**3GPP TSG-RAN WG4 Meeting#98-bis-e R4-2106597**

**E-meeting,12th April– 20th April, 2021**

**Agenda item: 5.3.2.3.1**

**Source: ZTE Corporation**

**Title: TP to TS 38.176-1: TX IMD requirements**

**Document for:** **Approval**

1. Introduction

In the past RAN4#98e meetings, work split has been agreed among companies, therefore in this contribution, we want to share the draft TP for section 6.7 Tx IMD requirements test for further discussion.

1. Reference

[1] R4-2103856 WF on IAB conformance specification work split and drafting guidelines, approved.

1. Annex

<Start of TP>

## 6.7 Transmitter intermodulation

### 6.7.1 Definition and applicability

The transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the antenna, RDN and antenna array. The requirement shall apply during the transmitter ON period and the *transmitter transient period*.

For *IAB type 1-H*, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *TAB connector*.

For *IAB type 1-H*, there are two types of transmitter intermodulation cases captured by the transmitter intermodulation requirement:

1) Co-location transmitter intermodulation in which the interfering signal is from a co-located base station.

2) Intra-system transmitter intermodulation in which the interfering signal is from other transmitter units within the *IAB type 1-H*.

For *IAB type 1-H*, the co-location transmitter intermodulation requirement is considered sufficient if the interference signal for the co-location requirement is higher than the declared interference signal for intra-system transmitter (D.30) intermodulation requirement.

### 6.7.2 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 and IAB-MT type 1-H* is defined in TS 38.174 [xx], clause 6.7.2.

### 6.7.3 Test purpose

The test purpose is to verify the ability of the transmitter units associated with the *single-band connectors* or *multi-band connector* under test to restrict the generation of intermodulation products in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna to below specified levels.

### 6.7.4 Method of test

#### 6.7.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

*IAB 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.

NOTE: When testing in M (or MRFBW), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or BRFBW) and T (or TRFBW), and only with the interferer located inside the supported frequency range.

#### 6.7.4.2 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* or *multi-band connector* under test to measurement equipment as shownin annex D.3.2 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) The measurement device characteristics shall be:

- Detection mode: True RMS.

3) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* Prated,c,TABC for *IAB type 1-H* (D.21). Channel set-up shall be according to IAB-DU-FR1-TM 1.1 for IAB-DU type 1-H and IAB-MT-FR1-TM 1.1 for IAB-MT type 1-H.

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 for IAB-DU type 1-H and in clause 4.9.x for IAB-MT type 1-H.

1. For IAB 1-H, generate the interfering signal according to IAB-DU-FR1-TM 1.1for IAB-DU and IAB-MT-FR1-TM 1.1 for IAB-MT, as defined in clause 4.9.2, with the minimum channel bandwidth (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 and a centre frequency offset from the lower/upper edge of the wanted signal or edge of sub-block inside a sub-block gap , for n = 1, 2 and 3, but exclude interfering frequencies that are outside of the allocated downlink operating band or interfering frequencies that are not completely within the sub-block gap or within the Inter RF Bandwidth gap.

5) Adjust ATT attenuator (as in the test setup in annex D.3.2 for *IAB type 1-H*) so that level of the interfering signal is as defined in clause 6.7.5.

6) Perform the unwanted emission tests specified in clauses 6.6.3 and 6.6.4 for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 6.6.3 and 6.6.4. The width of the intermodulation products shall be taken into account.

7) Perform the transmitter spurious emissions test as specified in clause 6.6.5, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 6.6.5. The width of the intermodulation products shall be taken into account.

8) Verify that the emission level does not exceed the required level in clause 6.7.5 with the exception of interfering signal frequencies.

9) Repeat the test for the remaining interfering signal centre frequency offsets according to step 4.

10) Repeat the test for the remaining test signals defined in clause 6.7.5 for additional requirements and for *IAB type 1-H* intra-system requirements.

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

11) For a *multi-band 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*.

NOTE: The third order intermodulation products are centred at 2F1±F2 and 2F2±F1. The fifth order intermodulation products are centred at 3F1±2F2, 3F2±2F1, 4F1±F2, and 4F2±F1 where F1 represents the test signal centre frequency or centre frequency of each sub-block and F2 represents the interfering signal centre frequency. The widths of intermodulation products are:

- (n\*BWF1 + m\* BWF2) for the nF1±mF2 products;

- (n\* BWF2 + m\* BWF1) for the nF2±mF1 products;

where BWF1 represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or sub-block bandwidth and BWF2 represents the interfering signal channel bandwidth.

### 6.7.5 Test requirements

#### 6.7.5.1 *IAB-DU type 1-H* and *IAB-MT type 1-H*

##### 6.7.5.1.1 Co-location minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3, 6.6.4 and 6.6.5 in the presence of an NR interfering signal according to table 6.7.5.1.1-1.

The requirement is applicable outside the *IAB RF Bandwidth edges*. The interfering signal offset is defined relative to the *IAB RF Bandwidth* *edges* or *Radio Bandwidth* edges.

For *TAB connectors* supporting operation in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block* edges.

For *multi-band connector*, the requirement shall apply relative to the *IAB RF Bandwidth* *edges* of each operating band. In case the inter RF Bandwidth gap is less than 3\*BWChannel MHz (where BWChannel is the minimal *IAB-DU channel bandwidth* and *IAB-MT channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the inter RF Bandwidth gap.

Table 6.7.5.1.1-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR single carrier, or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers |
| Interfering signal type | NR signal, the minimum *IAB-DU channel bandwidth* (BWChannel) or *IAB-MT channel bandwidth* (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5. |
| Interfering signal level | Rated total output power per *TAB connector* (Prated,t,TABC) in the *operating band* – 30 dB |
| Interfering signal centre frequency offset from the lower/upper edge of the wanted signal or edge of *sub-block* inside a gap | , for n=1, 2 and 3 |
| NOTE 1: Interfering signal positions that are partially or completely outside of any downlink *operating band* of the TAB connector are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink *operating bands* in the same geographical area.  NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79. | |

##### 6.7.5.1.2 Intra-system minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3 and 6.6.4 in the presence of an NR interfering signal according to table 6.7.5.1.2-1.

Table 6.7.5.1.2-1: Interfering and wanted signals for intra-system transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR signal |
| Interfering signal type | NR signal of the same *IAB-DU channel bandwidth or IAB-MT channel bandwidth* and SCS as the wanted signal (Note 1). |
| Interfering signal level | Power level declared by the IAB manufacturer (Note 2). |
| Frequency offset between interfering signal and wanted signal | 0 MHz |
| NOTE 1: The interfering signal shall be incoherent with the wanted signal.  NOTE 2: The declared interfering signal power level at each *TAB connector* is the sum of the co-channel leakage power coupled via the combined RDN and Antenna Array from all the other *TAB connectors*, but does not comprise power radiated from the Antenna Array and reflected back from the environment. The power at each of the interfering *TAB connectors* is Prated,c,TABC. | |

##### 6.7.5.1.3 Additional requirements

For Band n41 operation in Japan, the transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3, 6.6.4 and 6.6.5 in the presence of an NR interfering signal according to table 6.7.5.1.3-1.

Table 6.7.5.1.3-1 Interfering and wanted signals for the additional transmitter intermodulation requirement for Band n41

|  |  |
| --- | --- |
| Parameter | Value |
| Wanted signal | NR single carrier (NOTE) |
| Interfering signal type | NR signal of 10 MHz *channel bandwidth* |
| Interfering signal level | Rated total output power in the operating band – 30 dB |
| Interfering signal centre frequency offset from the lower/upper carrier centre frequency of the wanted signal | ± 5 MHz  ± 15 MHz  ± 25 MHz |
| NOTE: This requirement applies for NR carriers allocated within 2545-2645 MHz. | |

<End of TP>