**3GPP TSG-RAN4 Meeting #104-bis-e *R4-2215419***

**Electronic Meeting, October 10th - October 19th, 2022**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **Draft** | **rev** | **-** | **Current version:** | **17.7.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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 | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Draft CR on test cases for beam failure detection and link recovery for extending NR operation to 71GHz | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CATT | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Perf | | | | |  | ***Date:*** | | | 2022-09-26 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Current specification has not inlcuded test cases for beam failure detection and link recovery for 71GHz | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add test cases on test cases for beam failure detection and link recovery for 71GHz | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No test cases on beam failure detection and link recovery for 71GHz | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | New A.14.5.5.X1, A.14.5.5.X2, A.14.5.5.X3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

<Start of Changes>

### A.14.5.5 Beam Failure Detection and Link recovery procedures

#### A.14.5.5.X1 Beam Failure Detection and Link Recovery Test for FR2-2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

##### A.14.5.5.X1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q0 configured for a serving cell and that the UE 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 UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2-2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.14.5.5.X1.1-1, A.14.5.5.X1.1-2, and A.14.5.5.X1.1-3 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 A.14.5.5.X1.1-1 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 A.14.5.5.X1.1-1 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 UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.14.5.5.X1.1-1: Supported test configurations for FR2-2 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 2 | TDD duplex mode, 480 kHz SSB SCS, 400 MHz bandwidth |
| 3 | TDD duplex mode, 960 kHz SSB SCS, 400 MHz bandwidth |

Table A.14.5.5.X1.1-2: General test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active PCell | | 1,2,3 |  | Cell 1 |  |
| RF Channel Number | | 1,2,3 |  | 1 |  |
| Duplex mode | | 1,2,3 |  | TDD |  |
| TDD Configuration | | 1,2,3 |  | TDDConf.3.1 |  |
| BWchannel | | 1 |  | 100: NRB,c = 66 |  |
| 2 |  | 400: NRB,c = 66 |  |
| 3 |  | 400: NRB,c = 33 |  |
| Data RBs allocated | | 1 |  | 66 |  |
| 2 |  | 66 |  |
| 3 |  | 33 |  |
| PDSCH/PDCCH subcarrier spacing | | 1 | kHz | 120 |  |
| 2 | kHz | 480 |  |
| 3 | kHz | 960 |  |
| DL initial BWP configuration | | 1,2,3 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1,2,3 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1,2,3 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1,2,3 |  | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1,2,3 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1,2,3 |  | CR.3.1 TDD |  |
| Dedicated CORESET Reference Channel | | 1,2,3 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1,2,3 |  | OP.1 |  |
| CP length | | 1,2,3 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1,2,3 |  | TCI.State.0 |  |
| CSI-RS for tracking | | 1,2,3 |  | TRS.2.1 TDD |  |
| SSB Configuration | | 1,2,3 |  | SSB.1 FR2 |  |
| SMTC Configuration | | 1,2,3 |  | SMTC.3 |  |
| PRACH Configuration | | 1,2,3 |  | FR2 PRACH configuration 4 | A.3.8.3.4 |
| DRX configuration | | 1,2,3 |  | OFF |  |
| CSI-RS configuration for BFD/CBD/RLM | | 1,2,3 |  | CSI-RS.3.2 TDD | A.3.14.2 |
| CSI-RS index assigned as BFD RS (q0) | | 1,2,3 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) | | 1,2,3 |  | 1 |  |
| CSI-RS index assigned as RLM RS | | 1,2,3 |  | 0,1 |  |
| Beam failure detection transmission parameters | DCI format | 1,2,3 |  | 1-0 |  |
| Number of Control OFDM symbols | 1,2,3 |  | 2 |  |
| Aggregation level | 1,2,3 | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1,2,3 | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1,2,3 | dB | 0 |  |
| DMRS precoder granularity | 1,2,3 |  | REG bundle size |  |
| REG bundle size | 1,2,3 |  | 6 |  |
| Gap pattern ID | | 1,2,3 |  | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1,2,3 |  | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1,2,3 | dBm/SCS | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1,2,3 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1,2,3 |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1,2,3 |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1,2,3 |  | CSI-RS.3.1 TDD | A.3.14.2 |
| reportConfigType | | 1,2,3 |  | periodic |  |
| reportQuantity | | 1,2,3 |  | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1,2,3 | slot | 40 |  |
| CSI reporting offset | | 1,2,3 | slot | 4 |  |
| T310 | | 1,2,3 | ms | 1000 |  |
| N310 | | 1,2,3 |  | 2 |  |
| T1 | | 1,2,3 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1,2,3 | s | 1.17 |  |
| T3 | | 1,2,3 | s | 0.9 |  |
| T4 | | 1,2,3 | s | 0 |  |
| T5 | | 1,2,3 | s | 0.31 |  |
| D1 | | 1,2,3 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.14.5.5.X1.1-3: Cell specific test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.3.15 | | | | |
| Assumptpion for UE beams Note 10 | |  | Rough | | | | |
| 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 1,2,3 | dB | 5 Note 11 | -3 Note 11 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1,2,3 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| CSI-RS\_RP of set q1 | Config 1,2,3 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
|  | Config 1,2,3 | dBm/120 KHz | -104.7 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | | |
| 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 UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE 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 UEs 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 A.14.5.5.X1.1-1.  Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.  Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband | | | | | | | |

Table A.14.5.5.X1.1-4: Void

Table A.14.5.5.X1.1-5: Void



**Figure A.14.5.5.X1.1-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode**

##### A.14.5.5.X1.2 Test Requirements

The UE 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 UE 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 UE measures and evaluate beam candidate from beam candidate set q1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q1. The UE 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 UE. The rate of correct events observed during repeated tests shall be at least 90%.

#### A.14.5.5.X2 Beam Failure Detection and Link Recovery Test for FR2-2 PCell configured with CSI-RS-based BFD and LR in DRX mode

##### A.14.5.5.X2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q0 configured for a serving cell and that the UE 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 UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2-2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.14.5.5.X2.1-1, A.14.5.5.X2.1-2, A.14.5.5.X2.1-3, and A.14.5.5.X2.1-4 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 A.14.5.5.X2.1-1 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 A.14.5.5.X2.1-1 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 UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.14.5.5.X2.1-1: Supported test configurations for FR2-2 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 2 | TDD duplex mode, 480 kHz SSB SCS, 400 MHz bandwidth |
| 3 | TDD duplex mode, 960 kHz SSB SCS, 400 MHz bandwidth |

Table A.14.5.5.X2.1-2: General test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active PCell | | 1,2,3 |  | Cell 1 |  |
| RF Channel Number | | 1,2,3 |  | 1 |  |
| Duplex mode | | 1,2,3 |  | TDD |  |
| TDD Configuration | | 1,2,3 |  | TDDConf.3.1 |  |
| BWchannel | | 1 |  | 100: NRB,c = 66 |  |
| 2 |  | 400: NRB,c = 66 |  |
| 3 |  | 400: NRB,c = 33 |  |
| Data RBs allocated | | 1 |  | 66 |  |
| 2 |  | 66 |  |
| 3 |  | 33 |  |
| PDSCH/PDCCH subcarrier spacing | | 1 | kHz | 120 |  |
| 2 | kHz | 480 |  |
| 3 | kHz | 960 |  |
| DL initial BWP configuration | | 1,2,3 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1,2,3 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1,2,3 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1,2,3 |  | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1,2,3 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1,2,3 |  | CR.3.1 TDD |  |
| Dedicated CORESET Reference Channel | | 1,2,3 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1,2,3 |  | OP.1 |  |
| CP length | | 1,2,3 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1,2,3 |  | TCI.State.0 |  |
| CSI-RS for tracking | | 1,2,3 |  | TRS.2.1 TDD |  |
| SSB Configuration | | 1,2,3 |  | SSB.1 FR2 |  |
| SMTC Configuration | | 1,2,3 |  | SMTC.3 |  |
| PRACH Configuration | | 1,2,3 |  | FR2 PRACH configuration 4 | A.3.8.3.4 |
| DRX configuration | | 1,2,3 |  | DRX.3 | A.3.3.3 |
| CSI-RS configuration for BFD/CBD/RLM | | 1,2,3 |  | CSI-RS.3.2 TDD | A.3.14.2 |
| CSI-RS index assigned as BFD RS (q0) | | 1,2,3 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) | | 1,2,3 |  | 1 |  |
| CSI-RS index assigned as RLM RS | | 1,2,3 |  | 0,1 |  |
| Beam failure detection transmission parameters | DCI format | 1,2,3 |  | 1-0 |  |
| Number of Control OFDM symbols | 1,2,3 |  | 2 |  |
| Aggregation level | 1,2,3 | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1,2,3 | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1,2,3 | dB | 0 |  |
| DMRS precoder granularity | 1,2,3 |  | REG bundle size |  |
| REG bundle size | 1,2,3 |  | 6 |  |
| Gap pattern ID | | 1,2,3 |  | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1,2,3 |  | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1,2,3 | dBm/SCS | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1,2,3 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1,2,3 |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1,2,3 |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1,2,3 |  | CSI-RS.3.1 TDD | A.3.14.2 |
| reportConfigType | | 1,2,3 |  | periodic |  |
| reportQuantity | | 1,2,3 |  | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1,2,3 | slot | 40 |  |
| CSI reporting offset | | 1,2,3 | slot | 4 |  |
| T310 | | 1,2,3 | ms | 1000 |  |
| N310 | | 1,2,3 |  | 2 |  |
| T1 | | 1,2,3 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1,2,3 | s | 5.43 |  |
| T3 | | 1,2,3 | s | 5.16 |  |
| T4 | | 1,2,3 | s | 0 |  |
| T5 | | 1,2,3 | s | 0.31 |  |
| D1 | | 1,2,3 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.14.5.5.X2.1-3: Cell specific test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.3.15 | | | | |
| Assumption for UE beams Note 10 | |  | Rough | | | | |
| 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 1,2,3 | dB | 5 Note 11 | -3 Note 11 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1,2,3 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| CSI-RS\_RP of set q1 | Config 1,2,3 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
|  | Config 1,2,3 | dBm/120 KHz | -104.7 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | | |
| 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 UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE 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 UEs 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 A.14.5.5.X2.1-1.  Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.  Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.  Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband | | | | | | | |

Table A.14.5.5.X2.1-4: Void

Table A.14.5.5.X2.1-5: Void

Table A.14.5.5.X2.1-6: Void



**Figure A.14.5.5.X2.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

##### A.14.5.5.X2.2 Test Requirements

The UE 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 UE 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 UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q1. The UE 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 UE. The rate of correct events observed during repeated tests shall be at least 90%.

#### A.14.5.5.X3 Scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2-2 PCell configured with SSB-based BFD and LR in non-DRX mode

##### A.14.5.5.X3.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements in clause 8.5.7 and 8.5.8.

The test parameters are given in Tables A.14.5.5.X3.1-1, A.14.5.5.X3.1-2 and A.14.5.5.X3.1-3 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 A.14.5.5.X3.1-1 shows the variation of the downlink SNR of the SSB in set q0 in the active cell to emulate SSB based beam failure. Figure A.14.5.5.X3.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. This test will focus on the scheduling availability during beam failure detection) and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.14.5.5.X3.1-1: Supported test configurations for FR2-2 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

Table A.14.5.5.X3.1-2: General test parameters for FR2-2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active PCell | | 1-2 |  | Cell 1 |  |
| RF Channel Number | | 1-2 |  | 1 |  |
| Duplex mode | | 1-2 |  | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 |  |
| BWchannel | | 1-2 |  | 100: NRB,c = 66 |  |
| Data RBs allocated | | 1-2 |  | 66 |  |
| PDSCH/PDCCH subcarrier spacing | | 1-2 | kHz | 120 |  |
| DL initial BWP configuration | | 1-2 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1-2 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1-2 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1-2 |  | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1 |  | SR.3.2 TDD |  |
| 2 | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1 |  | CR.3.1 TDD |  |
| 2 | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1 |  | CCR.3.1 TDD |  |
| 2 | CCR.3.7 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 |  |
| CP length | | 1-2 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-2 |  | TCI.State.0 |  |
| CSI-RS for tracking | | 1-2 |  | TRS.2.1 TDD |  |
| SSB Configuration | | 1 |  | SSB.1 FR2 |  |
| 2 | SSB.2 FR2 |  |
| SMTC Configuration | | 1-2 |  | SMTC.1 |  |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 2 | A.3.8.3.2 |
| DRX configuration | | 1-2 |  | OFF |  |
| SSB index assigned as BFD RS (q0) | | 1-2 |  | 0 |  |
| SSB index assigned as CBD RS (q1) | | 1-2 |  | 1 |  |
| Beam failure detection transmission parameters | DCI format | 1-2 |  | 1-0 |  |
| Number of Control OFDM symbols | 1-2 |  | 2 |  |
| Aggregation level | 1-2 | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1-2 | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1-2 | dB | 0 |  |
| DMRS precoder granularity | 1-2 |  | REG bundle size |  |
| REG bundle size | 1-2 |  | 6 |  |
| Gap pattern ID | | 1-2 |  | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1 | dBm/SCS | -95 | Threshold used for Qin\_LR\_SSB |
| 2 | -92 |
| powerControlOffsetSS | | 1-2 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD |  |
| reportConfigType | | 1-2 |  | periodic |  |
| reportQuantity | | 1-2 |  | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1-2 | slot | 40 |  |
| CSI reporting offset | | 1-2 | slot | 4 |  |
| T310 | | 1-2 | ms | 1000 |  |
| N310 | | 1-2 |  | 2 |  |
| T1 | | 1-2 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-2 | s | 2.6 |  |
| T3 | | 1-2 | s | 1.64 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 1.01 |  |
| D1 | | 1-2 | s | 0.97 |  |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.  Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.14.5.5.X3.1-3: Cell specific test parameters for FR2-2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA Setup | |  | Setup1 defined in A.3.15.1 | | | | |
| Assumption for UE beams Note 10 | |  | Rough | | | | |
| 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\_SSB of set q0 | Config 1-2 | dB | 5Note 11 | -3Note 11 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-2 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| SSB\_RP of set q1 | Config 1 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
| Config 2 | -101.5 | -101.5 | -81.5 | -81.5 | -81.5 |
|  | Config 1-2 | dBm/120 kHz | -104.7 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | | |
| 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 UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE 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 UEs other than the device under test as part of OCNG.  Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.14.5.5.X3.1-1.  Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.  Note 10: Information about types of UE beam given in B.2.1.3 and does not limit UE implementation or test system implementation  Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband. | | | | | | | |

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**Figure A.14.5.5.X3.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

##### A.14.5.5.X3.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

<End of Changes>