**3GPP TSG-RAN WG4 Meeting #100-e R4-2113801**

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

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.176-1** | **CR** | **-** | **rev** | **-** | **Current version:** | **16.0.0** |  |
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| *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 conducted conformance testing (CSI reporting and Interworking) to TS 38.176-1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***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 conducted conformance testing (CSI reporting and Interworking) as per work split. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | For introducing IAB-MT conducted conformance testing (CSI reporting and Interworking), update clause 8.2.3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be inconsistence between the specification 38.176-1 and RAN 4 agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.2.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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>*

### 8.2.3 CSI reporting requirements

#### 8.2.3.1 General

##### 8.2.3.1.1 Applicability rule for IAB-MT

###### 8.2.3.1.1.1 General

Unless otherwise stated, for an IAB-MT declared to support more than 4 *TAB connectors* (for *IAB type 1-H*), the performance requirement tests for 4 RX antennas shall apply, and the specific connectors used for testing is up to IAB-MT implementation.

Testing of performance requirements for RI and PMI reporting is optional.

###### 8.2.3.1.1.2 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.14 in table 4.6-1).

###### 8.2.3.1.1.3 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.

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

Unless otherwise stated, for *IAB type 1-H*, the CSI reporting tests shall apply only in case the number of NZP-CSI-RS ports in the test case satisfies maximum number of ports across all configured NZP-CSI-RS resources per CC declared to be supported (see D.201 in table 4.6-1).

Unless otherwise stated, for *IAB type 1-H*, the CSI reporting 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).

#### 8.2.3.2 Reporting Channel Quality Indicator (CQI)

##### 8.2.3.2.1 Definition and applicability

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [24]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

Which specific test(s) are applicable to IAB-MT is based on the test applicability rules defined in clause 8.2.1.2.

##### 8.2.3.2.2 Minimum requirement

The minimum requirement is in TS 38.174 [2] clause 8.2.3.1.

##### 8.2.3.2.3 Test purpose

The test shall verify the receiver's ability to report CQI values accordance with the CQI definition given in TS 38.214 [24].

##### 8.2.3.2.4 Method of test

8.2.3.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

8.2.3.2.4.2 Test procedure

1) Connect the IAB-MT tester generating the wanted signal and AWGN generators to all IAB-MT antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6.

2) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.3.2.4.2-1.

Table 8.2.3.2.4.2-1: AWGN power level at the IAB-MT input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 30 kHz | 40 | -77.2 dBm / 38.16MHz |

3) The characteristics of the wanted signal shall be configured according to the corresponding DL reference measurement channel defined in annex A and the test parameters in table 8.2.3.2.4.2-2.

Table 8.2.3.2.4.2-2: Test parameters for testing CQI reporting

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 40 | | | |
| Subcarrier spacing | | kHz | 30 | | | |
| Default TDD UL-DL pattern (Note 1) | |  | 7D1S2U, S=6D:4G:4U | | | |
| SNR | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | |  | AWGN | | | |
| Antenna configuration | |  | 2x4 | | | |
| Beamforming Model | |  | As specified in Annex J.3 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | | | |
| Number of CSI-RS ports (*X*) |  | 2 | | | |
| CDM Type |  | FD-CDM2 | | | |
| Density (ρ) |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 | | | |
| NZP CSI-RS-timeConfig periodicity and offset | slot | 10/1 | | | |
| ReportConfigType | |  | Periodic | | | |
| CQI-table | |  | Table 2 | | | |
| reportQuantity | |  | cri-RI-PMI-CQI | | | |
| cqi-FormatIndicator | |  | Wideband | | | |
| pmi-FormatIndicator | |  | Wideband | | | |
| Sub-band Size | | RB | 16 | | | |
| Csi-ReportingBand | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | slot | 10/9 | | | |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| RI Restriction |  | N/A | | | |
| CQI/RI/PMI delay | | ms | 9.5 | | | |
| Maximum number of HARQ transmission | |  | 1 | | | |
| Measurement channel | |  | M-FR1-A.3.5-2 | | | |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern. | | | | | | |

4) Adjust the equipment so that required SNR specified in table 8.2.3.2.4.2-2 is achieved at the IAB-MT input.

5) For each test specified in table 8.2.3.2.4.2-2 applicable for the IAB-MT, measure the median CQI and the BLER at median CQI and (median CQI+1 or median CQI-1) as per clause 8.2.3.2.5.

##### 8.2.3.2.5 Test requirement

For the parameters specified in Table 8.2.3.2.4.2-2, and using the downlink physical channels specified in Annex A, the test requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of ±1 of the reported median more than 90% of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

#### 8.2.3.3 Reporting of Precoding Matrix Indicator (PMI)

##### 8.2.3.3.1 Definition and applicability

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reported PMI compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated with equal probability of each applicable i1 and i2 combination and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 1 with higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio:



In the definition of **, for 4TX and 8TX PMI requirements, is 90 % of the maximum throughput obtained at  using the precoders configured according to the UE reports, and is the throughput measured at with random precoding.

##### 8.2.3.3.2 Minimum requirement

The minimum requirement is in TS 38.174 [2] clause 8.2.3.2.

##### 8.2.3.3.3 Test purpose

The test shall verify the receiver's ability to achieve throughput gain under multipath fading propagation conditions using reporting PMI comparing to using random PMI.

##### 8.2.3.3.4 Method of test

8.2.3.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

8.2.3.3.4.2 Test procedure

1) Connect the IAB-MT tester generating the wanted signal and AWGN generators to all IAB-MT antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6.

2) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.3.3.4.2-1.

Table 8.2.3.3.4.2-1: AWGN power level at the IAB-MT input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 30 kHz | 40 | -77.2 dBm / 38.16MHz |

3) The characteristics of the wanted signal shall be configured according to the corresponding DL reference measurement channel defined in annex A and the test parameters in table 8.2.3.3.4.2-2.

Table 8.2.3.3.4.2-2: Test parameters for testing PMI reporting

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 |
| Bandwidth | | MHz | 40 | 40 |
| Subcarrier spacing | | kHz | 30 | 30 |
| Default TDD UL-DL pattern (Note 1) | |  | 7D1S2U, S=6D:4G:4U | 7D1S2U, S=6D:4G:4U |
| Propagation channel | |  | TDLA30-5 | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 4  (N1,N2) = (2,1) | High XP 8 x 4  (N1,N2) = (4,1) |
| Beamforming Model | |  | As specified in Annex J.3 | As specified in Annex J.3 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 | 8 |
| CDM Type |  | FD-CDM2 | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 4, (0,-) | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (5,-) |
| NZP CSI-RS-timeConfig periodicity and offset | slot | 10/1 | 10/1 |
| ReportConfigType | |  | Periodic | Periodic |
| CQI-table | |  | Table 1 | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| cqi-FormatIndicator | |  | Wideband | Wideband |
| pmi-FormatIndicator | |  | Wideband | Wideband |
| Sub-band Size | | RB | 16 | 16 |
| csi-ReportingBand | |  | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | slot | 10/9 | 10/9 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) | (4,1) |
| CodebookSubsetRestriction |  | 11111111 | 0x FFFF |
| RI Restriction |  | 00000001 | 00000010 |
| CQI/RI/PMI delay | | ms | 5.5 | 6.5 |
| Maximum number of HARQ transmission | |  | 4 | 4 |
| Measurement channel | |  | M-FR1-A.3.5-5 | M-FR1-A.3.5-6 |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern.  Note 2: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i1, i2 combination.  Note 3: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4) for Test 1 or slot#(n-6) for Test 2, this reported PMI cannot be applied at the gNB downlink before slot#(n+4) for Test 1 or slot#(n+6) for Test 2 respectively.  Note 4: Randomization of the principle beam direction shall be used as specified in Annex F.2.4.2.4. | | | | |

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

5) Adjust the equipment so that required SNR specified in clause 8.2.3.3.1 is achieved at the IAB-MT input.

6) For each test specified in table 8.2.3.3.4.2-2 applicable for the IAB-MT, calculate **.

##### 8.2.3.3.5 Test requirement

For the parameters specified in Table 8.2.3.3.4.2-2, and using the downlink physical channels specified in Annex A, the test requirements are specified in Table 8.2.3.3.5-1.

Table 8.2.3.3.5-1 Test requirements for PMI reporting

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Test 1** | **Test 2** |
| ** | 1.29 | 1.49 |

#### 8.2.3.4 Reporting of Rank Indicator (RI)

##### 8.2.3.4.1 General

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

##### 8.2.3.4.2 Minimum requirements

The minimum requirement is in TS 38.174 [2] clause 8.2.3.3.

##### 8.2.3.4.3 Test purpose

The test shall verify the receiver's ability to report rank indicator accurately represents the channel rank.

##### 8.2.3.4.4 Method of test

8.2.3.4.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

8.2.3.4.4.2 Test procedure

1) Connect the IAB-MT tester generating the wanted signal and AWGN generators to all IAB-MT antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6.

2) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.3.4.4.2-1.

Table 8.2.3.4.4.2-1: AWGN power level at the IAB-MT input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 30 kHz | 40 | -77.2 dBm / 38.16MHz |

3) The characteristics of the wanted signal shall be configured according to the corresponding DL reference measurement channel defined in annex A and the test parameters in table 8.2.3.4.4.2-2.

Table 8.2.3.4.4.2-2: Test parameters for testing RI reporting

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | Test 4 |
| Bandwidth | | MHz | 40 | 40 | 40 | 40 |
| Subcarrier spacing | | kHz | 30 | 30 | 30 | 30 |
| Default TDD UL-DL pattern (Note 1) | |  | 7D1S2U, S=6D:4G:4U | 7D1S2U, S=6D:4G:4U | 7D1S2U, S=6D:4G:4U | 7D1S2U, S=6D:4G:4U |
| SNR | |  | -2 | 16 | 16 | 22 |
| Propagation channel | |  | TDLA30-5 | TDLA30-5 | TDLA30-5 | TDLA30-5 |
| Antenna configuration | |  | ULA Low 2x4 | ULA Low 2x4 | ULA High 2x4 | ULA Low 4x4 |
| Beamforming Model | |  | As specified in Annex J.3 | As specified in Annex J.3 | As specified in Annex J.3 | As specified in Annex J.3 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (X) |  | 2 | 2 | 2 | 4 |
| CDM Type |  | FD-CDM2 | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) |  | 1 | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 3 (6,-) | Row 3 (6,-) | Row 3 (6,-) | Row 4 (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (13,-) | (13,-) | (13,-) |
| NZP CSI-RS-timeConfig periodicity and offset | slot | 10/1 | 10/1 | 10/1 | 10/1 |
| ReportConfigType | |  | Periodic | Periodic | Periodic | Periodic |
| CQI-table | |  | Table 2 | Table 2 | Table 2 | Table 2 |
| reportQuantity | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| cqi-FormatIndicator | |  | Wideband | Wideband | Wideband | Wideband |
| pmi-FormatIndicator | |  | Wideband | Wideband | Wideband | Wideband |
| Sub-band Size | | RB | 16 | 16 | 16 | 16 |
| csi-ReportingBand | |  | 1111111 | 1111111 | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | slot | 10/9 | 10/9 | 10/9 | 10/9 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A | (2,1) |
| CodebookSubsetRestriction |  | 010000 for fixed rank 2,  010011 for following rank | 000011 for fixed rank 1,  010011 for following rank | 000011 for fixed rank 1,  010011 for following rank | 11111111 |
| RI Restriction |  | N/A | N/A | N/A | 00000010 for fixed Rank 2 and 00001111 for follow RI |
| CQI/RI/PMI delay | | ms | 9.5 | 9.5 | 9.5 | 9.5 |
| Maximum number of HARQ transmission | |  | 1 | 1 | 1 | 1 |
| RI Configuration | |  | Fixed RI = 2 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 2 and follow RI |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern.  Note 2: Measurements channels are specified in Table A.3.5-1. M-FR1-A.3.5-1 is used for Rank 1 case. M-FR1-A.3.5-2 is used for Rank 2 case. M-FR1-A.3.5-3 is used for Rank 3 case. M-FR1-A.3.5-4 is used for Rank 4 case. | | | | | | |

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

5) Adjust the equipment so that required SNR specified in Table 8.2.3.4.4.2-2 is achieved at the IAB-MT input.

6) For each test specified in table 8.2.3.4.4.2-2 applicable for the IAB-MT, calculate **.

##### 8.2.3.4.5 Test requirement

The test requirement for RI reporting is defined as

a) The ratio of the throughput obtained when transmitting based on IAB-MT reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ ;

b) The ratio of the throughput obtained when transmitting based on IAB-MT reported RI and that obtained when transmitting with fixed rank 2 shall be ≥ ;

For the parameters specified in Table 8.2.3.4.4.2-2 and using the downlink physical channels specified in Annex A, the test requirements are specified in Table 8.2.3.4.5-1.

Table 8.2.3.4.5-1 Test requirements for RI reporting

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **1 | N/A | 1.05 | 0.9 | N/A |
| **2 | 0.9 | N/A | N/A | 0.9 |

*<END OF THE CHANGE 1>*