**3GPP TSG-RAN WG4 Meeting #99-e DRAFT R4-2108575**

Online, 19 - 27 May 2021

**Source:** Huawei

**Title:** TP to TS 38.176-1 - Tx dynamic range, clause 6.3

**Agenda Item:** 6.3.2.3.1

**Document for:** Approval

# Introduction

This is an updated version of R4-2111403 following review comments made in the 1st round of RAN4#99. Modifications include:

* The GTW agreement for the IAB-MT test requirements has been implemented:

*Agreement:*

IAB-MT type 1H/1O: -10 log(Maximum RB)- 5/10+/- ([5.5]+ TT)

IAB-MT type 2O: -10 log(Maximum RB)- 5/10 +/- ([6]+TT)

The following has been done

* IAB-DU tests are copied from 38.141-1,
* references t0 BS type 1-C are removed and references to BS type 1-H have been modified to IAB-DU type 1-H
* References are highlighted in yellow to be checked when the skeleton is more complete.
* 5MHz CBW is removed from test requirements
* IAB-MT aggregate power control there is no specific test case (R4-2103997)
* For IAB-MT test requirement the TT is added as per the agreed MU spreadsheet.

# TP to TS 38.176-1 v0.1.0 – Editors update

**--- Start of changes ---**

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.174: "NR Integrated access and backhaul radio transmission and reception".

[3] 3GPP TS 38.xxx-2: "NR Integrated access and backhaul radio conformance testing Part 1: Conducted conformance testing".

[x1] 3GPP TS 38.104: “NR; Base Station (BS) radio transmission and reception”

[x2] 3GPP TS 38.213: "NR; Physical layer procedures for control".

**--- Next change ---**

## 6.3 Output power dynamics

### 6.3.1 IAB-DU Output Power Dynamics

#### 6.3.1.1 General

The requirements in clause 6.3.1 apply during the *transmitter ON period*. Transmit signal quality requirements (as specified in clause 6.5) shall be maintained for the output power dynamics requirements of this clause.

#### 6.3.1.2 RE power control dynamic range

##### 6.3.1.2.1 Definition and applicability

The RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at *maximum carrier output power* (Pmax,c,TABC, or Pmax,c,AC) for a specified reference condition.

For *IAB-DU type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

##### 6.3.1.2.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB-DU type 1-H* is defined in TS 38.174 [2], clause 6.3.1.2.

##### 6.3.1.2.3 Test purpose

No specific test or test requirements are defined for conducted RE power control dynamic range. The Error Vector Magnitude (EVM) test, as described in clause 6.5.4 provides sufficient test coverage for this requirement.

#### 6.3.1.3 Total power dynamic range

##### 6.3.1.3.1 Definition and applicability

The IAB-DU total power dynamic range is the difference between the maximum and the minimum transmit power of an OFDM symbol for a specified reference condition.

For *IAB-DU type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

NOTE: The upper limit of the dynamic range is the OFDM symbol power for a BS when transmitting on all RBs at maximum output power. The lower limit of the total power dynamic range is the average power for single RB transmission. The OFDM symbol shall carry PDSCH and not contain RS or SSB.

##### 6.3.1.3.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector*.

The minimum requirement for *IAB-DU type 1-H* is in TS 38.174 [2], clause 6.3.1.3.

##### 6.3.1.3.3 Test purpose

The test purpose is to verify that the total power dynamic range is within the limits specified by the minimum requirement.

##### 6.3.1.3.4 Method of test

###### 6.3.1.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested: M; see clause 4.9.1.

Set the channel set-up of the connector under as shown in annex D.3 for *IAB type 1-H*.

###### 6.3.1.3.4.2 Procedure

For *IAB type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector(s)* under test as shown in annex D.3.1 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) Set each connector under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models in clause 4.9.2 at Prated,c,TABC for *IAB type 1-H* (D.21).

3) For *IAB type 1-H*, set the BS to transmit a signal according to:

- NR-FR1-TM3.1a if 256QAM is supported without power back off, or

- NR-FR1-TM3.1 if 256QAM is supported with power back off, or

- NR-FR1-TM3.1 if 256QAM is not supported by IAB-DU.

4) Measure the OFDM symbol TX power (OSTP) as defined in the annex H.

5) For *IAB type 1-H*, set to transmit a signal according to:

NR-FR1-TM2a if 256QAM is supported, or

NR-FR1-TM2 if 256QAM is not supported ;

6) Measure the OFDM symbol TX power (OSTP) as defined in the annex H.

In addition, for *multi-band connectors*, the following steps shall apply:

7) For a *multi-band TAB connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

##### 6.3.1.3.5 Test requirements

The downlink (DL) total power dynamic range for each NR carrier shall be larger than or equal to the level in table 6.3.1.4.5-1.

Table 6.3.1.3.5-1: IAB-DU total power dynamic range

|  |  |
| --- | --- |
| NR channel | Total power dynamic range (dB) |
| bandwidth (MHz) | 15 kHz SCS | 30 kHz SCS | 60 kHz SCS |
| 10 | 16.7 | 13.4 | 10 |
| 15 | 18.5 | 15.3 | 12.1 |
| 20 | 19.8 | 16.6 | 13.4 |
| 25 | 20.8 | 17.7 | 14.5 |
| 30 | 21.6 | 18.5 | 15.3 |
| 40 | 22.9 | 19.8 | 16.6 |
| 50 | 23.9 | 20.8 | 17.7 |
| 60 | N/A | 21.6 | 18.5 |
| 70 | N/A | 22.3 | 19.2 |
| 80 | N/A | 22.9 | 19.8 |
| 90 | N/A | 23.4 | 20.4 |
| 100 | N/A | 23.9 | 20.9 |

NOTE: Additional test requirements for the EVM at the lower limit of the dynamic range are defined in clause 6.5.4.

**--- Next change ---**

### 6.3.2 IAB-MT Output Power Dynamics

#### 6.3.2.1 Total power dynamic range

##### 6.3.2.1.1 Definition and applicability

The IAB-MT total power dynamic range is the difference between the maximum and the minimum controlled transmit power in the channel bandwidth for a specified reference condition. The maximum and minimum output powers are defined as the mean power in at least one sub-frame 1ms.

NOTE: The specified reference condition(s) are specified in the conformance specification Changes in the controlled transmit power in the channel bandwidth due to changes in the specified reference condition are not include as part of the dynamic range.

##### 6.3.2.1.2 Minimum requirement

The IAB-MT total power dynamic range is defined in TS 38.174 [2], clause 6.3.2.1.2

##### 6.3.2.1.3 Test purpose

The test purpose is to verify that the IAB-MT total power dynamic range is within the limits specified by the minimum requirement.

##### 6.3.2.1.4 Method of test

###### 6.3.2.1.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested: M; see clause 4.9.1.

Set the channel set-up of the connector under as shown in annex D.3 for *IAB type 1-H*.

###### 6.3.2.1.4.2 Procedure

For *IAB type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector(s)* under test as shown in annex D.3.1 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) Set each connector under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models in clause 4.9.2 at Prated,c,TABC for *IAB type 1-H* (D.21).

3) Set the IAB-DU to transmit a signal according to NR-IAB-MT-FR1-TM3.1

4) Measure the power over 1ms

5) Set to transmit a signal according to NR-IAB-MT-FR1-TM2.

6) Measure the power over 1ms

In addition, for *multi-band TAB connectors*, the following steps shall apply:

7) For a *multi-band TAB connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

##### 6.3.2.1.5 Test requirements

The ΔP between the power measured in step 4 and step 5 of clause 6.3.2.1.4.2 shall be:

Table 6.3.2.1.5: IAB-MT Output power dynamics test requirements.

|  |  |  |
| --- | --- | --- |
| IAB-MT Type | IAB-MT channel bandwidth | Requirement (Note 1) |
| Wide area | ≤40MHz | 10 log(Maximum RB) -1.2 > ΔP ≥ 10 log(Maximum RB) + 11.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) -1.5 > ΔP ≥ 10 log(Maximum RB) + 11.5 |
| Local area | ≤40MHz | 10 log(Maximum RB) +3.8 > ΔP ≥ 10 log(Maximum RB) + 15.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) +3.5 > ΔP ≥ 10 log(Maximum RB) + 16.5 |
| Note 1: Step\_max is the power step between maximum and minimum power control settings. |

#### 6.3.2.2 Relative power tolerance for local area IAB-MT type 1-H

##### 6.3.2.2.1 Definition and applicability

The relative power tolerance is the ability of the transmitter to set its output power in a target sub-frame (1 ms) relatively to the power of the most recently transmitted reference sub-frame (1 ms) if the transmission gap between these sub-frames is less than or equal to 20 ms.

##### 6.3.2.2.2 Minimum requirement

The IAB-MT total power dynamic range is defined in TS 38.174 [2], clause 6.3.3.1

##### 6.3.2.2.3 Test purpose

No specific test or test requirements are defined for Relative power tolerance. The Total power dynamic range test, as described in clause 6.3.2.1 provides sufficient test coverage for this requirement.

#### 6.3.2.3 Aggregate power tolerance for local area IAB-MT type 1-H

##### 6.3.2.3.1 Definition and applicability

The aggregate power control tolerance is the ability of the transmitter to maintain its power in a sub-frame (1 ms) during non-contiguous transmissions within [21 ms] in response to 0 dB commands with respect to the first transmission and all other power control parameters as specified in 3GPP TS 38.213 [x2] kept constant.

##### 6.3.2.3.2 Minimum requirement

The IAB-MT Aggregate power tolerance is defined in TS 38.174 [2], clause 6.3.3.2

##### 6.3.2.3.3 Test purpose

No specific test or test requirements are defined for IAB-MT Aggregate power tolerance.

**--- End of changes ---**