**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2104790**

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Title: TP for TS 38.176-2: OTA transmit ON/OFF power

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Agenda item: 5.3.2.4.1

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# Background

This contribution provides the TP for TS 38.176-2: Transmit ON/OFF power. According to the discussion in the previous meetings, TS 38.141-2 is taken as reference with the following modifications/clarifications.

1. Replace BS with IAB-DU and/or IAB-MT.
2. Replace 38.104 to 38.174.
3. Replace Figure 6.5.2.1-1 with the correct figure.
4. 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 38.176-2:

6.5 OTA transmit ON/OFF power

6.5.1 OTA transmitter OFF power

6.5.1.1 Definition and applicability

IAB nodeIAB nodeTransmit 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*.

6.5.1.2 Minimum requirement

The minimum requirement for *IAB-DU type 1-O* is in TS 38.174 [x], clause 9.5.2.2.

The minimum requirement for *IAB-DU type 2-O* is in TS 38.174 [x], clause 9.5.2.3.

The minimum requirement for *IAB-MT type 1-O* is in TS 38.174 [x], clause 9.5.2.4.

The minimum requirement for *IAB-MT type 2-O* is in TS 38.174 [x], clause 9.5.2.5.

6.5.1.3 Test purpose

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

6.5.1.4 Method of test

Requirement is tested together with transmitter transient period, as described in clause 6.5.2.4.

6.5.1.5 Test requirements

The conformance testing of transmit OFF power is included in the conformance testing of transmitter transient period; therefore, see clause 6.5.2.5 for test requirements.

6.5.2 OTA transmitter transient period

6.5.2.1 Definition and applicability

OTA transmitter OFF power is defined as the mean power measured over 70/N µs 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 supporting intra-band contiguous CA, the OTA 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* or *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 Channel Bandwidth*.

For *IAB type 1-O*, the transmitter OFF power is defined as the output power at the *co-location reference antenna* conducted output(s). For *IAB type 2-O* the transmitter OFF power is defined as TRP.

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

6.5.2.2 Minimum requirement

The minimum requirement for *IAB-DU type 1-O* is in TS 38.174 [x], clause 9.5.3.2.

The minimum requirement for *IAB-DU type 2-O* is in TS 38.174 [x], clause 9.5.3.3.

The minimum requirement for *IAB-MT type 1-O* is in TS 38.174 [x], clause 9.5.3.4.

The minimum requirement for *IAB-MT type 2-O* is in TS 38.174 [x], clause 9.5.3.5.

6.5.2.3 Test purpose

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

6.5.2.4 Method of test

6.5.2.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

*Base Station 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.

Directions to be tested:

- The requirement for *IAB type 1-O* is specified as co-location requirement. For general description of co-location requirements, refer to clause 4.12.

- The requirement for *IAB type 2-O* is verified by an EIRP measurement at a direction corresponding to the OTA peak directions set reference beam direction pair (D.8) for the beam identifier (D.3) which provides the highest intended EIRP.

6.5.2.4.2 Procedure

6.5.2.4.2.1 General procedure

1) Place the IAB node at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the IAB node with the test system.

6.5.2.4.2.2 *IAB-DU type 1-O and IAB-MT type 1-O*

3) Set the IAB node in the direction of the declared beam peak direction of thebeam direction pair, for the beam to be tested.

4) Place the *co-location test antenna* as specified in clause 4.12.

5) Configure the beam peak direction of the BS according to the declared beam direction pair.

6) Set the IAB node 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.

For a IAB node declared to be capable of multi-carrier and/or CA operation, use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2 on all carriers configured.

7) Measure the mean power spectral density at the output(s) of co-location test antenna as power sum over two orthogonal polarizations over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the IAB node 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.

8) For an IAB node supporting contiguous CA, measure the mean power spectral density at the output(s) of co-location test antenna as power sum over two orthogonal polarizations over 70/N μs filtered with a square filter of bandwidth equal to the *aggregated BS 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 BS channel bandwidth.*

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

9) For a *multi-band RIB* 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.

6.5.2.4.2.3 *IAB-DU type 2-O* and *IAB-MT type 2-O*

3) Set the IAB node in the direction of the declared beam peak direction of the *beam direction pair*, for the beam to be tested.

4) Set the IAB node to transmit according to the applicable test configuration in clause 4.8 using the corresponding test model NR- IAB-DU-FR2-TM1.1 or NR-IAB-MT-FR2-TM1.1 and set of physical channels in clause 4.9.2.

 For a IAB node declared to be capable of multi-carrier and/or CA operation, use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 using the corresponding test model NR- IAB-DU-FR2-TM1.1 or NR-IAB-MT-FR2-TM1.1 and set of physical channels in clause 4.9.2 on all carriers configured.

5) Measure the mean EIRP spectral density as the power sum over two orthogonal polarizations over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the NR BS 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 + 3 μs to 35/N μs before start of next transmitter ON period - 3 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

NOTE: Make sure that the measurement receiver is not overloaded.

6) For an IAB node supporting contiguous CA, measure the mean EIRP spectral density as the power sum over two orthogonal polarizations over 70/N μs filtered with a square filter of bandwidth equal to the *aggregated IAB-DU channel bandwidth* or *aggregated IAB-MT 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 + 3 μs to 35/N μs before start of next transmitter ON period – 3 μs. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *aggregated BS channel bandwidth.*

6.5.2.5 Test requirements

6.5.2.5.1 *IAB-DU type 1-O* and *IAB-MT type 1-O*

The mean power spectral density measured according to clause 6.5.2.4.2 shall be less than -102.6 dBm/MHz for carrier frequency f ≤ 3.0 GHz.

The mean power spectral density measured according to clause 6.5.2.4.2 shall be less than -102.4 dBm/MHz for carrier frequency 3.0 GHz < f ≤ 6.0 GHz.

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

6.5.2.5.2 *IAB-DU type 2-O* and *IAB-MT type 2-O*

The measured mean EIRP spectral density according to clause 6.5.2.4.2 shall be less than -33.1 + Prated,c,EIRP- Prated,c,TRP dBm/MHz for carrier frequency 24.15 GHz < f ≤ 29.5 GHz, where Prated,c,EIRP is the value declared for the *reference beam direction pair* (D.8) for the beam identifier (D.3) which provides the highest intended EIRP.

The measured mean EIRP spectral density according to clause 6.5.2.4.2 shall be less than -32.7 + Prated,c,EIRP- Prated,c,TRP dBm/MHz for carrier frequency 37 GHz < f ≤ 43.5 GHz, where Prated,c,EIRP is the value declared for the *reference beam direction pair* (D.8) for the beam identifier (D.3) which provides the highest intended EIRP.