**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2104787**

**Electronic Meeting, Apr. 12-20, 2021**

Title: TP for TS 38.176-1: Transmit ON/OFF power

Source: CATT

Agenda item: 5.3.2.3.1

Document for: Endorsement

# Background

This contribution provides the TP for TS 38.176-1: Transmit ON/OFF power. According to the discussion in the previous meetings, TS 38.141-1 is taken as reference with the following modifications/clarifications.

1. Replace BS with IAB-DU and/or IAB-MT.
2. Remove antenna connector which is for type 1-C.
3. Replace 38.104 to 38.174.
4. Replace Figure 6.4.2.1-1 with the correct figure.
5. Clause number, declaration numbers are highlighted for future review when the numbers in spec are fixed.

# Reference

[1] R4-2017491, WF on detail aspects on IAB conformance testing, Nokia, Nokia Shanghai Bell

# TP for TS 38.176-1:

6.4 Transmit ON/OFF power

6.4.1 Transmitter OFF power

6.4.1.1 Definition and applicability

Transmit OFF power requirements apply to TDD operation of IAB-DU and TDD operation of IAB-MT.

Transmitter OFF power is defined as the mean power measured over 70/N us filtered with a square filter of bandwidth equal to the *transmission bandwidth configuration* of the IAB (BWConfig) centred on the assigned channel frequency during the *transmitter OFF period*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

For IAB-DU, for *multi-band connectors* and for *single band connectors* supporting transmission in multiple *operating bands*, the requirement is only applicable during the *transmitter OFF period* in all supported *operating bands*.

For IAB supporting intra-band contiguous CA, the transmitter OFF power is defined as the mean power measured over 70/N us filtered with a square filter of bandwidth equal to the *Aggregated IAB-DU/MT Channel Bandwidth* BWChannel\_CA centred on (Fedge,high+Fedge,low)/2 during the *transmitter OFF period*. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *Aggregated IAB-DU (IAB-MT) Channel Bandwidth*.

6.4.1.2 Minimum requirement

The minimum requirement for *IAB-DU type 1-H* is in TS 38.174 [x], clause 6.4.1.3.

The minimum requirement for *IAB-MT type 1-H* is in TS 38.174 [x], clause 6.4.1.4.

6.4.1.3 Test purpose

The purpose of this test is to verify the transmitter OFF power is within the limits of the minimum requirements.

6.4.1.4 Method of test

Requirement is tested together with transmitter transient period, as described in clause 6.4.2.4.

6.4.1.5 Test requirements

The conformance testing of transmit OFF power is included in the conformance testing of transmitter transient period; therefore, see clause 6.4.2.5 for test requirements.

6.4.2 Transmitter transient period

6.4.2.1 Definition and applicability

Transmitter transient period requirements apply to TDD operation of IAB-DU and TDD operation of IAB-MT.

The transmitter transient period is the time period during which the transmitter is changing from the transmitter OFF period to the transmitter ON period or vice versa. The transmitter transient period is illustrated in figure 6.4.2.1-1 for IAB-DU and IAB-MT.



**Figure 6.4.2.1-1: Example of relations between transmitter ON period, transmitter OFF period and transmitter transient period for IAB-DU and IAB-MT**

For IAB-DU type 1-H and IAB-MT type 1-H, this requirement shall be applied at each TAB connector supporting transmission in the operating band.

6.4.2.2 Minimum requirement

The minimum requirement for *IAB-DU type 1-H* is in TS 38.174 [x], clause 6.4.2.2.

The minimum requirement for *IAB-MT type 1-H* is in TS 38.174 [x], clause 6.4.2.3.

6.4.2.3 Test purpose

The purpose of this test is to verify the transmitter transient periods are within the limits of the minimum requirements.

6.4.2.4 Method of test

6.4.2.4.1 Initial conditions

Test environment:

* normal; see annex B.2.

RF channels to be tested for single carrier:

* M; see clause 4.9.1.

RF bandwidth positions to be tested for multi-carrier and/or CA:

* MRFBW in single-band operation, see clause 4.9.1;
* BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

6.4.2.4.2 Procedure

The minimum requirement is applied to all *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 for *IAB type 1-H*. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect *TAB connector* to measurement equipment as shown in annex D.3.1 for *IAB type 1-H*. All *TAB connectors* not under test shall be terminated.

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity, efficiency and avoiding e.g. carrier leakage, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

2) For single carrier set the *TAB connector* under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models or set of physical channels in clause 4.9.2 at manufacturers declared *rated carrier output power* per *TAB connector* (Prated,c,TABC, D.21).

For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

3) Measure the mean power spectral density over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the *TAB connector* centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period – 10 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

4) For a *TAB connector* supporting contiguous CA, measure the mean power spectral density over 70/N μs filtered with a square filter of bandwidth equal to the *aggregated IAB node channel bandwidth* BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period – 10 μs. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *aggregated IAB-DU channel bandwidth or aggregated IAB-MT channel bandwidth*.

In addition, for *multi-band connector(s)*, the following steps shall apply:

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

6.4.2.5 Test requirements

The measured mean power spectral density according to clause 6.4.2.4.2 shall be less than -83 dBm/MHz for carrier frequency f ≤ 3.0 GHz.

The measured mean power spectral density according to clause 6.4.2.4.2 shall be less than -82.5 dBm/MHz for carrier frequency 3.0 GHz < f ≤ 6.0 GHz.

For *multi-band connector*, the requirement is only applicable during the transmitter OFF period in all supported operating bands.