**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-211xxxx**

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

**Agenda item:** 9.5.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for 100-e [310] NR\_Repeater\_RF\_Part2

**Document for:** Information

# Introduction

This discussion covers the repeater radiated RF requirements from agenda item 9.5.3. There are 3 topic areas

* Transmitter issues
* Emissions
* Other RF

All papers in this discussion area are discussion papers with highlighted observations and proposals, the main sub-topics and options from the papers have been extracted for discussion and any acceptable proposals can be captured in WF documents from each of the discussion areas

# Topic #1: Transmitter issues

This topic covers agenda item 9.5.3.1 radiated RF repeater transmitter requirements, the sub-topics includes are:

* DL transmission (UE side)
* UL transmission (BS side)
* ALC

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111919 | CATT | **Proposal 1:** Define power accuracy requirements for EIRP accuracy requirements and BS EIRP accuracy requirement is reused.  **Proposal 2:** FR2 UL output power requirements follow DL requirements if no class definition is agreed. |
| R4-2112201 | CMCC | **Proposal 1:** repeater 2-O maximum TRP output power shall remain with in ±3 dB of the rated carrier TRP output power as declared by the manufacturer.  **Observation 1:** directional RF requirements as gNB spec is necessary for repeater DL to support FR2 deployment and enlarge FR2 coverage.  **Proposal 2:** the same EIRP power tolerance requirement as gNB spec could still apply for repeater DL. And the details are listed as below:  “For each declared beam, in normal conditions, for any specific beam peak direction associated with a beam direction pair within the OTA peak directions set, a manufacturer claimed EIRP level in the corresponding beam peak direction shall be achievable to within ± 3.4 dB of the claimed value. For each declared beam, in extreme conditions, for any specific beam peak direction associated with a beam direction pair within the OTA peak directions set, a manufacturer claimed EIRP level in the corresponding beam peak direction shall be achievable to within ±4.5 dB of the claimed value. “  **Proposal 3:** the same min peak EIRP and maximum output power limits in terms of EIRP and TRP as UE spec still apply for repeater as below:  Table 3 minimum peak EIRP for power class 1   |  |  | | --- | --- | | **Operating band** | **Min peak EIRP (dBm)** | | n257 | 40.0 | | n258 | 40.0 | | n260 | 38.0 | | n261 | 40.0 | | NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |   Table 4 maximum output power limits for power class 1   |  |  |  | | --- | --- | --- | | **Operating band** | **Max TRP (dBm)** | **Max EIRP (dBm)** | | n257 | 35 | 55 | | n258 | 35 | 55 | | n260 | 35 | 55 | | n261 | 35 | 55 |   **Proposal 4:** for repeaters with power larger than PC1, min peak EIRP, maximum TRP in terms of TRP and EIRP are all based on manufacturer’s declaration without any upper limits and tolerance.  **Observation 3:** it’s unclear whether PC3 and PC4 derived from requirement of handheld UE and high-power handheld UE are also necessary to be included in repeater classes definition.  **Proposal 5:** when test repeater ALC functionality, multiple levels of input powers are preferred to reflect variable characteristics of repeater as the input power exceeds maximum allowed value. Besides, all of these test signals should be less than the risky upper limits to protect repeater not be destroyed by much larger input power. |
| R4-2112765 | NTT DOCOMO | **Observation 1:** To limit the output power of “unplanned” repeater up to any other UE’s Power Classes may be needed in certain countries and/or regions in order to use repeater freely placed and moved.  **Proposal 1:** If additional class for FR2 UL proposed in [2] will not be agreed, RAN4 introduce following NOTE in core requirements for OTA output power for NR repeater in FR2 UL.   * NOTE: In certain country/regions, the radiated output power of “unplanned” repeater for UL might be limited not to exceed the output power of any UE power classes (23dBm).   **Observation 2:** Having ALC requirements implicit was agreed and the repeater gain is adjusted by ALC function.  **Proposal 2:** RAN4 consider power accuracy for DL EIRP while assuming input power to reach maximum output power and input power in excess of that.  **Proposal 3:** If RAN4 doesn't consider the case where repeaters have multiple fixed beam options in their external tool or device pre-configuration, RAN4 consider one beam peak direction as measurement direction for DL EIRP, which is based on manufacturer declaration. |
| R4-2113361 | Ericsson | **Proposal 1:** EIRP and TRP accuracy for DL is the same as for the BS requirement  **Proposal 2:** Simplify the testing description for EIRP compared to BS by not including declaration of peak directions set and test directions. Testing is in a single declared direction.  **Proposal 3:** Either limit the maximum declarable rated TRP in UL to 31dBm or create two classes in a similar manner to IAB.  **Proposal 4:** Either limit the maximum declarable rated EIRP to 55dBm or create two classes in a similar manner to IAB.  **Proposal 5:** For TRP and EIRP accuracy, apply the same requirements for UL as for DL. |
| R4-2113672 | Nokia | **Proposal 1:** For Release 17 repeater specification, consider whether simplifications to directional requirements are possible due to fixed beam direction.  **Observation 1:** There is no upper limit for rated carrier TRP for IAB-DU type 2-O that operates in FR2 for WA and LA.  **Proposal 2:** For DL (access) FR2 type 2-O WA repeaters, it may not be necessary to define upper limit for the rated carrier TRP.  **Proposal 3:** For DL (access) FR2 type 2-O LA repeaters, given the possible deployment scenarios of LA class, it would be good to have a power upper limit.  **Proposal 4:** For DL (access) FR2 LA repeaters, one possible power upper limit could be the limits of FR2 LA IAB-DU.  **Proposal 5:** It would be sufficient to consider a single EIRP measurement in the boresight direction.  **Observation 2:** Repeater is communicating with the gNB with one or few beams in the backhaul link. EIRP parameter makes sense in backhaul link.  **Observation 3:** Automatic gain controlling may not need to be specified for repeater; the same functionality could be obtained by using an implementation specific approach. AGC is only needed in context of limiting maximum output power and unwanted emissions with high-power input signal.  **Proposal 6:** AGC requirements shall be specified as implicit requirements. |
| R4-2114230 | Huawei | Radiated output power – EIRP accuracy should be based on output power (as max) and only needs testing in a single direction |
| R42114482 | Qualcomm | **Proposal 3:** ALC performance should be specified over an input signal power range  **Proposal 4:** ALC stability should be specified to ensure output power stability, at least for FR2 repeaters. |

## Open issues summary

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

### Sub-topic 1-1 - DL Transmission (UE side)

Sub-topic relating to issues with the DL transmission output power.

**Issue 1-1-1: DL Transmission (UE side) power accuracy vs gain**

* Proposals
  + Option 1: Define power accuracy same as BS EIRP
  + Option 2: Define power accuracy same as BS TRP
  + Option 3: Define power accuracy same as BS EIRP and TRP
* Recommended WF
  + TBA

**Issue 1-1-2: DL Transmission (UE side) directional requirements**

* Proposals
  + Option 1: Same as BS (multiple directions declare)
  + Option 2: Single direction only (boresight)
* Recommended WF
  + TBA

**Issue 1-1-3: DL Transmission (UE side) WA power limit**

* Proposals
  + Option 1: No upper power limit for WA
  + Option 2:
* Recommended WF
  + TBA

**Issue 1-1-4: DL Transmission (UE side) LA power limit**

* Proposals
  + Option 1: Upper limit for FR2 LA (suggest same as FR2 OAB-DU but this has no limit?)
  + Option 2:
* Recommended WF
  + TBA

### Sub-topic 1-2 - UL Transmission (BS side)

Sub-topic relating to issues with the UL transmission power.

**Issue 1-2: UL Transmission (BS side)**

Option 4 can be selected along with the other options

* Proposals
  + Option 1: Same as DL
  + Option 2: Single class limited to 31dBm TRP / 55dBm EIRP
  + Option 3: 2 classes - PC1 (31dBm TRP/ 55dBm EIRP) with same requirements as UE and >PC1 with no limit or tolerance.
  + Option 4: Additional 23dBm (TRP) power limit for unplanned UE’s (as requirement or note)
* Recommended WF
  + TBA

### Sub-topic 1-3 – ALC

Subtopic for issues relating to the transmit ALC, contributions seem to agree ALC is required to ensure output power stability there are varying views on exactly how it is specified and tested.

**Issue 1-3-1: ALC**

* Proposals
  + Option 1: ALC is implicit
  + Option 2: ALC specified over an input signal power range
* Recommended WF
  + TBA

**Issue 1-3-2: ALC**

* Proposals
  + Test with multiple input levels.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 1-1-1: DL Transmission (UE side) power accuracy vs gain**  Option 3 is OK  **Issue 1-1-2: DL Transmission (UE side) directional requirements**  There is no dynamic beamforming and there can only be one direction of maximum EIRP. So option 2 is OK (although the single direction might not be the panel boresight). On the other hand, the BS like declaration would collapse down to a single direction anyhow.  **Issue 1-1-3: DL Transmission (UE side) WA power limit**  Agree no power limit  **Issue 1-1-4: DL Transmission (UE side) LA power limit**  Agree same power limit as LA BS or IAB-DU in principle. But for FR2, there is no power limit ? Also, how about medium range ? (Of course, this is somewhat related to BS classes…) |
| CATT | **Issue 1-1-1: DL Transmission (UE side) power accuracy vs gain**  Option 3 may be safer if there’s some regulations for TRP.  **Issue 1-1-2: DL Transmission (UE side) directional requirements**  Option 2 single direction.  **Issue 1-1-3: DL Transmission (UE side) WA power limit**  **Issue 1-1-4: DL Transmission (UE side) LA power limit**  We have agreed WA, MR and LA, and there’s no power limit for FR2 BS, maybe no limit for all of them? |
| Huawei | **Issue 1-1-1:** Option 3  **Issue 1-1-2:** Option 2 single direction is sufficient as there is no dynamic beam forming  **Issue 1-1-3:** No power limit for WA is ok  **Issue 1-1-4:** Its ok to follow the BS, if there is no power limit in BS then we probably don’t need one for repeater |
| CMCC | **Issue 1-1-1: DL Transmission (UE side) power accuracy vs gain**  Option 3 since it is approved to define TRP and EIRP requirements for repeater.  **Issue 1-1-2: DL Transmission (UE side) directional requirements**  Option 1 is more preferred. For FR2, only one beam is not enough for DL since one narrow beam can’t cover whole DL coverage. We should guarantee all the DL beams meet the RF requirements.  **Issue 1-1-3: DL Transmission (UE side) WA power limit and Issue 1-1-4: DL Transmission (UE side) LA power limit**  No power limits and repeater declare it. |
| Docomo | **Issue 1-1-1:** Option 3  **Issue 1-1-2:** If it is assumed that the NR FR2 repeater has only a fixed (no dynamic) beam, we are fine with Option 2. Otherwise, Option 1 is more preferred.  **Issue 1-1-3, Issue 1-1-4:** Based on the GTW discussion on class definition, we are OK to follow the BS. |
| Nokia | Issue 1-1-1: option 3  Issue 1-1-2: option 2, dynamic beamforming is not within WID scope  Issue 1-1-3: Option 1  Issue 1-1-4: We would be ok with having no power limit for DL in FR2 |
| ZTE | **Issue 1-1-1: Option 3**  **Issue 1-1-2: Option 2**  **Issue 1-1-3: Follow the GTW conclusion**  **1-1-4: Follow the same power limits of BS/IAB-DU.** |
| QCOM | **Issue 1-1-1: DL Transmission (UE side) power accuracy vs gain**  Prefer Option 3: Define power accuracy same as BS EIRP and TRP  **Issue 1-1-2: DL Transmission (UE side) directional requirements**  Prefer Option 1: Same as BS (multiple directions declare) . A repeater may be designed to serve more than one direction at once.  **Issue 1-1-3: DL Transmission (UE side) WA power limit**  Prefer Option 1: No upper power limit for WA  **Issue 1-1-4: DL Transmission (UE side) LA power limit**  We are OK with option 1 |
| CommScope | **Issue 1-1-1:** Option 3  **Issue 1-1-2:** Option 2  **Issue 1-1-3:** Option 1  **Issue 1-1-4:** No power limits for repeater; power limits shall be declared by the vendor |

Sub topic 1-2

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| **Company** | **Comments** |
| Ericsson | Options 2-4 are all OK for us. Where there is no UL power limit, the 3GPP specification is no longer providing a guarantee that co-existence is secured and site-specific planning is needed to ensure no interference to neighbor operators… but this is the approach adopted for IAB. |
| CATT | If there will be a limitation for one class, may be PC1 is better to have more flexibility. So option 3? |
| Huawei | Based on class discussion it seems we will have 2 classes, if we follow the IAB-MT approach then for FR2 there is no need for a power limit. We would also be ok with the LA having a power limit based on UE. Option 4 to have a not for lower regional requirements is also ok. |
| CMCC | As discussed in 18th GTW of [308] power class, it is approved to define two classes with power limitation and without power limitation. From our point of view, one power level with power not larger than PC1 and the other without power limit and repeater could declare it. |
| Docomo | We are fine with Option 3. As commented by Huawei, if we follow the IAB-MT approach then there is no need for a power limit, but having limitation for output power makes it easier to understand the implicit concept of “unplanned/planned”. Since maximum output power can be declared at the level lower than that of PC1, Option 4 does not need to be included in this stage (Actually, whether it shall be limited the UL output power lower than 23dBm has not been regulated yet in Japan). |
| Nokia | Option 3 would be closest to the GtW agreement on classes with the understanding that only the maximum allowed power levels from UE requirements are adopted. |
| ZTE | Perhaps the IAB-MT approach could be adopted. But as Ericsson stated, where there is no UL power limit, the 3GPP specification is no longer providing a guarantee that co-existence is secured and site-specific planning is needed to ensure no interference to neighbor operators. |
| QCOM | Options 3 and 4 are ok |
| CommScope | Option 1, since there are so many deployment possibilities which can not be foreseen now. A power limitation in the standard might take away opportunities to solve coverage problems in the field. |

Sub topic 1-3

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 1-3-1: ALC**  Agree option 1; we should not specify it and it can be tested implicitly |
| CATT | Maybe following FR1 approach is ok. |
| Huawei | Issue 1-3-1: option 1 ALC is implicit in the output power requirement  Issue 1-3-2: Testing with 2 input levels as in the current repeater requirements is ok. |
| CMCC | It is already approved that ALC could be implicitly specified and tested in last meeting.  For ALC, it is suggested to test ALC with multiple input levels and test requirements should be different among different input level to reflect different characteristics. It seems the same agreement apply for both FR1 and FR2. |
| Nokia | Issue 1-3-1 and 1-3-2: In our understanding ALC is implicitly tested by verifying output power, emissions and potentially also EVM with different input levels, corresponding to input level resulting with max output power and another higher input level. |
| QCOM | **Issue 1-3-1: ALC and Issue 1-3-2: ALC**  We are ok with any of the proposals |
| CommScope | **Issue 1-3-1:** Option 1  **Issue 1-3-2:** Test with two input levels (nominal input power and 10dB higher level than nominal input power) |

### CRs/TPs comments collection

There were no CRs/TPs submitted in this section

## 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.*

**Moderator:** Most of the big open issues for FR2 are similar to those for FR1 conducted [309] to avoid duplicating the same issue it has been suggested in a number of places that we wait for the FR1 agreement and use the same approach for FR2. As such we do not have too many technical issue to discuss in FR2 WF’s. Suggest a single WF is allocated to capture the agreements and open issues for all RF issues (Topics 1-3). With the exception of the OOB gain further investigations which is FR2 specific and needs its own WF.

***WF on NR Repeater FR2 RF- Huawei***

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| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic #1-1-1** | **DL Transmission (UE side) power accuracy vs gain**  *Tentative agreements:* o **Option 3:** Define power accuracy same as BS EIRP and TRP  *Candidate options:*  *Recommendations for 2nd round:*Capture agreement in WF |
| **Sub-topic #1-1-2** | **DL Transmission (UE side) directional requirements**  *Tentative agreements:* Most agree that single direction is ok if there is a single beam, CMCC and QCOM indicate the possibility of multiple fixed beams, this is perhaps different from the BS directional requirements and could be accommodated?  *Candidate options:*  *Recommendations for 2nd round:* Agree single direction for single fixed beam. Further discuss how to define and test fixed multi-beam repeater, in WF |
| **Sub-topic #1-1-3** | **DL Transmission (UE side) WA power limit**  *Tentative agreements:* o **Option 1:** No upper power limit for WA  *Candidate options:*  *Recommendations for 2nd round:* Capture agreement in WF |
| **Sub-topic #1-1-4** | **DL Transmission (UE side) LA power limit**  *Tentative agreements:*No upper power limit for LA in DL  *Candidate options:*  *Recommendations for 2nd round:* Capture agreement in WF |
| **Sub-topic #1-2** | **UL Transmission (BS side)**  It has already been agreed there will be 2 power classes, one with no power limit and one with power limit so the issue is what the power limit is, PC1 seems to be agreeable  *Tentative agreements:* Class with power limit use PC1 (as in option 2)  *Candidate options:*  *Recommendations for 2nd round:* Capture agreement in WF |
| **Sub-topic #1-3-1** | **ALC**  *Tentative agreements:* Option 1 ALC is implicit  *Candidate options:*  *Recommendations for 2nd round:* Capture agreement in WF |
| **Sub-topic #1-3-2** | **ALC**  *Tentative agreements:* Test ALC with multiple input levels  *Candidate options:*2 input levels one which achieves maximum output power and one 10dB higher (same as existing repeaters)  *Recommendations for 2nd round:* Capture agreements and remaining open issues in WF |

*Moderator: Suggest a singe WF is allocated to capture the agreements and open issue for this topic area:*

*WF on NR Repeater FR2 RF- Huawei*

### CRs/TPs

There were no CRs/TPs submitted in this section

## Discussion on 2nd round (if applicable)

Discussion can continue in the WF.

# Topic #2: Emisions

This topic deals with radiated unwanted emissions from the repeater and papers submitted in agenda item 9.5.3.2. The sub-topics have been split into

* ACLR
* Spurious emissions

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111921 | CATT | **Observation 1:** FR2 repeater ACLR is not measurable when the gain is larger than 70 dB.  **Observation 2:** When FR2 repeater gain is large, the noise floor may be higher than the FR2 BS OBUE requirements.  **Observation 3:** When FR2 repeater gain is large, the noise floor may be higher than the FR2 BS spurious emission requirements. DL spurious emission agreement may also need to be revisited. |
| R4-2112203 | CMCC | **Observation 1:** for repeater UL and DL, the amplification gain and output power will determine whether ACLR is measurable or not.  **Proposal 1:** We should at first determine gNB DL output power assumption before defining repeater DL ACLR requirements to achieve the same adjacent protection as gNB as listed in table 1.  **Observation 2:** if gain is larger than the value in above table then it’s hard to measure repeater ACLR requirements.  **Proposal 2:** the equivalent ACLR requirement as listed in table 2 is suggested for repeater DL only when the gain meet the limits in table 3, otherwise no ACLR requirement is required since it’s hard to measure it.  **Proposal 3:** the same OBUE requirements as gNB still apply for repeater DL with some modifications of the description of frequency edge. But it should be noted the more stringent requirement between OBUE and absolute ACLR requirements finally apply for repeater if the assumed output power of gNB is less than 15dBm/MHz. |
| R4-2112766 | NTT DOCOMO | **Observation 1:** Spurious emission requirements for IAB-MT are the same with that of BS including regional difference.  **Proposal 1:** RAN4 reuse the general spurious emission requirements for BS including regional difference (Category A/B) as requirements for NR repeater in FR2 UL.  **Proposal 2:** RAN4 introduce the additional spurious emission requirements for EESS protection in UE specification for NR repeater as regional requirements without applying NS concept. |
| R4-12113365 | Ericsson | **Proposal 1:** For ACLR, apply -13dB/MHz (Medium range) or -20dBm/MHz (Local area) for ACLR  **Proposal 2:** Adopt the relevant BS OBUE requirements directly. |
| R4-2113673 | Nokia | **Observation 1:** As relative ACLR depends on the desired signal power, it may not be measurable if the desired signal power is very or if it is in the scale of noise power level.  **Observation 2:** OBUE is an upper bound, which is independent on the signal power level, defined to limit the unwanted emissions in the adjacent bands.  **Proposal 1:** For NR repeaters, if the signal level is in the scale of noise power level, it is meaningful to use OBUE as a metric to measure the unwanted emissions in the adjacent channels, instead of ACLR.  **Proposal 2:** Specify relative ACLR to guarantee emissions performance at lower than maximum output power level. Further discuss in performance part of the work whether ACLR can be verified.  **Observation 3:** Same principles can apply in setting ACLR and CACLR requirements  **Observation 4:** In case only OBUE requirements would be defined,, direct re-use of gNB/IAB OBUE requirements may not be possible as it would result in less protection for adjacent channel operation.  **Proposal 3:** In case ACLR is not defined or OBUE requirements need to be made more stringent to align with legacy ACLR requirements.  **Observation 5:** With no co-existence study it is challenging to evaluate what are the correct emissions requirements for UL transmissions when operating above UE output power levels.  **Proposal 4:** Additional spurious emission requirements for EESS protection in UE specification are specified for NR repeater as regional requirements without applying NS concept.  **Proposal 5:** Consider setting both DL and UL emission limit to align with allowed BS emission levels or setting UL emissions limit to be at same absolute level as UE requirements.  **Observation 6:** Possible impact on blocking performance due to high UL output powers remains unconfirmed. |
| R4-2114230 | Huawei | ACLR – we don’t think this is needed as OBUE covers outside the passband and EVM inside the passband |

## Open issues summary

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

### Sub-topic 2-1 - ACLR

This sub-topic address the proposal raised for ALCR.

Most contributions noted that ALCR is only a reasonable requirement under certain gain and input power assumptions

**Issue 2-1: ACLR**

* Proposals
  + Option 1: ACLR requirement is used under restricted gain conditions
  + Option 2: No relative ACLR requirement is necessary (absolute ALCR only)
  + Option 3: No ACLR is necessary (OBUE is sufficient)
  + Option 4: No ACLR with more stringent OBUE requirements
  + Option 5: ACLR needed; FFS absolute, relative or both.
    - Gain relevant to ACLR is out-of-passband gain, no in-band gain
    - Measurement can be specified at full output power
* Recommended WF
  + TBA

### Sub-topic 2-2 – Spurious emisions

This sub-topic address proposal related to spurious emissions, the issues are split into spurious emissions and additional spurious emissions

**Issue 2-2-1: Spurious emissions**

* Proposals
  + Option 1: Reuse BS spurious emissions
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 2-2-2: Additional Spurious emissions**

* Proposals
  + Option 1: Reuse BS Additional spurious emissions
  + Option 2: TBA
* Recommended WF
  + TBA

**Issue 2-2-3:** EESS protection

* Proposals
  + Option 1: EESS protection from UE added without NS concept
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 2-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 2-1: ACLR**  We need to be careful about what is meant by gain. If thermal noise is amplified in the adjacent channel then it is the gain in the adjacent channel to the passband that is of importance, not the gain in the passband. The repeater vendor may need to have some kind of filtering to suppress out of passband gain.  It is important to note that amplified thermal noise in the adjacent channel will be interference to a neighbor operator and cause degradations in the same way as emissions from non-linearities. So it is important to ensure that re-amplified thermal noise is regulated. Limiting out of passband gain is not the same as limiting in-band gain.  We do not quite follow the discussion on measurability of ACLR. It can be measured at full output power. Also BS and UE has ACLR requirements that apply at lower than full output power and measurability does not seem to be an argument not to specify a requirement in those cases. Measuring at full output power is likely to be sufficient though.  We are open to discuss whether a relative or absolute or both ACLR. Relative ACLR may have problems because the passband width may be several carriers.  We have proposed an option 5 based on these arguments. |
| CATT | Same echo to Ericsson with FR1 ACLR. Especially for FR2, the analog filter attenuation, if there’s a band filter, should be very small even the adjacent channel is out of the band because the band width is very large for FR2. There can also some different gain from PA and antenna for out of the band area. But that’s based on my current knowledge and some guess, some implementation clarification is welcome. |
| Huawei | It’s not completely clear what the difference between the definition ACLR and ACRR is for the repeater, if the adjacent channel is outside the repeater passband then this is the same as ACRR, normally ACLR would be considered in-band. Maybe we should clarify these points? Of course currently ACRR I only applied for UTRA or co-existence with UTRA (not E-UTRA).  If full gain is applied to the in-band and adjacent signal then there are few cases where the amplified noise is lower than the ACLR specification this is why it is not specified n existing repeater requirement I believe. For outside the passband the oob gain is specified as lower which makes the amplified noise much lower and would enable measurement of the adjacent channel. As oob gain does not mention the input signal it is a measure of gain only (not any potential distortion). So for cases where repeater has high output power the relative out of passband adjacent channel may be larger than the noise and the absolute level then relative ACLR may be useful.  We think its maybe better to somehow make it clear that A:CR is the adjacent channel outside the passband though.  This seems consistent with Ericsson proposed option 5 |
| CMCC | **Issue 2-1: ACLR**  The key issue is how to assume the adjacent channel amplification gain for ACLR requirements. there are possibilities that the adjacent channel of ACLR requirements fall within the passband, outside the passband, or partially fall into the passband depending on bandwidth comparison between passband and one single carrier. this scenario is very like BS device cases where the realistic RF bandwidth of BS would also include several consecutive carriers and the adjacent channel would also fall within the RF bandwidth or outside the RF bandwidth. But the measurement adjacent channel of ACLR is just assumed to be inside the RF width, which means there is no analogy RF filter to suppress adjacent channel emission. This could also apply for repeater’s spec. and we still think the amplification gain for the adjacent channel of ACLR measurement is the same as that of passband since it is assumed inside passband. |
| Nokia, Nokia Shanghai Bell | Overall, we think we should try to align the principles of emission requirements and what emission requirements are defined as much as possible with FR1 to keep consistency in the specifications.  We would be ok to proceed with defining both relative and absolute ACLR, but we are not convinced ACLR can be limited to be defined only outside the passband, as this would not guarantee co-existence within the passband.  In case there is no ACLR then OBUE requirement needs to be made more stringent to guarantee equivalent protection of adjacent users as ACLR. |
| Ericsson | To CATT, CMCC, Nokia: We added some comments for FR1; FR2 comments are similar. We should clarify (including in the definition) whether the passband is expected to only contain carriers from the same operator. If it can contain carriers from other operators then some kind of in-passband requirement is needed, and if noise and emissions can be amplified in other operators carriers then there is a problem. If it is clarified that the passband(s) only contain carriers from the same operator then ACLR can be defined outside of the passband.  Regarding the difference between ACLR and ACRR; in our understanding ACLR will capture the emissions from active components in the repeater to the adjacent band and ACRR (& OOB gain) can be used to regulate re-amplification of noise and other operators carriers. |
| CommScope | **Issue 2-1:** Option 3 |

Sub topic 2-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1 OK (all issues) |
| CATT | We made mistake in our contribution, the out of band gain should be considered for spurious emissions. So according to our analysis, if only 6 dB difference, reusing BS requirement may be ok. |
| Huawei | All the proposed option 1 are ok |
| CMCC | Option 1 OK for all issues |
| Docomo | Option 1 is OK for all issues. |
| Nokia | We are also ok with option 1 for all issues. |
| ZTE | We are fine with Option 1 |
| QCOM | Option 1 is ok |
| CommScope | Option 1 is OK for all issues. |

### CRs/TPs comments collection

There were no CRs/TPs submitted in this section

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-1** | **ACLR**  *Tentative agreements:*  *Candidate options:* There are a number of issue raised in the discussion which require clarification before agreements can be made on ACLR. These include:   * Is adjacent channel inside passband, outside passband or both * Is relative ACLR needed * Clarify the definition of ACLR and ACRR (and are both needed?)   *Recommendations for 2nd round:* This issue is also being discussed in FR1 conducted and the issues are the same in both, nothing seems FR2 or radiated specific. Suggest that the discussion is focused on FR1 [309] and we adopt similar principles for FR2 (radiated) |
| **Sub-topic#2-2-1** | **Spurious emissions**  *Tentative agreements: o* **Option 1***:* Reuse BS spurious emissions  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-2-2** | **Additional Spurious emissions**  *Tentative agreements:* **Option 1:** Reuse BS Additional spurious emissions  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-2-3** | **EESS protection**  *Tentative agreements:* **o Option 1:** EESS protection from UE added without NS concept  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

There were no CRs/TPs submitted in this section

## 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”.*

Discussion can continue in the WF.

# Topic #3: Other RF requirements for FR2

This topic area deals with other RF radiated requirements submitted in agenda item 9.5.3.3. It is split into 4 sub topics

* EVM
* OOB gain and ACRR
* Noise floor
* RX IM

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111923 | CATT | **Observation 1:** Defining only one EVM limit is clearer. If several EVM limits are defined, they can’t be correlated to the modulation schemes. FR2 EVM should exclude 3.5% case.  **Observation 2:** The FR2 repeater in band gain and the assumptions of analysis scenario for out of band gain requirement should be decided to further analyze this requirement. |
| R4-2112202 | CMCC | **Proposal 1:** EVM basic limits should be defined to avoid severe distortion of received signal.  **Observation 1:** more stringent EVM requirements is suggested for NR repeater to reduce noise.  **Observation 2:** vector error created by NR repeater could be less than E-UTRA repeater spec and NR BS spec.  **Proposal 2:** to reduce whole link EVM, [5%-6%] EVM is suggested for 64QAM or other lower order modulation scheme for FR1 and FR2  **Observation 3:** 256 QAM is also the important modulation scheme in network when repeater is deployed.  **Proposal 3:** 256 QAM is also suggested for repeater EVM with more stringent limit than 3.5% to reduce extra interference to wanted signal for FR1 and FR2 DL.  **Observation 4:** when define FR1 NR ACRR, above four factors should be considered. (moderator: factors copies below)   * Factor 1: Whether to include repeater’s ACLR requirements into the analysis of NR ACRR since NR may define ACLR requirements while UTRA spec doesn’t * Factor 2: The effect of larger bandwidth of NR * Factor 3: The interference source assumption for ACRR requirements   + Option 1: nearby interferer source closer to the repeater than donor BS.   + Option 2: interferer source with the same power and same distance as donor BS. * Factor 4: the difference between simulation assumptions   **Observation 5:** interference introduced by ACLR requirements is even severe (8dB) compared with interference amplified by repeater adjacent channel gain according to ACRR requirements.  **Observation 6:** simulations results show the location of aggressor gNB almost doesn’t impact final interference level.  **Proposal 4:** interferer source is assumed with the same power and same distance as donor BS when define ACRR requirements.  **Observation 7:** key simulation parameters are almost the same for UTRA and NR spec when define ACRR requirements.  **Proposal 5:** if we don’t consider repeater’s ACLR requirements during the analysis of ACRR then the same ACRR requirements as E-UTRA spec could still apply for NR FR1, i.e. 33dBm for output power larger than 31dBm and 20dB for less output power. Otherwise, ACRR should be more stringent considering ACLR interference is relatively large and negligible.  **Proposal 6:** for FR2, new simulation is required to define ACRR requirements and we should at first define simulation parameters values and the key parameters are listed as in table 3.  **Observation 8:** ACRR and out of band gain requirements are both used to regulate gain outside passband and out of band gain is calculated based on ACRR simulation results. ACRR is for integrated power amplification over the whole adjacent channel while out of band gain is to define peak gain limited by a mask where a narrower measurement bandwidth is used.  **Proposal 7:** if the same ACRR basic limit as E-UTRA spec still apply for NR FR1 spec, the same out of band gain basic limits mask as E-UTRA spec still apply for NR spec with some modification of frequency offset.  **Proposal 8:** out of band gain for FR2 should be based on ACRR simulation results. |
| R4-2113366 | Ericsson | **Proposal 1:** Either do not specify EVM as a 3GPP repeater requirement or specify several levels with a declaration.  **Proposal 2:** No need to link repeater EVM levels to modulation orders.  **Proposal 3:** If EVM level is declared, declare level independently for the DL and UL directions.  **Proposal 4:** Set a requirement on a maximum passband output power level with no input signal applied.  **Proposal 5:** RX IM signal types are a CW and a modulated signal with bandwidth [50] MHz.  **Proposal 6:** For RX IM, position the first CW at 5MHz from the passband edge and the second CW such that the IM product falls into the center of the passband.  **Proposal 7:** For RX IM, set the CW power to [-70] dBm.  **Proposal 8:** A maximum out of band gain of around 30-40dB is sufficient for avoiding amplification of other unwanted emissions sources.  **Proposal 9:** The ACRR requirement should be at least 28dB  **Proposal 10:** Discuss whether an even greater ACRR should be considered (in case re-amplified/distorted versions of other operator carriers are not noise like) |
| R4-2113674 | Nokia | **Proposal 1:** EVM requirements shall use the same EVM-% linked together with modulation schemes as specified for gNBs and UEs.  **Proposal 2:** More than one EVM-% needs to be specified and the maximum supported modulation order shall be declared by the repeater manufacturer.  **Proposal 3:** Maximum supported modulation order is declared separately and independently for UL and DL.  **Observation 1:** Reasonable selection for separation distance and antenna configurations needs to be done when deriving the OOB gain requirement.  **Observation 2:** 50 m free space path loss is extremely close to 10 m NLOS channel path loss.  **Proposal 4:** Take full antenna gain into account when deriving OOB gain requirement.  **Proposal 5:** Sufficiently large frequency offsets need to be set before tightening of the OOB gain requirement in FR2. |
| R4-2114482 | Qualcomm | **Proposal 5:** Support of 256 QAM should be declared. Further it would make sense to declare the uplink and downlink separately. |
| R4-2113206 | ZTE | **Observation 2:** The OTA EVM test accuracy of uplink need further evaluation. |

## Open issues summary

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

### Sub-topic 3-1 - EVM

This sub-topic address the proposal raised for EVM.

**Issue 3-1-1: EVM and modulation order**

* Proposals
  + Option 1: Single EVM limit (modulation order independent up to 64QAM)
  + Option 2: EVM levels are declared (but not linked to modulation order)
  + Option 3: Maximum modulation order is declared
* Recommended WF
  + TBA

**Issue 3-1-2: 256 QAM**

* Proposals
  + Option 1: 3.5% level (i.e. 256QAM is excluded)
  + Option 2: 256QAM is declared
* Recommended WF
  + TBA

**Issue 3-1-3: EVM limit**

* Proposals
  + Option 1: EVM levels are stricter than BS levels
  + Option 2: EVM levels are same as BS levels
* Recommended WF
  + TBA

**Issue 3-1-4: UL and DL EVM**

* Proposals
  + Option 1: UL and DL declared separately
* Recommended WF
  + TBA

### Sub-topic 3-2 – OOB gain and ACRR

This sub-topic address proposal related to OOB gain and ACRR which in some proposals are linked.

**Issue 3-2: OOB gain**

* Proposals
  + Option 1: Assumptions agreed and further analysis required
  + Option 2: ACRR 28dB, OOB gain 40-40dB
* Recommended WF
  + Option 1: Most papers recommend further work and./or simulations are required, we should try to agree a set of simulation assumptions in a WF

### Sub-topic 3-3 – Noise floor

Noise figure requirements were discussed last meeting, they were raised in only a single paper this meeting

**Issue 3-3: Noise floor**

* Proposals
  + Option 1: Set requirement on max passband output power with no signal applied.
* Recommended WF

### Sub-topic 3-4 – RX IM

This sub-topic address proposal related to RX IM, these were propose in a single paper with detailed requirements.

**Issue 3-4: RX IM**

* Proposals
  + Option 1: Set RX IM with CW and 50MHz modulated signal positioned at 5MHz form passband edge (as per R42113366)
* Recommended WF

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 3-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 3-1-1: EVM and modulation order**  Since the repeater does not generate a signal, we do not see a strong need to relate EVM to modulation order. It is important to consider that there are at least two scenarios; where the repeater is used to extend coverage with low data rates/modulation/high coding (e.g. for MTC); in these cases signal fidelity is not critical and e.g. 10-20% EVM addition may be fine, but cost may be a factor. Another scenario is one in which preservation of signal fidelity is of importance.  **Issue 3-1-2: 256 QAM**  Actually 3.5% is not sufficient for supporting 256QAM, since the 3.5% will be in addition to the EVM from the transmitter. However, we do not see a need to link signal fidelity/added EVM in the repeater to modulation from the source transmitter explicitly.  **Issue 3-1-3: EVM limit**  We do not see a need to link the added EVM to requirements on other equipments explicitly. Of course, the EVM seen as needed for link performance can act as a guide though.  **Issue 3-1-4: UL and DL EVM**  It can make sense to declare separately, since link budget and SNR may differ.  **Issue 3-2: OOB gain**  Our understanding (as discussed in the other thread) is that OOB gain is best set to avoid amplification of emissions from other sources to greater than the emissions limits for the repeater and ACRR should avoid amplification of carriers from other sources to be greater than the emissions limits of the repeater (under the understanding that amplification of carriers outside of the passband will also distort them). Analyzing further is fine. |
| CATT | **EVM**  For FR2, maybe only one value and some relaxation can be considered, if companies can agree. And also don’t think 256 QAM is needed, 3.5% is not needed either.  UL and DL can be declared separately. |
|  | **Issue 3-1-1:**  Whilst the repeater does not generate signal only amplifies it the EVM is not linked to modulation order, however it is useful to know the repeater capability wrt to the modulation order. It is unlikely the repeater will generate significant EVM as such a single value is the simplest method and there is not real need for a low cost high EVM version. Option 1 is ok  **Issue 3-1-2:** Whilst EVM should not be too difficult to meet 256QAM is probably tougher than other linearity requirements (adjacent channel) as such is worth making an exception of a declarable capability.  **Issue 3-1-3:** The EVM from the repeater will be in addition to that of the BS/UE, ideally the repeater will have a lower contribution so the total is not degraded to greatly. We should discuss what an acceptable degradation is. The existing repeater has an EVM contribution of 8% which is equivalent o the 64QAM requirement, TR 25.956 explains having an equal contribution from both repeater and BS/UE gives a rise in EVM but the degradation is small compared to the noise with no repeater, hence the degradation is justified. Assuming this argument si justified we can take the same approach although some checking should be done.  **Issue 3-1-4:**  Declaring separately is ok – option 1 |
| CMCC | **Issue 3-1-1: EVM and modulation order**  Two levels of EVM requirements. One for modulation scheme less than 64QAM and the other for 256QAM. It’s true the distortion of repeater for different modulation could be almost the same as long as the input EVM are the same. We are OK to define only one EVM level for all modulation schemes that’s less than or equal to 64QAM. But for 256 QAM if they reuse the same EVM as other modulation scheme then the total EVM after repeater could be much severe and the distortion of repeater is not acceptable. Of cause this doesn’t mean all repeater should support 256QAM, the support of 256QAM could be based on declaration.  **Issue 3-1-2: 256 QAM**  At first we want to explain there are scenarios that repeater should support 256 QAM. For example, in the basement where donor antenna is deployed outside the basement. And maybe the gNB is just located very near to the donor antenna of repeater on the ground. 256QAM could be supported by some high capability repeaters or based on operator’s demand.  3.5% is not enough for 256QAM because 3.5% is the total requirement of the whole link. It is better to define a EVM limits less than 3.5%. Of cause the support of 256QAM could be based on declaration.  **Issue 3-1-3: EVM limit**  Option 1 is preferred.  **Issue 3-1-4: UL and DL EVM**  Option 1 is preferred. |
| Nokia | Issue 3-1-1: Option 3, with EVM levels linked to modulation order  Issue 3-1-2: Support for 256QAM is declared and when supported the repeater contribution to EVM cannot exceed 3.5%.  Issue 3-1-3: Option 2  Issue 3-1-4: Option 1 |
| ZTE | Issue 3-1-1: Option 1, since we did not see strong relationship between EVM and modulation orders.  Issue 3-1-2: Before the confirming the EVM will be linked to modulation orders, it seems not suitable to discuss this topic.  Issue 3-1-3: Option .  Issue 3-1-4: Option1. |
| QCOM | **Issue 3-1-1: EVM and modulation order** we prefer EVM that is tailored to the application. Low cost lower data rate applications should be allowed higher EVM and support of lower mod order. Mod order could be by declaration, and max EVM related to that mod order.  **Issue 3-1-2: 256 QAM** 256 QAM is declared  **Issue 3-1-3: EVM limit** We prefer to conclude on whether EVM is modulation dependent or not. Once we have that decision we can make an informed decision on values  **Issue 3-1-4: UL and DL EVM** Option 1 |
| CommScope | **Issue 3-1-1:** EVM shall be declared for all modulation levels due to formal reasons. This way it is possible to declare compliance of a repeater for all or selected modulation levels only.  **Issue 3-1-2:** 256 QAM shall be included  **Issue 3-1-3:** Option 2  **Issue 3-1-4:** Option 1 makes sense since for some product it makes sense to have a more stringent EVM requirement for the DL as for the UL. |

Sub topic 3-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 3-2: OOB gain**  Our understanding (as discussed in the other thread) is that OOB gain is best set to avoid amplification of emissions from other sources to greater than the emissions limits for the repeater and ACRR should avoid amplification of carriers from other sources to be greater than the emissions limits of the repeater (under the understanding that amplification of carriers outside of the passband will also distort them). Analyzing further is fine. |
| CATT | **Issue 3-2: OOB gain**  Support further study.  **Issue 3-3: Noise floor**  The same comment with FR1, some flexibility for the measurement may be better? Would like to see the views from TE vendor. |
| Huawei | **Issue 3.2:** Further analysis is ok but we should capture the conditions of the analysis. |
| CMCC | **Issue 3-2: OOB gain**  At first we should figure out the interference mechanism for OOB and ACRR at first. Other wise it’s hard to make any progress. The same methodology apply for FR1 and FR2. from our point of view, the OOB gain and ACRR are both used to reflect the interference schematic including amplification of emissions from other sources to less than the emissions limits for the repeater and amplification of wanted carriers from other sources to be greater than the emissions limits of the repeater. |
| Nokia | Option 1: Some further discussion for assumptions and further analysis is needed.  Our understanding of the relationship between out-of-band gain and ACRR is that it is similar to OBUE and relative ACLR, but ACRR and OOB gain consider emissions which are not originating from the repeater but from another source. ACLR and ACRR limit the integrated impact over adjacent channel whereas out-of-band gain and OBUE look at narrowband case. As a whole, a stronger narrowband emission peak can be allowed, as long as total interference stays in control. This is visible also from LTE FDD repeater specification, where OOB gain is allowed to be around 45 dB at the same frequency offsets where only 30 dB ACRR is allowed.  In case only OOB gain is defined and the narrowband gain is set considering that filter ripple may result in higher narrowband emissions, the overall requirement may end up significantly relaxed. While this would ease implementations, we also need to make sure this does not cause co-existence issues in the field. In FR2, filter ripple might not be an issue and perhaps there is more opportunities to define OOB gain in a manner that ACRR is not required. |
| ZTE | Further study is OK. |
| QCOM | **Issue 3-2: OOB gain** we agree withOption 1: Most papers recommend further work and./or simulations are required, we should try to agree a set of simulation assumptions in a WF |
| CommScope | **Issue 3-2:** Ok with option 1 |

Sub topic 3-3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | **Issue 3.3:** This issue is also discussed for FR1 [309] with the option also to measure and specify NF directly. Whilst this option 1 is ok measuring NF is perhaps better. We should perhaps follow the decision for FR1. |
| CMCC | **Issue 3.3:** we should define NF in the spec to reflect the internal noise introduced by repeater. And NF analyzer is one simple method to test NF. |
| Nokia | We agree to align with FR1 but we are not yet convinced NF or equivalent requirement is needed. |
| ZTE | We think this issue should wait for the conclusion of FR1. |
| CommScope | In our opinion the noise floor is a vendor specific parameter which is given in the product datasheet. There is no simple way to define a generic limit which represent all deployment scenarios. Hence, we propose not to define a requirement here. |

Sub topic 3-4

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | **Issue 3.4:** No objection to proposal currently but maybe detail does not to be agreed quite yet, similar discussion about modulated or CW signals in FR1 we can wait for teat discussion to be decided. |
| CMCC | **Issue 3-4: Rx IM**  It’s OK to define one modulated signal and one CW signal. FFS about the channel bandwidth and frequency offset.. |

### CRs/TPs comments collection

There were no CRs/TPs submitted in this section

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-1-1** | **EVM and modulation order**  *Tentative agreements:*  *Candidate options:* Opinion seems split between a single EVM value for all modulation order up to 64QAM and having a different value for each modulation order. Ericsson still propose a EVM declaration not linked to modulation order perhaps we can drop this option?  *Recommendations for 2nd round:* Further discuss options, this is same issue as FR1 conducted [309] it has no FR2 radiated specific issues so we should perhaps focus the discussion on FR1 and use the same conclusion. |
| **Sub-topic#3-1-2** | **256 QAM**  Not everyone sees the need for 256QAM however the majority seem to think it can be a declared capability, can we tentatively agree its declared ?  *Tentative agreements:* 256 QAM is declared function  *Candidate options:*  *Recommendations for 2nd round:*Further discuss the level of EVM needed to support 256QAM |
| **Sub-topic#3-1-3** | **EVM limit**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* There is no obvious preference for either option. It is likely we need to answer to some of the other issues before the values can be agreed. Again this is a similar issue in FR1 conducted [309] so we can focus the discussion on FR1 and use similar approach for FR2 once this is agreed. |
| **Sub-topic#3-1-4** | **UL and DL EVM**  *Tentative agreements:* ***o Option 1****: UL and DL declared separately*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-2** | **OOB gain**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* All companies favor further work. Suggest a WF is used to capture the conditions and scenarios for that further work so we can focus the investigations for next meeting. There will be similarities with FR1 however the conditions for FR2 are likely to be different so the WF can be separate (although clearly if similar is done for FR1 there should be some alignment) |
| **Sub-topic#3-3** | **Noise floor**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* No clear agreement, however once again the issue is the same as for FR1 conducted [309] so we can follow the decision from that discussion. |
| **Sub-topic#3-4** | **RX IM**  *Tentative agreements:*Agree 1 modulated and 1 CW interferer, FFS on the BW, freq offset and level  *Candidate options:*  *Recommendations for 2nd round:* The BW, freq offset and levels can be returned to next meeting. |

**WF on FR2 OOB gain further studies - Ericsson**

### CRs/TPs

There were no CRs/TPs submitted in this section

## 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”.*

Discussion can continue in the WF.

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| WF on NR Repeater FR2 RF | Huawei | Capture all the agreements and open issues in one WF, highlight open issues where the FR2 will follow the FR1 [309] decisions. |
| WF on FR2 OOB gain further studies | Ericsson | FR2 assumptions are sufficiently different form FR1 that this should be a separate WF from any work done for FR1 [309] |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

All existing docs are discussion docs with recommendations, these agreeable recommendations can be captured in the WF’s.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2111919 | Discussion on NR repeater radiated output power | CATT | Noted |  |
| R4-2111921 | Discussion on NR repeater radiated emission requirements | CATT | Noted |  |
| R4-2111923 | Discussion on NR repeater other requirements for FR2 | CATT | Noted |  |
| R4-2112201 | discussion on repeater power related radiated requirements | CMCC | Noted |  |
| R4-2112202 | discussion on other RF radiated requirements for NR repeater | CMCC | Noted | Some issues also relevant to [309] |
| R4-2112203 | discussion on repeater emission related radiated requirements | CMCC | Noted |  |
| R4-2112765 | Views on output power requirements for FR2 NR repeater | NTT DOCOMO, INC. | Noted |  |
| R4-2112766 | Views on spurious emission requirements for FR2 NR repeater | NTT DOCOMO, INC. | Noted |  |
| R4-2113206 | Discussion on repeater EVM requirements | ZTE Corporation | Noted | Only observation 2, other issue in [309] |
| R4-2113361 | Repeater radiated power requirement | Ericsson | Noted |  |
| R4-2113365 | Repeaters radiated unwanted emissions | Ericsson | Noted |  |
| R4-2113366 | Repeater radiated other requirements | Ericsson | Noted |  |
| R4-2113672 | Radiated power related requirements consideration for NR repeaters | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2113673 | Repeater OTA unwanted emissions | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2113674 | Signal quality and OOB gain considerations for FR2 NR repeaters | Nokia, Nokia Shanghai Bell | Noted |  |
| R4-2114230 | Repeater radiated RF requirements | Huawei | Noted |  |
| R4-2114482 | Repeater conducted and power-related requirements | Qualcomm Incorporated | Noted | Only proposals 2-5, other issues in [309] |

Notes:

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

## 2nd round

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

Notes:

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

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
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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)