**3GPP TSG-RAN WG4 Meeting # 98-e R4-200XXXX**

**Electronic Meeting,25th Jan – 5th Feb, 2021**

**Agenda item:** 7.4.3.3, 7.4.3.4

**Source:** Moderator (Samsung)

**Title:** Email discussion summary for [98e][307] NR\_IAB\_Conformance\_Part2

**Document for:** Information

# Introduction

This thread is assigned to cover Rel-16 NR IAB RF conducted and radiated conformance testing except the general aspects and common issues.

According to contributions submitted under related agendas, the summary is divided in topics as below:

* Topic#1: Dynamic range, Power control and Frequency error for IAB-MT
* Topic#2: Possibility to control test burden

The contributions submitted under agenda 7.4.3.3 and 7.4.3.4 on common issues such as test set-up, MU/TT, declaration, etc will be summarized in [306] except the dedicated proposals on two topics above. Furthermore, the TP attached in the contribution will not be treated at least in 1st round discussion.

# Topic #1: Dynamic range, power control and frequency error for IAB-MT

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2100370**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100370.zip) | CATT | For dynamic range test,  **Observation 1: For test point [1], both testing it by following BS approach or being covered by maximum output power test can guarantee the performance.**  **Observation 2: Test point 2 can be omitted if EVM test covers this point.**  **Observation 3: Test point 3 needs to be tested. 1 RB can be tested for local area IAB-MT and [5] RB can be tested for wide area IAB-MT.**  **Observation 4: Test point 4 can be omitted.**  **Observation 5: Partial RB with maximum output power test case is not needed for wide area IAB-MT, but testing this scenario for local area IAB-MT can bring benefit for network deployment.**  For frequency error test,  **Observation 6: For the frequency error test, the connection between TE and IAB-MT can follow UE approach.**  **Observation 7: Test configuration for frequency error can follow BS approach.**  **Observation 8: The test parameters, initial connection with TE and test procedure can follow UE approach.**  For power control test,  **Proposal: IAB-MT power control requirement is not tested in R16, if it’s tested in future releases FFS.** |
| [**R4-2101418**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101418.zip) | Qualcomm Incorporated | Proposed tests for dynamic range:   1. Maximum output power with full RB allocation 2. Maximum output power with 1/4 RB allocation 3. Minimum output power (as set by 5/10 dB dynamic range requirement) with full RB allocation.   Proposal for power control test:   * Use full RB allocation for the power control allocation * Power should be varied between minimum and maximum with the smaller steps(+/- 2dB) * Use two way setup for the test in which DUT follows the TE commands   Proposal for the Frequency error test:   * Use two way setup * Reuse the UE test environment in terms of reference channels and signal levels |
| [**R4-2102013**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102013.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: It has been agreed that dynamic range requirements require maximum of 5 or 10 dB PSD variation depending on IAB-MT class when channel is fully allocated.**  **Observation 2: It has been agreed that single RB transmission requirement uses the same PSD as full RB transmissions.**  **Observation 3: Testing maximum output power with narrow PRB allocation has not been agreed and shall not be done.**  **Proposal 1: Adopt the two following test points for dynamic range test:**  **1) Maximum output power with full RB allocation and maximum output power**  **2) single RB allocation with 5/10 dB lower PSD as used in test point 1)**  **Observation 4: There is an opportunity to re-use maximum output power test result for single carrier for test point 1)** |
| [**R4-2102327**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102327.zip) | Ericsson | **Observation-1: Power control requirement rely on TX dynamic range to provide the output power adjustability.**  **Observation-2: Power control requirement allow the TX output power uncertainty due to the TX gain setting change**.  **Observation-3: Power control requirement allow the TX output power uncertainty due to the TX gain setting change** **while not allowing such uncertainty for DR will overdrive the design without benefiting the system performance**.  **Proposal-4: consider the power output inaccuracy due to the TX gain setting change in TX dynamic change test.**  **Observation-4: Power control test case cover the TX DR case if the similar power pattern as UE test case is introduced.**  **Proposal-5: Test model design need to cover the case where less # of RB could be configured for power control testing case.** |
| [**R4-2102330**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102330.zip) | Ericsson | **Figure 1 : DUT and TE using the external synch reference (a) or DUT generated sync reference (b) for RF TX testing**  **Proposal-1: Use the Figure 1 test setup as one alternative for the IAB-MT frequency error test setup when BS test equipment is used.** |
| [**R4-2102335**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102335.zip) | Ericsson | **Proposal-1: modify the TX dynamic range reference condition with full RB transmission in core specification.**  **Observation-1: Power control requirement rely on TX dynamic range to provide the output power adjustability.**  **Observation-2: Power control requirement allow the TX output power uncertainty due to the TX gain setting change**.  **Proposal-2: consider the power output inaccuracy due to the TX gain setting change in TX dynamic change test.** |

## Open issues summary

Last meeting the WF on dynamic range, power control (LA) and frequency error for IAB-MT agreed in R4-2017490 as below. Based on this contributions are provided to resolve the remaining issues for this meeting.

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| 2.1 WF on dynamic range test  **Agreement**: RAN4 will introduce conformance test cases for dynamic range requirements for both wide-area and local-area IAB-MT classes.   * RAN4 will further discuss the uncertainty impact on the feasibility of introducing test case   The following test points were identified as candidates in RAN4#97e and they will be down selected in next RAN4 meeting and should be reviewed based on agreement on updated DR requirement if any   * [1] Maximum output power with full RB allocation. * [2] Minimum output power (as set by 5/10 dB dynamic range requirement) with full RB allocation. * [3] Narrow RB allocation with the same PSD as [2]. * [4] Partial RB allocation with same PSD as [1]. * Others proposals, for example maximum output power with partial RB allocation, if any reasonable justifications   The following aspects will be considered/decided when the test points are concluded.   * The reference side condition agreed in R4-2008775. * If some test point can be covered by other requirements. * The typical scenarios of IAB-MT backhaul function. * The exact RB number for narrow/partial RB allocation based on reference condition definition in core requirements * Whether test point set/combination for dynamic range is different for Wide Area and Local Area IAB-MT * Others if any.   2.2 WF on power control test for Local Area IAB-MT  **Agreement**: Dynamic range and power control tests are defined separately.   * Further discussion on test applicable rules among these test cases is not excluded.   For relative power accuracy test,   * The smallest power control step size is considered. * The followings will be discussed in next meeting.   + How to accommodate this test with the test set-up structure.     - If two way signal is necessary.(this also relates to the generic test setup discussion)   + Power control step size, RB allocation, etc.   2.3 WF on frequency error test  The following will be discussed in next meeting   * How to accommodate this test with the test set-up structure to be agreed for IAB-MT test environment setup   + If two way signal is necessary. |

### Sub-topic 1-1: Dynamic range

R4-2102335 proposed to revise the reference condition for TX dynamic range as “**full RB allocation**” in core specification and take into account “**power output inaccuracy due to the TX gain setting change in TX dynamic change test** “

R4-2100370 provided observations that Test point 1 and Test point 3 are needed for dynamic range. Test point 2 can be removed if covered by EVM testing. Furthermore test condition on partial RB allocation with maximum output power may be benefit for Local Area IAB-MT.

R4-2102013 suggested to take two test points as below for dynamic range:

1) Maximum output power with full RB allocation and maximum output power(Test point 1 in WF)

2) single RB allocation with 5/10 dB lower PSD as used in test point 1) (Updated Test point 3 in WF)

R4-2101418 proposed the test point as below:

* Maximum output power with full RB allocation(Test point 1 in WF)
* Maximum output power with 1/4 RB allocation(belongs other proposal in WF)
* Minimum output power (as set by 5/10 dB dynamic range requirement) with full RB allocation.(Test point 2 in WF)

Furthermore, several contribution share the similar understanding that test point 1 can be covered by total output power test

**Issue 1-1: Test point**

* Proposals
  + Option 1:Consider two test points for IAB-MT dynamic range as below:
  + Maximum output power with full RB allocation and maximum output power(Test point 1 in last meeting WF)
  + single RB allocation with 5/10 dB lower PSD as used in test point 1) (Updated Test point 3 in last meeting WF)
  + Option 2: consider dynamic range on full RB allocation only and update core requirement
  + Option 3:
  + Maximum output power with full RB allocation(Test point 1 in WF)
  + Maximum output power with 1/4 RB allocation(belongs other proposal in WF)
  + Minimum output power (as set by 5/10 dB dynamic range requirement) with full RB allocation.(Test point 2 in WF)
* Recommended WF
  + It’s encouraged companies share preference on the options on test points selection. And it would be appreciated if companies can share opinion on whether Dynamic PSD(X) and constant PSD(Y) we agreed last year should be applied for IAB-MT.

### Sub-topic 1-2: Power control for Local Area IAB-MT

R4-2100370 suggested to postpone the definition on conformance testing requirement for power control on Local Area IAB-MT.

R4-2102327 proposed to power control cover DR case and the test model design should consider the partial RB allocation case.  
 =>It seems this imply the partial RB allocation case is suggested dedicatedly for Local Area IAB-MT since power control is only applied for Local Area IAB-MT.

R4-2101418 suggested as below

* Use full RB allocation for the power control allocation
* Power should be varied between minimum and maximum with the smaller steps(+/- 2dB)
* Use two way setup for the test in which DUT follows the TE commands

=>In UE testing on the relative power tolerance is verified by update on RB allocation together with +/-1dB TPC command. If it is the common understanding that the frequency re-allocation is not so frequently whether it is possible to take this into account of test point for dynamic range?

**Issue 1-2-1: Power control test points**

Proposals

* + Option 1: No specific test for this requirement but can be verified implicitly by other requirement
  + Option 2: To be verified by below configuration
  + Use full RB allocation for the power control allocation
  + Power should be varied between minimum and maximum with the smaller steps(+/- 2dB)
  + Option 3: Partial PRB allocation to be considered in Test model design if to reuse the similar test configuration as UE.
* Recommended WF
  + Even though we agreed to define power control and power dynamic range separately in last meeting, it seems the proposal on each requirement are still related to each other. Hence it would be appreciated if each company can provide feedback on both requirement with whole picture consideration.

**Issue 1-2-2: Test set-up**

Proposals

* + Option 1: follow BS approach to define limited parameter to ensure the flexibility
  + Option 2: Use two way setup for the test in which DUT follows the TE commands
* Recommended WF
  + TBA

### Sub-topic 1-3: Frequency error

R4-2100370 the suggestion is that except Test configuration can follow BS approach remaining aspect including set-up should follow UE approach.

R4-2101418 suggested that for IAB-MT frequency error all UE parameter such as two way signal and environment should be reused.

R4-2102330 proposed to allow the alternative solution to measure the IAB-MT frequency error with BS test equipment with external synch reference or DUT generated sync reference.

* It seems RAN4 should clarify whether the frequency error of IAB-MT can be verified together with EVM as BS.

**Issue 1-3: frequency error**

* Proposals
  + Option 1: Verification can be done together with EVM and allow the alternative to apply BS test equipment
  + Option 2: Verify by UE approach including test set-up and test environment.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |
| CATT | **Issue 1-1: Test point**  We prefer option 1 combined with one of the test points (Maximum output power with 1/4 RB allocation(belongs other proposal in WF)) in option 3 if it can be agreed. For local area MT, maximum output power with small RBs is a real scenario for the deployment. However, we don’t intend to reverse the agreed WF last year even though it’s not reasonable according to our current understanding.  **Issue 1-2-1: Power control test points**  We don’t have strong opinion on this test as the dynamic range is so small.  **Issue 1-2-2: Test set-up**  If it’s tested, we think IAB-MT needs to understand parent node’s command of power control, so seems two-way set up is necessary.  **Issue 1-3: frequency error**  We still prefer option 2 as this requirement is defined as relative frequency accuracy. And we have a clarification question that if option 1 is agreed, how to handle the implementation related to option 2. We’re not sure if RF part should consider forward compatibility for R17 IAB. If option 1 is adopted, some modifications for R17 may be needed. |

### CRs/TPs comments collection

It is suggested to focus on technical discussion rather than detail TP.

## 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** |
| #1 |  |  |

### CRs/TPs

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

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| **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*

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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 #2: Possibility to control test burden

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2101962](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101962.zip) | ZTE Corporation | **Proposal 1: the number of IAB-MT conformance testing directions for each radiated Tx requirements should also that of IAB-DU.**  **Proposal 2: for Tx spurious emission and Rx OOBB requirement, either test requirements for IAB-DU or IAB-MT.** |
| [R4-2102014](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102014.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: RF requirements of IAB-DU and IAB-MT need to be sufficiently similar to apply test reduction.**  **Proposal 1: For implementations sharing the same RF hardware between IAB-MT and IAB-DU, amount of duplicated testing shall be minimized when it does not bring added value.**  **Proposal 2: It shall be declared whether RF HW is shared between IAB-MT and IAB-DU.**  **Proposal 3: It shall be declared whether RF HW is identical copy between IAB-MT and IAB-DU**  **Proposal 4: For shared or identical RF HW implementations it is deemed that test coverage is complete when combined set of IAB-DU and IAB-MT RF channel positions and test directions is the same as corresponding RF channel and test direction set of gNB.**   * **FFS for which tests this is applied and what side conditions apply**   **Proposal 5: When it is identified that either IAB-MT or IAB-DU requirement is more demanding, it is sufficient to test only the more demanding requirement for shared or identical RF HW implementations.**  **Proposal 6: For shared or identical RF HW implementations receiver blocker tests (ACS, IBB, Rx IMD) are sufficient to perform only for IAB-MT with CP-OFDM interferer signal** |
| [R4-2102321](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102321.zip) | Ericsson | **Proposal-1: Add new declaration in the manufacture declaration list for how the transceiver is mapped tot the IAB-DU and IAB-MT.**  **Proposal-2: Add new chapter for the test case dependency for the shared architecture IAB implementation.**  **Proposal-3: the unwanted emission test can be reduced on share architecture and either IAB-DU or IAB-MT test would be good enough if the rated output power declaration is the same. Higher output power should be tested if the declared power is different.** |
| [R4-2102420](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102420.zip) | Huawei | **Observation 1:** There is very little scope to reduce the number of Tx directions/channels in the existing BS transmitter directional requirements test coverage.  **Observation 2:** There is limited scope to reduce the number of channels for some transmitter TRP measurements but as these requirements are linked to regulatory limits the small gain in testing time does not justify the test coverage reduction.  **Observation 3:** There is no scope to further reduce the co-location test coverage.  **Observation 4:** the only scope for reducing the number of receiver test case is in-band blocking where the number of directions is reduced from 5 to 2.  The IAB-MT test coverage should be the same as the IAB-DU, in the case of shared architecture test with common requirements (such as spurious emissions) need only be carried out once using the worst case test models. |

## Open issues summary

Last meeting RAN4 agreed the WF in R4-2017491 on test burden and test coverage as below :

**Test burden and test coverage analysis**

- Possible reduction of tests will be further analyzed taking into account test coverage for both IAB-DU and IAB-MT and for both conducted and radiated testing. Aspects to be analyzed include but are not limited to

* RF channels
* Test directions
* Shared vs. separated RF architecture
  + Is this declared
  + Testing only more demanding requirement for shared architecture

### Sub-topic 2-1

**Issue 2-1: Test coverage including directions**

* Proposals
  + Option 1: The test coverage including test directions(in case of OTA) of IAB-MT should be the same as IAB-DU
  + Option 2: TBA
* Recommended WF
  + Confirm the understanding

**Issue 2-2: Applicability and criteria to test reduction**

* Proposals
  + Proposal 1: For shared RF HW or identical RF HW between IAB-MT and IAB-DU the duplicated testing shall be minimized when it does not bring added value
  + Proposal 2: FFS on criteria on how to reduce the test for above cases
    - Criteria 1: For which requirement(s) RF channel positions and test direction# verified and combined by both IAB-DU and IAB-MT in conformance testing can be recognized to compose the full set of test coverage purpose. Or to ensure the completed test set of conformance testing on IAB node how to split between IAB-DU and IAB-MT
    - Criteria 2: For which requirement(s) the worst case / most challenging case, if can be identified, could be applied
    - Criteria 3: for which requirement(s) verification on either IAB-MT or IAB-DU could be adequate.
    - Other criteria is not precluded.
  + Proposal 3: To decide whether new sub-clause needed to capture above criteria(s) in conformance testing spec.
* Recommended WF
  + Confirm the understanding and provide view on FFS part

**Issue 2-3: Additional declaration**

* Proposals: additional declaration(s) on top of existing BS ones should be introduced and further study needed on the detail on
  + Alternative 1:
    - whether RF HW is shared between IAB-MT and IAB-DU
    - whether RF HW is identical copy between IAB-MT and IAB-DU
  + Alternative 2: how the transceiver is mapped tot the IAB-DU and IAB-MT
  + other alternative is not precluded.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1:  Sub topic 2-2:  ….  Others: |
| CATT | **Issue 2-1: Test coverage including directions**  Our current understanding aligns with option 1.  **Issue 2-2: Applicability and criteria to test reduction**  We support the direction of proposal 1. The general criteria need to be captured in spec. Other clarification such as which requirements should be tested for both IAB-DU and IAB-MT if there’re any even the HW is shared. For the detail split for IAB-DU and IAB-MT regarding the common test, we don’t think it’s necessary. Flexibility for vendors should be allowed.  **Issue 2-3: Additional declaration**  Declaration may be needed and the declaration similar with Alternative 1 may be sufficient. |

### CRs/TPs comments collection

No TP will be discussed for this topic.

## 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*

|  |  |  |
| --- | --- | --- |
|  | **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** |
| 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”* |