**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 6.6,6.9

**Source:** Moderator(ZTE)

**Title:** Email discussion summary for RAN4#94e\_#78\_NR\_NewRAT\_EMC

**Document for:** Information

# Introduction

For the RAN4#94e\_#78\_NR\_NewRAT\_EMC, the main topics are about BS and UE EMC including agenda item 6.6, 6.9 and 8.5.6. The discussion will separate into two parts:

Topic #1: NR EMC for agenda item 6.9

Topic #2: IAB EMC for agenda item 8.5.6.

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

# Topic #1: NR EMC

For agenda item 6.9:

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001252 | ZTE | To add TX exclusion band for NR BS type 1-O.  The exclusion band is ΔfOBUE |
| R4-2001717 | ZTE | To add TX exclusion band for OTA AAS BS.  The exclusion band is ΔfOBUE |
| R4-2001905 | Ericsson | Reduction of test configuration for MSR bs |
| R4-2001906 | Ericsson | Add reverberation chamber for RX immunity test. |
| R4-2001832 | Huawei | **Proposal 1**: agree on the introduction of the direct field strength measurement test method for the EMC Radiated Emissions requirements of the BS type 1-C and BS type 1-H in TS 38.113. |
| R4-2001833 | Huawei | Correspond CR for the Discussion above.  New limit and test method for the field strength metric |

## Open issues summary

### Subtopic 1-1 TX exclusion band:

The TX exclusion band has been agreed for BS type 1-O and OTA AAS BS in RAN4#93 meeting, however, the value is not decided yet.

**Issue 1-1: TX exclusion band value**

* Proposals
  + Use ΔfOBUE as TX exclusion band
  + Option 2: TBA
* Recommended WF
  + TBA

### Subtopic 1-2 Reduction of test configuration for MSR BS

A set of EMC test configuration reduction proposal based on test result covering has been provided.

**Issue 2-1: How to treat the test result covering issue**

* Proposals
  + NB-IoT cover GSM
  + LTE cover WCDMA
  + NR cover LTE/WCDMA
* Recommended WF
  + More technical reason analysis is needed before the reduction

### Subtopic 1-3 Field strength measurement for radiated emission

Despite current EIRP radiated emission measurement, a measurement based on CISPR 32 is provided:

**Issue 3-1: New metric for radiated emission**

* Proposals
  + Add as one optional test method
  + new test method is provided
* Recommended WF

### Subtopic 1-4 Reverbation chamber for RI test

Agree on the introduction of reverberation chamber as an alternative test method for receiver immunity across the BS EMC specifications:

**Issue 4-1: New metric for radiated emission**

* Proposals
  + Correspond CR to be submitted
* Recommended WF

## Companies views’ collection for 1st round

### Open issues

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments** | |
| Nokia, Nokia Shanghai Bell | Sub topic 1-1:  Sub topic 1-2: Further clarifications on the strategy used to reduce the number of test configurations in the ppt slides. How do you select CS?  Sub-topic 1-3: From R4-2001832,  “The direct radiated field strength measurement is required to be performed on a validated test site in accordance with CISPR 16 [3] or ANSI C63.4 [5]. In addition, according to CISPR 32 [4], tables A.4 and A.5 (taking class B equipment for example), and considering ordinary test setup against BSs in test labs, the direct field strength measurements could be conducted at 3 m or 10 m on an open area test site (OATS) or semi anechoic chamber (SAC) for frequencies up to 1 GHz, or at 3 m on a free space open area test site (FSOATS) for frequencies above 1 GHz.”  In CISPR 32 the test sites in the frequency range 30 MHz to 1GHz are: Open Area Test Site (OATS) or Semi Anechoic Chamber (SAC) of Fully Anechoic Room (FAR). One of these or the other can be used and the only requirement is that the test site complies to the Normalized Site Attenuation defined in CISPR 16-1-4 clause 6.  In CISPR 32 the test sites in the frequency range above 1 GHz is: Free Space Open Area Test Site (FSOATS). This should include a Semi Anechoic Chamber (SAC) with RF absorbers on the floor or a Fully Anechoic Room (FAR) that meet the VSWR requirement of CISPR 16-1-4, clause 7.  Tables A.4 and A.5 of CISPR 32 are related to Class B limits but the table for the test sites is Table A.1 of CISPR 32.  ….  Others: | |
| Ericsson | | Issue 1-1: agree but needs alignment  Issue 2-1:  Issue 3-1:  To use EM field strength measurement as an alternative to substitution method is a commonly used praxis today (test labs, ANSI)  Substitution is used in cases of measurements close to limit.  Calculation of limits is done for radiation from a tuned dipole. Proposed levels shall be checked if correct, they look be correct.  So we might should support this proposal with following comments:  1. As I write above, if measurements close to limit, say 3 dB, substitution method shall be used on this frequencies.  2. Limits below 1 GHz shall apply for quasi-peak detector / 120 kHz as according to CISPR 32.  3. Limits above 1 GHz shall apply for average detector / 1 MHz as according to CISPR 32.  ….  Others: |
| ZTE | | Sub topic 1-1:  Looks OK for Ericsson and Nokia.  Sub topic 1-2:  We have agreed the motivation of reducing the TC. However, it seems a little fast for make decision now. For example, weather the test result of NB-IoT can cover GSM or vice versa has not been discussed yet. It is recommended that further technical discussion about the reduction can be provided. My suggestion is we have a WF in this meeting and try to have conclusion in April meeting.  Sub topic 1-3:  The radiated emisison of 113 series has been referred to SM.329 since the UTRA spec. Corresponding note as “this is the radiated spurious emission requirement of base station enclosure” hence the EIRP level are used. For field strength method, currently it is used as catogery Z in SM.329 and it applies only to unintentional radiator, say the switch or gateway who doesn’t have RF parts in it. So we think this two test although have similar test setup, they are testing different emissions. In this case, the field strength test is not a simple calculation with metric change, but internally the test is different. So we dont’t agree to add this test into 38.113 spec.  Others: | |
| Huawei | | Sub topic 1-1: this topic was discussed but I don’t think that formally the approach was agreed.  Sub topic 1-2:  There are a lot of open issues. First of all, we are not sure how we can simplify the testing for unwanted emissions/EMC – for the proposal, there are some assumption on the internal BS architecture which are not expresses, e.g. the exact same RF chain used for certain RATs.  This requires more study.  - This requires some systemized study first.  - Testing simplification would be nice to achieve, as long as test coverage is not limited. Still, in case of EMC (or in case of unwanted emissions) it is hard to judge that, i.e. how can we reassure that harmful EMC emissions are not occurring in case of certain RAT combinations? This depends on the internal BS design (HW components, RF chains design, etc.), e.g. what if the simplified testing framework will allow that certain RF chains are not active during testing? - This framework would impact both high-end and low-end device, so the internal RF integration levels would vary. We need to reassure that test framework simplification would not reduce the test scope for the BS product.  -  we need to clarify the assumptions which were used for derivation of results presented in this contribution, e.g. MSR BS (non-AAS and AAS), single-band case, etc.  - which EMC requirement is actually aimed by this optimization proposal as this is not clear?  - For the conducted immunity: agree that tests such as ESD, EFT, Voltage dips and surges shall be sufficient to be tested once for MSR BS, irrespective of the RAT's used.  - Observations 1, 2, 3 in this contribution are not obvious and not precise enough to be concluded at this point of time; those require further study and discussion.  - If we would like to develop a framework for the MSR BS testing simplification, we shall aim at RAT-agnostic analysis. Otherwise we would need to re-do the same exercise at the time new/modified RAT is introduced.  Sub-topic 1-3:  We would like to keep the discussion open during this e-meeting to better understand concerns from other companies.  Sub-topic 1-4:  - it shall be clarified what is meant by the "introduction", which technical report and/or EMC TS is expected to be impacted --> if this is intended for RI in all BS EMC specs then a (Rel-17) WI may be required.  - it shall be clarified if test method specific aspects shall/shall not be captured in the EMC specifications. Refer to the BS RF approach: TS is OTA chamber agnostic, with all the OTA chamber details captured in (new) TR 37.941. | |
| ZTE | | Sub-topic 1-1: For Huawei’s comment, I agree taht the decision of TX exclusion band is needed for OTA AAS BS has not been made. However, we have consencus during the offline meeting. The only issue left is the value of the TX exclusion band. We are open to the discussion that company can provide there values to this topic.  Sub-topic 1-4: For the RX RI test, currently the test method refers to IEC 61000-4-3 which has a very clear explaination including calibration, test uncertainty and other required information for current chamber test method. However, the reverb chamber test method is not included. So I recommend not to capture this in 3GPP spec. | |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **Comments collection** | |
| R4-2001252 | | Nokia, Nokia Shanghai Bell  OK |
| Ericsson: agree |
| Huawei: text is not aligned with the Rx exclusion, there is no motivation for the use of Tx exclusion band (refer to the first sentence of the Rx exclusion band). |
| R4-2001717 | | Nokia, Nokia Shanghai Bell  OK |
| Ericsson: same as for 1252 |
| Huawei: similar as 1252 |
| R4-2001906 | | Nokia, Nokia Shanghai Bell  This is neither a CR nor a TP!  Moderator: This will be removed, sorry for the mistake.  Moderator: I will mark void for this section. Company please provide feed back on sub topic 1-4 of this paper. I have merged HW’s comments to subclause 1.3.1. |
| Company B |
| Huawei: this shall be a discussion topic.  - it shall be clarified what is meant by the "introduction", which technical report and/or EMC TS is expected to be impacted --> if this is intended for RI in all BS EMC specs then a (Rel-17) WI may be required.  - it shall be clarified if test method specific aspects shall/shall not be captured in the EMC specifications. Refer to the BS RF approach: TS is OTA chamber agnostic, with all the OTA chamber details captured in (new) TR 37.941. |
| R4-2001833 | | Nokia, Nokia Shanghai Bell  NOTE 4 in Table 8.2.1.3-1 is not technically correct. See comments above.  NOTE 5: “Though options …” -> “Two options …” |
| Ericsson: not agree for now. See comments on 1832 |
| ZTE: Not agree, see comments on 1832 |

## Summary for 1st round

### Open issues

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

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** | |
| R4-2001252 | |  |
| R4-2001717 | |  |
| R4-2001906 | |  |
| R4-2001833 | |  |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: IAB EMC

The IAB EMC has been discussed in this topic and to answer the questions from last meeting. Set of core requirements has been discussed.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001253 | ZTE | Proposal 1: Radiated emission requirement for IAB with different enclosure, the requirements are the same and they are applied per enclosure.  Proposal 2: For TDM IAB-node with only one enclosure, reuse current radiated emission requirement of BS in TS 38.113.  Proposal 3: For FDM and SDM IAB-node with only one enclosure, radiated emission should be tested in 3 cases based on declaration.  Proposal 4: Similar principle of BS EMC spec for the type 1-O and 2-O BS will be applied to the type 1-O and 2-O TDM IAB-node for radiated emission requirement.  Proposal 5: For IAB with different enclosure, the conducted emission limit of Class A and Class B applies based on different usage environment.  Proposal 6: Reuse base station requirement for harmonic current emission and voltage fluctuation and flicker to an IAB-node. |
| R4-2001254 | ZTE | Observation 1: EMC immunity requirement is defined per enclosure/port and its location environment.  Observation 2: The immunity test which are based on IEC 61000 series will be similar for DU and MT, however, the test level can be different.  Observation 3: The immunity test based on ports can be finalized as tests and requirements are defined specifically on ports but with different levels for different environment.  Observation 4: For different enclosure case, the radiated immunity test can be performed for each enclosure as UE requiremaent for MT and BS requirement for DU.  Observation 5: The easiest way to define radiated immunity test for one enclosure case is test each function separately, but this method cannot test the real case of IAB function. |
| R4-2001255 | ZTE | TP to TR on IAB EMC emission requirements |
| R4-2001256 | ZTE | TP to TR on IAB EMC immunity requirements |
| R4-2001257 | ZTE | TP to TR on explain the difference for structure of IAB EMC and RF requirement |

## Open issues summary

The IAB EMC discussion follows the WF R4-1916077 from RAN4#93, main issues listed in the WF has been discussed.

### Sub-topic 2-1 IAB emission requirement

The emission requirement has been separated into radiated emission and other emission requirement. For radiated emission, detail discussion based on enclosure and multiplex mode has been provided.

**Issue 2-1: IAB radiated emission requirement**

* Proposals
  + Different enclosure: requirement applies per enclosure
  + One enclosure:
    - TDM IAB node reuse base station requirement
    - FDM and SDM IAB node need 3 test cases
  + 1-O and 2-O IAB: follow BS principle as radiated spurious emission will cover radiated emission
* Recommended WF
  + TBA

**Issue 2-2: IAB conducted emission requirement**

* Proposals
  + Class A and Class B limits to be defined for indoor and outdoor use
* Recommended WF
  + TBA

**Issue 2-3: Harmonic and current requirement**

* Proposals
  + Reuse bases station requirement
* Recommended WF
  + TBA

### Sub-topic IAB immunity requirement

For immunity requirement, it is divided into radiated immunity requirement and other immunity requirement:

**Issue 2-1: Radiated immunity requirement**

* Proposals
  + Different enclosure: UE requirement apply to MT and BS requirement apply to DU
  + One enclosure: Test each function separately. However, more discussion is needed.
* Recommended WF
  + TBA

**Issue 2-2: Other immunity test**

* Proposals
  + Different enclosure:
    - test methods are similar
    - Test levels can be different based on use environment
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments** | |
| Ericsson | Sub topic 2-1:  Comment on 1253: Wrong statement in Introduction about indoor and outdoor BS use. In TS the outdoor term only is used to determine interfaces connected to outdoor lines (immunity consideration only!). There is no difference between indoor and outdoor BS when it comes to regulations.  Do not standardize enclosure configurations, multiple enclose concept already gives freedom to make choice of any configuration. We should leave open the choice of testing all enclosures together or separately.  Wrong assumption in Discussion about MSR equal to multi radio BS. It gives wrong conclusions. MSR is supposed to have common active components for all supported RATs. An MSR BS cannot be made out of several separated radios, with different PAs that can be tested separatelly.  Observation 1 is wrong. One enclosure cannot be regarded as UE if it sits on a mast, for example. In principle the whole system shall be regarded as a BS, especially in TDD case when the same receiver is used for both MT and DU.  Conducted emission: do not agree with proposal. I recomend to follow regulatory considerations expressed in ETSI standards. Try to harmonize, not to differentiate.  Decision about class A or B emission is first regulatory and secondly business consideration  Proposal 1: agree  Proposal 2: agree  Proposal 3: agree  Proposal 4: agree  Proposal 5: not agree. It is ok in USA, but not in Europe. In Europe AC port has always clas B requirement, so we cannot choose a certain solution in 3GPP.  Proposal 6: agree  Sub topic 2-2:  Comment on 1254:  Not agree with description av choice of immunity levels. We recommend to existing ETSI product standards. Beyond regulatory requirements, it is up to manufacturer to decided to apply more strength requirement. 3GPP is not regulatory. Immunity requirements are regulatory only in EU and regions accepting EU rules.  Others: | |
| Huawei | | sub-topics 2-1: radiated emissions  - the proposals seem to be reasonable way forward with the following comments:  - Proposal3: this requires clarification, i.e. not to impose redundant testing.  - P5: the IAB classification for RF is still somehow unclear (e.g. BS class) so the above proposals shall probably be postponed. Restricting the use of IAB to the residential case is probably not the default deployment type - this needs to be clarified also in the RF room, possibly during the discussion on the BS class for IAB. Does the "residential" case mean the CPE type of product?  Sub-topic 2-2: radiated immunity  - O1: "location environment": probably we need to have some declaration saying whether the IAB is intended for outdoor / indoor (residential). There is EMF issue to consider. Tne initial thinking is that the indoor case is not really in the scope, while it may not be specifically excluded. Lets refer to the BS class  - O4: we need to clarify whether the multi-hop case is within the scope or not: if yes, then it is not clear if we shall link MT/DU to UE/BS requirements. This may require to have an assumption that a single hop case of tested, only. Motivation for the BS vs UE requirements differentiation is needed obtain proper assumptions for the IAB node requirements.  - single / multiple enclosures: this will impact also RF RSE: we shall clarify this in the RF room (how not to limit the architectures, whether or not single/multiple enclosures are considered). |
| ZTE | | Thanks all for the comments.  Sub topic 1-1:  For Ericsson,:  Regarding the radiated emission comment:we can agree the choice of test togeter or separately. However, this two cases means different requirements. Imagine when you perform the radiated emission test with both DU and MT transmitting, then there should be at least 3dB reduction to the current limit. I believe this is similar with current decision of spurious emission for BS type 1-H and 1-O.  Regarding the comment on observation 1: We agree with your argument, however, your argument support the truth that”requirements should be defined for different immplementation” which should not be ture. One way forward maybe we can define the most stringent requirement but obviously this is not a very good choice.  For the Class A and Class B limit, the class B limit is more stringent and if it is acceptable to the group, then we are ok with this.  Again thank you for accepting most of the proposals, maybe this can be captured in the TR as a baseline and company can provide further discussion.  For Huawei;  For proposal 3, the 3 time test can be a starting point, we can try to find a better method.  For proposal 5, yes, that is what I mean as some cases maybe in FR2, DU is set outside on the roof while MT is set indoor.  Sub topic 1-2:  For Ericsson:  The question is which product this IAB belongs to? To BS or UE?After this is decided, we ca choose ETIS 3401 489-50 or -52. This is also the reason why we think a new TS is needed for IAB since you cannot agree that this belongs to UE for sure, but hardly you can agree IAB belongs to BS expecially R17 we are condiering moving IAB(We agree this is not considered in R16).  For Huawei:  For O1: We agree with your comments we can wait for more information from RF discussion.  For O4: We think the multi-hoop must be considered since this is the big difference between EMC test performance criteria and RF test. Also some dicussion on the DU and MT switching time is ongoing and we think this is relative to the two-loop topic.  Others: |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **Comments collection** | |
| R4-2001255 | | Ericsson: not agree - Not support free choice of Class if it differs from regulatory on conducted emission. See other comments on discussion paper in 1254 |
| Huawei:  - this TP is pending the discussion in 1253/1254 as there are multiple open items, also related to the ongoing RF discussions.  - For sake of e-meeting progress, probably TP revision is needed - still it is not clear how much can be agreed this e-meeting. |
|  |
| R4-2001256 | | Ericsson: not agree completely, see comments to 1253 |
| Huawei:  - this TP is pending the discussion in 1253/1254 as there are multiple open items, also related to the ongoing RF discussions.  - For sake of e-meeting progress, probably TP revision is needed - still it is not clear how much can be agreed this e-meeting. |
|  |
| R4-2001257 | | Ericsson: not agree, see comment for 1253 |
| Huawei:  - this TP is pending the discussion in 1253/1254 as there are multiple open items, also related to the ongoing RF discussions.  - For sake of e-meeting progress, probably TP revision is needed - still it is not clear how much can be agreed this e-meeting. |
|  |

## 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:* |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| --- | --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** | |
| R4-2001255 | |  |
| R4-2001256 | |  |
| R4-2001257 | |  |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |