**3GPP TSG-RAN WG4 Meeting # 102-e R4-2207156**

**Electronic Meeting, 21 February – 03 March 2022**

**Agenda item:** 10.5.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [102-e][306] NR\_Repeater\_RF\_Part2

**Document for:** Information

# Introduction

This topic is spit into 3 sub topics as per the agenda and an additional topic to cover the TP’s submitted for the TS drafting.

* 1. Tx power
  2. Radiated emissions
  3. Other RF
  4. TP’s

This topic was discussed on the 1st day on the meeting in GTW (21/2/22) before any 1st round comments were received. As such some of the open issues are already resolved or the options reduced. The discussion document has been updated to cover these agreements. So only open issues require companies to contribute further.

# Topic #1: Tx Power

There is a single contribution with a proposal on clarifications for the TX and Rx OTA directions.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2205030 | Ericsson | **Observation 1:** It is difficult to link a Tx beam directions declaration with an RX AoAoA because the beam peak directions and RoAoA are different concepts, except for the reference direction.  **Proposal 1:** For repeater requirements, the input signal for DL should be the same as the reference direction for UL TX and vice versa. No further input directions declared for Rel-17. |

## Open issues summary

There is only 1 issue for the TX power topic addressing the OTA directions declarations.

### Sub-topic 1-1 – OTA directions

Some clarifications on the agreements on OTA directions from last meeting are proposed.

**Issue 1-1: OTA directions declarations**

* Proposals
  + Option 1: For repeater requirements, the input signal for DL should be the same as the reference direction for UL TX and vice versa. No further input directions declared for Rel-17.
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 – OTA directions

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | In general we agree with the proposal although we should try to fit this principle in with the BS beam declaration format if possible. Basically this means we declare only 1 beam identifier and the OTA peak directions set reference beam direction pair (D8). |
| Nokia, Nokia Shanghai Bell | We are ok with the proposal 1, and furthermore we also think this can be accommodated to the BS beam declaration framework. |

### CRs/TPs comments collection

TP’s are handled together in topic#4

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1-1** | *Tentative agreements:* For repeater requirements, the input signal for DL should be the same as the reference direction for UL TX and vice versa. No further input directions declared for Rel-17. This is to be accomplished within the existing beam declaration format.  *Candidate options:*  *Recommendations for 2nd round:* take this agreement into consideration when drafting the TP’s |

### CRs/TPs

TP’s are handled together in topic#4

## Discussion on 2nd round (if applicable)

# Topic #2: Radiated Emissions

The radiated emission contributions concentrate on inside passband OBUE

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2204549 | NTT Docomo | **Observation 1:** For FR1, it was agreed the nominal channel bandwidth equals to [min (100MHz, passband bandwidth)].  **Observation 2:** The adjacent channel centre frequency offset can be covered by passband as nominal channel if the transmitted channel is single and occupies whole passband.  **Observation 3:** Repeaters don’t recognize whether transmitting signal is single channel.  **Proposal 1:** RAN4 use min (400MHz, passband bandwidth) to determine nominal channel bandwidth. |
| R4-2204561 | CMCC | **Proposal 1:** the channel bandwidth for FR2 UL ACLR/CACLR is suggested as *Min (BW of the highest or lowest carrier in the edge of passband, passband bandwidth)*.  **Observation 1:** the principle to define inside OBUE is to choose the more stringent limit between gNB OBUE and ACLR. Here the ACLR is the more relax one between relative ACLR and absolute ACLR.  Table 3: inside OBUE limits for 24.25-33.4GHz   |  |  |  |  | | --- | --- | --- | --- | | Prated,t,TRP  assuming 400MHz BW | Inside OBUE  dBm/MHz | | | | WA | MR | LA | | <23 | -20 | -20 | -20 | | 23~30 | P-43 | -20 | -20 | | 30~34 | -13 | -20 | -20 | | 34~41 | -13 | -13 | -13 | | >41 | -13 | -13 | -13 |   Table 4: inside OBUE limits for 37-52.6GHz   |  |  |  |  | | --- | --- | --- | --- | | Prated,t,TRP  assuming 400MHz BW | Inside OBUE  dBm/MHz | | | | WA | MR | LA | | <21 | -20 | -20 | -20 | | 21~28 | P-41 | -20 | -20 | | 28~32 | -13 | -20 | -20 | | 32~39 | -13 | -13 | -13 | | >39 | -13 | -13 | -13 |   **Proposal 2:** it’s suggested to define inside OBUE as in above table 3 and table 4 for DL.  **Proposal 3:** it’s suggested to reuse the same approach to define inside OBUE as conducted part for UL. |
| R4-2205029 | Ericsson | **Proposal 1:** For FR2, set the “Passband emissions” requirement to be -13dBm/MHz for all repeater classes and both DL and UL. |
| R4-2205973 | Huawei | **Proposal 3:** Use the BS OBUE limits for the FR2 inside passband OBUE limits. |

## Open issues summary

There are 2 issues connected to emissions, the nominal channel BW and the OBUR requirement.

### Sub-topic 2-1 – Nominal channel BW

2 proposals for nominal channel BW were proposed.

**Issue 2-1: Nominal channel BW**

* Proposals
  + Option 1: min (400MHz, passband bandwidth) to determine nominal channel bandwidth.
  + Option 2: min (BW of the highest or lowest carrier in the edge of passband, passband bandwidth).
* Recommended WF
  + TBA

Issue was discussed in GTW (21/2/22) and agreement reached (option1 here). No need to further discuss in this topic area (or at all).

### Sub-topic 2-2 – OBUE value

There are 3 proposals for the level requirement for OBUE (with no input signal)

**Issue 2-2: OBUE level**

* Proposals
  + Option 1: More stringent between OBUE and ACLR (based on nominal BW) UL and DL
  + Option 2: -13dBm/MHz all classes UL and DL (i.e. WA BS OBUE limit)
  + Option 3: Use class dependent BS OBUE limits
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 – Nominal channel BW

Nominal channel BW was discussed in GTW (21/2/22) under issue 3-2-1 and an agreement was made. No need to further discuss under this topic in 1st round.

Sub topic 2-2 - OBUE level

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | The absolute ACLR value is too strict in many cases as would make implementation very difficult, we think it’s better to stick with OBUE limits. There are no OBUE class dependent limits for FR2 (they are all the same) so option 2 and 3 are the same. So option 2. |
| Ericsson | Option 1 is OK for us, but option 2 is simpler and in our view adequate. Either is acceptable. Regarding option 3; the OBUE limit allows -5dBm close to the carrier; since there is no filtering this seems rather high; hence our preference for option 1 or 2. |
| CATT | We’re ok with the option 2. But think the name “OBUE” is indeed confusing, so need to discuss how to write it in the spec. |
| Nokia, Nokia Shanghai Bell | We are ok with option 2. |
| QCOM | Option 2 is simple and should be sufficient |

### CRs/TPs comments collection

TP’s are handled together in topic#4

## 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** | GTW agreement reached under issue 3-2-1 the nominal channel BW is min (400MHz, passband bandwidth) |
| **Sub-topic#2-2** | *Tentative agreements:* Option 2: -13dBm/MHz all classes UL and DL (i.e. WA BS OBUE limit)  *Candidate options:*  *Recommendations for 2nd round:* use agreement to help draft TP’s |

### CRs/TPs

TP’s are handled together in topic#4

## 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”.*

# Topic #3: Other RF requirements

There are a couple of other RF requirements in this topic area

* + OOB gain and ACRR
  + EVM
  + Inputs IMD

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203946 | CATT | **Observation 1:** BS OBUE requirements are absolute power level which leads different rejection level for different CBW with same output power.  **Observation 2:** BS OBUE performance is dominated by the digital filter, so the frequency offset is not proper to be used for RF repeater.  **Proposal:** Use Option 2: Half of minimum CHBW supported by bands i.e. 25MHz to define FR2 out of band gain requirement. |
| R4-2205028 | Ericsson | **Proposal 1:** Adopt option 2, with maximum gain above the cutoff 60dB, under the assumption that the ACRR baseline assumption is confirmed.  **Proposal 2:** For the minimum power at which EVM is valid, follow the same approach as FR1. |
| R4-2205466 | ZTE | **Proposal 1:** to support option 1 with modulated signal to 50MHz;  **Proposal 2:** in-band gain for FR2 could be 80dBc at most;  **Proposal 3:** to specify the OOBB limit for FR2 as following:  Table 1: Out of band gain limits   |  |  | | --- | --- | | Frequency offset, f\_offset\_CW | Maximum gain | | 0.1\*BWcontiguous ≤ Δf < ΔfB | 65 dB | | ΔfB ≤ Δf < Δfmax | 57dB | | NOTE 1: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. | |   For Δfmax ≤ f\_offset\_CW the out of band gain shall not exceed the maximum gain of table 2 or the maximum gain stated in table 1 whichever is lower.  Table 2: Out of band gain limits 2   |  |  | | --- | --- | | Frequency offset, f\_offset\_CW | Maximum gain | | Δfmax ≤ f\_offset\_CW | Out of band gain ≤ minimum donor coupling loss |     **Proposal 4: to specify the OOBB limit for FR2 as following:**   |  |  |  |  | | --- | --- | --- | --- | | Co-existence with other systems | Repeater maximum output power | Channel offset from the centre frequency of the first or last 50MHz channel within the pass band. | ACRR limit | | NR | Declared maximum output power | 50 MHz | 28 (Note 1)  26 (Note 2) | | Declared maximum output power | 100 MHz | 28 (Note 1)  26 (Note 2) | | NOTE 1: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 2: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz. | | | | |
| R4-2205972 | Huawei | **Proposal 1:** The BS FR2 OBUE offset is used for the frequency offset i.e. 0.1\* BWcontiguous  **Proposal 2:** For WA and MR OOB gain id 55dB  **Proposal 3:** For LA OOB gain is 45dB  **Proposal 4:** Use the baseline assumption ACRR equals ACLR |
| R4-2205973 | Huawei | On EVM  **Proposal 1:** Rx antenna gain is a declarable parameter (with the same limits as the BS)  **Proposal 2:** The minimum power EVM requirement is as follows:  The EVM requirement is valid from the input level that produces the maximum *rated output power* (Prated,in) to the minim input power for a 5MHz channel shown in table x.x-1  Table : x.x-1 Minimum input power for EVM   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | BS class | Minimum input power for a 50MHz channel (dBm) | | | | | | | 24.25 – 33.4 GHz | | | 37 – 52.6 GHz | | | | Up to 16 QAM | 64QAM note 1 | 256QAM note 2 | Up to 16 QAM | 64QAM note 1 | 256QAM note 2 | | WA, MR, LA | -64- GRX\_ANT | -60- GRX\_ANT | -53- GRX\_ANT | -62- GRX\_ANT | -58- GRX\_ANT | -51- GRX\_ANT | | Note 1: 64 QAM optional by manufacturers declaration  Note 2: 256 QAM optional by manufacturers declaration | | | | | | |   For input IMD  **Proposal 4:** Use 2 CW signals to specify input IMD  **Proposal 5:** the FR2 input IMD power level is -53 dBm - GANT\_RX |
| R4-2206046 | Nokia | **Observation 1:** In maximum output power case thermal noise has minor impact on EVM with the given assumptions (40 dBm EIRP output power, 80 dB gain, 400 MHz bandwidth)  **Proposal 1:** Specify 16QAM EVM of 12.5% to be applicable down to -74 dBm/MHz input PSD levels, excluding repeater antenna gain.  **Observation 2:** Reasonable selection for separation distance and antenna configurations needs to be done when deriving the OOB gain requirement.  **Proposal 2:** Take full antenna gain into account when deriving OOB gain requirement.  **Proposal 3:** Sufficiently large frequency offsets need to be set before tightening of the OOB gain requirement in FR2.  **Proposal 4:** Consider using mask in table 6 for discussion for OOB gain in FR2-1.  Table 6: Proposed OOB gain for FR2-1   |  |  | | --- | --- | | Frequency offset, f\_offset\_CW | Maximum gain | | 50 MHz  f\_offset\_CW < 150  150 MHz  f\_offset\_CW < 400  400 MHz  f\_offset\_CW < f\_offset\_max | 68 dB  55 dB  35 dB |   **Observation 3:** Proposal 4 does not take into account other signal sources than donor BS and does not guarantee protection immediately outside passband, and therefore there is a risk that the requirements are not stringent enough.  **Proposal 5:** Apply same requirement also for uplink  **Proposal 6:** ACRR in FR2 is set to 28 dB at 28 GHz and 26 dB at 39 GHz.  **Proposal 7:** ACRR is specified over 400 MHz bandwidth immediately adjacent to repeater passband.  **Proposal 8:** Apply same requirement also for uplink |

## Open issues summary

In this Topic we look at the OOB gain, ACRR , min power EVM and the input IMD requirements.

### Sub-topic 3-1 – OOB gain

2 proposals for nominal channel BW were proposed.

**Issue 3-1-1: OOB gain Frequency offset (lowest breakpoint)**

Both the options in the WF from last meeting remain in the submitted contributions.

* Proposals
  + Option 1: Half of minimum CHBW supported by bands i.e. 25MHz
  + Option 2: The BS FR2 OBUE offset is used for the frequency offset i.e. 0.1\* BWcontiguous
  + Option 3: 50MHz
* Recommended WF
  + TBA

GTW discussion:

Agreement:

0.1\*Minimum {400MHz, passband BW}

**Issue 3-1-2: OOB gain below lowest Frequency offset (lowest breakpoint)**

* Proposals
  + Option 1: No limit
  + Option 2: TBA
* Recommended WF
  + TBA

Agreement: option 1: No limit

**Issue 3-1-4: OOB limits**

It was discussed in GTW that the number of breakpoints and the limits should be discussed together as such issue 3-2-3 and 3-2-4 are merged.

* Proposals
  + Option 2: 65 then 57dB (ZTE)
  + Option 4: 68dB/55dB/35dB Nokia (150MHz, 400MHz as 2nd, 3rd breaking points)
* Recommended WF
  + TBA

Agreement: Further discuss among option 2 and option 4.

**Issue 3-1-5: OOB in UL**

* Proposals
  + Option 1: Apply same OOB gain limit in U (as DL)
  + Option 2: TBA
* Recommended WF
  + TBA

### Sub-topic 3-2 – ACRR

**Issue 3-2-1: ACRR value**

* Proposals
  + Option 1: 28/26 dB (28GHz/39GHz) i.e, same as BS ACLR
  + Option 2: TBA
* Recommended WF
  + TBA

GTW discussion:

ZTE: What’s the assumption of 1st and 2nd adjacent channel BW for ACRR?

Agreement:

ACRR values: Option 1: 28/26 dB (28GHz/39GHz) i.e, same as BS ACLR

ACRR range: ACRR is specified over minimum {400MHz, passband BW} immediately adjacent to repeater passband.

**Issue 3-2-2: ACRR range**

* Proposals
  + Option 1: ACRR is specified over 400 MHz bandwidth immediately adjacent to repeater passband.
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 3-2-3: ACRR in UL**

* Proposals
  + Option 1: ACRR in UL same as DL
  + Option 2: TBA
* Recommended WF
  + TBA

Agreement:

For WA: same as DL side i.e. same as BS ACLR

For LA: same as UE ACLR

### Sub-topic 3-3 – EVM

**Issue 3-3-1: Minimum Power for EVM**

There are a number of values proposed which vary due to some different assumptions in the calculations which are difficult to list as proposals. The major difference between the Nokia and Huawei calculation seems to be the distribution of EVM degradation (50% vs 20%), Ericsson propose to follow the method used for FR1.

* Proposals
  + Option 1: Follow same approach as FR1.
  + Option 2: TBA
* Recommended WF
  + Wait for agreement on FR1 and calculate appropriate FR2 values

**Issue 3-3-2: Antenna gain for EVM**

* Proposals
  + Option 1: EVM value excludes antenna gain (antenna gain is declarable parameter)
  + Option 2: TBA
* Recommended WF
  + TBA

### Sub-topic 3-4 – Input IMD

**Issue 3-4-1: Input IMD signals**

* Proposals
  + Option 1: Use 2 CW signals to specify input IMD
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 3-4-2: Input IMD Power level**

* Proposals
  + Option 1: FR2 input IMD power level is -53 dBm - GANT\_RX
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 – OOB gain

OOB gain was discussed in G+TW (21/2/22) only modified issue 2-2-4 remains to be further discussed in 1st round.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-2-4: OOB limit |
| Huawei | Issue 3-1-4: OOB limit  Considering a passband of approx. 1GHz, Option 2 has an average OOB gain of 63dB and option 4 has average of 44dB. Our proposal was 55dB so in the middle of these 2. Option 2 is perhaps a bit to high (easier) and option 4 a bit too low (tougher). However as option 4 is graduated it is only tough once you are a long way from the edge of the passband and is comparable to out proposal close to the passband – as such option 4 seems preferable. Also option 4 is slightly easier to derive the breakpoints as they are fixed values. So option 4. |
| Ericsson | Issue 3-1-4: OOB limit  Option 2 needs some clarification as the breakpoint is based on BWcontiguous. Suppose the contiguous bandwidth is e.g. 1 or 2 GHz ? Then in effect the upper limit would extend across many carriers.  Likely either is OK, mild preference for option 4. |
| Nokia, Nokia Shanghai Bell | Issue 3-1-4: We prefer option 4 as it better guarantees sufficient rejection at larger frequency offsets and the bandwidth definitions are clear. |
| QCOM | issue 3-1-4 we prefer option 4. |

Sub topic 3-2 – ACRR

ACRR issue were agree in GTW (21/2/22) no need to further discuss in 1st round.

|  |  |
| --- | --- |
|  |  |
|  |  |

Sub topic 3-2 - EVM

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-3-1: Minimum Power for EVM:  Issue 3-3-2: Antenna gain for EVM: |
| Huawei | Issue 3-3-1: Minimum Power for EVM:  Agree follow same approach as FR1, yesterday in GTW for conducted it was agreed that the level would be an absolute No (not relative), EVM contribution would be 50% (i.e. 3dB) that we would use the BS NF assumptions and that power levels would be presented as PSD per MHz. I don’t recall agreement if 2dB IM was to be added, our view is it’s safe and consistent with sensitivity calc to add it.  This gives a table:  Table : x.x-1 Minimum input power for EVM   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | BS class | Minimum input power (dBm/MHz) | | | | | | | 24.25 – 33.4 GHz | | | 37 – 52.6 GHz | | | | Up to 16 QAM | 64QAM note 1 | 256QAM note 2 | Up to 16 QAM | 64QAM note 1 | 256QAM note 2 | | WA, MR, LA | -81- GRX\_ANT | -77- GRX\_ANT | -70- GRX\_ANT | -79- GRX\_ANT | -5- GRX\_ANT | -68- GRX\_ANT | | Note 1: 64 QAM optional by manufacturers declaration  Note 2: 256 QAM optional by manufacturers declaration | | | | | | |   Issue 3-3-2: Antenna gain for EVM:  Antenna gain is part of the input power definition but is variable by declaration, we discussed in issue 1-1 that the receiver antenna gain should be the same as the TX gain on the same side. This is currently not declared but beamwidth is (D.12) . So we can either add a declaration for gain or use the existing beamwidth declaration to calculate gain e.g.  we prefer the later as beam width is an “intended use” type parameter. |
| Ericsson | Issue 3-3-1: Minimum Power for EVM:  On second thinking and contrary to our propsoal, due to the potential differences between OTA and conducted, it may be better to discuss the FR2 approach separately.  Issue 3-3-2: Antenna gain for EVM:  We prefer not to declare antenna gain; this amounts to a declaration of the minimum power. Adpoting the “Rated TRP – X” approach could be a way to avoid the need to consider antenna gain whilst still getting a fixed requirement. Another way if a fixed PSD is preferred could be to assume worst expected antenna gain when deriving the level. |
| CATT | Issue 3-3-2: Antenna gain for EVM:  The principle should align between FR1 and FR2. Our proposal for FR1 is maximum gain considering the maximum gain is the worst case for NF. But we’re not 100% confident with this. It depends on what’s the purpose for this. Lower gain with lower output power also works, but we need some principle and can’t be based on declaration because different gain leads to different performance, low gain may have some benefit for the test results. |
| Nokia, Nokia Shanghai Bell | Issue 3-3-1: Given the worse ACLR and phase noise if FR2, we think noise figure contributes less to the EVM. Therefore, we suggest budgeting only 20% for noise. Our proposal is -74 dBm/MHz excluding antenna gain. This is using 12 dB noise figure, but we would be also  Issue 3-3-2: We declare both TRP and EIRP for Tx power so we think the directivity obtained from existing declarations could be used for antenna gain here.  We do not see a need to specify the repeater internal gain setting. |

Sub topic 3-4 – Input IMD

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-4-1: Input IMD signals:  Issue 3-4-2: Input IMD Power level: |
| Huawei | Issue 3-4-1: Input IMD signals:  Proposal was ours so we are ok with option 1  Issue 3-4-2: Input IMD Power level:  Proposal was ours so we are ok with option 1 |
| Ericsson | Issue 3-4-1: Input IMD signals:  Option 1 is OK  Issue 3-4-2: Input IMD Power level:  This leaves the antenna gain open. We prefer to adopt a fixed value in the same manner as for BS OOB blocking. Previously we suggested -70 dBm (See R4-2118244) |
| Nokia, Nokia Shanghai Bell | Issue 3-4-1: Input IMD signals  We agree with option 1.  Issue 3-4-2: Input IMD power level  The principle is ok but we need to agree how to set the antenna gain. One option would be to use the directivity we get from Tx TRP and EIRP declarations. |

### CRs/TPs comments collection

TP’s are handled together in topic#4

## Summary for 1st round

### Open issues

Some agreements reached in GTW 21/2/22 1st round discussion continues after the GTW

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#3-1-1** | GTW Agreement : OOB gain Frequency offset (lowest breakpoint) is 0.1\*Minimum {400MHz, passband BW} |
| **Sub-topic#3-1-2** | GTA Agreement : No OOB limit below the frequency breakpoint |
| **Sub-topic#3-1-4** | During GTW more time was requested to compare option 2 and 4, all companies who have since expressed preference have favored option 4.  *Tentative agreements:* Option 4: 68dB/55dB/35dB Nokia (150MHz, 400MHz as 2nd, 3rd breaking points)  *Candidate options:*  *Recommendations for 2nd round:* use agreement to help draft TP’s |
| **Sub-topic#3-2-1** | GTW Agreement:  ACRR values: Option 1: 28/26 dB (28GHz/39GHz) i.e, same as BS ACLR |
| **Sub-topic#3-2-2** | GTW Agreement: ACRR range: ACRR is specified over minimum {400MHz, passband BW} immediately adjacent to repeater passband. |
| **Sub-topic#3-2-3** | GTW Agreement:  For WA: same as DL side i.e. same as BS ACLR  For LA: same as UE ACLR |
| **Sub-topic#3-3-1** | The only open issue (excluding the antenna gain issue in 3-3-2) is the % of the EVM allocation for FR2 of which there are 2 options, which result in 4dB different in power level. This can be further discussed in 2nd round  *Tentative agreements:*  *Candidate options:*  Option 1: EVM contribution 50%  Option 2: EVM contribution 20%  *Recommendations for 2nd round:* Continue to discuss try to find an agreement so TP’s can be drafted. |
| **Sub-topic#3-3-2** | How to capture antenna gain, is an open issue a number of proposals have appeared I the discussion but no clear favorite choice. Declaring antennas gain has been mentioned as undesirable but the proposal in the comments same to suggest different ways of calculating it from existing declarations. These are listed as options to be further discussed in the 2nd round.  The repeater internal gain setting has also been discussed, the decision ion this can perhaps follow the FR1 approach.  *Tentative agreements:* Internal gain setting : follow FR1 approach  *Candidate options:*  Option 1: calculate antennas gain form the beam width declarations  Option 2: calculate antenna gain from the EIRP and TRP declarations  *Recommendations for 2nd round:* Continue to discuss try to find agreement so TP’s can be drafted. |
| **Sub-topic#3-4-1** | *Tentative agreements:* Option 1: Use 2 CW signals to specify input IMD  *Candidate options:*  *Recommendations for 2nd round:* Use agreement to help draft TP’s |
| **Sub-topic#3-4-2** | For the input IMD values, 2 approaches have been suggested in the comments. To related to antennas gain (in the same way as EVM, issue 3-3.2) or used a fixed value.  *Tentative agreements:*  *Candidate options:*  Option 1: Related to antennas gain e.g. [-53dBm] – G\_RX\_ANT : where G\_RX\_ANT is the same as that agreed in 3-3-2  Option 2: Fixed value e.g.[-70fBm]  *Recommendations for 2nd round:* Continue to discuss in 2nd round |

### CRs/TPs

TP’s are handled together in topic#4

## 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”.*

# Topic #4: TP porposals

There are 4 TP’s submitted by the allocated section authors for TS drafting which have been grouped in this topic.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2204560 | CMCC | TP to TS 38.106 radiated EVM and input IMD |
| R4-2205204 | Nokia | TP to TS 38.106 clause 7.5 Unwanted emissions radiated |
| R4-2205467 | ZTE | TP to TS 38.106 clause 9.9 ACRR requirement |
| R4-2205974 | Huawei | TP to TS 38.106 clause 9.1 and 9.2 |

## Open issues summary

Only TP’s are discussed in this topic area, no issues list is provided.

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2204560 | Huawei: Placed some comments in document in drafts folder. In general EVM tables don’t handle the 16QAM issue the way I had understood it. Some suggested improvements on direction handling text. Lots of hanging text sections (suggested corrections). The minimum EVM requirement is not included. |
| Ericsson: For the EVM, there needs to be a description of the range of input power over which the core EVM requirement applies (for now, pending agreement a placeholder could be added)  Since in this case the repeater receives an input from test equipment, maybe the description in 9.6.1 could be updated to:  *The Error Vector Magnitude (EVM) is a measure of the difference between the symbols provided at the input of the repeater and the measured signal symbols at the output of the repeater after the equalization by the measurement equipment*.  For 9.6.1.2, in the following sentence, since RBs are not allocated to a repeater maybe it is better to use the word “input” instead of “allocated”:  *EVM requirements shall apply over all allocated resource blocks. Different modulation schemes listed in table 9.6.1.1-1 shall be considered for rank 1.*  For the input intermodulation, our proposal is that it is tested with an input only in the reference direction. Whatever is agreed, since there is no receiver sensitivity there would need to be a redefinition of minSENS, minSENS OTA etc. in some manner.  We propose to change the sentence about the frequency applicability from:  *The frequency separation between the two interfering signals shall be adjusted so that the 3rd order intermodulation product could fall into the whole pass band.*  To:  *The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the a part of the pass band*.  Just to improve clarity |
| Docomo: Very minor comment. Huawei made a lot of corrections, but the table number in clause 9.7 is still different. It should be “Table 9.7.2-1” instead of “Table 6.7.2-1”. We updated the file uploaded by Huawei in drafts folder. |
| Nokia: We support the changes Huawei and Docomo have made on the draft document. In addition the low-power EVM needs to be further aligned with the outcome of the discussion. |
| QCOM: TO Huawei, can you please describe where the values in minimum input power came from. If we understand that we can determine if it is acceptable. Thank you. |
| R4-2205204 | Huawei: ACLR, maybe the minimum requirements cover it but it’s not very clear that it only applies to channels outside the passband – maybe this would be good to state in the general section. Also we need to be careful with the defined terms non-contiguous spectrum BS definition refers to sub-blocks which in turn are defined **sub-block:** one contiguous allocated block of spectrum for transmission and reception by the same base station  are these definitions suitable for repeater? They no doubt need some modification, We should perhaps include the definitions with the TP.  OBUE we are still discussing but is there a difference between UL and DL? This needs to be clarified in requirement. In general section there are statements that OBUE apply for all intended operational modes etc. This should [perhaps be expanded to state for repeater its applicable in both transmission directions?  SE, upper limits is based on upper edge of operating band – should this be passband?  In existing repeater spec emissions requirement are specified as being met in the presence of certain input signals, It should perhaps be stated what the input condition is or at least that requirements met for all valid input conditions? As this is OTA the directions of input signals should also be mentioned. |
| Ericsson:  In the first paragraph of 7.5.1, the words” channel bandwidth” need to be replaced by “passband”  For 7.5.2.1, the paragraph needs updates so that it does not refer to “allocated channel bandwidth”, but rather to “assumed reference channel bandwidth” or similar.  7.5.2.2 the term “repeater channel bandwidths” needs to be defined. Possibly “nominal repeater channel bandwidths” may be more clear.  7.5.3.2.1, the references to multi-carrier and CA should be removed as the repeater does not have these concepts. The text can be simplified to state that the OBUE applies from the edges of passbands and between passbands. The term contiguous transmission bandwidth can be removed and replaced with passband. |
| Docomo: Minor comment. For 7.5.2.2, the ACLR limit for UL LA class is supposed to be in Table 7.5.2.2-1a but the table is not in the clause. The ACLR limit is the same among all classes, so “a” at the end of the table number should be removed. |
|  |
| R4-2205467 | Huawei: The OTA directions should be mentioned and that the requirement is directional, i.e. what directions is this requirement valid over. It’s relative so the gain values don’t matter so it should be perhaps specified in reference directions? The statements about donor link maintained via antennas seems unnecessary  There is hanging text e.g. section 9.9.1.1, 9.9.2.1  Section 9.9.1.1 seems odd – what does it mean there is no require net for NR signals ? in 9.9.2 it states the req is for the protection of NR signals? |
| Ericsson: It is not obvious why the sentence “The carrier in the *pass band* and in the adjacent channel shall be of the same type (reference carrier)” is needed; from the fact that he spec is NR it is obvious that the input signal will be NR, and for the adjacent channel to the passband the requirement is on a gain.  The section 9.9.1.1 should be removed as there is an agreement to define a minimum requirement. Also 9.9.2 should be removed as the requirement is not a co-existence requirement. 9.9.2.1 should then become 9.9.1.1  In 9.9.2.1 (which becomes 9.9.1.1), there is a need to refer to the nominal bandwidth as agreed and also adjust the offset for the adjacent channel accordingly. A reference to note 1 in the table needs to be added to the row on local area repeater, so that the applicability of note 1 to the local area repeater is clear. |
| Nokia: We support comments from Huawei and Ericsson. In addition, in out view it is not necessary to have separate tables for UL and DL if the only difference is not including medium range for UL. |
| R4-2205974 | Ericsson:  It would be useful to add a note that for the downlink the OTA peak directions set collapses to a single direction as there is no active beamforming. (The note could be clarified or removed in Rel-18 as part of a smart repeaters WI) |
| Nokia: The limits in Table 9.2.1-1 apply for UL transmission and also the text above needs similar correction. |
|  |

## Summary for 1st round

### Open issues

Only TPs are discussed in this topic area.

### CRs/TPs

TP’s are handled together in topic#4

## 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 repeater RF requirements | Huawei | Capture agreements and open issue for radiated issues. |
|  |  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2203946 | Discussion on out of band gain and ACRR requirements for FR2 | CATT | Note |  |
| R4-2204549 | Views on the ACLR requirements for NR repeater for FR2 | NTT DOCOMO, INC. | Note |  |
| R4-2204560 | TP to TS 38.106 radiated EVM and input IMD | CMCC | Revised |  |
| R4-2204561 | Discussion on repeater emission related radiated requirements | CMCC | Note |  |
| R4-2205028 | Repeaters radiated requirements | Ericsson | Note |  |
| R4-2205029 | Repeaters radiated emissions requirements | Ericsson | Note |  |
| R4-2205030 | Repeater radiated power requirements | Ericsson | Note |  |
| R4-2205204 | TP to TS 38.106 clause 7.5 Unwanted emissions radiated | Nokia, Nokia Shanghai Bell | Revised |  |
| R4-2205466 | Further discussions on other requirements of radiated repeater | ZTE Corporation | Note |  |
| R4-2205467 | TP to TS 38.106 clause 9.9 ACRR requirement | ZTE Corporation | Revised |  |
| R4-2205972 | Repeater FR2 OOB gain and ACRR | Huawei | Note |  |
| R4-2205973 | Repeater FR2 other RF | Huawei | Note |  |
| R4-2205974 | TP to TS 38.106 clause 9.1 and 9.2 | Huawei | Revised |  |
| R4-2206046 | EVM, OOB gain and ACRR for FR2 NR Repeaters | Nokia, Nokia Shanghai Bell | Note |  |

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** |
| R4-22xxxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx | 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

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Huawei | Richard Kybett | richard.kybett@huawei.com |
| Nokia, Nokia Shanghai Bell | Toni Lähteensuo | Toni.h.lahteensuo (at) nokia.com |

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)