3GPP TSG-RAN WG4 Meeting # 96-e R4-200xxxx

Electronic Meeting, 17-28 Aug., 2020

**Agenda item:** 7.4.2.1.1

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [96e][308] NR\_IAB\_RF\_Part\_1

**Document for:** Information

# Introduction

The email discussion thread [95e][307] NR\_IAB\_RF\_Part\_1 discusses Tx Power related requirements. The contributions in agenda 7.4.2.1.1 and the related part in R4-2010912 are included in this thread. The targets of this email thread for 1st round and 2nd round are as follows,

* 1st round:
  + Collect the views for the open issues to see if there can be some agreements or WFs.
  + Collect the comments for the TPs.
* 2nd round:
  + Agree the WF for each topic.
  + Agree the TPs.

# Topic #1: LA IAB-MT maximum output power and scaling factor

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009792**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009792.zip) | CATT | Proposal 5: 24 dBm is agreed to be the LA IAB-MT TRP if 10 dB dynamic range is not revisited. |
| [**R4-2010147**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010147.zip) | Samsung | Conducted power cap for IAB-MT type 1-H:  Proposal 1: Prated,c,TABC for LA IAB-MT type 1-H is suggested to be defined as 38dBm.  Proposal 2: The scaling factor of basic limit for LA gNB type 1-H is applied for LA IAB-MT type 1-H.  IAB MT class Prated,c,sys Prated,c,TABC  Local Area IAB-MT ≤ 38 dBm +10log(NTXU,counted) ≤ 38 dBm  TRP upper limit for LA IAB-MT type 1-O:  Proposal 3: TRP upper limit for LA IAB-MT type 1-O is suggested to be defined as 47dBm.  Proposal 4: It is suggested to utilize scaling factor 8 of basic limit for IAB-MT type 1-O.  IAB MT class Prated,c,TRP  Local Area IAB-MT ≤ + 47 dBm |
| [**R4-2010293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010293.zip) | Nokia, Nokia Shanghai Bell | Proposal 1: The rated maximum output power per TAB connector shall align with the BS local area requirement. i.e. ≤ 24 dBm |
| [**R4-2010950**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010950.zip) | ZTE Corporation | Proposal 1: to adopt both option 1 and option 2. (*Moderator: 38 dBm and 24 dBm*) Proposal 2: to adopt option 2. Proposal 3: to use the same scaling factor as IAB-MT 1-H for IAB-MT 1-O. |
| [**R4-2011032**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011032.zip) | Ericsson | Proposal#1: Maximum TRP of 33dBm for IAB-MT of type 1-O for local area IAB-MT considering the coexisting of layout2 scenario.  Proposal#2: Maximum TRP of 24dBm per TAB connector for IAB-MT of type 1-H for local area IAB-MT considering the coexisting of layout2 scenario.  Proposal#3: Reuse the equation for scaling the TRP power of BS type 1-H to IAB of type 1-H. |

## Open issues summary

### Sub-topic 1-1: MOP fo LA IAB-MT type 1-H

There’re two options (24 dBm or 38 dBm) in the last meeting’s WF. There’re supporters for both options in this meeting. Considering 24 dBm has more supporter and the technical analysis in [R4-2009792](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009792.zip) that IAB-MT Tx signal may block parent node’s Rx path with the small dynamic range, moderator suggests 24 dBm as the recommended WF.

* Proposals
  + Option 1: 24 dBm per TAB connector (CATT, Nokia, Ericsson, ZTE (proposed both) )
  + Option 2: 38 dBm per TAB connector (Samsung, ZTE (proposed both) )
* Recommended WF
  + Option 1

Aug. 18th GTW discussion:

Samsung: we can comparised to with option 1.

Agreement: Option 1: 24 dBm per TAB connector

### Sub-topic 1-2: MOP fo LA IAB-MT type 1-O

The proposals from companies are based on the proposal for sub-topic 1-1 and 9 dB is used for the upper limit considering there could be maximum 8 Tx paths although smaller number Tx paths is allowed. Therefore, moderator suggest the recommended WF is the agreements in sub topic 1-1 + 9 dB as the agreements and companies don’t need to discuss this more.

* Proposals
  + Option 1: 33 dbm (Ericsson, Nokia)
  + Option 2: 47 dBm (Samsung)
* Recommended WF
  + （The agreements in Sub-topic 1-1）+ 9 dB

Aug. 18th GTW discussion:

Agreement: Option 1: 33 dBm

### Sub-topic 1-3: Scaling factor for IAB-MT 1-H

According to the discussion in last meeting, moderator’s understanding is that the proposals from [R4-2010147](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010147.zip), [R4-2010950](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010950.zip) and [R4-2011032](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011032.zip) align each other. The difference is whether the proposal is for per cell or the total. Although there’s not much discussion if the IAB-MT can support a number of cells at the same time, reusing BS concept and approach may not have any harm that the BS approach also support one cell case. Therefore, moderator recommends reusing BS approach in the spec.

* Proposals
  + Option 1: NTXU,counted = min(NTXU,active , 8×Ncells) (Samsung, Ericsson, Nokia)
  + Option 2: N = min(NTXU,active , 8) (ZTE)
* Recommended WF
  + Option 1

Aug. 18th GTW discussion:

E///: we are fine with opt 1. We are not using same term for IAB\_DU and IAB-MT; for TP we need to re-define the term for “NTXU”.

Nokia/Samsung: We will separate definition for IAB-DU and IAB-MT. For potential usage case of Ncell, CA scenario could be one of them.

Agreement: Option 1: NTXU,counted = min(NTXU,active , 8×Ncells)

### Sub-topic 1-4: emission scaling factor for IAB-MT 1-O

There’re two proposals for the scaling factor of IAB-MT 1-O, moderator’s understanding is that [R4-2010147](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010147.zip) proposes the scaling factor for the upper limit of output power but [R4-2010950](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010950.zip) proposes the emission scaling factor. In case there’s some misunderstanding from moderator, the two proposals are listed as following and the recommended WF uses the proposal in [R4-2010950](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010950.zip).

* Proposals
  + Option 1: use the same scaling factor as IAB-MT 1-H (ZTE, Nokia)
  + Option 2: 8 (Samsung, Ericsson (R4-2011033))
* Recommended WF
  + Option 1

Aug. 18th GTW discussion:

Samsung: we prefer option2, this scaling factor applied for both IAB-MT classes. It’s hard to declare N of TRU on OTA cases, we prefer to use 8 with 9dB.

E///: we prefer option2. Without connector, diffcult to declare Num of TXU. For IAB-MT 1-0, I’m wondering less than 8 TXU would be unlikly for 1-O.

Huawei: We support option 1. For IAB-MT 1-O, there is some cases with less than 8 TXU, if we use same scaling factor as 1-H, we can reslove this limitation for IAB\_MT.

E///: IAB-MT /DU colated, better to align between IAB-DU and IAB-MT. We don’t see the necesity to tighter the requirements.

Nokia: we slightly prefer option 1, also fine with option2. Option 1 offer more flexcibility.

Agreement: further discuss among option 1 and option 2.

## Companies views’ collection for 1st round

|  |  |
| --- | --- |
| **Issues** | **Comments** |
| Sub-topic 1-1: MOP fo LA IAB-MT type 1-H   * Proposals   + Option 1: 24 dBm per TAB connector   + Option 2: 38 dBm per TAB connector * Recommended WF   + Option 1 | Aug 18th GTW Agreement: Option 1: 24 dBm per TAB connector  CATT: We’re ok with the recommended WF.  Huawei: The argument for reduced power control was that systems would be deployed with the appropriate power level for the link they were intended for. As such arguments about link budget seem not so valid. The limit is a maximum limit so lower power nodes can always be deployed they do not have to be on the limit. However we are probably ok with the recommended WF if that is consensus.  Samsung: our suggestion is with the target to enable the maximum flexibility in implantation. However, considering the majority view is option 1, we are OK with recommended WF which is also matched with NF agreed for FR1 IAB-MT. |
| Sub-topic 1-2: MOP fo LA IAB-MT type 1-O   * Proposals   + Option 1: 33 dbm   + Option 2: 47 dBm * Recommended WF   + （The agreements in Sub-topic 1-1）+ 9 dB | Aug 18th GTW Agreement: Option 1: 33 dBm  CATT: We’re ok with the recommended WF.  Huawei: agree with WF  Samsung: same as topic 1-1. OK with WF. |
| Sub-topic 1-3: Scaling factor for IAB-MT 1-H   * Proposals   + Option 1: NTXU,counted = min(NTXU,active , 8×Ncells)   + Option 2: N = min(NTXU,active , 8) * Recommended WF   + Option 1 | Aug 18th GTW Agreement: Option 1: NTXU,counted = min(NTXU,active , 8×Ncells)  CATT: We’re ok with the recommended WF.  Huawei: it seems unlikely that the multiple cells concept is needed for IAB-MT, however as stated its not been discussed and it does not harm so agree with recommended WF to keep it.  Samsung: OK with WF. |
| Sub-topic 1-4: emission scaling factor for IAB-MT 1-O   * Proposals   + Option 1: use the same scaling factor as IAB-MT 1-H   + Option 2: 8 * Recommended WF   + Option 1 | Aug 18th GTW Status: further discuss among option 1 and option 2  CATT: We’re ok with the recommended WF.  Huawei: this should be aligned with sub-topic 1-2, there should be only 1 scaling factor either 9 or 10log(N). The problem with option 1 is verifying the No of TRx when there are no connectors (this was a very very very long discussion during AAS) however if you fix at 8 then it appears like a relaxation if there are fewer than 8 TRX. In addition the justification for the scaling becomes invalid. In this respect option 1 seems preferable if we can solve the definition issue.  Samsung: Our preference is still option2. As indicated by HW it is not easy to verify active TRXU for OTA case for IAB-MT as well. And with scaling factor of 8( i.e. 9dB) it will make the spec more simply and easier to be understood.  Moderator: Please input your further comments after Aug. 18th GTW below: |

## 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 |  |  |

## 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: Pcmax related issues

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009792**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009792.zip) | CATT | Observation 1: The power control procedure to determine the output power for UE except the Pcmax part can be reused by IAB-MT.  Observation 2: If Pcmax for IAB-MT is defined in RAN4, the whole RAN1 UL power control procedure can be reused by IAB-MT.  Observation 3: If Pcmax for IAB-MT is defined in RAN4, the whole RAN1 PHR procedure can be reused by IAB-MT.  Proposal 1: Two power classes can be defined for both FR1 and FR2. One is corresponding to Wide Area IAB-MT class, the other is corresponding to Local Area IAB-MT class.  Proposal 2-4, the Power class and Pcmax definition for IAB type 1-H, type 1-O and type 2-O.  Observation 1: Tolerance of IAB-MT Power control is not need to be tested. |
| [**R4-2010111**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010111.zip) | CMCC | Observation 1: before the definition of Pcmax, it is necessary to identify whether to regulate IAB-MT’s maximum allowed output power by the network or in the RF requirements.  Observation 2: For fixed IAB, PEMAX,c(P-max) will be trivial as output power has already been adjusted at the original network planning phase to guarantee the regional regulation.  Observation 3: the definition of Pcmax including PEMAX,c is related to the tough definition of IAB-MT maximum output power.  Observation 4: Factor PPowerClass is related to the number of IAB-MT maximum output power categories.  Observation 5: Factor ΔPPowerClass is not applicable for the Pcmax definition.  Observation 6: the MPR structure for UE may be suitable to be reused by IAB-MT. The smaller dynamic power range parameter should be taken into consideration in the MPR calculation.  Observation 7: A-MPR could still be reserved for some specific regional requirements.  Observation 8: the main difference of Pcmax between two IAB-MT classes is the different value not the different definition. |
| [**R4-2010147**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010147.zip) | Samsung | Pcmax  it is accepted to have as simple method to define this requirement or merge the requirement in other existing requirements with further study on the impact on conformance testing details  Power control for LA IAB-MT:  Observation 1: Due to deployment scenario there is no strong necessity to define absolute power control for IAB-MT to verify open loop power control.  Observation 2: closed loop power control can be verified to some extend by dynamic range(X)-dynamic PSD with procedure proposed in this contribution.  Proposal 7: no explicit power control requirement to be defined in release 16 for fixed IAB-MT. |
| [**R4-2010293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010293.zip) | Nokia, Nokia Shanghai Bell | Proposal 2: Local Area IAB-MT power control accuracy requirements to follow the UE requirement in FR1 (TS 38.101-1/2), i.e. Absolute, relative and aggregated power tolerance.  Proposal 3: MPR and A-MPR are not defined for IAB-MT  Proposal 4: Interband CA, SUL and SRS related relaxation factors are not defined for IAB-MT  Proposal 5: Consider adopting the below PCMAX boundaries for configured transmitted power requirement as for Local Area IAB-MT in FR1.  PCMAX\_L,f,c = MIN {PEMAX,c, (*Pdeclared -* ΔP) }  PCMAX\_H,f,c = MIN {PEMAX,c, (*Pdeclared +* ΔP) }  Proposal 6: Consider adopting the below PCMAX boundaries for configured transmitted power requirement as for Local Area IAB-MT in FR1.  PCMAX\_L,f,c = (*Pdeclared -* ΔP)  PCMAX\_H,f,c = (*Pdeclared +* ΔP)  Proposal 7: PHR is not included in PCMAX definition. |
| [**R4-2010912**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010912.zip) | Qualcomm Incorporated | Observation: Absolute power tolerance requirements for the LA IAB-MT are not needed.  Proposal 1: The UE relative power control requirements should be re-used for the LA IAB-MT.  Proposal 2: do not define MPR/A-MPR in the specifications. Power reduction should be declared if needed.  Proposal 3: Pemax should be enforced.  Proposal 4: Pcmax,f,c should follow the UE definition and include a power reduction factor and Pemax. |
| [**R4-2010950**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010950.zip) | ZTE Corporation | Proposal 4: to adopt option 1 for both WA and Local area IAB-MT with MPR and A-MPR up to vendors’ declaration;  Proposal 5: to use legacy UE absolute power accuracy as baseline for IAB-MT.  Proposal 6: to use legacy UE relative power tolerance as baseline for IAB-MT with some tailoring considering Tx dynamic range as 5dB for IAB-MT.  Proposal 7: to use legacy UE Aggregated power tolerance as baseline for IAB-MT. |

## Open issues summary

Pcmax definition is a little complicated for IAB-MT. The common understanding from last meeting is that Pcmax needs to be defined for IAB-MT but how to define them for different types (and different classs) needs more study.

### Sub-topic 2-1: Factors considered in Pcmax definition or not

The factors are discussed in some contributions, and the views for some factors are very divergent. The factors mentioned in the contributions may need to be discussed one by one. Moderator thinks for other factors not discussed in the contributions, we suppose they will not be considered in the definition. The factors mentioned in the contributions are the following.

|  |  |
| --- | --- |
| **Factors** | **Views in the contributions** |
| PPowerClass | Yes: CATT  No: Nokia  Other: CMCC: Factor PPowerClass is related to the number of IAB-MT maximum output power categories. |
| MPR/A-MPR | Yes: CMCC  No: CATT, Nokia  Other: QC: not define MPR, but include a power reduction factor (QC) |
| Pemax | Yes: QC, Nokia  No: CATT |
| ΔPPowerClass | Yes:  No: CATT, Nokia |
| PHR | Yes:  No: CATT, Nokia |
| Interband CA, SUL and SRS related factors | Yes:  No: CATT, Nokia |

Moderator’s observation is that only the power class, MPR/A-MPR and Pemax needs to be discussed further. Other factors can be agreed as not considered.

**Recommended WF:** The factors other than PPowerClass, MPR/A-MPR and Pemax are not considered in Pcmax definition.

For PPowerClass, MPR/A-MPR and Pemax, please input your comments if they should be included or related to the Pcmax definition.

Aug. 18th GTW discussion:

Agreement: parameters inlcude in IAB-MT Pcmax defition/requirements:

* PowerClass not needed
* ΔPPowerClass not needed
* MPR/A-MPR

QC: No need MPR/A-MPR requirements in the specification for IAB-MT. Meanwhile some power backoff with declaration basis still needed.

CMCC: We proposed to include MPR/A-MPR. Similar sturcture as MPR/A-MPR for power backoff in the Pcmax definition.

Nokia: NO need to MPR/A-MPR. For power backoff , we do some defintion for some cases. The values of Pcmax is outpout power declaration basis, this power backoff included in the declared power, without clear and separate declaration/Indication.

E///: Similar view as Nokia. IAB\_MT power backoff is complicated cosidering antenna gain difference compared to normal UE.

Huawei: Similar as Nokia and E///.

QC: If the commmon understanding is the power back-off can be included in declared output power under different conditions, then no need to MPR/A-MPR.

* No MPR/A-MPR factors in the Pcmax defintion euqation, the power backoff including antenna gain if impacted will be included in the declared output power.
* Pemax: not needed

Nokia: we are fine not to include Pemax.

E///: we are also fine not to include Pemax. IE Pemax in SIB1 used for UE in the coverage, for coverage extension, we think not needed as output power is declaration basis for IAB-MT.

QC: We need to include Pemax. If operators fine not to include this parameter considering pre-define with deployment or exchange through OAB, we are also fine not to have this value.

CMCC: IAB-MT output power can be controlled by planned deployment. We are fine not inclue this parameter in Pcmax definition.

* PHR not need to be included in Pcmax definition.

CATT: PHR does not exisit in UE Pcmax definition.

QC: Pcmax as reference for PHR. PHR not need to be included in Pcmax definition.

Samsung: PHR not needed in the definition, we still need to the applicable rule/usage for PHR in RRM session during performance phase.

QC: In performance part, we discuss the mapping tables e.tc. Still RF core responsibility to discuss the reference for PHR.

* Interband CA, SUL and SRS related factors not needed

### Sub-topic 2-2: Pcmax definition

There’re proposals from two companies (CATT and Nokia), companies can provide comments to the two proposals.

* CATT proposal:

**IAB-MT type 1-H:**

Pdeclared,c,sys ≤ PCMAX,f,c ≤ Prated,c,sys

**IAB-MT type 1-O:**

The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds

PUMAX,f,c ≤ EIRPmax

while the corresponding measured total radiated power PTMAX,f,c is bounded by

PTMAX,f,c ≤ Prated,c,TRP

**IAB-MT type 2-O:**

The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds

PUMAX,f,c ≤ EIRPmax

while the corresponding measured total radiated power PTMAX,f,c is bounded by

PTMAX,f,c ≤ Prated,c,TRP

* Nokia proposal

*Moderator note: The proposal for WA IAB-MT is not clear.*

Local Area IAB-MT in FR1

PCMAX\_L,f,c = MIN {PEMAX,c, (*Pdeclared -* ΔP) }

PCMAX\_H,f,c = MIN {PEMAX,c, (*Pdeclared +* ΔP) }

Local Area IAB-MT in FR2

PCMAX\_L,f,c = (*Pdeclared -* ΔP)

PCMAX\_H,f,c = (*Pdeclared +* ΔP)

Aug. 18th GTW discussion:

QC: For UE, we have some factors with maximum allowance i.e. MPR, A-MPR. If we have any factors for above purpose, then it can be declared. Then declaration can be different pending conditions i.e. Number of RBs, and MCS.

Nokia: Our propose approach aligned what QC mentioned, the declaration would be specified for specific test mode.

E///: We can refer to power accuracy requirements. Do we need to define this repeated here again?

QC: We don’t need to include the tolerance for Pcmax requirements.

Samsung: we share similar view as E///, if no other factors considering in the Pcmax, it can be covered by the accuracy requirements with declared power. We are also fine to include the Pcmax definition there for PC purpose.

Nokia: Output power is starting point, only if the conditions or factors changed, then we need to have this other-wise probably not needed.

Huawei: The tolerance only include core tolerance not considering test tolerance. For OTA, still need to be clarified TRP VS EIRP ?

To be further discussed:

* Side condition compared to the accuracy requirements with declared power?

QC: should cover all the possible side conditions.

* For OTA requirements, TRP and or EIRP based?

QC: EIRP basis

* Whether we need to consider tolerance (core tolerance and or test tolerance) in this Pcmax?

QC: core tolerance should be captured here.

Still include Pcmax definition in the core specification, for the side condition and whether to have applicable test cases for Pcmax requirements additional to power accuracy requirements test cases can be further discussed.

Low limitation:

High limitation:

### ~~Sub-topic 2-3: Power class definition~~

Aug. 18th GTW discussion: It will not be discussed further.

There’re power class proposals from one company, companies can comment to the proposals.

* CATT proposal:

Proposal 1: Two power classes can be defined for both FR1 and FR2. One is corresponding to Wide Area IAB-MT class, the other is corresponding to Local Area IAB-MT class.

Proposal 2: Power classes for each IAB-MT type can be defined as following

Table 1: IAB-MT type 1-H Power classes

| *IAB-MT type 1-H* Power class | Prated,c,sys |
| --- | --- |
| Power class 1 | (Note 1) |
| Power class 2 | ≤ 24 dBm +10log(NTXU,counted) |
| NOTE 1: There is no upper limit for the Prated,c,sys for Power class 1.  NOTE 2: Power class 1 is corresponding to Wide Area IAB-MT, Power class 2 is corresponding to Local Area IAB-MT. | |

Table 2: *IAB-MT type 1-O* Power classes

|  |  |  |
| --- | --- | --- |
| *IAB-MT type 1-O* Power classes | Prated,c,TRP | Maximum EIRP level at beam peak direction |
| Power class 1 | Note 1 | Note 2 |
| Power class 2 | ≤ + 33 dBm | Note 2 |
| NOTE 1: There is no upper limit for the Prated,c,TRP for power class 1.  NOTE 2: The maximum EIRP level at beam peak direction EIRPmax is declared by the manufacturer.  NOTE 3: Power class 1 is corresponding to Wide Area IAB-MT, Power class 2 is corresponding to Local Area IAB-MT. | | |

Table 3: IAB-MT type 2-O Power classes

|  |  |  |
| --- | --- | --- |
| *IAB-MT type 1-O* Power classes | Prated,c,TRP | Maximum EIRP level at beam peak direction |
| Power class 1 | Note 1 | Note 2 |
| Power class 2 | Note 1 | Note 2 |
| NOTE 1: Prated,c,TRP is declared by the manufacturer.  NOTE 2: The maximum EIRP level at beam peak direction EIRPmax is declared by the manufacturer.  NOTE 3: Power class 1 is corresponding to Wide Area IAB-MT, Power class 2 is corresponding to Local Area IAB-MT. | | |

### Sub-topic 2-4: Power control test

The views on power control test are still different. Some proposals are the views to the whole power control test, some proposals are the views to the each tolerance test. In order not to make the discussion so divergent, the email discussion in this meeting focuses on if the specfic requirement is needed and the details can be discussed in future meetings. Moderator doesn’t have recomended WF for the issues in this topic.

Moderator’s another observation is that there’s not much discussion on if there’s some difference for WA and LA IAB-MT. The status can be summarized after the 1st round discussion to see if some WF can be reached.

Issue 2-4-1: Absolute power tolerance

* Proposals
  + Option 1: Yes (ZTE, Nokia)
  + Option 2: No (CATT, Samsung, QC )
* Recommended WF

Issue 2-4-2: Relative power tolerance

* Proposals
  + Option 1: Yes (ZTE, Nokia, QC)
  + Option 2: No (CATT, Samsung )
* Recommended WF

Issue 2-4-3: Aggregated power tolerance

* Proposals
  + Option 1: Yes (ZTE, Nokia)
  + Option 2: No (CATT, Samsung )
* Recommended WF

## Companies views’ collection for 1st round

|  |  |
| --- | --- |
| **Issues** | **Comments** |
| Sub-topic 2-1: Factors considered in Pcmax definition or not  **Recommended WF:** The factors other than PPowerClass,MPR/A-MPR and Pemax are not considered in Pcmax definition.  For PPowerClass, MPR/A-MPR and Pemax, please input your comments if they should be included or related to the Pcmax definition. | It’s closed according to Aug 18th GTW discussion  CATT: We’re ok with the recommended WF. We think MPR/A-MPR and Pemax are not included with Pcmax. Ppowerclass is related to Pcmax, how to include Ppowerclass depends on the further discussion.  Huawei: PPowerClass – My understanding is thsi is the UE maximim power and it’s a fixed requirement for the UE (witha tolerance) from 38.1011- table 6.2.1-1 for example a class 3 UE has a Ppowerclass of 23dBm. For the IAB-MT the power is declared and as such is fundamentally different from thsi variable. However something is needed to report the IAB-MT power capability – maybe thsi coudl be it?  MPR/A-MPR – Power reduction will not be needed for the IAB-MT so these are not needed  Pemax – As the IAB-MT are fixed in a region and deployed by operator there is no need for teh network to inform the IAB-MT of any regional power restrictions.  Qualcomm:Pcmax is needed for testing the IAB-MT output power. Any factor that would modify the declared output should be included in the equation.  Ppowerclass is a fixed parameter for the UE. Since the IAB-MT power is declared, Ppowerclass should be replaced with a Pdeclared. In some cases the IAB-MT might take a power backoff to meeting the RF requirements. This should also be declared and included as a factor in the Pcmax equation(e.g. Pbackoffdeclared).  About the equations, Nokia’s proposal seems better. If ΔP is the power tolerance, this should be added in testing spec, not the core spec. We need to add a term for the power backoff as stated in the comment above. |
| Sub-topic 2-2: Pcmax definition  Please provide comments to the two proposals from CATT ([R4-2009792](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009792.zip)) and Nokia ([R4-2010293](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010293.zip)) | Status after Aug. 18th GTW discussion:Still include Pcmax definition in the core specification, for the side condition and whether to have applicable test cases for Pcmax requirements additional to power accuracy requirements test cases can be further discussed.  CATT: For Nokia’s proposal, we don’t think IAB-MT will use the Pemax for the commercial UE. If there’s some limit of power, the limits for WA MT and LA MT shouldn’t be the same. So we think Pemax is excluded from Pcmax. Some clarification of meaning ofΔP is needed.  Huawei: the CATT proposal, what is the difference between Pdeclared and Prated. For BS at least Prated is a declared value.For Nokia proposal, we dont think Pemax is needed and its not clear what deltaP is? If some of these additional variable are needed then both definitions look quite simple, but possibly it could be even simpler and pcmax could just be a declared value?  Qualcomm: We believe Pemax is needed also for the IAB-MT to comply with any regulatory requirements on power limits. It is true that the IAB-MT is not moving and is under operator control the Pemax could be pre-configured but this shouldn’t be mandated. WE should also check with RAN2 if an IAB-MT can do initial system acquisition without support Pemax in case this is signaled.  About the equations, Nokia’s proposal seems better. If ΔP is the power tolerance, this should be added in testing spec, not the core spec. We need to add a term for the power backoff as stated in the comment above(Pbackoffdeclared)  Samsung: it seems the proposal from Nokia on Pcmax definition is no different compared to the accuracy requirement of declaration power. Does that mean this can covered by the test of power accuracy of declaration?  Moderator: Please input your further comments after Aug 18th GTW below: |
| Sub-topic 2-3: Power class definition  Please provide comments to the proposals from CATT ([R4-2009792](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009792.zip)) | Aug 18th GTW Agreement: It will not be discussed further.  Huawei: Ppowerclass seems to mean mean something in the UE spec that is not applicable to the IAB-MT. It looks like a target (wit tolerance) power level which the UE must meet. For IAB-MT we have no fixed targets the power is declared. AS such we should not use the term to avoid confusion. We have defined the classes as IAB-MT class and discussed the upper power limit in the previous sub-topic.  Qualcomm: What is this power class definition useful for?  Samsung: it seems the suggestion from R4-2009792 is feature of IAB-MT class rather than power class. The necessity of report on IAB-MT class may not a pure RAN4 issue. This should be understood further whether donor /parent need this in initial access. |
| Sub-topic 2-4: Power control test  Issue 2-4-1: Absolute power tolerance   * Proposals   + Option 1: Yes   + Option 2: No * Recommended WF   Issue 2-4-2: Relative power tolerance   * Proposals   + Option 1: Yes   + Option 2: No * Recommended WF   Issue 2-4-3: Aggregated power tolerance   * Proposals   + Option 1: Yes   + Option 2: No * Recommended WF | General comment if any:  CATT: we think no power control test is needed with the small dynamic range defined.  Huawei: Presumably we are discussing core requirements here not tests? As we have a requirements for power control then it seems reasonable that the tolerance of that control is specified as such some fro of power control tolerance should be specified. If it is 1 or all 3 does not make to much difference to conformance testing I think as the same measurement is compared to 3 different limits. But as the absolute tolerance is somewhat meaningless given the small range perhaps this should be omitted.    Issue 2-4-1: Absolute power tolerance  Huawei: option 2  Qualcomm: We proposed not to have absolute power tolerance because at least in FR2, the tolerance is comparable(or larger?) than the minimum dynamic range. Also, the MT is not expected to use open loop power control often so this requirement is not so important.  Samsung: option 2  Ericsson: No needed to defined for both WA and LA IAB-MT. RSRP eat most of the tolerance margin. The UE power tolerance is much bigger due to RSRP. Could rely on the output power accuracy test which is much better than UE power tolerance.  Issue 2-4-2: Relative power tolerance  Huawei: Option 1  Qualcomm: the MT will mostly work with closed loop power control so this requirement is useful. This requirement is much tighter than the absolute tolerance so can be tested.  Samsung: there is only 10dB power dynamic range for dynamic PSD. Not quite sure the necessity to have this requirement since if we consider accuracy and TT together they may exceed the range. And the relative power accuracy due to update on RB allocation can be covered by fixed PSD-dynamic range to some extent.  Ericsson: No need for WA IAB-MT considering the 5 dB Dynamic range and Measurment unceitainty and power accuracy; may be needed for LA IAB-MT.  Issue 2-4-3: Aggregated power tolerance  Huawei: Oprion 1 (soft preference)  Qualcomm: This requirement was introduced mainly to check that a UE is actually increasing/deacresing power after several commands. The relative power control tolerance by itself would allow the UE not to increase/decrease power at all and still be compliant. With this reasoning, this requirement should also be introduced for the MT.  Samsung: it can be covered by dynamic PSD power dynamic.  Ericsson: no needed for WA IAB-MT. As this requirement is ability to hold the transmit power within 21ms, the condition will not hold true for shared architecture. |

## 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:* |

*Suggestion on WF/LS assignment*

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

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| **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 #3: Dynamic range defintion details

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010147**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010147.zip) | Samsung | Dynamic range:  Proposal 5: it is suggested to refer to gNB total power dynamic range for IAB-MT constant PSD dynamic range and refer to UE MOP&min Tx power test for IAB-MT dynamic PSD dynamic range verification  Proposal 6: It’s suggested to consider reference conditions presented in this contribution for IAB-MT dynamic range FR2. |
| [**R4-2010912**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010912.zip) | Qualcomm Incorporated | The dynamic PSD should be guaranteed for higher order modulations that are more likely to be used by the IAB-MT (at least 16QAM or even 64QAM). |
| [**R4-2011293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011293.zip) | Huawei | the variable Y discussed in the WF does not need to be defined or used in the core specification as Y will only change if the specified reference condition changes. |

## Open issues summary

The side conditions and how to capture them in the spec are the open issues for dynamic range. Moderator doesn’t have recommended WF for the two issues before the 1st round.

### Sub-topic 3-1: Should dynamic range Y be captured in core spec

* Proposals
  + Option 1: Yes
  + Option 2: No ( Huawei )
* Recommended WF

### Sub-topic 3-2: Side conditions for dynamic range

There’re proposals from two companies (Samsung and QC), companies can provide comments to the two proposals.

* Samsung proposal:

Proposal 5: it is suggested to refer to gNB total power dynamic range for IAB-MT constant PSD dynamic range and refer to UE MOP&min Tx power test for IAB-MT dynamic PSD dynamic range verification

Proposal 6: It’s suggested to consider reference conditions presented in this contribution for IAB-MT dynamic range FR2.

* QC proposal:

The dynamic PSD should be guaranteed for higher order modulations that are more likely to be used by the IAB-MT(at least 16QAM or even 64QAM).

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Sub topics** | **Comments** |
| Sub-topic 3-1: Should dynamic range Y be captured in core spec   * Proposals   + Option 1: Yes   + Option 2: No * Recommended WF | CATT: we think option 2 could be ok.  Huawei: Our view in the TP was based on it not seeming necessary – but we are open to discussion. At this stage option 2.  Qualcomm: Y is important to guarantee enough dynamic range in our opinion. Without this we risk having a really small range because total range will not be Y+X but max(X,Y)  Samsung: Option 1  Ericsson: option 2 is ok. UE spec does not have Y requirements, should consider to follow UE spec on this. |
| Sub-topic 3-2: Side conditions for dynamic range  There’re proposals from two companies (Samsung and QC), companies can provide comments to the two proposals.   * Samsung proposal:   Proposal 5: it is suggested to refer to gNB total power dynamic range for IAB-MT constant PSD dynamic range and refer to UE MOP&min Tx power test for IAB-MT dynamic PSD dynamic range verification  Proposal 6: It’s suggested to consider reference conditions presented in this contribution for IAB-MT dynamic range FR2.   * QC proposal:   The dynamic PSD should be guaranteed for higher order modulations that are more likely to be used by the IAB-MT(at least 16QAM or even 64QAM). | CATT: Generally, we think we can discuss the test configuration in the performance part. For Samsung proposal, UE MOP is tested for 1 RB and inner full RB, minimum ouput power is tested only for outer full RB.For the IAB-MT maximum output power, we think RB number smaller than full RB number is also important. For QC proposal, we may need some discussion if back off is allowed.  Huawei: The way the requirement is worded in the current TP proposal the DR is required under any specific condition, as such all modulations order etc are covered by the core spec. The actual test conditions we should discuss in conformance. For power control steps, these have not yet been agreed so core req not drafted but as these are UE requirements it makes sense they will somewhat follow the UE format.  **Qualcomm: We can also discuss this in the performance part but the issue would be guarantee enough dynamic range, from a few RB transmission at low power(minimum Tx power) to full power(max declared power) to full number of RBs transmitted at full power.**  Samsung: We agree that this aspect can be covered by conformance testing. But we provide contribution on those details according to WF agreed in last meeting. our proposal on dynamic PSD-power dynamic range is based on full RB allocation. But for maximum output power test configuration it should be separated discussion.  **Ericsson: Relate to the decision of the sub topic 3-1. The side condition for modulation could be declaration based. However, the detail specific reference channel could be discussed in conformance testing phase.** |

## 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:* |

*Suggestion on WF/LS assignment*

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

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| **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 #4: TP review

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010293.zip) | Nokia, Nokia Shanghai Bell | TP to TR 38.809 Completing IAB-MT power related requirements |
| [**R4-2010724**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010724.zip) | Nokia, Nokia Shanghai Bell | TP to TS 38.174: Output power requirements |
| [**R4-2011293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011293.zip) | Huawei | TP to TS 38.174 -IAB TX dynamic range |

## Open issues summary

3 TPs are provided. [R4-2011293](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011293.zip) is related to the discussion of Sub-topic 3-1. Companies can comment the issues except Sub-topic 3-1.

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **TPs** | **Comments** |
| [**R4-2010293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010293.zip) | Company A:  Company B:  Huawei: Not all these things have been agreed so we need to finalize the agreements 1st. Some specific comments:  7.1 another reason we did not specify 1-C as IAB expects a direction antennas so only AAS types were considered. For 10H the scaling of 8 is not fixed as stated. 7.2 local area limits not yet agreed. 9.1 not yet agreed scaling principle for 1-O. 9.2 for each beam over the specified directions. 9.3 Limits for local still being discussed  Ericsson: 7.1, wording "8x" need to be improved, 7.2, LA IAB-MT power pending on RAN4 agreeement. |
| [**R4-2010724**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010724.zip) | Company A:  Company B:  Huawei: 6.1. The Ncells text 2nd paragraph 2nd sentence only applies to IAB\_DU but the declaration covers both types. Numbering in 6.2.2 is wrong (subclause start 6.2.1), local area IAB-MT limits in table 3.2.1-1 not yet agreed. 9.2.2 and 9.2.3 effectively have the same requirement but one references and one writes it out, I think 9.2.2 is only clasue in this TP where referencing is used – seems inconsistent?  The declared directions sets etc, we use the same names for IAB-DU and IAB-MT, this is ok I don’t think we need DU and MT versions of them, but maybe in the introduction it can be stated they can be declared differently for DU and MT? Maybe not? What do others think?  Ericsson: 6.1 the active Transmit unit may need to be declared separately for IAB-MT and IAB-DU, so there is a need to define the parameter separately. 9.3.2.1, the output power is 33 dBm for LA IAB-MT type 1-O |
| [**R4-2011293**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011293.zip) | Company A:  Company B:  Ericsson: there are several Typo: title 9.4.2 "IAB-MT" -> "IAB-MT", title 9.4.2.1.2 and title 9.4.2.1.3 , "IAB-DU" ->"IAB-MT" |

## 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:* |

*Suggestion on WF/LS assignment*

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

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| --- | --- |
| **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”* |