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

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

**Agenda item:** 8.5.4, 8.5.4.1.2, 8.5.4.2.2

**Source:** Moderator (Samsung)

**Title:** Email discussion summary for RAN4#94e\_#83\_NR\_IAB\_RF\_Rx

**Document for:** Information

# Introduction

This is summary for email discussion topics with respect to contributions on IAB RF RX requirement except ACS and in-band blocking, which will be handled in RAN4#94e\_#81\_NR\_IAB\_Co-existence. The input is divided in to IAB-DU and IAB-MT respectively for below requirements:

1. Reference sensitivity
2. Dynamic range
3. Out-of-band blocking
4. RX intermodulation
5. In-channel selectivity
6. RX spurious emission

Considering the input is quite converged on IAB-DU and some of IAB-MT requirements the candidate target of email discussion for 1st round and 2nd round is suggested as below:

* 1st round: Focus on discussion on each specific requirement with target achieve agreement for:
	+ IAB-DU RX RF requirement for both FR1 and FR2
	+ IAB-MT RX RF requirement on Dynamic range, OOBB, RX IM, ICS and RX spurious emission
* 2nd round: Work on WF and/or TP to TR/TS based on achieved agreements on IAB discussion due to
	+ IAB-MT REFSENS discussion may have dependency on IAB-MT classification discussion
	+ TP drafting would be dependent on general discussion on the TS handling approach.

*Note 1: it is not precluded the agreement in 1st round on WF/TP without diverse opinions.*

*Note 2: For those TPs cover both IAB-MT and IAB-DU they are assigned to respective requirement under topic on IAB-MT.*

# Topic #1: IAB-DU RX RF requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000900 | CMCC | As listed in table the consideration on FR1 IAB-DU RX RF requirement are provided.

|  |  |
| --- | --- |
| **RF Requirement** | **IAB-DU** |
| OTA sensitivity | OTA EIS based on BS specs |
| Blocking characteristics | Based on BS specs |
| Receiver spurious emissions | Based on BS specs |
| Rx intermodulation | Based on BS specs |

 |
| R4-2000964 | Qualcomm Incorporated | *[Editor note: The proposals on topics target in this email discussion thread are abstracted as below]***Proposal 1. Re-use the gNB requirements for the IAB-DU as shown in Table 1.**

|  |  |
| --- | --- |
| **RF Requirement** | **IAB-DU** |
| OTA sensitivity level | Import from BS specs |
| Reference sensitivity level | Import from BS specs |
| OTA out-of-band blocking | Import from BS specs |
| OTA receiver spurious emissions | Import from BS specs |
| OTA receiver intermodulation | Import from BS specs |
| OTA in-channel selectivity | Import from BS specs |

 |
| R4-2001435 | Nokia, Nokia Shanghai Bell | **Proposal 1: Re-use BS type 2-O receiver requirements for IAB-DU for all receiver requirements in FR2.**According to requirement summary shown in table 1 of the contribution, applicable requirements for FR2 IAB-DU include OTA reference sensitivity level, OTA out-of-band blocking, OTA receiver spurious emissions, OTA receiver intermodulation and OTA in-channel selectivity.  |

## Open issues summary

There is common understanding the IAB-DU will reuse all BS related requirement as captured in RAN4#90bis meeting chairman note as:

Re-use BS RF requirements for IAB access link is a starting point

This meeting the contributions provided on IAB-DU further [reiterate](file:///C%3A%5CUsers%5Cliyankun%5CAppData%5CLocal%5Cyoudao%5Cdict%5CApplication%5C7.5.2.0%5Cresultui%5Cdict%5C?keyword=reiterate) this agreement with explicit proposals on IAB-DU.

### Sub-topic 1-1

For FR1 IAB –DU receiver requirements except ACS and in-band blocking.

**Issue 1-1: FR1 IAB-DU conducted receiver RF requirement**

* Proposals
	+ Reuse NR BS type 1-H receiver RF requirements for IAB-DU conducted receiver RF requirements including
		- Reference sensitivity level
		- Dynamic range
		- Out-of-band blocking
		- Receiver spurious emission
		- Receiver Intermodulation
		- In-channel selectivity
* Recommended WF
	+ Agree on above proposals

### Sub-topic 1-2

For FR1 and FR2 IAB –DU OTA type receiver requirements except ACS and in-band blocking.

**Issue 1-2: FR1 and FR2 IAB-DU OTA receiver RF requirement**

* Proposals
	+ Reuse NR gNB OTA receiver RF requirements for IAB-DU OTA receiver RF requirements including
		- OTA sensitivity level
		- OTA REFSENS
		- Dynamic range(applies for FR1 only)
		- Out-of-band blocking
		- Receiver spurious emission
		- Receiver Intermodulation
		- In-channel selectivity
* Recommended WF
	+ Agree on above proposal

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Sub topic 1-1: reuse NR BS type 1-H receiver RF requirements for IAB-DU, if IAB DU ACS/IBB should be considered as exceptional, then RX intermodulation signal should be considered as exceptional, as interfering signal powel level of ACS and RX IM is the same.Sub topic 1-2: the same comments as before. FR2 RX IM, values are slightly different ,it ‘s offset by IBB power level 8dB, so it’s related requirements …. |
| Huawei | Sub topic 1-1: ok |
| Ericsson | Sub topic 1-1: IAB-DU requirement should be connect to different type of IAB node and different class of IAB node. So the proposal could add IAB DU of IAB type 1-H for different IAB class for clarification.Sub topic 1-2: IAB-DU requirement should be connect to different type of IAB node and different class of IAB node. So the proposal could add IAB DU of IAB type 1-O for different IAB class for clarification. |
| Samsung | Sub topic 1-1: To ZTE’s comment it seems there is no contribution proposing modification of IAB-DU ACS/IBB on top of BS requirement. In co-existence study this is agreed as kind of common simulation assumption to simply reuse the same BS ACLR/ACS number for IAB-DU. To Ericsson’s comment, we agree the WF could be more specific to indicate the applicability for corresponding IAB type and classification. However, considering we still discuss the terminology and definition. Hence further refinement could be addressed when the general definition/classification/type is clear.Sub topic 1-2: same as comment to sub topic 1-2. |
| Nokia, Nokia Shanghai Bell | Sub-topic 1-2: we are fine with the proposal. |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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:* |

*Recommendations on WF/LS assignment*

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

### 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**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## 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-MT RX RF requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2000280](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000280.zip) | Samsung  | **REFSENS for FR2**Proposal 1: The declaration range of BS(IAB-DU) can be applied for IAB-MT for 50MHz baseline * + WA BS REFSENS declaration range can be applied for IAB-MT higher PC
	+ Small cell REFSENS declaration range can be applied for IAB-MT lower PC
	+ FRC of UE can be recombined to meet the declaration purpose for IAB-MT
 |
| [R4-2000281](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000281.zip) | Samsung | Proposal: no OTA **dynamic range** requirement would be defined for IAB receiver operating in FR2.  |
| [R4-2000283](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000283.zip) | Samsung | TP provided based on previous meeting AH agreement to Reuse **Rx spurious emission** from BS for IAB |
| [R4-2000284](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000284.zip) | Samsung | Proposal 1: **In-channel selectivity** requirement should be defined for IAB-DU only. Proposal 2: IAB TS 38.174 should be updated to remove In-channel selectivity for IAB-MT related sub-clauses.  |
| [R4-2000900](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000900.zip) | CMCC | As listed in table the consideration on FR1 IAB-MT RX RF requirement are provided.

|  |  |
| --- | --- |
| **RF Requirement** | **IAB-MT** |
| **OTA sensitivity** | OTA EIS based on BS specs |
| **Blocking characteristics** | FFS depending on PC |
| **Receiver spurious emissions** | Based on BS specs |
| **Rx intermodulation** | Not defined for UE in FR1 |

 |
| [R4-2000965](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000965.zip) | Qualcomm Incorporated | **Reference sensitivity level** should follow the BS framework of using the manufacturer’s declaration which may dependent on MT classification discussionNo **Dynamic range** requirement for IAB-MT**Receiver spurious emissions:** reuse UE requirement **Receiver intermodulation is not** needed for the IAB-MT.**In-channel selectivity** is not needed for the IAB-MT. |
| [R4-2000979](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000979.zip) | ZTE Corporation | Proposal: for IAB MT, to reuse the IAB DU **OOBB** requirement. |
| R4-2001019R4-2001020R4-2001021 | Ericsson | For FR1 IAB-Node it is reasonable to use the requirement concept from 1-H and 1-O, depending on IAB-Node type.For IAB-Node type 2-O, the BS concept of using a declared EIS met within a declared RoAoA can be adopted for both the DU and MT. Such a requirement would capture the array antenna capability and allow for various types of implementations.TPs provided for TS and TR for **FR2 OTA REFSENS**.  |
| R4-2001022R4-2001023R4-2001024 | Ericsson | Since the IAB-Node is a network node, it is reasonable to assume that the IAB-Node would experience the same level of **out-of-band blocking** interferer signal as a BS. Hence, the BS out-of-band blocking requirement is a good starting point for developing requirement for the IAB-NodeTPs provided for TS and TR for **FR2 OOBB requirement** |
| [R4-2001435](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2001435.zip) | Nokia, Nokia Shanghai Bell | **REFSENS**Proposal 2: Similarly as BS, IAB-MT shall declare its reference sensitivityProposal 3: The range of allowed reference sensitivity declarations shall cover at least the range from lowest allowed power from wide area BS type 2-O to highest power allowed for local area BS type 2-O.Proposal 4: IAB-MT and IAB-DU reference sensitivity declarations shall be independent of each other**OOBB**Proposal 6: Re-use BS OOB blocking requirements, including the in-band and out-of-band boundary, for IAB-MT. It is necessary to agree conditions when it is required to verify the requirement independently for IAB-MT and IAB-DU in the performance part of the WI.**IM**Proposal 7: OTA receiver intermodulation requirements shall not be specified for IAB-MT**ICS**Proposal 8: Given the target of forward compatible RF requirements and FDM operation being targeted in rel-17, discuss further whether in-channel selectivity requirements are needed for IAB-MT in FR2 in release 16 |

## Open issues summary

For IAB-MT receiver RF requirement targeted in this thread most contributions discuss and propose on IAB-MT requirements including:

* OTA REFSENS
* OTA dynamic range/maximum input level
* Out-of-band blocking
* OTA receiver intermodulation
* OTA receiver spurious emission
* In-channel selectivity

### Sub-topic 2-1

For OTA REFSENS requirement, all related contributions share the same baseline agreement that FR2 IAB-MT will follow the BS type 2-O liked declaration approach with declared basis level EISREFSENS\_50M within the *OTA REFSENS RoAoA*. However, several aspects still need further discussion are:

- EISREFSENS\_50M declaration range applied for IAB-MT

- Whether EISREFSENS\_50M of IAB-MT and EISREFSENS\_50M of IAB-DU can be declared independently, which may relied on IAB classification discussion

- FFS on FRC applied for IAB-MT REFSENS

For FR1 IAB-MT reference sensitivity there is preliminary discussion/idea to use the requirement concept from BS. However no specific proposal provided.

**Issue 2-1: FR2 OTA reference sensitivity**

* Proposals

- EISREFSENS\_50M declaration range applied for IAB-MT

* + Option 1: If multiple IAB-MT [power] classes agreed, multiple ranges may be defined
	+ Option 2: If only one IAB-MT [power] classes agreed, single range may be enough

- EISREFSENS\_50M declaration can be independent for IAB-MT and IAB-DU

- FFS on FRC for IAB-MT EISREFSENS

* Recommended WF
	+ TBA

### Sub-topic 2-2

It is agreed in RAN4#93 as captured in IAB AH minutes [R4-1916161]: Maximum input level requirement will not be defined”. Hence the proposal provided in this meeting is to clarify the under the sub-clause of OTA receiver dynamic range no requirement will be defined for IAB-MT.

**Issue 2-2: FR2 dynamic range for IAB-MT**

* Proposals
	+ No requirement will be needed and defined for IAB-MT under sub-clause Receiver dynamic range.
* Recommended WF
	+ Agree on above proposal

### Sub-topic 2-3

For out-of-band blocking, the necessity and applicability of BS-liked OOB requirement for IAB-MT are provided in contribution presented on this sub-topic. Almost the same proposals from different companies are shown on OOBB requirement for IAB-MT.

**Issue 2-3: Out-of-band blocking for IAB-MT for both FR1 and FR2**

* Proposals
	+ OOBB interference level : reuse corresponding interference level of BS OOBB requirement
	+ Frequency range applied for OOBB requirement : reuse BS boundary between in-band blocking and out-of-band blocking
* Recommended WF
	+ Agree on above proposal

### Sub-topic 2-4

For receiver Intermodulation requirement the view presented in contributions from companies is aligned as that this requirement is no need to define this requirement for FR2 IAB-MT. But for FR1 IAB-MT receiver IM, the applicability of those justifications valid for FR2 IAB-MT receiver IM is not specified.

**Issue 2-4: Receiver Intermodulation requirement for FR2 IAB-MT**

* Proposals
	+ Receiver intermodulation is not needed for FR2 IAB-MT
* Recommended WF
	+ Agree on above proposal

### Sub-topic 2-5

It is agreed in RAN4#93 as captured in IAB AH minutes [R4-1916161]: Reuse Rx spurious emission from BS for IAB node.

**Issue 2-5: OTA Receiver spurious emission**

* Proposals
	+ Option 1: Reuse BS RX spurious emission requirement for IAB
	+ Option 2: Reuse UE RX spurious emission requirement for IAB
* Recommended WF
	+ Option 1

### Sub-topic 2-6

In channel selectivity is defined for BS only but not for UE for both FR1 and FR2. Whether this is needed for IAB-MT is not agreed formally yet.

**Issue 2-6: In channel selectivity for IAB-MT**

* Proposals
	+ Option 1: no in-channel selectivity requirement will be defined for IAB-MT
	+ Option 2: FFS on In-channel selectivity for IAB-MT
* Recommended WF
	+ Option 1

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Sub topic 2-1: support option 1 to have multiple IAB MT power class as we difinitely need different deployment scenarios instead of single deployment scenario.Sub topic 2-2: okay and it’s fine about that. Sub topic 2-3: support to reus the BS OOBB requirement as the same analog filter shared for IAB DU and IAB MT.Sub topic 2-4: suppor to not define RX IM for FR2 IAB MT and FFS for FR1 IAB MTSub topic 2-5: support option 1 to reuse BS RX spurious emissionSub topic 2-6: support option 1 and there are no ICS requirement for IAB MT. |
| Huawei | Sub topic 2-1: Depends on classes but if BS classes are used then p1 is ok, p2 agree, p3 if the FRC’s are diffent (which they probably will be) then if noise BW is different (from BS) the refsens range may have to be adjusted.Sub topic 2-2: okSub topic 2-3: P1 ok, P2 ok but obviously needs to be consistent with in-band requirementSub topic 2-4: It’s not explained why RX IMD is not needed in IAB-MT (or UE). It is present for FR1 UE so presumably the high PL means it is not needed? The IAB-MT has a higher gain antenna so the calculation might change? I don’t agree or disagree but would like to better understand the background.Sub topic 2-5: This is ok, but if we treat some emissions like BS and some like UE it may confuse the regulators as to if this is like a BS or UE (or something different). In general I think we can treat all emissions like a BSSub topic 2-6: Background in 0284 seems reasonable so can agree. |
| Ericsson | Sub topic 2-1: option 1 is ok for us. This may connect to IAB class discussion.Sub topic 2-2: ok with proposal.Sub topic 2-3: ok with proposal.Sub topic 2-4: Ok with proposal.Sub topic 2-5: ok with option 1.Sub topic 2-6: ok with option 1. |
| Samsung | Sub topic 2-1:Depends on IAB-MT classification discussion conclusion we can update the WF for next step discussionSub topic 2-2: Support the recommended WF. Sub topic 2-3: fine with the recommended WFSub topic 2-4: fine with the recommended WFSub topic 2-5: Support option1. And the emission requirement for RX and TX should be discussed independently since the test condition for RX requirement should be Transmitter off for both IAB-DU and IAB-TX. But in TX emission the transmitter on status Sub topic 2-6: Support the recommended WF. |
| Qualcomm | Sub topic 2-1: we agree with moderators proposalsSub topic 2-2: we agree with recommended way forwardSub topic 2-3: we agree with recommended way forwardSub topic 2-4: we agree with recommended way forwardSub topic 2-5: we agree with recommended way forwardSub topic 2-6: we agree with recommended way forward |
| Nokia, Nokia Shanghai Bell | Sub-topic 2-1: We are fine with the proposal. It should be noted that even if multiple classes would be defined, they do not necessarily required different sensitivity declaration ranges. For example, macro-deployment may require very good sensitivity due to long link distance, but as well non-macro deployment may benefit from very good sensitivity in case the propagation attenuation is great in the link for other reasons than long distance.Sub-topic 2-2: We agree with the proposal.Sub-topic 2-3: We are ok with the proposal. We did not see anything about wanted signal level, but if BS interference level is agreed it would be natural to re-use also the BS wanted signal level.Sub-topic 2-4 – 2-6: We accept the way forward proposals for all three sub-topics.  |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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*

|  |  |  |
| --- | --- | --- |
|  | **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*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## 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”* |