: The middle BS ACLR values at 50GHz and 70GHz in TR 38.803 can be adopted for NR operation in 52.6 – 71 GHz range.
	+ Option 2: BS ACLR shall be set to 21 dB.
	+ Option 3: BS ACLR shall be set to 24 dB.
* Recommended WF
	+ TBA

**Issue 1-3-3: OBUE**

* Proposals
	+ Option 1: Postpone OBUE/emission mask discussion
	+ Option 2: For licensed operation supporting higher EIRP levels, RAN4 should re-use the FR2 approach and adapt the FR2 OBUE/emission mask for NR in 52.6 to 71 GHz and make adaptations taking to account larger carrier bandwidths.
	+ Option 3: Agree OBUE below:

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 39 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. |

* Recommended WF
	+ TBA

**Issue 1-3-4: Spurious emissions**

* Proposals
	+ Option 1: RAN4 should re-use the FR2 approach and use FR2 spurious emission requirements for NR in 52.6 to 71 GHz and make adaptations with respect Fstep,X taking to account larger carrier bandwidths.
	+ Option 2:
* Recommended WF
	+ TBA

**Issue 1-3-5: Occupied bandwidth**

* Proposals
	+ Option 1: A larger measurement step size for the OTA occupied bandwidth requirement, e.g. 400kHz, can be considered for NR operation in 52.6 – 71 GHz range with wider channel bandwidth.
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-1-1: **Power accuracy**We support option 1. Fractional bandwidth concept can also be re-used; hence we also support option 2. There is no solid technical justification to expand the fractional bandwidth concept to also include TRP. The fractional bandwidth concept was introduced to allow for EIRP variations due to gain variations over frequency. TRP is not affected. We do not support option 3.Issue 1-1-2: **Off power**We support option 1.Issue 1-1-3: **Transient period**We support Option 1.Issue 1-1-4: **Total power dynamic range**We prefer Option 1. |
| Nokia | Issue 1-1-1: **Power accuracy**Propose option 1 and option 2. Currently see no need for option 3.Issue 1-1-2: **Off power**Propose option 1; for option 2, analysis in R4-2109114 results in -27 dBm/MHz.Issue 1-1-3: **Transient period**Propose option 1.Issue 1-1-4: **Total power dynamic range**Propose option 1. |
| CATT | **Issue 1-1-1: Power accuracy**We support option 1 and Option 2.**Issue 1-1-2: Off power**We support option 1.**Issue 1-1-3: Transient period**We support option 1.**Issue 1-1-4: Total power dynamic range**We support option 1. |
| ZTE | **Issue 1-1-1: Power accuracy**support option 1 and Option 2**Issue 1-1-2: Off power** support option 1**Issue 1-1-3: Transient period**We support option 1.**Issue 1-1-4: Total power dynamic range**We support option 1. |
| Huawei | **Issue 1-1-1: Power accuracy**For option 1: we would be ok to consider FR2 accuracy values as starting point (in []?) but we would like to have more time for analysis. As the EIRP levels will be higher due to higher frequencies, it is not clear whether the accuracy tolerance (also considering the manufacturing process) can be simply reused. (for now we are not proposing that EIRP accuracy values need to be increased for 52-71GHz)For option 2:It shall be highlighted, that the 6% threshold for the fractional bandwidth consideration was selected based on the existing FR2 bands, where it was observed what is the potential gain variation. Once new 52-71 bands are introduced, we may need to revisit the FBW analysis to check if the 6% threshold is valid for or needs to be adjusted for higher bands. Therefore we are ok with the FBW concept as such, but we suggest to keep 6% in [] until we know what are the new bands and if existing FBW conclusions from FR2 holds.**Issue 1-1-2: Off power**FR2 Off power was calculated for 28GHz carrier. The existing value was using 128 TRXs, while 52-71 SI considered larger configurations as well. Therefore, it is expected that the re-calculation is well motivated. As there is range of parameter values to consider, it would be good to see more analysis before decision is taken. WF: provide more analysis on the OFF power re-calculation for 52-71 range. **Issue 1-1-3: Transient period**Option 1 is reasonable.**Issue 1-1-4: Total power dynamic range**Option 1 |

Sub-topic 1-2: Signal quality related requirements

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-2-1: **MIMO TAE**We support option 2.Issue 1-2-2: **CA TAE**We support option 3.Issue 1-2-3: **EVM**Option 1, seems reasonable and in line with current FR2. |
| Nokia | Issue 1-2-1: **MIMO TAE**Propose option 1, ok to further consider option 2.Issue 1-2-2: **CA TAE**Propose option 1, agree with option 2 and ok to further consider option 3 and option 4 based on option 2.Issue 1-2-3: **EVM**Propose option 1. |
| CATT | **Issue 1-2-1: MIMO TAE**FFS on TAE between any two TAB connectors from different transmitter groups, because they are used for transmitting two layers. The TAE between two layers is related to the performance.**Issue 1-2-2: CA TAE** FFS.**Issue 1-2-3: EVM**Option1. |
| ZTE | Issue 1-2-1: **MIMO TAE**Option 3, further evaluation are needed.Issue 1-2-2: **CA TAE**FFSIssue 1-2-3: **EVM**FFS, this is relying on the link level simulation results |
| Huawei | Issue 1-2-1: **MIMO TAE**Further evaluations are needed.Issue 1-2-2: **CA TAE**FFSIssue 1-2-3: **EVM**FR2 EVM for the modulation and coding schemes supported in 52-71 seems good starting point, but LL evaluation to verify the performance is good idea. EVM window length to be studied in the Perf part of the WI.  |

Sub-topic 1-3: Unwanted emissions related requirements

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-3-1: **Low emission PSD**Due to diverse emission mask requirements applicable in different regions and the flexibility in terms of both supported SCS and carrier bandwidths for NR in 52.6 to 71 GHz, further discussions and analysis is needed in RAN4 before defining the OBUE/transmitter emission masks.Issue 1-3-2: **ACLR**We support option 2.Issue 1-3-3: **OBUE**We support option 2.Issue 1-3-4: **Spurious emissions**We support option 1.Issue 1-3-5: **Occupied bandwidth**The aspect related to measurement step size is related to the description of the test procedure in conformance. When we reach conformance testing, we need to sort out how to handle the number of measurement points required for larger CBW. Now let’s focus on RF core aspects.  |
| Nokia | Issue 1-3-1: **Low emission PSD**Propose option 1.Issue 1-3-2: **ACLR**Propose option 1, but ok with option 3, option 2 cannot ensure performance in some simulated scenarios.Issue 1-3-3: **OBUE**Support option 2.Issue 1-3-4: **Spurious emissions**Support option 1.Issue 1-3-5: **Occupied bandwidth**Propose option 1.  |
| CATT | **Issue 1-3-1: Low emission PSD**FFS.**Issue 1-3-2: ACLR**Should wait the conclusion of co-existence simulation discussion.**Issue 1-3-3: OBUE**Support option 1 as the starting point as ACLR is not agreed.**Issue 1-3-4: Spurious emissions**Option 1 is fine.**Issue 1-3-5: Occupied bandwidth**Measurement step size can be discussed in conformance phase. |
| ZTE | **Issue 1-3-1: Low emission PSD**FFS.**Issue 1-3-2: ACLR**Option 3**Issue 1-3-3: OBUE**Option 3, indeed option 3 is just using the current FR2 approach.**Issue 1-3-4: Spurious emissions**Option 1 is fine.**Issue 1-3-5: Occupied bandwidth**This could be discussed in conformance testing phase.  |
| Huawei | **Issue 1-3-1: Low emission PSD**We share Ericsson concerns. FFS.**Issue 1-3-2: ACLR**This is related to the co-existence simulation discussion.**Issue 1-3-3: OBUE**Option 1**Issue 1-3-4: Spurious emissions**Option 1 is justified**Issue 1-3-5: Occupied bandwidth**More analysis on the core requirement needed. Option 1 not needed at this stage.  |

## 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 #1-1 General and output power requirements** | There is a good alignment for all issues:For power accuracy 4 companies agree re-use for FR2 EIRP accuracy and 1 company wants more time to study. All companies agree fractional bandwidth concept, 1 company requests currect FR2 break point of 6% to be put to square bracketsFor Off power 4 companies agree to re-use existing FR2 requirement of -36 dBm/MHz, one company requests more analysisFor transient period, all companies agree to consider this together with transmit OFF power, and also together with UE requirement.For total power dynamic range all companies agree to base the requirement on 10\*log10(Nrb)*Tentative agreements:*Re-use FR2 EIRP accuracyRe-use fractional bandwidth concept from current FR2Re-use OFF power requirement of -36 dBm/MHz from FR2Consider transient period together with transmit OFF power, and also together with UE requirement.Total power dynamic range requirement is based on 10\*log10(Nrb) for all SCS and ChBW*Candidate options:*Further study for EIRP accuracyFurther study whether 6% is correct breakpoint for fractional bandwidthFurther study OFF power level*Recommendations for 2nd round:*Confirm tentative agreements in WF. Company driving the WF to check UE discussion outcome on transient period and to consider whether current FR2 transient time can be proposed to drive further progress in this meeting. |
| **Sub-topic #1-2 Signal quality related requirements** | For MIMO TAE all options got some support with no clear preference for any optionFor CA TAE also no clear preference among companies, with 3 out of 5 companies requesting further studyFor EVM 3 companies agree that EVM requirements for BS type 2-O should be applicable for 52.6 – 71 GHz. Two companies request further study, one of them also preferring link level simulations.*Tentative agreements:*none*Candidate options:*Study CA TAE furtherConsider BS type 2-O EVM requirements, but allow further time to check*Recommendations for 2nd round:*Aim to achieve further progress in WF discussion, setting at least clear steps how to proceed towards next meeting. |
| **Sub-topic #1-3 Unwanted emissions related requirements** | For low emission PSD, 4 out of 5 companies request further study.For ACLR, 3 companies would be happy to agree a value, but prefer different values. Two companies do not want to agree before coexistence study discussion is completed.For OBUE, both postponing the discussion and adapting the FR2 OBUE mask for licensed operation got support, one company also has their own proposal for OBUE mask.* Moderator: it was agreed in previous meeting that licensed band will not be defined before regulatory requirements are clear and licensed operation is considered only in system parameters. Therefore discussion on licensed band in this agenda can stop.

For spurius emissions, all companies agree to re-use FR2 approach with adaptions to the emission mask step points to account for wider channel bandwidths.For occupied bandwidth measurement step size, majority view is to discuss this in performance part.*Tentative agreements:*Apply FR2 approach for spurious emissions, with necessary adaptations to emissions mask step frequenciesOccupied bandwidth measurement step size postponed to performance part.Moderator suggestion: no further discussion on licensed band requirements.*Candidate options:**Recommendations for 2nd round:*Capture tentative agreements in WF. Aim for further progress for low emission PSD, ACLR and OBUE in WF discussion, at least with clear steps how to proceed towards next meeting. |

## 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** |
| R4-2109115 | CATT | Proposal 1: Existing EISREFSENS\_50M can be used for reference sensitivity declaration for 52.6-71GHz. Proposal 2: To define new FRCs for 480 kHz SCS/400MHz CBW and 960kHz SCS/400MHz CBW for reference sensitivity for 52.6-71GHz. Proposal 3 ：To reuse current existing FR2 OOB blocker level for 52.6-71GHz. |
| R4-2109385 | Nokia, Nokia Shanghai Bell | Proposal 1: Three FRCs with 100MHz (120kHz SCS) and 400MHz (480kHz and 960kHz SCSs) can be defined for NR operation in 52.6 – 71 GHz range to cover up to the maximum channel bandwidth for each SCS.Proposal 2: The middle ACLR and ACS values between the values at 50GHz and 70GHz in TR 38.803 can be adopted for NR operation in 52.6 – 71 GHz range.Proposal 3: 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: Larger step size like 120MHz or 240MHz can be defined for minimum supported BS channel bandwidth larger than 400MHz for NR operation in 52.6 – 71 GHz range.Proposal 5: The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 should be applied at least for unlicensed NR operation in 52.6 – 71 GHz range in Europe.Proposal 6: The interferer levels for general receiver intermodulation for NR operation in 52.6 – 71 GHz range can be further discussed and decided once the in-band blocking levels are agreed.Proposal 7: The ICS value for NR operation in 52.6 – 71 GHz range can be decided based on UL IOT simulation results at 60GHz. |
| R4-2109871 | Ericsson | Proposal 1: Re-use the BS type 2-O concept for, OTA reference sensitivity requirement for the frequency range 52.6 to 71 GHz.Proposal 2: For OTA reference sensitivity add new FRC for 480 kHz SCS and 400 MHz carrier bandwidth. Proposal 3: For OTA reference sensitivity add new FRC for 960 kHz SCS and 400 MHz carrier bandwidth.Proposal 4: For OTA reference sensitivity add new FRC for 960 kHz SCS and FFS MHz carrier bandwidth for maximum supported carrier bandwidth.Proposal 5: For ACS and in-band blocking re-use interferer signal level from FR2.Proposal 6: For ACS and in-band blocking define interferer signal type based on minimum supported carrier bandwidth and sub-carrier spacing.Proposal 7: For out-of-band blocking re-use FR2 out-of-band interferer level. Proposal 8: For receiver blocking further consider DfOBUE and decide if DfOOB needs to be aligned or not. Proposal 9: For out-of-band blocking RF core requirement define the interferer signal upper frequency limit to 2nd harmonic similar as for FR2. |
| R4-2110602 | ZTE corporation | Proposal 1:the existing range specified for EISREFSENS\_50M could also applicable for 60GHz.Proposal 2: to agree ACS as 23dBc for 60GHz and channel bandwidth of interfering signal should be 100MHz;Proposal 3: a 33dB offset from the reference sensitivity used for interfering signal could also been applied for 60GHz.Proposal 4:to apply an offset of 8 dB below OTA blocking levels for RX IMD interfering signal. |

## 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: Sensitivity levels**

* Proposals (multiple can be selected)
	+ Option 1: Existing EISREFSENS\_50M can be used for reference sensitivity declaration for 52.6-71GHz.
	+ Option 2: the existing range specified for EISREFSENS\_50M could also applicable for 60GHz.
	+ Option 3: Re-use the BS type 2-O concept for, OTA reference sensitivity requirement for the frequency range 52.6 to 71 GHz.
* Recommended WF
	+ TBA

**Issue 2-1-2: FRCs**

* Proposals (multiple can be selected)
	+ Option 1: To define new FRCs for 480 kHz SCS/400MHz CBW and 960kHz SCS/400MHz CBW for reference sensitivity for 52.6-71GHz.
	+ Option 2: Three FRCs with 100MHz (120kHz SCS) and 400MHz (480kHz and 960kHz SCSs) can be defined for NR operation in 52.6 – 71 GHz range to cover up to the maximum channel bandwidth for each SCS.
	+ Option 3: For OTA reference sensitivity add new FRC for 960 kHz SCS and FFS MHz carrier bandwidth for maximum supported carrier bandwidth.
* Recommended WF
	+ TBA

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

This sub-topic covers ACS and in-band blocking related requirements.

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

**Issue 2-2-1: ACS**

Summary of ACLR/ACS results from TR 38.803:

|  |  |  |  |
| --- | --- | --- | --- |
| BS | 30 GHz | 45 GHz | 70 GHz |
| ACLR | 27.5 | 25.5 | 23.5 |
| ACS | 23.5 | 22.5 | 21.5 |

|  |  |  |  |
| --- | --- | --- | --- |
| UE | 30 GHz | 45 GHz | 70 GHz |
| ACLR | 17 | 16 | 15 |
| ACS | 22.5 | 21.5 | 20.5 |

|  |  |  |  |
| --- | --- | --- | --- |
| ACIR | 30 GHz | 45 GHz | 70 GHz |
| DL: BS ACLR / UE ACS | 21.3 | 20.0 | 18.7 |
| UL: UE ACLR / BS ACS | 16.1 | 15.1 | 14.1 |

* Proposals
	+ Option 1: The middle ACS values between the values at 50GHz and 70GHz in TR 38.803 can be adopted for NR operation in 52.6 – 71 GHz range.
	+ Option 2: Re-use interferer signal level from FR2
	+ Option 3: Agree ACS of 23 dB with 100 MHz interfering signal BW
* Recommended WF
	+ TBA

**Issue 2-2-2: in-band blocking**

* Proposals
	+ Option 1: 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.
	+ Option 2: 33dB offset from the reference sensitivity used for interfering signal is applied for 60GHz
* Recommended WF
	+ TBA

### Sub-topic 2-3: OOB 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: Blocker level**

* Proposals
	+ Option 1: reuse current existing FR2 OOB blocker level for 52.6-71GHz
	+ Option 2: TBA
* Recommended WF
	+ Option 1

**Issue 2-3-2: Frequency definitions**

* Proposals (multiple can be selected)
	+ Option 1: For out-of-band blocking RF core requirement define the interferer signal upper frequency limit to 2nd harmonic similar as for FR2.
	+ Option 2: For receiver blocking further consider DfOBUE and decide if DfOOB needs to be aligned
	+ Option 3: Larger step size like 120MHz or 240MHz can be defined for minimum supported BS channel bandwidth larger than 400MHz for NR operation in 52.6 – 71 GHz range.
* Recommended WF
	+ TBA

### Sub-topic 2-4: Others

This sub-topic covers receiver spurious emissions, Rx IMD and in-channel selective requirements.

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

**Issue 2-4-1: Receiver spurious emissions**

* Proposals
	+ Option 1: The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 should be applied at least for unlicensed NR operation in 52.6 – 71 GHz range in Europe.
	+ Option 2:
* Recommended WF
	+ TBA

**Issue 2-4-2: Rx IMD**

* Proposals
	+ Option 1: The interferer levels for general receiver intermodulation for NR operation in 52.6 – 71 GHz range can be further discussed and decided once the in-band blocking levels are agreed.
	+ Option 2: to apply an offset of 8 dB below OTA blocking levels for RX IMD interfering signal.
* Recommended WF
	+ TBA

**Issue 2-4-3: ICS**

* Proposals
	+ Option 1: The ICS value for NR operation in 52.6 – 71 GHz range can be decided based on UL IOT simulation results at 60GHz.
	+ Option 2:
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1: General and sensitivity related requirements

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-1-1: **Sensitivity levels**We support the idea to re-use FR2 requirement. Therefore, we support Option 1, Option 2 and Option 3.Issue 2-1-2: **FRCs**We support Option 1 and Option 3. 120 kHz SCS and 100 MHz CBW can be re-used |

|  |  |
| --- | --- |
| Nokia | Issue 2-1-1: **Sensitivity levels**Support option 3; for option 1 and option 2, propose to consider using 100MHz channel as base for 52.6-71GHz.Issue 2-1-2: **FRCs**Propose option 2, ok with option 1; for option 3, this means there is no FRC for 480 kHz SCS. |
| CATT | **Issue 2-1-1: Sensitivity levels**We support option 1, declaration range for EISREFSENS\_50M need more discussion due to NF and antenna size for 52.6GHz may be different existing FR2.**Issue 2-1-2: FRCs**We support option 1, small CBW FRCs are need. |
| ZTE | Issue 2-1-1: **Sensitivity levels**we support Option 1, Option 2 and Option 3.**Issue 2-1-2: FRCs**We support Option 1 |
| Huawei | Issue 2-1-1: **Sensitivity levels**Options 1 and 3 are reasonable. For the range we would like to have more study. Issue 2-1-2: **FRCs**Option 1/2. To double-check if 120 kHz SCS and 100 MHz CBW could be re-used. |

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

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-2-1: **ACS**We support Option 2. The interferer signal type needs to be updated to 100 MHz.Issue 2-2-2: **In-band blocking**We support Option 2. The interferer signal type needs to be updated with respect to SCS and CBW. |
| Nokia | Issue 2-2-1: **ACS**Propose option 1; for option 2, ACS blocker level should be recalculated using wider ChBW and higher NF; for option 3, it is tighter than ACS at 37 – 52.6 GHz.Issue 2-2-2: **In-band blocking**Propose option 1; for option 2, the interferer signal level should be agreed together with the interferer signal type. |
| CATT | **Issue 2-2-1: ACS**Should wait the conclusion of co-existence simulation discussion..**Issue 2-2-2: in-band blocking**We support option 1 which proposes option 2 as baseline, and also considers the possible co-existence simulation results. |
| ZTE | Issue 2-2-1: **ACS**Propose to have 22dBc for ACS instead of 23dBc**Issue 2-2-2: in-band blocking**Option 2 |
| Huawei | **Issue 2-2-1: ACS**Should wait the conclusion of co-existence simulation discussion.**Issue 2-2-2: in-band blocking**Option 1 |

Sub topic 2-3: OOB blocking

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-3-1: **Blocker level** We support option 1.Issue 2-3-2: **Frequency definitions**We support option 1 and option 2. Option 3 is for conformance testing to resolve. |
| Nokia | Issue 2-3-1: **Blocker level**OK with option 1.Issue 2-3-2: **Frequency definitions**Propose option 3, ok with option 1 and option 2. |
| CATT | **Issue 2-3-1: Blocker level** Option 1 is OK for us.**Issue 2-3-2: Frequency definitions**Option 1 and option 2 are fine for us. For Option 3, larger step size needs more discussion for conformance. |
| ZTE | **Issue 2-3-1: Blocker level** Option 1**Issue 2-3-2: Frequency definition**Fine with Option 1 and option 2. For option 3, this could be discussed in conformance testing phase. |
| Huawei | **Issue 2-3-1: Blocker level** Double-check during second round of Option 1 is ok.**Issue 2-3-2: Frequency definitions**Option 1 and 2. Tend to agree on the approach with option 3, but leave it for Perf part.  |

Sub topic 2-4: Others

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-4-1: **Receiver spurious emissions**ETSI EN 303 722 consider only low power devices. Since NR is intended to support different types of base stations with different types of power capabilities, we should follow the concept used for FR2. For NR FR2, we can use the same limits as for TX. For receiver spurious emissions we should not use ETSI BRAN as the general case. Instead rather align with transmitter spurious emission.Issue 2-4-2: **Rx IMD**We prefer Option 1.Issue 2-4-3: **ICS**ICS can be further discussed and decided once the in-band blocking levels and interferer types are agreed. |
| Nokia | Issue 2-4-1: **Receiver spurious emissions**Propose option 1.Issue 2-4-2: **Rx IMD**Propose option 1.Issue 2-4-3: **ICS**Propose option 1. |
| CATT | **Issue 2-4-1: Receiver spurious emissions**Fine for option 1**Issue 2-4-2: Rx IMD**Support option 1.**Issue 2-4-3: ICS**FFS. |
| ZTE | Issue 2-4-1: **Receiver spurious emissions**Fine with option 1**Issue 2-4-2: Rx IMD**Option 2 is more preferred, however we are also fine with option 1 to further discuss the issue.**Issue 2-4-3: ICS**Simulation results could be provided, however we think this requirement should be needed to test Reciver I/Q imbalance |
| Huawei | **Issue 2-4-1: Receiver spurious emissions**ETSI BRAN specs as reference for the unlicensed operation seems justified. Still, we are ok to have more discussion to address Ericsson concerns. **Issue 2-4-2: Rx IMD**Option 1 (or simply continue the discussion)**Issue 2-4-3: ICS**FFS. Shall we use 60GHz proxy frequency, or rather 70/71GHz as corner case? We may need more discussion on this in the general part.  |

## 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#2-1 General and sensitivity related requirements** | For sensitivity levels all options got rather equal support, with some comments that the declaration range will need to be checked and 100 MHz could be the baseline instead of 50 MHz.For FRC there is good alignment to define new FRCs for 400 MHz with both 480 and 960 kHz SCS. There seems to also some common understanding to have 100 MHz / 120 kHz FRC, but whether the current parameters from FR2 can be re-used needs further checking.* Moderator: Re-use of 100 MHz FRC has also linkage to spectrum utilization discussion in thread 145.

*Tentative agreements:*Use the same principle for sensitivity level as current FR2, but further check if 100 MHz/120 kHz can be the basis instead of 50MHz and further check whether the allowed declaration range needs an update.FRCs for 52.6 GHz – 71 GHz include 100 MHz/120 kHz, 400 MHz/480 kHz, 400 MHz/960 MHz.*Candidate options:**Recommendations for 2nd round:*Capture tentative agreements in WF. As part of WF discussion drive further clarifications on how to consider update from 50 MHz baseline to 100 MHz baseline. |
| **Sub-topic#2-2: ACS and in-band blocking**  | For ACS there is no alignment, with three different proposals and additionally two companies wanting to wait for coexistence simulation discussions to conclude.For inband blocking there is slight majority towards using current BS type 2-O blocking level as baseline, but also ensuring alignment with ACS. Two companies also recommend 33 dB offset from reference sensitivity. *Tentative agreements:*none*Candidate options*Using current BS type 2-O in-band blocking level as baseline, but also ensure alignment with ACS*Recommendations for 2nd round:*Aim to discuss and confirm the candidate option in WF and set next step how to proceed towards next meeting |
| **Sub-topic#2-3: OOB-blocking** | For OOB blocking all companies agree to re-use the FR2 blocker level.All companies also agree to have 2nd harmonic as upper frequency limit and further consider DfOBUE and whether DfOOB need to be aligned*Tentative agreements:*Re-use FR2 OOB blocker level for 52.6 – 71 GHz.Use 2nd harmonic as upper frequency limit for OOB blockingFurther consider DfOBUE and whether DfOOB need to be aligned*Candidate options:*Postpone measurement step size discussion to performance part.*Recommendations for 2nd round:*Capture agreements in WF.  |
| **Sub-topic#2-4: Others** | For receiver spurious emissions 4 companies would be ok with applying requirement from ETSI EN 303 722, while one company would prefer to align with Tx requirement.For Rx IMD, all companies agree to discuss and decide interferer levels after ACS and in-band blocking has been agreed.For ICS there are comments to study further, do simulations and wait for ACS and in-band blocking, and no clear preference can be found.*Tentative agreements:*Use ETSI EN 303 722 receiver spurious emission limit for 52.6 – 71 GHz..Discuss and decide Rx IMD interferer levels after ACS and in-band blocking has been agreed.*Candidate options:*Align receiver spurious limit with Tx spurious emission limit*Recommendations for 2nd round:*Capture tentative agreements in WF, aim to clarify how to proceed with ICS. |

## 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 BS TX RF requirements for 52.6 – 71 GHz | Nokia, Nokia Shanghai Bell |  |
| WF on BS RX RF requirements for 52.6 – 71 GHz | Huawei |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
|  |  |  |  |  |
| R4-2109114 | Discussion on BS TX RF requirements for 52 6-71GHz | CATT | Noted |  |
| R4-2109384 | Proposals on BS transmitter requirements for extending current NR operation to 71 GHz | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2109870 | On BS RF transmitter requirements for the frequency range 52 to 71 GHz | Ericsson | Noted |  |
| R4-2110601 | Discussion on BS Tx requirements for 60GHz | ZTE Corporation | Noted |  |
| R4-2109115 | Discussion on BS TX RF requirements for 52 6-71GHz | CATT | Noted |  |
| R4-2109385 | Proposals on BS transmitter requirements for extending current NR operation to 71 GHz | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2109872 | On BS RF transmitter requirements for the frequency range 52 to 71 GHz | Ericsson | Noted |  |
| R4-2110602 | Discussion on BS Tx requirements for 60GHz | ZTE Corporation | Noted |  |

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