**3GPP TSG-RAN WG4 Meeting # 101-e draft R4-2120743**

**Electronic Meeting, 1st – 12th November, 2021**

**Agenda item:** 8.16.4

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [101-e][312] NR\_exto71GHz\_BSRF

**Document for:** Information

# Introduction

This email discussion summary covers BS RF requirements for extending NR operation to 71 GHz. Based on the input contributions 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.

In addition, a third topic on CR worksplit has been added by moderator.

The template has been adapted to include comment section separately for each issue to facilitate discussion.

# Topic #1: Tx requirements

This topic covers Tx requirements.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2117247 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Re-use both current (3.4 dB in normal conditions and 4.5 dB in extreme conditions) EIRP and 3 dB TRP accuracy requirements from FR2-1 to FR2-2 and re-use 6% limit to allow two EIRP values to be declared.**Proposal 2:** The current FR2 BS 3 µs transient period should be applicable for NR operation in 52.6 – 71 GHz range.**Proposal 3:** The EVM window length for NR operation in 52.6 – 71 GHz range should be defined as 50% of the normal CP length.**Proposal 4:** Also consider other options to reduce EVM measurement time for NR operation in 52.6 – 71 GHz range, e.g., limit the number of samples over which the EVM has to be averaged.**Proposal 5:** 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, shorter CA time alignment error requirements (than that for BS type 2-O) may be considered for NR operation in 52.6 – 71 GHz range with larger SCS (than that for BS type 2-O).**Proposal 6:** The unwanted emissions for licensed operation can be further discussed when related regulatory requirements become available in the regions.**Proposal 7:** The out-of-band emissions and unwanted emissions in the spurious domain specified in ETSI EN 303 722 and/or ETSI EN 303 753 can be considered for unlicensed NR operation in 52.6 – 71 GHz range at least in Europe.**Proposal 8:** RAN4 to consider further whether TRP should be used as emission metric and whether the relative mask should be limited to bottom down at -22 dBr.**Proposal 9:** The proposed ACIR values in TR 38.803 at 70 GHz carrier frequency can be reused as the required ACIR values for extending current NR operation to 71 GHz. |
| R4-2117389 | CATT | **Observation 1:** The EIRP accuracy can’t guarantee the TAE.**Observation 2:** Existing FR2-1 TAE 65ns isn’t applicable for 52.6-71GHz.**Proposal 1:** To specifyΔfOBUE = 3500 MHz for FDL,high – FDL,low > 4000 MHz for 52.6-71GHz.**Proposal 2:** Re-use the FR2-1 OBUE requirement with ΔfOBUE = 3500 MHz for 52.6- 71 GHz.**Proposal 3:** Use FR2 approach with necessary adaptations on step size for spurious emissions (option 1)*Moderator’s note: Option 1 in proposal 3 refers to agreed WF in previous meeting in R4-2115643* |
| R4-2118461 | Ericsson | **Proposal 1:** In TS 38.104, Table 9.6.2.3-1 add a column to differentiate the EVM applicability within FR2.**Proposal 2:** 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 3:** Add table row for FR2-2 with new ACLR limit and supported carrier bandwidths in TS 38.104, Table 9.7.3.3-1.**Proposal 4:** For the frequency range 52.6 to 71 GHz within FR2 set fOBUE to 3000 MHz.**Proposal 5:** Re-use FR2-1 OBUE requirement concept for FR2-2 as proposed in Tables 2.2.3-9 and 2.2.3-10. **Proposal 6:** 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.**Proposal 7:** Remove TAE requirements for MIMO and rely on EIRP BS conformance to verify that TAE is within a working range, for a case when all TRX are declared in all transceiver groups.**Proposal 8:** For MIMO set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz.**Proposal 9:** For CA set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz.**Proposal 10:** A reference architecture for Non-contiguous Intra Band Carrier aggregation, is a UE with separate receivers for each component carrier.**Proposal 11:** TAE = 260 ns for non-contiguous carrier aggregation.**Proposal 12:** TAE = 3 µs for interband CA. |
| R4-2119190 | ZTE Corporation | **Proposal 1:** the acceptable TAE requirement should be around 10-20ns for 960kHz and 10-40ns for 480kHz;**Proposal 2**: to postpone EVM window requirement into conformance testing phase due to unclear out of band emission requirements; **Proposal 3:** to propose to follow the outcome of coexistence study of 52.6-71GHz for ACLR and out of band emission requirement. |

## Open issues summary and comment collection

Please note it is possible and often necessary to select multiple options to create coherent agreements/requirements.

### Sub-topic 1-1 EIRP and TRP output power requirements

**Issue 1-1: EIRP and TRP output power requirements**

Background: Agreed WF from R4-2115643: “Re-use both current ([3.4] dB in normal conditions and [4.5] dB in extreme conditions) EIRP and [3] dB TRP accuracy requirements from FR2-1 to FR2-2 and re-use [6%] limit to allow [two] EIRP values to be declared.”

* Proposals
	+ Option 1: Re-use both current (3.4 dB in normal conditions and 4.5 dB in extreme conditions) EIRP and 3 dB TRP accuracy requirements from FR2-1 to FR2-2 and re-use 6% limit to allow two EIRP values to be declared. (Nokia, R4-2117247)
	+ Option 2: TBA
* Recommended WF
	+ Option 1

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| **Company** | **Comments** |
| Nokia | Propose option 1, and no other option has been proposed by other participating companies in this meeting. |
| Ericsson | We support option 1 |
| CATT | Support option 1. |
| ZTE | Support option 1 |
| Qualcomm | We are ok with option 1. |

### Sub-topic 1-2 Transient times

**Issue 1-2: Transient times**

Background: Agreed WF from R4-2115643: The current FR2 BS [3] µs transient period should be applicable for NR operation in 52.6 – 71 GHz range.

* Proposals
	+ Option 1: The current FR2 BS 3 µs transient period should be applicable for NR operation in 52.6 – 71 GHz range. (Nokia, R4-2117247)
	+ Option 2: TBA
* Recommended WF
	+ Option 1

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| **Company** | **Comments** |
| Nokia | Propose option 1, and no other option has been proposed by other participating companies in this meeting. |
| Ericsson | We support option 1 |
| CATT | Support option 1. |
| ZTE | Fine with option 1 if there are not other valid inputs to confirm its feasibility to further improve it.It should be noted that improve UE transition period is also under discussion in Rel-18 WID package, maybe we might need to come back in next release. |
| Qualcomm | We are ok with option 1.  |

### Sub-topic 1-3 Signal quality - EVM

**Issue 1-3: Signal quality - EVM**

Background: Agreed WF from R4-2115643:

EVM-% from FR2-1 can be re-used for QPSK, 16QAM and 64 QAM.

[50%] EVM window length is used as starting point.

PT-RS for EVM is discussed after RAN1 decision on PT-RS configurations.

* Proposals
	+ Option 1: The EVM window length for NR operation in 52.6 – 71 GHz range should be defined as 50% of the normal CP length. (Nokia, R4-2117247)
	+ In TS 38.104, Table 9.6.2.3-1 add a column to differentiate the EVM applicability within FR2. (Ericsson, R4-2118461)
	+ To postpone EVM window requirement into conformance testing phase due to unclear out of band emission requirements (ZTE, R4-2119190)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, but OK to postpone till out of band emission requirements are decided. For proposal in R4-2118461, OK to add a column in Table 9.6.2.3-1, but ‘FR2’ may be used to include both ‘FR2-1’ and ‘FR2-2’ or a note can be added to state the 256QAM requirement is applicable for FR2-1 only. |
| Ericsson | We are ok to use 50% in [] as a starting point for normal CP length, for extend CP the starting point should be [85.9%]. If we later realize that we need to change due to any not foreseen reason we can do that. We also think we need to start to look into how to write the specification text. For EVM we will have different requirement scope for FR2-1 and FR2-2. We provide a solution to add frequency range support to the requirement table.  |
| CATT | Agree with ZTE that the window length is related to SU and the out of band emission requirements. There’re no agreements yet especially SU. But would also be ok to put 50% in [] and check it later. For 256QAM, agree that it should be clarified only for FR2-1. |
| ZTE | I think that companies already have common understandings how this requirement should be defined,We could start with 50% in square bracket and further check it with enough other requirements definitions.  |
| Qualcomm | We are ok with having a placeholder in 38.104 with values in square brackets and wait for band emission requirements and discussion before agreeing on the final value for EVM requirement.  |
| Huawei | Ok to extend Table 9.6.2.3-1 to add applicability - details TBD (use FR2 instead of FR2-1 plus FR2-2).EVM window length: I am puzzled why we keep discussing window length. This is conformance testing aspect. If anything, we can put the value in [].@Qualcomm: my understanding was that we have already agreed to reuse EVM requirement value last meeting, or?  |

### Sub-topic 1-4 Signal quality - EVM measurement period

**Issue 1-4: EVM measurement period**

Background: Agreed WF from R4-2115643: Continue discussion on limiting EVM measurement time in next meeting.

* Proposals
	+ Option 1: Also consider other options to reduce EVM measurement time for NR operation in 52.6 – 71 GHz range, e.g., limit the number of samples over which the EVM has to be averaged. (Nokia, R4-2117247)
	+ Option 2: TBA
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, and no other option has been proposed by other participating companies in this meeting. |
| Ericsson | As pointed out at last meeting, we have an issue regarding the testing of EVM following the FR2 way of doing things. One solution could be to reduce the number of samples in the averaging process. But before doing that we need to understand the impact on the result. We prefer to postpose this discussion until the conformance work. |
| CATT | In our understanding, in order to get reliable EVM value, the samples for different SCS may be in a similar level or same number. But different SCS leads to different sampling rate, thus different slot number or measurement internal. So the proposals in last meeting are more technically reasonable. The needed slots or interval can consider the current FR2-1 slot number. If it’s sufficient, it works for FR2-2. So in summary, we’re ok with the proposals in last meeting rather than using sample number which is a very vague concept in analog domain. |
| ZTE | This might be no urgent topic and also related with EVM measurement uncertainty at the end, we could further discuss at the conformance testing phase. |
| Qualcomm | Limiting the number of samples over which the EVM is averaged might have strong impact on the reliability of achieved results. We agree with the other companies to postpone this till the conformance phase.  |
| Huawei | Agree with Ericsson view. Postpone till conformance phase.  |

### Sub-topic 1-5 Signal quality – TAE

Background: Agreed WF from R4-2115643: Continue discussion on TAE requirements in next meeting.

**Issue 1-5: Signal quality - 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. Moreover, shorter CA time alignment error requirements (than that for BS type 2-O) may be considered for NR operation in 52.6 – 71 GHz range with larger SCS (than that for BS type 2-O). (Nokia, R4-2117247)
		- related observation (not part of option 1): Existing FR2-1 TAE 65ns isn’t applicable for 52.6-71GHz (CATT, R4-2117389)
	+ Option 2: Remove TAE requirements for MIMO and rely on EIRP BS conformance to verify that TAE is within a working range, for a case when all TRX are declared in all transceiver groups. (Ericsson, R4-2118461)
		- related observation (not part of option 2): The EIRP accuracy can’t guarantee the TAE (CATT, R4-2117389)
	+ Option 3: For MIMO set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz. (Ericsson, R4-2118461)
	+ Option 4: For CA set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz. (Ericsson, R4-2118461)
	+ Option 5: TAE = 260 ns for non-contiguous carrier aggregation. (Ericsson, R4-2118461)
	+ Option 6: TAE f= 3 µs for interband CA. (Ericsson, R4-2118461)
	+ Option 7: the acceptable TAE requirement should be around 10-20ns for 960kHz and 10-40ns for 480kHz; (ZTE, R4-2119190)
* Recommended WF2
	+ TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, but OK to consider results in R4-2117389 and R4-2119190 for larger SCS; for option 2, concur with R4-2117389 that the EIRP accuracy (within one antenna array) can’t guarantee the TAE (between two antenna sub-arrays).  |
| CATT | FFS on the final requirements. |
| Ericsson | TAE for MIMO: Option 2: If entire trx panel is used to generate every MIMO layer. Remove TAE requirements for MIMO and rely on EIRP BS conformance to verify that TAE is within a working rangeOption 3: If different groups of TRX or separate Radio Units generate different MIMO layers set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz TAE for intra band contiguous CA: Option 4: Set TAE = 65 ns for SCS = 480 kHz and TAE = 32.5 ns for SCS = 960 kHz. We have a common UE FFT as a precondition.TAE for intra band non-contiguous CAOption 5: TAE = 260 ns for non-contiguous carrier aggregation. We have separate UE RX chains (and FFT) as a precondition.TAE for inter-band CA: TAE = 3 µs for interband CA |
| ZTE | Similar comments Nokia , EIRP accuracy cannot guarantee the TAE requirement, this is different RF functionality in the AAU, we still propose to option 7 or at least more reasonable with acceptable loss could be proposed. |
| Huawei | Option 1 seems ok as starting point – to be confirmed next meeting. Option 2: not sure if we gain much even if we would remove this requirement. Seems quite basic requirement anyways.Option 3/4 may be also ok based on the pure numerology considerations, but impact of impairments is unclear. Option 5 shall be out of scope, as non-cont CA is proposed to be de-prioritized in the other thread.Option 6 requires some clarification on CA config – can be postponed.Option 7: FFS. |
| Ericsson | For SCS = 960 kHz and CP = 73 ns. Ericsson proposed that 40 ns of radio channel dispersion of signal ought to be possible to handle with TAE = 32.5 ns, since:CP – Dispersion – TAE > 0 ó CP – TAE > Dispersion.73 ns – 32.5 ns = 40.5 ns > 40 ns.Is TS 38.104 6.5.3.1 (Type 1-c as example, but type not important)“...For *BS type 1-C*, the TAE is defined as the largest timing difference between any two signals belonging to different *antenna connectors* for a specific set of signals/transmitter configuration/transmission mode....”For Ericsson TAE is not a +/- requirement, ie a TAE = 65 ns MIMO requirement (exiting requirement) means that \_*all*\_ DL MIMO layers come within 65 ns. This is the meaning of “largest timing difference between any two signals”\*\*\* Example with legacy existing 65 ns TAE: \*\*\*This case is NOT possible, since L1 and L3 are separated by 130 and requirement is for “any two signals”,MIMO\_L1 – 65 ns – MIMO\_L2 – 65 ns MIMO\_L3   |                                       |                           |   +------------------- 130 ns ----------------------+This IS possible:MIMO L1 --- MIMO L2 ---- MIMO-L3  |                          |                   |  +------------- 65 ns -------------+\*\*\* end legacy example TAE = 65 ns \*\*\*Basically of 73 ns CP for SCS=960 kHz TAE takes 32.5 ns (not 2\*32.5 ns). |

### Sub-topic 1-6 Emissions – OBUE and ACLR

**Issue 1-6: Emissions – OBUE and ACLR**

Background: Agreed WF from R4-2115643:

For OBUE, further discuss opportunities to re-use or adapt either ETSI BRAN or FR2-1 OBUE requirements to be used for FR2-2 in next meeting.

For ACLR, consider TR 38.803 requirements to be used for FR2-2, unless new simulation results show notable impact on the required ACIR comparing to the current ones in TR 38.803.

* Proposals for OBUE
	+ Option 1: The out-of-band emissions ~~and unwanted emissions in the spurious domain~~ specified in ETSI EN 303 722 and/or ETSI EN 303 753 can be considered for unlicensed NR operation in 52.6 – 71 GHz range at least in Europe. RAN4 to consider further whether TRP should be used as emission metric and whether the relative mask should be limited to bottom down at -22 dBr.(Nokia, R4-2117247)
		- *Moderator’s note: proposal split to spurious emissions and OBUE sections of the email discussion summary*
	+ Option 2: To specify ΔfOBUE = 3500 MHz for FDL,high – FDL,low > 4000 MHz for 52.6-71GHz. (CATT, R4-2117389)
	+ Option 3: Re-use the FR2-1 OBUE requirement with ΔfOBUE = 3500 MHz for 52.6- 71 GHz. (CATT, R4-2117389)
	+ Option 4: For the frequency range 52.6 to 71 GHz within FR2 set DfOBUE to 3000 MHz. (Ericsson, R4-2118461)
	+ Option 5: Re-use FR2-1 OBUE requirement concept for FR2-2 as proposed in Tables 2.2.3-9 and 2.2.3-10. (Ericsson, R4-2118461)

Table 2.2.3-9: Category A OBUE limits applicable in the frequency range 52.6 – 71 GHz

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| Frequency offset of measurement filter -3 dB point, Δf (MHz) | Frequency offset of measurement filter centre frequency, f\_offset(MHz) | Limit(dBm) | Measurement bandwidth(MHz) |
| 0 ≤ Δf < 0.1\*BWcontiguous | 0.5 ≤ f\_offset < 0.1\* BWcontiguous +0.5 | Min(-5, Max(Prated,t,TRP – [31], -12)) | 1 |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 ≤ f\_offset < f\_ offsetmax | Min(-13, Max(Prated,t,TRP – [39], -20)) | 1 |

Table 2.2.3-10: Category B OBUE limits applicable in the frequency range 52.6 – 71 GHz

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| Frequency offset of measurement filter -3 dB point, Δf(MHz) | Frequency offset of measurement filter centre frequency, f\_offset(MHz) | Limit(dBm) | Measurement bandwidth(MHz) |
| 0 ≤ Δf < 0.1\*BWcontiguous | 0.5 ≤ f\_offset < 0.1\* BWcontiguous +0.5 | Min(-5, Max(Prated,t,TRP – [31], -12)) | 1 |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 ≤ f\_offset < ΔfB +0.5 | Min(-13, Max(Prated,t,TRP – [39], -20)) | 1 |
| ΔfB ≤ Δf < Δfmax | ΔfB +5  ≤ f\_offset < f\_ offsetmax | Min(-5, Max(Prated,t,TRP – [29], -10)) | 10 |

For FR2-2, fB is for further study

* + Option 6: to propose to follow the outcome of coexistence study of 52.6-71GHz for ~~ACLR and~~ out of band emission requirement. (ZTE, R4-2119190)
		- *Moderator’s note: Original proposal in option 6 is split to both OBUE and ACLR sections of email discussion summary,*
* Proposal for OBUE for licensed operation only
	+ Option 1: The unwanted emissions for licensed operation can be further discussed when related regulatory requirements become available in the regions. (Nokia, R4-2117247)
* Proposal for ACLR
	+ Option 1: The proposed ACIR values in TR 38.803 at 70 GHz carrier frequency can be reused as the required ACIR values for extending current NR operation to 71 GHz. (Nokia, R4-2117247)
	+ Option 2: 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. (Ericsson, R4-2118461)
	+ Option 3: Add table row for FR2-2 with new ACLR limit and supported carrier bandwidths in TS 38.104, Table 9.7.3.3-1. (Ericsson, R4-2118461)
	+ Option 4: to propose to follow the outcome of coexistence study of 52.6-71GHz for ACLR ~~and out of band emission~~ requirement. (ZTE, R4-2119190)
		- *Moderator’s note: Original proposal in option 4 is split to both OBUE and ACLR sections of email discussion summary,*
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Nokia | **OBUE:** Propose option 1, but OK with option 2 and option 3, which are more aligned with the maximum 2GHz channel bandwidth than option 4 and option 5.**OBUE for licensed operation:** Propose option 1, and no other option has been proposed by other participating companies in this meeting.**ACLR:** Propose option 1; for option 2, our simulation results show that a higher BS ACLR value is required; OK with option 3; for option 4, the presented simulation results in this campaign aligned with option 1. |
| Ericsson | **OBUE:** Option 4 and Option 5**OBUE for licensed operation:** We prefer to harmonize the requirements for unlicensed and licensed operation. If a dedicate new requirement is required later, it can always be added for a specific band. **ACLR:** Option 2 and Option 3 |
| CATT | **OBUE:** Option 2 and Option 3.**OBUE for licensed operation:** We support the views from Ericsson that it’ll be good to align unlicensed and licensed requirements except any issue discovered.**ACLR:** It’ll be better to wait the co-existence simulation conclusion. |
| Samsung | **OBUE:**  similar to Ericsson and CATT it’s believed that the OBUE framework discussed under this sub topic should be applied for whole range of FR2-2 by default. If new regulation available later, the requirement can be revisited according to request.  |
| ZTE | we prefer to make the decision based on the discussion outcome of thread [130], otherwise it’s meaningless for that thread. In addition, based on the initial simulation results, more stringent requirements might be needed. |
| Qualcomm | **OBUE:** We are ok with option 2 and 3. **OBUE for licensed operation:** We agree with Ericsson’s view to harmonize the OBUE requirements for licensed and unlicensed operation. Further changes can be applied for the specific bands of interest.**ACLR:** It is recommended to wait for the conclusions in thread 130 as companies have been quite active in driving this requirement based on extensive simulation work.  |
| Huawei | OBUE: Option 1 ok. For the delta value: more time to check during the second round.OBUE for licensed operation: do we need to spend time on licensed-specific requirements, considering no licensed bands? Option1. |

### Sub-topic 1-7 Emissions – spurious emissions

**Issue 1-7: Emissions – spurious emissions**

Background: Agreed WF from R4-2115643:

Continue discussion and down-selection of the following options in next meeting.

Option 1: Use FR2 approach with necessary adaptations on step size for spurious emissions.

Option 2: Use ETSI EN 303 722 and/or 303 753 for spurious emissions.

* Proposals
	+ Option 1: ~~The out-of-band emissions and~~ unwanted emissions in the spurious domain specified in ETSI EN 303 722 and/or ETSI EN 303 753 can be considered for unlicensed NR operation in 52.6 – 71 GHz range at least in Europe. (Nokia, R4-2117247)
		- *Moderator’s note: proposal split to spurious emissions and OBUE sections of the email discussion summary*
	+ Option 2: 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. (CATT, R4-2117389; Ericsson, R4-2118461)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, but OK with option 2. |
| Ericsson | We prefer option 2. With correct adaptations the mask will be very similar as for ETSI BRAN c2 devices |
| CATT | Prefer option 2. |
| ZTE | Fine with option 2, however more concrete filter evaluation might be needed. |
| Qualcomm | We are ok with option 2.  |
| Huawei | Option 2 preferred to follow the FR2 approach. Mask comparisons with ETSI BRAN to be further studies.  |

### CRs/TPs comments collection

No CR or TP submitted.

## 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 EIRP and TRP output power requirements** | All companies agree option 1: Re-use both current (3.4 dB in normal conditions and 4.5 dB in extreme conditions) EIRP and 3 dB TRP accuracy requirements from FR2-1 to FR2-2 and re-use 6% limit to allow two EIRP values to be declared.*Tentative agreements:*Re-use both current (3.4 dB in normal conditions and 4.5 dB in extreme conditions) EIRP and 3 dB TRP accuracy requirements from FR2-1 to FR2-2 and re-use 6% limit to allow two EIRP values to be declared.*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic #1-2 Transient times** | All companies agree option 1: The current FR2 BS 3 µs transient period should be applicable for NR operation in 52.6 – 71 GHz range.*Tentative agreements:*The current FR2 BS 3 µs transient period should be applicable for NR operation in 52.6 – 71 GHz range.*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic #1-3 Signal quality - EVM** | There is good alignment between companies to consider [50%] as starting point for the requirement for further check is needed to confirm this once spectral utilization and out-of-band emission requirements have been agreed. It seems agreeable to add new column to Table 9.6.1.2-1 to differentiate EVM capability within FR2 range, but attention need to be paid to correct usage of terms FR2, FR2-1 and FR2-2.*Tentative agreements:*[50%] EVM window length is starting point for normal CP length. This is to be confirmed once spectral utilization and out-of-band emissions are agreed.Add new column to Table 9.6.1.2-1 to differentiate EVM capability within FR2 range. *Candidate options:**Recommendations for 2nd round:*Capture agreements to WF, editorial comments to be taken into account in draftCR to next meeting.  |
| **Sub-topic #1-4 Signal quality – EVM measurement time** | Most companies see this as a conformance issue and prefer to postpone the discussion. There were also several comments that reliability of the results need to be considered.*Tentative agreements:*Postpone to conformance. Measurement time reduction method need to consider impact on reliablity of results.*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF, no further discussion in this meeting. |
| **Sub-topic #1-5 Signal quality – TAE** | For TAE views are still mixed. Two companies prefer re-use existing MIMO TAE requirements, whereas two companies also see a need to make the allowed timing error shorter. For CA TAE number of comments was limited.*Tentative agreements:**Candidate options:*Proposal from moderator: Agree same TAE applies for 120 kHz SCS in FR2-2 as in FR2-1. Agree that only highest supported SCS is tested.FFS for higher SCS.*Recommendations for 2nd round:*Consider proposal from moderator. Further discussion on how to proceed with TAE requirements. |
| **Sub-topic #1-6 Emissions – OBUE and ACLR** | Overall it appears that most companies are willing to move forward with re-using FR2-1 OBUE requirements and adjusting deltafOBUE to be within 3 to 4 GHz range, and not separate licensed and unlicensed requirements at this point of time. When licensed regulatory rules are available, new requirements can be added if needed. For ACLR most companies prefer still to wait for coex study conclusion, while companies also point out that co-existence study results show far point towards being able to re-use 70 GHz ACLR results from TR 38.803.*Tentative agreements:*- Re-use FR2-1 OBUE, deltafOBUE needs more discussion but tentatively in range [3 – 4 GHz]. Re-use of FR2-1 includes using TRP as metric.- no separate requirements for licensed and unlicensed at this point of time- for ACLR wait for coex study conclusion in thread 130*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic #1-7 Emissions – spurious emissions** | Companies views align to option 2: 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.*Tentative agreements:*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.*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |

### CRs/TPs

No CR or TP submitted.

## Discussion on 2nd round (if applicable)

WF author to organize discussion within the WF document where needed. Please use word format for easy commenting.

The discussion below is a copy of what chairman captured during GTW discussion on November 8th.

**GTW discussion for TAE:**

Huawei: For 120kHz SCS, reusing same as FR2-1, it’s agreeable. We would like to further discuss and highest SCS case.

ZTE: We bring some simulation results, for 960kHz, the performance will be degraded with Ericsson proposed values. We would like check the views for expected performance and target scenario.

Ericsson: For MIMO case with one panel, this can be relied on BS conformance test on EIRP. If we have different panel/units for MIMO layer, we have proposed specific values in our paper considering the implementation and performance.

Nokia: Test should be applied for all possible implementation; and we should not specify requirements for specific implementation.

CATT: How to proceed the study, if we do evaluation, how to align the simulation assumption, and what’s the criteria.

Huawei: We shouldn’t stick to specific implementation for specifying core requirements.

ZTE: Share similar view as other companies, we should define requirements as implementation agonistic.

For CA case, not sure whether it’s urgent or not?

Ericsson: We follow the approach in TR 38.808.

ZTE: Totally timing error will close to CP based on delay spread and TAE.

Nokia: The criteria on performance will strongly depend on receiver implementation. We proposed to scale the TAE based on SCS compared to lower SCS.

Nokia: For CA cases, this is more related to UE implementation; we can reuse existing FR2-1 requirements.

Ericsson: We are ok for scale approach for 960kHz, we need to further discuss the baseline. For inter-band, we can reuse 3us. For intra-band non-contiguous CA case, existing FR2-1 can be reused. For Intra-band contiguous, normally single FFT assumed; the TAE should be within CP which existing FR2-1 not applicable.

Huawei: For inter-band CA, 3 us is enough. There is some parallel discussion on main session on deprioritizing.

Agreement:

Agree same TAE applies for 120 kHz SCS in FR2-2 as in FR2-1. Agree that only highest supported SCS is tested.

For MIMO case: “Scale the value under 120kHz for larger SCS cases” as starting point

For CA cases: FFS

**GTW discussion on emissions – OBUE and ACLR:**

CATT: How the 3GHz derived?

Ericsson: Filter technology will be similar as FR2-1. We think we can decide the value between 3.5 and 3 GHz.

ZTE: We are fine with value within the range, we need to further discuss filter response based on OBUE and spurious emission requirements.

Huawei: We would like to have more analysis, with the range [3-4] GHz. We are open to align the values for delta\_f\_OBUE and delta\_f\_OBB

Nokia: What’s the timeline companies expected? We would like to make progress as soon as possible.

Ericsson: We refer to Rel-15 FR2 filter response; we believe 3GHz is proper value.

Huawei: We can take next meeting as deadline to conclude this.

CATT: We referred to ETSI document, using equation to derive the value.

ZTE: We think ETSI can be baseline to bring analysis for filter response.

Agreement:

[Re-use FR2-1 OBUE], deltafOBUE needs more discussion but tentatively in range [3 – 4 GHz]. Re-use of FR2-1 includes using TRP as metric.

No separate requirements for licensed and unlicensed at this point of time.

For ACLR wait for coex study conclusion in thread 130.

Make decision on deltafOBUE on Jan 2022 RAN4 meeting.

Align the value for deltafOBUE and deltafOOB.

**GTW discussion on spurious emissions:**

Ericsson: For FR2, we have CAT A and CAT B requirements. We may have one CAT A and CAT B for FR-2 as well.

Agreement:

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.

Email discussion:

Ericsson comment on TAE, also duplicated to section 1.2.5

|  |  |
| --- | --- |
| Ericsson | For SCS = 960 kHz and CP = 73 ns. Ericsson proposed that 40 ns of radio channel dispersion of signal ought to be possible to handle with TAE = 32.5 ns, since:CP – Dispersion – TAE > 0 ó CP – TAE > Dispersion.73 ns – 32.5 ns = 40.5 ns > 40 ns.Is TS 38.104 6.5.3.1 (Type 1-c as example, but type not important)“...For *BS type 1-C*, the TAE is defined as the largest timing difference between any two signals belonging to different *antenna connectors* for a specific set of signals/transmitter configuration/transmission mode....”For Ericsson TAE is not a +/- requirement, ie a TAE = 65 ns MIMO requirement (exiting requirement) means that \_*all*\_ DL MIMO layers come within 65 ns. This is the meaning of “largest timing difference between any two signals”\*\*\* Example with legacy existing 65 ns TAE: \*\*\*This case is NOT possible, since L1 and L3 are separated by 130 and requirement is for “any two signals”,MIMO\_L1 – 65 ns – MIMO\_L2 – 65 ns MIMO\_L3   |                                       |                           |   +------------------- 130 ns ----------------------+This IS possible:MIMO L1 --- MIMO L2 ---- MIMO-L3  |                          |                   |  +------------- 65 ns -------------+\*\*\* end legacy example TAE = 65 ns \*\*\*Basically of 73 ns CP for SCS=960 kHz TAE takes 32.5 ns (not 2\*32.5 ns). |

ZTE: I think that TAE requirement is defined as relative timing difference between different antenna ports (logical antenna ports for MIMO transmission), we have the same understanding on this issues.

As I commented during the GTW session,  if we follow Nokia's suggestion to have the scaling factor with 65ns with 120kHz, then for 960kHz, TAE requirement would 8ns and 16ns for 480kHz, we think that it migth be a bit too stringent, therefore if to use x2 factor, then it would be **16ns for 960kHz and 32ns for 480kHz**, then it would be also aligned with our simulation results with acceptable performance loss @BLER 10%.

ZTE: TAE: Whether we could have different requirements for 480kHz and 960kHz if only highest supported scs is tested.

 Nokia: Yes, we can have different requirements for 480kHz and 960kHz, but only 960kHz is tested.

# Topic #2: Rx requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2117248 | Nokia, Nokia Shanghai Bell | **Proposal 1:** The same sensitivity ranges for BS type 2-O can be reused for FR2-2.**Proposal 2:** Some FR2 parameters (like modulation and coding rate) can be reused for NR operation in 52.6 – 71 GHz range, while other parameters (like allocated resource blocks) and thus they should be finalized when the parameters they depend on (like maximum SU for each SCS and channel bandwidth combination) are finalized.**Proposal 3:** The proposed ACIR values in TR 38.803 at 70 GHz carrier frequency can be reused as the required ACIR values for extending current NR operation to 71 GHz.**Proposal 4:** Use 100 MHz channel bandwidth with 120 kHz SCS for the ACS and in-band blocking interferer signal for NR operation in 52.6 – 71 GHz range, and reuse DFT-s-OFDM to ease test equipment implementation.**Proposal 5:** ΔfOOB can be specified depending on the bandwidth of the operating band in 52.6 – 71 GHz range.**Proposal 6:** The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 and/or ETSI EN 303 753 can be considered for unlicensed NR operation in 52.6 – 71 GHz range at least in Europe. Alternatively, the FR2 approach to use the transmitter spurious emissions limits also for the receiver can also be considered.**Proposal 7:** 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 8:** Specify the BS ICS requirement as 10 Db for NR operation in 52.6 – 71 GHz range. |
| R4-2117390 | CATT | **Proposal 1:** Existing G-FR2-A1-2 can be re-used for 100MHz/120kHz for ICS for 52.6-71GHz.**Proposal 2:** To specifyΔfOOB = 3500 MHz for FDL,high – FDL,low > 4000 MHz for 52.6-71GHz.**Proposal 3:** Use FR2 approach with necessary adaptations on step size for spurious emissions (option1).**Proposal 4:** Re-use the 8 Db offset below OTA in-band blocking levels for receiver intermodulation interferer level for 52.6-71GHz. |
| R4-2118462 | Ericsson | **Proposal 1**: For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-6) for 480 kHz SCS and 400 MHz carrier bandwidth.**Proposal 2:** For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-7) for 960 kHz SCS and 400 MHz carrier bandwidth.**Proposal 3:** For ACS applicable for FR2-2 define the interferer signal mean power to EISREFSENS\_50M + [25.7] + ΔFR2\_REFSENS.**Proposal 4:** For ACS add a new row dedicated for FR2-2 in Table 10.5.1.3-1 in TS 38.104.**Proposal 5:** For ACS define interfering signal type as 100 MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs.**Proposal 6:** For ACS add new rows dedicated for FR2-2 for supported carrier bandwidths in Table 10.5.1.3-2 in TS 38.104.**Proposal 7:** When DfOBUE is determined align DfOOB with DfOBUE.**Proposal 8:** For IBB add new row in Table 10.5.2.3-0 in TS 38.104 for FR2-2 specific DfOOB.**Proposal 9:** For IBB re-use interfering signal power from FR2-1 for FR2-2.**Proposal 10:** For IBB define interfering signal type as 100 MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs.**Proposal 11:** For IBB add a new row in Table 10.5.2.3-1 dedicated for FR2-2 supported carrier bandwidths.**Proposal 12:** For FR2-2 align receiver spurious emission with transmitter spurious emission following the approach used for FR2-1.**Proposal 13:** For receiver spurious emission re-use emission levels from FR2-1.**Proposal 14:** For receiver spurious emission consider proposed values for Fstep,x (Table 2.4-2) for licensed operation and unlicensed operation.**Proposal 15:** For receiver intermodulation set the interfering signal level to EISREFSENS\_50M + 25 + ΔFR2\_REFSENS**Proposal 16:** For receiver intermodulation define the interfering signal type as 100MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs.**Proposal 17:** For in-channel selectivity re-use FR2-1 relation of 10 Db between wanted signal and interfering signal.**Proposal 18:** For in-channel selectivity scale wanted power and interfering power levels for 100 MHz and 400 MHz carrier bandwidths. |
| R4-2119191 | ZTE Corporation | **Proposal 1:** the existing PT-RS configuration in FR2 FRC could also been applied for 52.6-71GHz.**Proposal 2:** for 480kHz and 960kHz SCS FRC, wait for the conclusion of spectral utilization of 480kHz and 960kHz. **Proposal 3:** to propose to follow the outcome of coexistence study of 52.6-71GHz for ACS requirement;**Proposal 4:** to propose to follow the outcome of coexistence study of 52.6-71GHz for IBB requirement;**Proposal 5:** to reuse 14dBc in-channel selectivity for 52.6-71GHz BS ICS requirement;  |

## Open issues summary

Please note it is possible and often necessary to select multiple options to create coherent agreements/requirements.

### Sub-topic 2-1 EIS

**Issue 2-1: EIS**

Background: Agreed WF from R4-2115644: For OTA reference sensitivity use FR2 EIS\_REFSENS\_50M sensitivity declaration as the starting point, i.e., BS sensitivity for FR2-2 is declared based on 50 MHz reference and allowed power level to be declared for each class is according to TS 38.104, clause 10.3.3.

* Proposals
	+ Option 1: The same sensitivity ranges for BS type 2-O can be reused for FR2-2. (Nokia, R4-2117248)
	+ Option 2: TBA
* Recommended WF
	+ Option 1

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| **Company** | **Comments** |
| Nokia | Propose option 1, and no other option has been proposed by other participating companies in this meeting. |
| Ericsson | We prefer option 1 |
| CATT | Ok with option 1. |
| ZTE | Option 1 might be okay as starting point. |
| Qualcomm | We are ok with option 1.  |

### Sub-topic 2-2 FRC

**Issue 2-2: FRC**

Background: Agreed WF from R4-2115644: Existing G-FR2-A1-3 can be re-used for 120 kHz SCS. The following aspects needs further considerations.

- Further discuss definition of new FRC required for 480 kHz and 960 kHz SCS for reference sensitivity and ICS requirement

* Proposals
	+ Option 1: Some FR2 parameters (like modulation and coding rate) can be reused for NR operation in 52.6 – 71 GHz range, while other parameters (like allocated resource blocks) and thus they should be finalized when the parameters they depend on (like maximum SU for each SCS and channel bandwidth combination) are finalized. (Nokia, R4-2117248)
	+ Option 2: Existing G-FR2-A1-2 can be re-used for 100MHz/120kHz for ICS for 52.6-71GHz. (CATT, R4-2117390)
	+ Option 3: For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-6) for 480 kHz SCS and 400 MHz carrier bandwidth. (Ericsson, R4-2118462)
	+ Option 4: For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-7) for 960 kHz SCS and 400 MHz carrier bandwidth. (Ericsson, R4-2118462)
	+ Option 5: the existing PT-RS configuration in FR2 FRC could also been applied for 52.6-71GHz. (ZTE, R4-2119191)
	+ Option 6: for 480kHz and 960kHz SCS FRC, wait for the conclusion of spectral utilization of 480kHz and 960kHz. (ZTE, R4-2119191)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, OK with option 2 and to further consider options 3 to 6. |
| Ericsson | There are a lot of details to be settled before we can design new FRCs for 480 and 960 kHz. At this point in time, we prefer option 2, 3,4 and 5. The specific details to design the new FRC needs to be determined later.  |
| CATT | Agree with Ericsson that many details need to be agreed. Generally, all of the proposals seems no issue in high level but we think they can be a starting point and check in the future discussions to finalize the FRCs. |
| ZTE | Agree with Ericsson and CATT. |
| Qualcomm | We agree with the points raised by Ericsson.  |
| Huawei | Option 1, 6: quite obvious. It seems to me that we have already decided similar to options 2, 3, 4. Option 5: too speculative. Shall we part this FRC discussion till SU is concluded?  |

### Sub-topic 2-3 ACS

**Issue 2-3: ACS**

Background: Agreed WF from R4-2115644: Further discuss interferer signal levels for ICS, ACS and in-band blocking, receiver intermodulation.

* Proposals
	+ Option 1: The proposed ACIR values in TR 38.803 at 70 GHz carrier frequency can be reused as the required ACIR values for extending current NR operation to 71 GHz. (Nokia, R4-2117248)
	+ Option 2: Use 100 MHz channel bandwidth with 120 kHz SCS for the ACS ~~and in-band blocking~~ interferer signal for NR operation in 52.6 – 71 GHz range, and reuse DFT-s-OFDM to ease test equipment implementation. (Nokia, R4-2117248)
		- *Moderator’s note: Proposal is split to ACS and in-band blocking sections of the email discussion summary*
	+ Option 3: For ACS applicable for FR2-2 define the interferer signal mean power to EISREFSENS\_50M + [25.7] + ΔFR2\_REFSENS. (Ericsson, R4-2118462)
	+ Option 4: For ACS add a new row dedicated for FR2-2 in Table 10.5.1.3-1 in TS 38.104. (Ericsson, R4-2118462)
	+ Option 5: For ACS define interfering signal type as 100 MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs. (Ericsson, R4-2118462)
	+ Option 6: For ACS add new rows dedicated for FR2-2 for supported carrier bandwidths in Table 10.5.1.3-2 in TS 38.104. (Ericsson, R4-2118462)
	+ Option 7: to propose to follow the outcome of coexistence study of 52.6-71GHz for ACS requirement (ZTE, R4-2119191)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1 and option 2; OK with option 3, option 4, and option 6; for option 5, interfering signal should have 64RBs with 120kHz SCS to make it 100MHz; for option 7, the presented simulation results in this campaign aligned with option 1. |
| Ericsson | We prefer option 3, 4,5 and 6. Based on coex sims results, outcome from 38.803 and technology capability is seems reasonable to set the requirement limit according to option 3.  |
| CATT | For the RB number, SU conclusion is needed. |
| ZTE | Similar as ACLR/OBUE requirement, we would like to wait for the decision of thread 130. |
| Qualcomm | We would recommend waiting for the conclusions resulting from the thread 130.  |
| Huawei | Same as ZTE and Qualcomm. Park this topic till 130 is concluded. Otherwise hard to expect progress.  |

### Sub-topic 2-4 In-band blocking

**Issue 2-4: In-band blocking**

Background: Agreed WF from R4-2115644: Further discuss interferer signal levels for ICS, ACS and in-band blocking, receiver intermodulation.

* Proposals
	+ Option 1: Use 100 MHz channel bandwidth with 120 kHz SCS for the ~~ACS and~~ in-band blocking interferer signal for NR operation in 52.6 – 71 GHz range, and reuse DFT-s-OFDM to ease test equipment implementation. (Nokia, R4-2117248)
		- *Moderator’s note: Proposal is split to ACS and in-band blocking sections of the email discussion summary*
	+ Option 2: For IBB add new row in Table 10.5.2.3-0 in TS 38.104 for FR2-2 specific DfOOB. . (Ericsson, R4-2118462)
	+ Option 3: For IBB re-use interfering signal power from FR2-1 for FR2-2.(Ericsson, R4-2118462)
	+ Option 4: For IBB define interfering signal type as 100 MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs. (Ericsson, R4-2118462)
	+ Option 5: For IBB add a new row in Table 10.5.2.3-1 dedicated for FR2-2 supported carrier bandwidths. (Ericsson, R4-2118462)
	+ Option 6: To propose to follow the outcome of coexistence study of 52.6-71GHz for IBB requirement (ZTE, R4-2119191)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1; OK with option 2, option 3, and option 5; for option 4, interfering signal should have 64RBs with 120kHz SCS to make it 100MHz; for option 6, the presented simulation results in this campaign aligned with option 1. |
| Ericsson | We prefer option 1, 2, 3, 4 and 5 based on co-ex sim results, TR 38.803 and higher frequency. |
| CATT | SU conclusion is needed for RB number. |
| ZTE | Similar as ACLR/OBUE requirement, we would like to wait for the decision of thread 130. |
| Qualcomm | We agree with ZTE to wait for the coexistence work to finalize before deciding on IBB.  |
| Huawei  | Same comment as for ACS.  |

### Sub-topic 2-5: ΔfOOB

**Issue 2-5:** ΔfOOB

* Proposals
	+ Option 1: ΔfOOB can be specified depending on the bandwidth of the operating band in 52.6 – 71 GHz range. (Nokia, R4-2117248)
	+ Option 2: To specifyΔfOOB = 3500 MHz for FDL,high – FDL,low > 4000 MHz for 52.6-71GHz. (CATT, R4-2117390)
	+ Option 3: When DfOBUE is determined align DfOOB with DfOBUE. (Ericsson, R4-2118462)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, but OK with option 2 which is more aligned with the maximum 2GHz channel bandwidth than option 3. |
| Ericsson | We prefer option 3. For TX we have proposed 3000 MHz. We also have some sympathy for Option 1, since bands tend to be wider for higher frequencies, we may just need a new row in the table for bands wider than 4000 MHz.  |
| CATT | Option 2. We referred ETSI regulations to derive the DfOBUE. |
| ZTE | More discussion might be needed. |
| Qualcomm | We are ok with options 1 and 2.  |
| Huawei | Option 3 sounds reasonable – this is what we did in the past. More time to analyze the delta values itself. |

### Sub-topic 2-6 Spurious emissions

**Issue 2-6: Spurious emissions**

Background: For receiver spurious emission further consider following options:

Option 1: Use FR2 approach with necessary adaptations on step size for spurious emissions.

Option 2: Use ETSI EN 303 722 and/or 303 753 for spurious emissions.

* Proposals
	+ Option 1: The receiver unwanted emissions in the spurious domain specified in ETSI EN 303 722 and/or ETSI EN 303 753 can be considered for unlicensed NR operation in 52.6 – 71 GHz range at least in Europe. Alternatively, the FR2 approach to use the transmitter spurious emissions limits also for the receiver can also be considered. (Nokia, R4-2117248)
	+ Option 2: Use FR2 approach with necessary adaptations on step size for spurious emissions (option1) *(moderator: this refers to agreed WF in R4-2115644)*. (CATT, R4-2117390)
	+ Option 3: For FR2-2 align receiver spurious emission with transmitter spurious emission following the approach used for FR2-1. (Ericsson, R4-2118462)
	+ Option 4: For receiver spurious emission re-use emission levels from FR2-1. (Ericsson, R4-2118462)
	+ Option 5: For receiver spurious emission consider proposed values for Fstep,x (Table 2.4-2) for licensed operation and unlicensed operation. (Ericsson, R4-2118462)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1, but OK with option 2 where Fstep,x are more aligned with Annex 2 of ERC Recommendation 74-01 than options 3 to 5. |
| Ericsson | We prefer option 3, 4 and 5.  |
| CATT | Option 2. The difference between option 3-5 and option 2 is the step size.  |
| Qualcomm | We are ok with option 2.  |
| Huawei | Align with Tx. Option 2. |

### Sub-topic 2-7 Rx IMD

**Issue 2-7: Rx IMD**

Background: Agreed WF from R4-2115644: 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, unless technical concerns are identified with this approach by the next RAN4 meeting.

Further discuss interferer signal levels for ICS, ACS and in-band blocking, receiver intermodulation.

* 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. (Nokia, R4-2117248)
	+ Option 2: Re-use the 8 Db offset below OTA in-band blocking levels for receiver intermodulation interferer level for 52.6-71GHz. (CATT, R4-2117390)
	+ Option 3: For receiver intermodulation set the interfering signal level to EISREFSENS\_50M + 25 + ΔFR2\_REFSENS (Ericsson R4-2118462)
	+ Option 4: For receiver intermodulation define the interfering signal type as 100MHz DFT-s-OFDM NR signal, 120 kHz SCS, 32 RBs. (Ericsson R4-2118462)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1; OK with option 2 and option 3; for option 4, interfering signal should have 64RBs with 120kHz SCS to make it 100MHz. |
| Ericsson | We prefer option 3 and 4 |
| CATT | Option 2-3, the RB number in option 4 needs more discussion and the SU conclusion should be waited. |
| ZTE | Fine with option 1, for SU would be critical input to decide freq offset of interfering signal. |
| Huawei | Option 1 |

### Sub-topic 2-8 In-channel selectivity

**Issue 2-8: In-channel selectivity**

Background: Agreed WF from R4-2115644: Further discuss interferer signal levels for ICS, ACS and in-band blocking, receiver intermodulation.

* Proposals
	+ Option 1: Specify the BS ICS requirement as 10 Db for NR operation in 52.6 – 71 GHz range. (Nokia, R4-2117248, Ericsson R4-2118462)
	+ Option 2: For in-channel selectivity scale wanted power and interfering power levels for 100 MHz and 400 MHz carrier bandwidths. (Ericsson R4-2118462)
	+ Option 3: to reuse 14dBc in-channel selectivity for 52.6-71GHz BS ICS requirement; (ZTE, R4-2119191)
* Recommended WF

TBA

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| **Company** | **Comments** |
| Nokia | Propose option 1; Ok with option 2; for option 3, simulation results in R4-2117248 and R4-2119191 show 10Db ICS is sufficient. |
| Ericsson | We prefer option 1 and option 2 |
| CATT | FRC for ICS needs discussion, and we also need to decide if the SNR for FRC reuse FR2-1 value. |
| ZTE | For option2, it depends on the FRC discussion.For Option 1 and option 3, indeed ICS requirement is 14dBc instead of 10dBc,just power offset between interference signal and wanted signal is 10dB after the calculation.  |

### CRs/TPs comments collection

No CR or TP submitted.

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Sub-topic#2-1 EIS** | All companies agree with option 1: The same sensitivity ranges for BS type 2-O can be reused for FR2-2.*Tentative agreements:*The same sensitivity ranges for BS type 2-O can be reused for FR2-2.*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic#2-2 FRC** | Companies’ comments reflect that further agreements need to be reached e.g. on spectrum utilization to finalize FRC. However, in high level there seems to be good aligned for options 2, 3 and 4, as long as the details are finalized later.*Tentative agreements:*

|  |
| --- |
| - Existing G-FR2-A1-2 can be re-used for 100MHz/120kHz for ICS for 52.6-71GHz. |
| - For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-6) for 480 kHz SCS and 400 MHz carrier bandwidth |
| - For OTA reference sensitivity define a new dedicated FRC (G-FR2-A1-7) for 960 kHz SCS and 400 MHz carrier bandwidth.  |

*Candidate options:*Re-use modulation and coding rate from FR2-1.*Recommendations for 2nd round:*Capture agreements in WF. |
| **Sub-topic#2-3 ACS** | Majority of companies sees the need to wait for co-existence study outcome to define final values. A high level agreement to use 100 MHz DFT-s-OFDM interferer signal seems possible, but spectrum utilization details are needed to finalize the definition. It was also seen acceptable to add a new dedicated row dedicated to FR2-2 in ACS tables.*Tentative agreements:**-* use 100 MHz DFT-s-OFDM interferer, SU details FFS- Add new rows for FR2-2 in relevant ACS tables*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic#2-4 In-band blocking** | For IBB discussion was very similar to ACS, with similar suggested tentative agreements.*Tentative agreements:**-* use 100 MHz DFT-s-OFDM interferer, SU details FFS- Add new rows for FR2-2 in relevant IBB tables*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF. |
| **Sub-topic#2-5 ΔfOOB** | There were mixed views with most support for option 2 and option 3, which can be further discussed in 2nd round*Tentative agreements:**Candidate options:*- To specifyΔfOOB = 3500 MHz for FDL,high – FDL,low > 4000 MHz for 52.6-71GHz. - When DfOBUE is determined align DfOOB with DfOBUE. *Recommendations for 2nd round:*Further discuss candidate options, capture outcome to WF. |
| **Sub-topic#2-6 Spurious emissions** | Companies views align behind option 2: Use FR2 approach with necessary adaptations on step size for spurious emissions. In practice this means aligning with Tx levels and using TRP as metric.*Tentative agreements:*Use FR2 approach with necessary adaptations on step size for spurious emissions, i.e. align emission levels with TX requirementsUse TRP as emissions metricStep size Fstepx needs further discussion.*Candidate options:**Recommendations for 2nd round:*Capture agreements to WF. |
| **Sub-topic#2-7 Rx IMD** | For Rx IMD discussion was similar to ACS and IBB. High level alignment is possible but SU agreement is needed to finalize requirement.*Tentative agreements:*- use 100 MHz DFT-s-OFDM signal with [8] dB offset. - SU agreement is needed before frequency offset and RB number details can be agreed.*Candidate options:**Recommendations for 2nd round:*Capture agreement to WF. |
| **Sub-topic#2-8 In-channel selectivity** | Companies comments align to support option 1 and 2. Further clarification in WF is needed whether 10 dB refers to requirement value or power difference between signals.*Tentative agreements:*- Specify the BS ICS requirement as 10 dB for NR operation in 52.6 – 71 GHz range.- For in-channel selectivity scale wanted power and interfering power levels for 100 MHz and 400 MHz carrier bandwidths.*Candidate options:**Recommendations for 2nd round:*Capture agreements in WF. Clarify exact definition for 10 dB. |

### 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)

WF author to organize discussion within the WF document where needed. Please use word format for easy commenting.

Comments to WF during 2nd round are duplicated here:

In channel selectivity:

ZTE: More clarify is needed on 10dB here, if it’s power difference between wanted signal and interfering signal which is same as the existing FR2 ICS requirements, it should be fine for us, otherwise more discussion might be needed.

|  |  |
| --- | --- |
| EISREFSENS\_50M+ 3+ ΔFR2\_REFSENS | EISREFSENS\_50M + 13 + ΔFR2\_REFSENS |

Nokia: Our ICS proposal in the NR SI (15dB) in R4-1711156 (referred to in TR 38.817-02 clause 10.9.3) was based on simulation results which already included the higher SNR impact for 16QAM, comparing the results in R4-1711156 and our results in R4-2117248, it can be seen that FR2-2 ICS can be 5dB lower than that of FR2-1, i.e., 10dB.

ZTE: Based on our simulation results, a bit higher ICS requirement is expected, around 12dBc ICS which is slightly higher than 10dB, therefore we would like to check whether this is fine for other companies.

Nokia: ICS is not the difference between wanted power and interfering power, according to the equations in clause 10.9.3 of TR 38.817-02

Ericsson: Based on above comments, 10 dB seems to be a reasonable compromise.

Huawei: As there is still range of values under consideration, we also would like to keep that point open, or put range of values in [].

Ericsson: Looking at the requirement I understand it as the interferer signal level is attenuated 10 dB with respect to the wanted signal.

I added 10 dB with in brackets since multiple values is proposed this meeting. Then we can come back next meeting to confirm.

Nokia: Ok with this version.

# Topic #3: CR worksplit for core specification 38.104

This topic covers CR worksplit for core specification 38.104. The intention is to avoid duplicated work.

## Companies’ contributions summary

No input contributions to this topic, discussion is initiated by moderator.

## Open issues summary and comment collection

### Sub-topic 3-1 CR worksplit for core specification 38.104

**Issue 3-1: CR worksplit for core specification 38.104**

It would in general be useful to avoid duplicated work and minimize the additional effort required in reviewing (draft) CRs. Meeting arrangements and guidelines suggest that “For RF agendas, draft CRs and draft TPs/TPs for Rel-17 non-spectrum related work are allowed. It is encouraged that companies discuss and agreed on the work splitting first.”

* Proposals by moderator
	+ Proposal 1: Worksplit is taken into use for 38.104. Any possible agreement for performance part is to be done later, and is not part of this discussion.
	+ Proposal 2: Initial suggestion for worksplit provided below in Table 3.2.1-1 is to be commented in first round.

**Table 3.2.1-1: CR worksplit for 38.104**

|  |  |
| --- | --- |
| **Specification clauses** | **Volunteer company** |
| 1-5 | Company #1 |
| 9.1 – 9.5 | Company #2 |
| 9.6 – 9.8 | Company #3 |
| 10.1 – 10.5 | Company #4 |
| 10.6 – 10.9 | Company #5 |
| Annexes for FRCs | Company #6 |

* + Proposal 3: Volunteer companies to be listed in a WF during 2nd round.
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Volunteer for 9.1 – 9.5 |
| Ericsson | We prefer option 1, 2 and 3. We have provided draft spec text for both TX and RX. We volunteer for 9.6 – 9.8 |
| CATT | Volunteer for 10.1-10.5. |
| ZTE | Volunteer for 10.6-10.9 |
| Huawei | General sections of 38.104 were handled in the other topic already. ok to volunteer for drafting, but not sure if much can be completed for FRC 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #3-1 CR worksplit for core specification 38.104** | *Tentative agreements:*

|  |  |
| --- | --- |
| **Specification clauses** | **Volunteer company** |
| 1-5 | N/A, handled in thread 128 |
| 9.1 – 9.5 | Nokia |
| 9.6 – 9.8 | Ericsson |
| 10.1 – 10.5 | CATT |
| 10.6 – 10.9 | ZTE |
| Annexes for FRCs | Huawei |

*Candidate options:**Recommendations for 2nd round:*Capture agreement in WF, with the clarification that this is only for core part. |

### CRs/TPs

No CR or TP submitted.

## Discussion on 2nd round (if applicable)

Discussion in WF if needed.

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on BS RF Tx requirements | Nokia, Nokia Shanghai Bell | Topic 1 |
| WF on BS RF Rx requirements and CR worksplit | Ericsson | Topic 2 and Topic 3 |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2117247 | Proposals on BS transmitter requirements for extending current NR operation to 71 GHz | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2117389 | Discussion on the BS TX RF requirements for 52.6-71GHz | CATT | Noted |  |
| R4-2118461 | On BS RF transmitter requirements for the frequency range 52 to 71 GHz | Ericsson | Noted |  |
| R4-2119190 | Discussion on BS Tx requirements for 52.6-71GHz | ZTE Corporation | Noted |  |
| R4-2117248 | Proposals on BS receiver requirements for extending current NR operation to 71 GHz | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2117390 | Discussion on the BS RX RF requirements for 52.6-71GHz | CATT | Noted |  |
| R4-2118462 | On BS RF receiver requirements for the frequency range 52 to 71 GHz | Ericsson | Noted |  |
| R4-2119191 | Discussion on BS Rx requirements for 52.6-71GHz | 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** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| R4-2120677 | WF on BS RF Tx requirements | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2120678 | WF on BS RF Rx requirements and CR worksplit | Ericsson | Agreeable |  |

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

# Annex

Contact information

|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)