**3GPP TSG-RAN WG4 Meeting #100-e R4-2115716**

**Electronic Meeting, 16th - 27th Aug, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.176-2** | **CR** | **-** | **rev** | **-** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | draftCR on IAB-MT radiated conformance testing (General and Demodulation) to TS 38.176-2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB-Perf | | | | |  | ***Date:*** | | | 2021-08-06 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Provide updated draft CR for NR IAB-MT radiated conformance testing (General and Demodulation) as per work split. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | For introducing IAB-MT radiated conformance testing (General and Demodulation), update clause 8.2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be inconsistence between the specification 38.176-2 and RAN 4 agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*<START OF THE CHANGE 1>*

## 8.2 IAB-MT performance requirements

### 8.2.1 General

#### 8.2.1.1 Scope and definitions

Radiated performance requirements specify the ability of the *IAB-MT type 1-O* and *IAB-MT type 2-O* to correctly demodulate signals in various conditions and configurations. Radiated performance requirements are specified at the RIB.

Radiated performance requirements for the IAB-MT are specified for the fixed reference channels defined in annex A and the propagation conditions in annex J. The requirements only apply to those FRCs that are supported by the IAB-MT.

The radiated performance requirements for *IAB-MT type 1-O* and for *IAB-MT type 2-O* are limited to two OTA *demodulations branches* as described in clause 8.1.1.2. Conformance requirements can only be tested for 1 or 2 *demodulation branches* depending on the number of polarizations supported by the IAB-MT, with the required SNR applied separately per polarization.

NOTE: IAB-MT can support more than 2 *demodulation branches*, however OTA conformance testing can only be performed for 1 or 2 *demodulation branches*.

The SNR used in this clause is specified based on a single carrier and defined as:

SNR = S / N

Where:

S is the total signal energy in the slot on a single *TAB connector* (for *IAB-MT type 1-H*).

N is the noise energy in a bandwidth corresponding to the transmission bandwidth over the duration of a slot on a single TAB connector (for *IAB-MT type 1-H*).

### 8.2.2 Demodulation performance requirements

#### 8.2.2.1 General

##### 8.2.2.1.1 Applicability rule for IAB-MT

8.2.2.1.1.1 General

Unless otherwise stated, for an IAB-MT declared to support more than 2 demodulation branches (for *IAB-MT type 1-O* and *IAB-MT type 2-O*), the performance requirement tests for 2 demodulation branches shall apply, and the mapping between connectors and demodulation branches is up to IAB-MT implementation.

The tests requiring more than [20] dB SNR level are set to N/A in the test requirements.

8.2.2.1.1.2 Applicability of requirements for different subcarrier spacings

Unless otherwise stated, the tests shall apply only for each subcarrier spacing declared to be supported (see D.7 in table 4.6-1).

8.2.2.1.1.3 Applicability of requirements for TDD with different UL-DL patterns

Unless otherwise stated, for each subcarrier spacing declared to be supported, if IAB-MT supports multiple TDD UL-DL patterns, only one of the supported TDD UL-DL patterns shall be used for all tests.

###### 8.2.2.1.1.4 Applicability of requirements for IAB-MT features

Unless otherwise stated, for *IAB type 1-O*, the PDSCH 256QAM tests (Test 1-1 of Clause 8.2.2.2.5.1) shall apply only for the 256QAM for PDSCH for FR1 declared to be supported (see D.200 in table 4.6-1, *pdsch-256QAM-FR1*).

Unless otherwise stated, for both *IAB type 1-O* and *IAB type 2-O*, the PDSCH tests shall apply only in case the PDSCH MIMO rank in the test case does not exceed the maximum number of PDSCH MIMO layers declared to be supported (see D.202 in table 4.6-1, *maxNumberMIMO-LayersPDSCH*).

Unless otherwise stated, for *IAB type 2-O*, the PDSCH tests shall apply only for the PT-RS option declared to be supported (see D.203 in table 4.6-1, *onePortsPTRS* (MSB)).

Note: Applicability information may be obtained based on vendor declaration (Section 4.6) or alternatively from reading capability signaling.

#### 8.2.2.2 Performance requirements for PDSCH

##### 8.2.2.2.1 Definition and applicability

The performance requirement of PDSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ re-transmissions.

Which specific test(s) are applicable to IAB-MT is based on the test applicability rules defined in clause 8.2.2.1.1.

##### 8.2.2.2.2 Minimum requirements

For *IAB type 1-O*, the minimum requirement is in TS 38.174 [2], clause 11.2.2.1.1.

For *IAB type 2-O*, the minimum requirement is in TS 38.174 [2], clause 11.2.2.2.1.

##### 8.2.2.2.3 Test purpose

The test shall verify the receiver's ability to achieve throughput under multipath fading propagation conditions for a given SNR.

##### 8.2.2.2.4 Method of test

8.2.2.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

RF channels to be tested for carrier aggregation: MBW Channel CA; see clause 4.9.1.

Direction to be tested: OTA REFSENS *receiver target reference direction* (see D.54 in table 4.6-1).

8.2.2.2.4.2 Test procedure

1) Place the IAB-MT with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex E.3.

2) Align the manufacturer declared coordinate system orientation of the IAB-MT with the test system.

3) Set the IAB-MT in the declared direction to be tested.

4) Connect the IAB-MT tester generating the wanted signal, multipath fading simulators and AWGN generators to a test antenna via a combining network in OTA test setup, as shown in annex E.3. Each of the demodulation branch signals should be transmitted on one polarization of the test antenna(s).

5) The characteristics of the wanted signal shall be configured according to the corresponding DL reference measurement channel defined in annex A, and according to additional test parameters listed in table 8.2.2.2.4.2-1.

Table: 8.2.2.2.4.2-1 Test parameters for testing PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **IAB type 1-O** | **IAB type 2-O** |
| Cyclic prefix | | Normal | Normal |
| Default TDD UL-DL pattern (Note) | | 7D1S2U, S=6D:4G:4U | 3D1S1U, S=10D:2G:2U |
| HARQ | Maximum number of HARQ transmissions | 4 | 4 |
| RV sequence | 0, 2, 3, 1 | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 | 1 |
| DM-RS duration | single-symbol DM-RS | single-symbol DM-RS |
| DM-RS position (*l0*) | 2 | 2 |
| Additional DM-RS position | pos1 | pos1 |
| Number of DM-RS CDM group(s) without data | 1 for Rank 1 and Rank 2 tests 2 for Rank 3 and Rank 4 tests | 1 |
| DM-RS port(s) | {1000} for Rank 1 tests {1000-1001} for Rank 2 tests {1000-1002} for Rank 3 tests {1000-1003} for Rank 4 tests | {1000} for Rank 1 tests {1000-1001} for Rank 2 tests |
| DM-RS sequence generation | NID0=0 | NID0=0 |
| Time domain resource assignment | PDSCH mapping type | A | A |
| Start symbol | 2 | 1 |
| Allocation length | 12 | 13 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth | Full applicable test bandwidth |
| PT-RS configuration | Frequency density (*KPT-RS*) | Not configured | 2 |
| Time density (*LPT-RS*) | 1 |
| PRB bundling size | | 2 | 2 |
| VRB-to-PRB mapping type | | Not interleaved | Not interleaved |
| PDSCH & PDSCH DMRS Precoding configuration | | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with PRB bundling granularity | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with PRB bundling granularity |
| Note: The same requirements are applicable to TDD with different UL-DL patterns. | | | |

6) The multipath fading emulators shall be configured according to the corresponding channel model defined in annex J.

7) Adjust the test signal mean power so the calibrated radiated SNR value at the IAB-MT receiver is as specified in clause 8.2.2.2.5.1 and 8.2.2.2.5.2 for *IAB type 1-O* and *IAB type 2-O* respectively, and that the SNR at the IAB receiver is not impacted by the noise floor.

The power level for the transmission may be set such that the AWGN level at the RIB is equal to the AWGN level in table 8.2.2.2.4.2-2.

Table 8.2.2.2.4.2-2: AWGN power level at the IAB-MT input

|  |  |  |  |
| --- | --- | --- | --- |
| **IAB type** | **Sub-carrier spacing (kHz)** | **Channel bandwidth (MHz)** | **AWGN power level** |
| IAB type 1-O | 30 | 40 | -77.2 - ΔOTAREFSENS dBm / 38.16 MHz |
| IAB type 2-O | 60 | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 47.52 MHz |
| 120 | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz |
| NOTE 1: ΔOTAREFSENS as declared in D.53 in table 4.6-1 and clause 7.1.  NOTE 2: ΔFR2\_REFSENS = -3 dB as described in clause 7.1, since the OTA REFSENS reference direction (as declared in D.54 in table 4.6-1) is used for testing.  NOTE 3: EISREFSENS\_50M as declared in D.28 in table 4.6-1. | | | |

8) For reference channels applicable to the IAB, measure the throughput.

##### 8.2.2.2.5 Test requirements

8.2.2.2.5.1 Test requirement for *IAB type 1-O*

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in Tables 8.2.2.2.5.1-1 and 8.2.2.2.5.1-2 at the given SNR with the test parameters stated in Table 8.2.2.2.4.2-1.

Table 8.2.2.2.5.1-1: Minimum requirements for PDSCH Type A with Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **FRC (Annex A)** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Fraction of maximum throughput (%)** | **SNR**  **(dB)** |
| 1-1 | M-FR1-A.3.3-1 | 40/30 | TDLA30-10 | 2x2, ULA Low | 70 | 26.3 |
| 1-2 | M-FR1-A.3.1-1 | 40/30 | TDLA30-10 | 2x2, ULA Low | 30 | 3.2 |

Table 8.2.2.2.5.1-2: Minimum requirements for PDSCH Type A with Rank 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **FRC (Annex A)** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Fraction of maximum throughput (%)** | **SNR**  **(dB)** |
| 2-1 | M-FR1-A.3.2-1 | 40/30 | TDLA30-10 | 2x2, ULA Low | 70 | 20.8 |

8.2.2.2.5.2 Test requirement for *IAB type 2-O*

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in Tables 8.2.2.2.5.2-1 and 8.2.2.2.5.2-2 at the given SNR with the test parameters stated in Table 8.2.2.2.4.2-1.

Table 8.2.2.2.5.2-1: Minimum requirements for PDSCH Type A with Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **FRC (Annex A)** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Fraction of maximum throughput (%)** | **SNR**  **(dB)** |
| 1-1 | M-FR2-A.3.1-1 | 100/120 | TDLA30-75 | 2x2, ULA Low | 30 | 4.1 |
| 1-2 | M-FR2-A.3.2-1 | 100/120 | TDLA30-75 | 2x2, ULA Low | 70 | 13.5 |

Table 8.2.2.2.5.2-2: Minimum requirements for PDSCH Type A with Rank 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **FRC (Annex A)** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Fraction of maximum throughput (%)** | **SNR**  **(dB)** |
| 2-1 | M-FR2-A.3.1-2 | 100/120 | TDLA30-75 | 2x2, ULA Low | 70 | 15.9 |
| 2-2 | M-FR2-A.3.1-3 | 50/60 | TDLA30-75 | 2x2, ULA Low | 70 | 16.0 |
| 2-3 | M-FR2-A.3.2-2 | 100/120 | TDLA30-75 | 2x2, ULA Low | 70 | 20.3 |

#### 8.2.2.3 Demodulation performance requirements for PDCCH

##### 8.2.2.3.1 Definition and applicability

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

Which specific test(s) are applicable to IAB-MT is based on the test applicability rules defined in clause 8.2.2.1.1.

##### 8.2.2.3.2 Minimum requirement

For *IAB type 1-O*, the minimum requirement is in TS 38.174 [2], clause 11.2.2.1.2.

For *IAB type 2-O*, the minimum requirement is in TS 38.174 [2], clause 11.2.2.2.2.

##### 8.2.2.3.3 Test purpose

The test shall verify the receiver's ability to detect the Downlink Scheduling Grant (Pm-dsg) under multipath fading propagation conditions for a given SNR.

##### 8.2.2.3.4 Method of test

8.2.2.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

RF channels to be tested for carrier aggregation: MBW Channel CA; see clause 4.9.1.

Direction to be tested: OTA REFSENS *receiver target reference direction* (see D.54 in table 4.6-1).

8.2.2.3.4.2 Test procedure

1) Place the IAB-MT with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex E.3.

2) Align the manufacturer declared coordinate system orientation of the IAB-MT with the test system.

3) Set the IAB-MT in the declared direction to be tested.

4) Connect the IAB-MT tester generating the wanted signal, multipath fading simulators and AWGN generators to a test antenna via a combining network in OTA test setup, as shown in annex E.3. Each of the demodulation branch signals should be transmitted on one polarization of the test antenna(s).

5) The characteristics of the wanted signal shall be configured according to the corresponding DL reference measurement channel defined in annex A, and according to additional test parameters listed in table 8.2.2.3.4.2-1.

Table: 8.2.2.3.4.2-1 Test parameters for testing PDSCH

|  |  |  |
| --- | --- | --- |
| **Parameter** | **IAB type 1-O** | **IAB-type 2-O** |
| Cyclic prefix | Normal | Normal |
| Default TDD UL-DL pattern (Note) | 7D1S2U, S=6D:4G:4U | 3D1S1U, S=10D:2G:2U |
| DM-RS sequence generation | NID=0 | NID=0 |
| Frequency domain resource allocation for CORESET | Start from RB = 0 with contiguous RB allocation | Start from RB = 0 with contiguous RB allocation |
| CCE to REG mapping type | Interleaved | Interleaved |
| Interleaver size | 3 | 3 for test with aggregation level 2, 8 2 for test with aggregation level 4 |
| REG bundle size | 2 for test with aggregation level 2, 4  6 for test with aggregation level 8 | 2 for test with aggregation level 2, 8 6 for test with aggregation level 4 |
| Shift Index | 0 | 0 |
| Slots for PDCCH monitoring | Each slot | Each slot |
| Number of PDCCH candidates for the tested aggregation level | 1 | 1 |
| PDCCH Precoding configuration | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 |
| Note: The same requirements are applicable to TDD with different UL-DL patterns. | | |

6) The multipath fading emulators shall be configured according to the corresponding channel model defined in annex J.

7) Adjust the test signal mean power so the calibrated radiated SNR value at the IAB-MT receiver is as specified in clause 8.2.2.3.5.1 and 8.2.2.3.5.2 for *IAB type 1-O* and *IAB type 2-O* respectively, and that the SNR at the IAB receiver is not impacted by the noise floor.

The power level for the transmission may be set such that the AWGN level at the RIB is equal to the AWGN level in table 8.2.2.3.4.2-2.

Table 8.2.2.3.4.2-2: AWGN power level at the IAB-MT input

|  |  |  |  |
| --- | --- | --- | --- |
| **IAB type** | **Sub-carrier spacing (kHz)** | **Channel bandwidth (MHz)** | **AWGN power level** |
| IAB type 1-O | 30 | 40 | -77.2 - ΔOTAREFSENS dBm / 38.16 MHz |
| IAB type 2-O | 60 | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 47.52 MHz |
| 120 | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz |
| NOTE 1: ΔOTAREFSENS as declared in D.53 in table 4.6-1 and clause 7.1.  NOTE 2: ΔFR2\_REFSENS = -3 dB as described in clause 7.1, since the OTA REFSENS reference direction (as declared in D.54 in table 4.6-1) is used for testing.  NOTE 3: EISREFSENS\_50M as declared in D.28 in table 4.6-1. | | | |

8) For reference channels applicable to the IAB, measure the miss-detection of the Downlink Scheduling Grant (Pm-dsg).

##### 8.2.2.3.5 Test requirements

8.2.2.3.5.1 Test requirement for *IAB type 1-O*

The Pm-dsg shall be equal to or smaller than 1%, for the cases stated in Table 8.2.2.3.5.1-1 at the given SNR with the test parameters stated in Table 8.2.2.3.4.2-1.

Table 8.2.2.3.5.1-1: Minimum requirements for PDCCH

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **FRC (Annex A)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Pm-dsg (%)** | **SNR**  **(dB)** |
| 1 | 40/30 | 102 | 1 | 2 | M-FR1-A.3.4-1 | TDLA30-10 | 1x2, ULA Low | 1 | 7.9 |
| 2 | 40/30 | 102 | 1 | 4 | M-FR1-A.3.4-1 | TDLA30-10 | 1x2, ULA Low | 1 | 5.8 |
| 3 | 40/30 | 90 | 1 | 8 | M-FR1-A.3.4-1 | TDLA30-10 | 2x2, ULA Low | 1 | 0.3 |

8.2.2.3.5.2 Test requirement for IAB type 2-O

The Pm-dsg shall be equal to or smaller than 1%, for the cases stated in Table 8.2.2.3.5.2-1 at the given SNR with the test parameters stated in Table 8.2.2.3.4.2-1.

Table 8.2.2.3.5.2-1: Minimum requirements for PDCCH

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **FRC (Annex A)** | **Propagation conditions (Annex J)** | **Antenna configuration** | **Pm-dsg (%)** | **SNR**  **(dB)** |
| 1 | 100/120 | 60 | 1 | 2 | M-FR2-A.3.4-1 | TDLA30-75 | 1x2, ULA Low | 1 | 8.1 |
| 2 | 100/120 | 60 | 1 | 4 | M-FR2-A.3.4-2 | TDLA30-75 | 1x2, ULA Low | 1 | 4.6 |
| 3 | 100/120 | 60 | 1 | 8 | M-FR2-A.3.4-3 | TDLA30-75 | 2x2, ULA Low | 1 | 1.9 |

*<END OF THE CHANGE 1>*