**3GPP TSG-RAN WG4 Meeting #** **98bis-e R4-2104928**

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

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.174** | **CR** |  | **rev** | **1** | **Current version:** | **16.1.0** |  |
|  | | | | | | | | |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <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:*** | [draft CR] Test cases for Beam Failure Detection and Link Recovery with CSI-RS in FR1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB-Perf | | | | |  | ***Date:*** | | | 2021-04-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The test cases for Beam Failure Detection and Link Recovery with CSI-RS in FR1 need to be specified in TS 38.174. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add the test case for Beam Failure Detection and Link Recovery with CSI-RS in FR1 according to the corresponding core requirements in clause 12.3.2.3 and 12.3.2.6 in TS 38.174. A new Annex (G) is created for the test cases. Content is added to G.2.3.2.2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The test cases are missing from the specification and the functions of IAB-MTs cannot be guaranteed. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | G.2.3.2.2 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

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| --- | --- |
| ***This CR's revision history:*** | Revised from R4-2104928. |

*<start of the change 1>*

### G.2.3.2.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR

#### G.2.3.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the IAB-MT properly detects CSI-RS-based beam failure in the set q0 configured for a serving cell and that the IAB-MT performs correct CSI-RS-based link recovery based on beam candicate set q1. The purpose is to test the downlink monitoring for beam failure detection within the IAB-MTs active DL BWP, during the evaluation period, and link recovery. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 12.3.2.

The test parameters are given in Tables G.2.3.2.2.1-1, G.2.3.2.2.1-2 and G.2.3.2.2.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure G.2.3.2.2.1-1 shows the variation of the downlink SNR of the CSI-RS in set q0 in the active cell to emulate CSI-RS based beam failure. Figure G.2.3.2.2.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the IAB-MT shall be fully synchronized to cell 1. The IAB-MT shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms.

Table G.2.3.2.2.1-1: Supported test configurations for FR1 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth |
| 2 | TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth |
| Note: The IAB-MT is only required to pass in one of the supported test configurations in FR1 | |

Table G.2.3.2.2.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | Comment |
|  | | | |  | Test 1 |  |
| Active PCell | | | |  | Cell 1 |  |
| RF Channel Number | | | |  | 1 |  |
| Duplex mode | Config 1, 2 | | |  | TDD |  |
| CORESET Reference Channel | Config 1 | | |  | CR.1.1 TDD |  |
|  | Config 2 | | |  | CR.2.1 TDD |  |
| SSB Configuration | Config 1 | | |  | SSB.1 FR1 |  |
|  | Config 2 | | |  | SSB.2 FR1 |  |
| SMTC Configuration | Config 1 | | |  | SMTC.1 | G.1.6 |
|  | Config 2 | | |  | SMTC.1 |  |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | |  | 15 KHz |  |
|  | Config 2 | | |  | 30 KHz |  |
| csi-RS-Index assigned as beam failure detection RS in set q0 | | | |  | 0 |  |
| OCNG parameters | | | |  | OP.1 | G.1.2.1 |
| CP length | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | | |  | 1-0 |  |
|  | Number of Control OFDM symbols | | |  | 2 |  |
|  | Aggregation level | | | CCE | 8 |  |
|  | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
|  | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
|  | DMRS precoder granularity | | |  | REG bundle size |  |
|  | REG bundle size | | |  | 6 |  |
| Gap pattern ID | | | |  | N.A. |  |
| csi-RS-Index assigned as candidate beam detection RS in set q1 | | | |  | 1 | N |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the IAB-MT applies the value 0. (Table 8.1.1-1of TS 38.133). |
| rsrp-ThresholdSSB | | Config 1 | | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
|  | | Config 2 | |  | -95 |  |
| powerControlOffsetSS | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | |  | n1 | see clause 5.17 of TS 38.321 [14] |
| beamFailureDetectionTimer | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [14] |
| CSI-RS configuration for q0 and q1 | | | Config 1 |  | CSI-RS.1.2 TDD |  |
|  | | | Config 2 | CSI-RS.2.2 TDD |  |
| CSI-RS configuration for CSI reporting | | | Config 1 |  | CSI-RS.1.1 TDD |  |
|  | | | Config 2 |  | CSI-RS.2.1 TDD |  |
| TRS configuration | | | Config 1 |  | TRS.1.1 TDD |  |
|  | | | Config 2 |  | TRS.1.2 TDD |  |
| CSI-RS-Index assigned as RLM RS | | | Config 1 |  | CSI-RS.1.2 TDD |  |
|  | | | Config 2 |  | CSI-RS.2.2 TDD |  |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 0.2 | During this time the the IAB-MT shall be fully synchronized to cell 1 |
| T2 | | | | s | 0.18 |  |
| T3 | | | | s | 0.14 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 0.08 |  |
| D1 | | | | s | 0.04 |  |
| Note 1: IAB-MT-specific PDCCH is not transmitted after T1 starts. | | | | | | |

Table G.2.3.2.2.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB |  | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB |  | | | | |
| EPRE ratio of PSS to SSS | | dB |  | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB |  | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |  | | | | |
| EPRE ratio of OCNG DMRS to SSS | | dB |  | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | dB |  | | | | |
| SNR\_CSI-RS of set q0 | Config 1 | dB | 5 | -3 | -12 | -12 | -12 |
|  | Config 2 |  | 5 | -3 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | -10 | -10 | 10 | 10 | 10 |
|  | Config 2 |  | -10 | -10 | 10 | 10 | 10 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS kHz | -108 | -108 | -88 | -88 | -88 |
|  | Config 2 |  | -105 | -105 | -85 | -85 | -85 |
|  | Config 1 | dBm/15 KHz | -98 | | | | |
|  | Config 2 |  | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the IAB-MT prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the IAB-MT prior to the start of time period T1.  Note 4: Void  Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.  Note 6: The signal contains PDCCH for IAB-MTs other than the device under test as part of OCNG.  Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure G.2.3.2.2.1-1.  Note 9: The SNR values are specified for testing a IAB-MT which supports 2RX on at least one band. For testing of a IAB-MT which supports 4RX on all bands, the SNR during T3 is modified as specified in clause G.1.3. | | | | | | | |



**Figure G.2.3.2.2.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing**

#### G.2.3.2.2.2 Test Requirements

The IAB-MT behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the IAB-MT shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the IAB-MT measures and evaluate beam candidate from beam candidate set q1.

No later than time point F occurring no later than D1 = 30+10 ms after the start of T5, the IAB-MT shall transmit preamble on a beam associated with the candidate beam set q1. The IAB-MT shall not transmit preamble on a beam associated with the candidate beam set q1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the IAB-MT. The rate of correct events observed during repeated tests shall be at least 90%.

*<end of the change 1>*