3GPP TSG-RAN WG4 Meeting #104-e R4-221xxxx

Electronic Meeting, 15th – 26th Aug., 2022

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.6.0** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Big CR for NR UE power saving enh (Rel-17) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MediaTek Inc. | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_UE\_pow\_sav\_enh-Perf | | | | |  | ***Date:*** | | | 2022-08-30 |
|  |  | | | |  | |  | | |  |
| ***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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Add the following CR endorced in RAN4 #104-e meeting, for the test cases of Rel-17 NR UE Power Saving Enhancements.   |  |  |  | | --- | --- | --- | | R4-2215060 | CR on TS38.133 for relaxed RLM test for FR1 PSCell configured with SSB-based RLM RS in EN-DC mode (A.4.5.1.X) | MediaTek inc. | | R4-2214887 | Draft CR on RRM test case for RLM relaxation based on SSB in FR2 for EN-DC | CATT | | R4-2214947 | [darftCR] SSB based BFD and and LR for FR2 PSCell (TC 13) | ZTE Corporation | | R4-2214949 | Draft CR on TS38.133 for relaxed RLM test for FR1 Pcell configured with CSI-RS-based RLM in NR SA mode | CMCC | | R4-2214948 | draftCR on TC for CSI-RS-based BFD and LR | Nokia, Nokia Shanghai Bell | | | | | | | | | |
|  | | . | | | | | | | | |
| ***Summary of change:*** | | * **Change#1**: introduce a new DRX configuration with 80 ms periodicity (R4-2214949) * **Change#2**:introduce a new clause of test cases for RLM SSB in FR1 EN-DC (R4-2215060) * **Change#3**: introduce a new clause of test cases for RLM SSB in FR2 EN-DC (R4-2214887) * **Change#4**: introduce a new clause of test cases for BFD SSB in FR2 EN-DC (R4-2214947) * **Change#5**: introduce a new clause of test cases for RLM CSI-RS in FR1 NR-SA (R4-2214949) * **Change#6**: introduce a new clause of test cases for BFD CSI-RS in FR2 NR-SA (R4-2214948) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The test cases are missing for the UEs with RLM/BFD relaxation in R17. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | (new) A.3.3.X1, (new) A.4.5.1.X2, (new) A.5.5.1.X3, (new) A.5.5.5.X4, (new) A.6.5.1.X5, (new) A.7.5.5.X6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

---------------------------------------- Beginning of 1st Change -------------------------------------------------

A.3.3.X1 DRX Configuration X1: DRX cycle = 80 ms and TAT = Infinity

**Table A.3.3.X1-1: DRX.X1: DRX cycle = 80 ms and time alignment timer (TAT) = Infinity**

|  |  |
| --- | --- |
| **Field** | **Value** |
| drx-onDurationTimer | 6 ms |
| drx-InactivityTimer | 1 ms |
| drx-RetransmissionTimerDL | 1 slot |
| drx-RetransmissionTimerUL | 1 slot |
| drx-LongCycleStartOffset | 80 ms |
| shortDRX | disable |
| TimeAlignmentTimer | Infinity |
| Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2] | |

------------------------------------------------ End of 1st Change -------------------------------------------------

---------------------------------------- Beginning of 2nd Change -------------------------------------------------

#### A.4.5.1.X2 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

##### A.4.5.1.X2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements specified in clause 8.1.2.4 for UE fulfilling good serving cell quality criterion and low mobility criterion, if configured.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to ‘*rlf*’. Supported test configurations are shown in table A.4.5.1.X2.1-1. The test parameters are given in Tables A.4.5.1.X2.1-2 and A.4.5.1.X2.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.X2.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI 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.4.5.1.X2.1-1: Supported test configurations for FR1 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Table A.4.5.1.X2.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
|  | | |  | Test 1 |
| Active E-UTRA PCell | | |  | Cell 1 |
| E-UTRA RF Channel Number | | |  | 1 |
| Active PSCell | | |  | Cell 2 |
| RF Channel Number | | |  | 2 |
| Duplex mode | | Config 1, 4 |  | FDD |
|  | | Config 2, 3, 5, 6 |  | TDD |
| BWchannel | | Config 1, 4 | MHz | 10: NRB,c = 52 |
|  | | Config 2, 5 |  | 10: NRB,c = 52 |
|  | | Config 3, 6 |  | 40: NRB,c = 106 |
| DL initial BWP configuration | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | Config 1, 2, 3, 4, 5, 6 |  | DLBWP.1.1 |
| UL initial BWP configuration | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | Config 1, 2, 3, 4, 5, 6 |  | ULBWP.1.1 |
| TDD | | Config 1, 4 |  | Not Applicable |
| Configuration | | Config 2, 5 |  | TDDConf.1.1 |
|  | | Config 3, 6 |  | TDDConf.2.1 |
| CORESET | | Config 1, 4 |  | CR.1.1 FDD |
| Reference | | Config 2, 5 |  | CR.1.1 TDD |
| Channel | | Config 3, 6 |  | CR.2.1 TDD |
| SSB | | Config 1, 4 |  | SSB.1 FR1 |
| Configuration | | Config 2, 5 |  | SSB.1 FR1 |
|  | | Config 3, 6 |  | SSB.2 FR1 |
| SMTC | | Config 1, 2, 4, 5 |  | SMTC.1 |
| Configuration | | Config 3, 6 |  | SMTC.1 |
| PDSCH/PDCCH | | Config 1, 2, 4, 5 |  | 15 kHz |
| subcarrier spacing | | Config 3, 6 |  | 30 kHz |
| PRACH | | Config 1, 2, 4, 5 |  | Table A.3.8.2.1-1 |
| Configuration | | Config 3, 6 |  | Table A.3.8.2.1-1 |
| SSB index assigned as RLM RS | | |  | 0 |
| OCNG parameters | | |  | OP.1 |
| CP length | | |  | Normal |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |
| Out of sync | DCI format | |  | 1-0 |
| transmission parameters | Number of Control OFDM symbols | |  | 2 |
|  | Aggregation level | | CCE | 8 |
|  | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | | dB | 4 |
|  | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | | dB | 4 |
|  | DMRS precoder granularity | |  | REG bundle size |
|  | REG bundle size | |  | 6 |
| DRX Configuration | | |  | DRX.3 |
| Gap pattern ID | | |  | N.A. |
| Layer 3 filtering | | |  | Enabled |
| T310 timer | | | ms | 0 |
| T311 timer | | | ms | 1000 |
| N310 | | |  | 1 |
| N311 | | |  | 1 |
| CSI-RS for CSI | | Config 1, 4 |  | CSI-RS.1.1 FDD |
| reporting | | Config 2, 5 |  | CSI-RS.1.1 TDD |
|  | | Config 3, 6 |  | CSI-RS.2.1 TDD |
| CSI-RS for | | Config 1, 4 |  | TRS.1.1 FDD |
| tracking | | Config 2, 5 |  | TRS.1.1 TDD |
|  | | Config 3, 6 |  | TRS.1.2 TDD |
| T1 | | | s | 5.2 |
| T2 | | | s | 0.68 |
| T3 | | | s | 2.48 |
| D1 | | | s | 2.44 |
| 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.  Note 3: E-UTRAN is in non-DRX mode under test. | | | | |

Table A.4.5.1.X2.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
|  | |  | T1 | T2 | T3 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| 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 | 0 | | |
| 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 on | Config 1, 4 | dB | 1 | 1 | -15 |
| RLM-RS | Config 2, 5 |  | 1 | 1 | -15 |
|  | Config 3, 6 |  | 1 | 1 | -15 |
|  | Config 1, 4 | dBm/15kHz | -98 | | |
|  | Config 2, 5 |  | -98 | | |
|  | Config 3, 6 |  | -98 | | |
|  | Config 1, 4 | dBm/SCS | -98 | | |
|  | Config 2, 5 |  | -98 | | |
|  | Config 3, 6 |  | -95 | | |
| goodServingCellEvaluationRLM | |  | configured | | |
| offset in goodServingCellEvaluationRLM | | dB | Not configured | | |
| goodServingCellEvaluationRLM | | dB | 0 | | |
| s-SearchDeltaP-Connected | | dB | 3 | | |
| t-SearchDeltaP-Connected | | s | 5 | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.X2.1-1.  Note 5: 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 A.3.6. | | | | | |

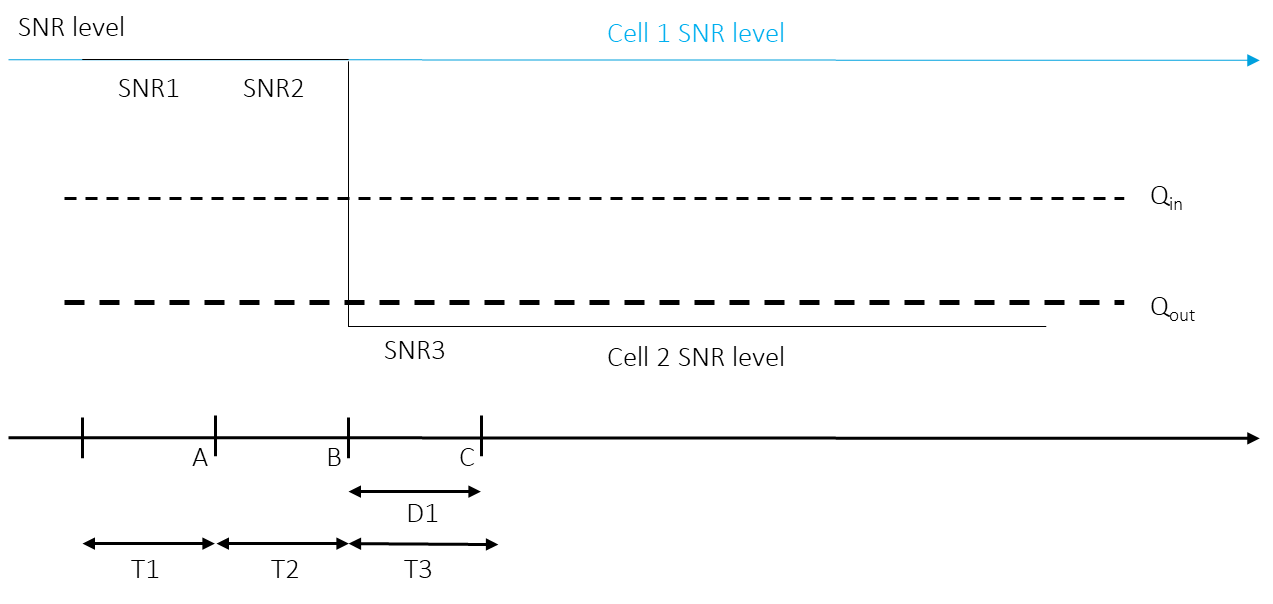


Figure A.4.5.1.X2.1-1: SNR variation for out-of-sync testing

A.4.5.1.X2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

------------------------------------------------ End of 2nd Change ------------------------------------------------

---------------------------------------- Beginning of 3rd Change -------------------------------------------------

#### A.5.5.1.X3 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

##### A.5.5.1.X3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.2.4 for UE fulfilling good serving cell quality criterion.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to ‘*rlf*’. Supported test configurations are shown in table A.5.5.1.X3.1-1. The test parameters are given in Tables A.5.5.1.X3.1-2, and A.5.5.1.X3.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.X3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI 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.5.5.1.X3.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

Table A.5.5.1.X3.1-2: General test parameters for FR2 out-of-sync testing for UE fulfilling relaxed measurement criterion

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| **Test 1** |
| Active E-UTRA PCell | | |  | Cell 1 |
| E-UTRA RF Channel Number | | |  | 1 |
| Active PSCell | | |  | Cell 2 |
| RF Channel Number | | |  | 2 |
| Duplex mode | | Config 1, 2 |  | TDD |
| BWchannel | | Config 1, 2 |  | 100: NRB,c = 66 |
| Data RBs allocated | | Config 1, 2 |  | 66 |
| DL initial BWP configuration | | Config 1, 2 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | Config 1, 2 |  | DLBWP.1.1 |
| UL initial BWP configuration | | Config 1, 2 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | Config 1, 2 |  | ULBWP.1.1 |
| TDD Configuration | | Config 1, 2 |  | TDDConf.3.1 |
| RMSI CORESET Reference Channel | | Config 1, 2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | | Config 1, 2 |  | CCR.3.4 TDD |
| SSB Configuration | | Config 1, 2 |  | SSB.1 FR2 |
| SMTC Configuration | | Config 1, 2 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 |  | 120 KHz |
| PRACH Configuration | | Config 1, 2 |  | Table A.3.8.3.4 |
| SSB index assigned as RLM RS | | Config 1, 2 |  | 0 |
| OCNG parameters | | |  | OP.1 |
| CP length | | |  | Normal |
| Out of sync transmission parameters | DCI format | |  | 1-0 |
| Number of Control OFDM symbols | |  | 2 |
| Aggregation level | | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | | dB | 4 |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | | dB | 4 |
| DMRS precoder granularity | |  | REG bundle size |
| REG bundle size | |  | 6 |
| DRX Configuration | | |  | DRX.3 |
| Gap pattern ID | | |  | N.A. |
| Layer 3 filtering | | |  | *Enabled* |
| T310 timer | | | ms | *0* |
| T311 timer | | | ms | 1000 |
| N310 | | |  | 1 |
| N311 | | |  | 1 |
| CSI-RS for CSI reporting | | Config 1, 2 |  | CSI-RS.3.1 TDD |
| reportConfigType | | |  | periodic |
| reportQuantity | | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | | slot | 40 |
| CSI reporting offset | | | slot | 4 |
| TCI states for PDCCH/PDSCH | | |  | TCI.State.2 |
| CSI-RS for tracking | | Config 1, 2 |  | TRS.2.1 TDD |
| T1 | | | s | 0.2 |
| T2 | | | s | 14.48 |
| T3 | | | s | 28.88 |
| D1 | | | s | 28.84 |
| 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.  Note 3: E-UTRAN is in non-DRX mode under test. | | | | |

Table A.5.5.1.X3.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests for UE fulfilling relaxed measurement criterion

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
|  | |  | T1 | T2 | T3 |
| AoA setup | |  | Setup 1 defined in A.3.15 | | |
| Assumption for UE beamsNote 5 | |  | Rough | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| 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 | 0 | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |  | | |
| EPRE ratio of OCNG DMRS to SSS | | dB |  | | |
| EPRE ratio of OCNG to OCNG DMRS | | dB |  | | |
| ssb-Index 0 SNR | Config 1, 2 | dB | 2Note 6 | 2Note 6 | -15 |
|  | Config 1, 2 | dBm/15KHz | -104.7dBm | | |
| goodServingCellEvaluationRLM | |  | configured | | |
| offset in goodServingCellEvaluationRLM | | dB | Not configured | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: 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 A.3.6.  Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband | | | | | |

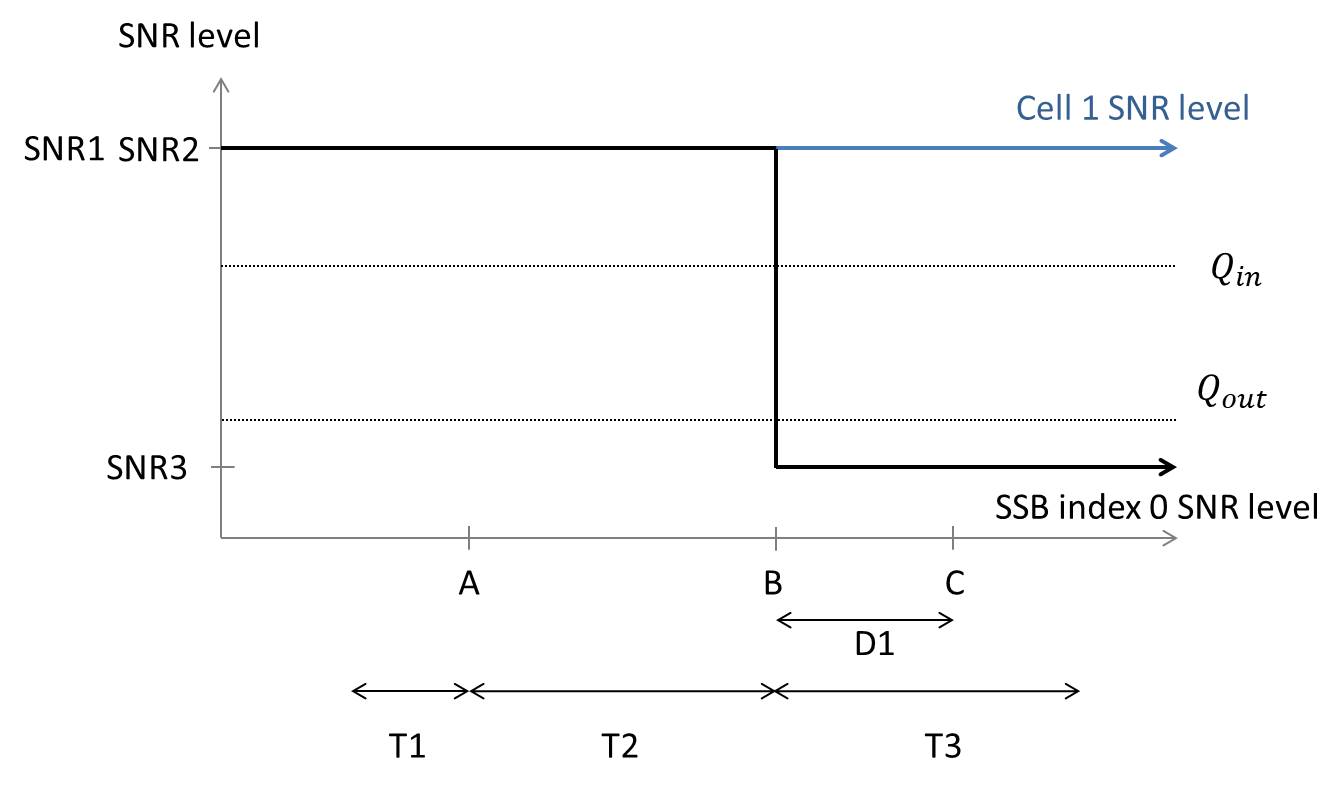


Figure A.5.5.1.X3.1-1: SNR variation for out-of-sync testing

##### A.5.5.1.X3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

------------------------------------------------ End of 3rd Change ------------------------------------------------

---------------------------------------- Beginning of 4th Change -------------------------------------------------

#### A.5.5.5.X4 Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in DRX mode for UE fulfilling relaxed measurement criterion

##### A.5.5.5.X4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.2.4 for UE fulfilling good serving cell quality criterion, if configured. *goodServingCellEvaluationBFD* [2] criterion is configured according to the parameters listed in Table A.7.5.5.X4.1-2.

The test parameters are given in Tables A.5.5.5.X4.1-1, A.5.5.5.X4.1-2 and A.5.5.5.X4.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.X4.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.X4.1-1 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 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCSell 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.5.5.5.X4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 2 | LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 3 | LTE FDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth |
| 4 | LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

Table A.5.5.5.X4.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active E-UTRA PCell | | 1-4 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-4 |  | 1 |  |
| Active PCell | | 1-4 |  | Cell 2 |  |
| RF Channel Number | | 1-4 |  | 2 |  |
| Duplex mode | | 1-4 |  | TDD |  |
| TDD Configuration | | 1-4 |  | TDDConf.3.1 |  |
| BWchannel | | 1-4 | MHz | 100: NRB,c = 66 |  |
| Data RBs allocated | | 1-4 |  | 66 |  |
| PDSCH/PDCCH subcarrier spacing | | 1-4 | kHz | 120 |  |
| DL initial BWP configuration | | 1-4 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1-4 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1-4 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1-4 |  | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD |  |
| 3-4 | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD |  |
| 3-4 | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD |  |
| 3-4 | CCR.3.7 TDD |  |
| OCNG parameters | | 1-4 |  | OP.1 |  |
| CP length | | 1-4 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-4 |  | TCI.State.0 |  |
| CSI-RS for tracking | | 1-4 |  | TRS.2.1 TDD |  |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 |  |
| 3-4 | SSB.2 FR2 |  |
| SMTC Configuration | | 1-4 |  | SMTC.3 |  |
| PRACH Configuration | | 1-4 |  | FR2 PRACH configuration 2 | A.3.8.3.2 |
| DRX configuration | | 1-4 |  | [DRX.3] | A.3.3.3 |
| SSB index assigned as BFD RS (q0) | | 1-4 |  | 0 |  |
| SSB index assigned as CBD RS (q1) | | 1-4 |  | 1 |  |
| SSB index assigned as RLM RS | | 1-4 |  | 0,1 |  |
| Beam failure detection transmission parameters | DCI format | 1-4 |  | 1-0 |  |
| Number of Control OFDM symbols | 1-4 |  | 2 |  |
| Aggregation level | 1-4 | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1-4 | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1-4 | dB | 0 |  |
| DMRS precoder granularity | 1-4 |  | REG bundle size |  |
| REG bundle size | 1-4 |  | 6 |  |
| Gap pattern ID | | 1-4 |  | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1-4 |  | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -95 | Threshold used for Qin\_LR\_SSB |
| 3-4 | -92 |
| powerControlOffsetSS | | 1-4 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-4 |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1-4 |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-4 |  | CSI-RS.3.1 TDD |  |
| reportConfigType | | 1-4 |  | periodic |  |
| reportQuantity | | 1-4 |  | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1-4 | slot | 40 |  |
| CSI reporting offset | | 1-4 | slot | 4 |  |
| T310 | | 1-4 | ms | 1000 |  |
| N310 | | 1-4 |  | 1 |  |
| T1 | | 1-4 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-4 | s | [3.37] |  |
| T3 | | 1-4 | s | [5.56] |  |
| T4 | | 1-4 | s | 0 |  |
| T5 | | 1-4 | s | 0.61 |  |
| D1 | | 1-4 | s | 0.57 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.5.5.5.X4.1-3: Cell specific test parameters for FR2 PSCell for SSB-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 beamsNote 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 1-4 | dB | 6Note 11 | 6Note 11 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-4 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| SSB\_RP of set q1 | Config 1-2 | dBm/ | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
|  | Config 3-4 | SCS | -101.5 | -101.5 | -81.5 | -81.5 | -81.5 |
|  | Config 1-4 | dBm/120 KHz | -104.7 | | | | |
| goodServingCellEvaluation |  | dB | 4 | | | | |
| 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.5.5.5.X4.1-1.  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 | | | | | | | |

****

**Figure A.5.5.5.X4.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode**

##### A.5.5.5.X4.2 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 initiate 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 = 560+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%.

------------------------------------------------ End of 4th Change ------------------------------------------------

---------------------------------------- Beginning of 5th Change -------------------------------------------------

A.6.5.1.X5 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM for UE fulfilling relaxed measurement criterion

A.6.5.1.X5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.3.4 for UE fulfilling good serving cell quality criterion.

The test parameters are given in Tables A.6.5.1.X5.1-1, A.6.5.1.X5.1-2, and A.6.5.1.X5.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.X5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. 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. 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. In the test, SSB0 is configured as the BFD-RS.

**Table A.6.5.1.X5.1-1: Supported test configurations for FR1 PCell**

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth |
| 3 | TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.X5.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
|  | |  | **Test 1** |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
|  | Config 2, 3 |  | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
|  | Config 2 |  | TDDConf.1.1 |
|  | Config 3 |  | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
|  | Config 2 |  | CR.1.1 TDD |
|  | Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.3 FDD |
|  | Config 2 |  | CCR.1.3 TDD |
|  | Config 3 |  | CCR.2.2 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
|  | Config 2 |  | SSB.1 FR1 |
|  | Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
|  | Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
|  | Config 3 |  | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
|  | Config 2 |  | TRS.1.1 TDD |
|  | Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
|  | Config 2 |  | Resource #4 in TRS.1.1 TDD |
|  | Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State. 2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync 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 | 4 |
|  | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
|  | DMRS precoder granularity |  | REG bundle size |
|  | REG bundle size |  | 6 |
| DRX | |  | [DRX.X1] |
| Gap pattern ID | |  | N.A. |
| Layer 3 filtering | |  | Enabled |
| T310 timer | | ms | 0 |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS configuration for CSI reporting | Config 1 |  | CSI-RS.1.1 FDD |
|  | Config 2 |  | CSI-RS.1.1 TDD |
|  | Config 3 |  | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 2.48 |
| T3 | | s | 4.88 |
| D1 | | s | 4.84 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

**Table A.6.5.1.X5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | | |
|  | |  | **T1** | **T2** | **T3** |
| EPRE ratio of PDCCH DMRS to SSSPDCCH\_beta | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRSPDCCH\_DMRS\_beta | | dB | 4 | | |
| EPRE ratio of PBCH DMRS to SSSPBCH\_beta | | dB | 0 | | |
| EPRE ratio of PBCH to PBCH DMRSPSS\_beta | | dB |  | | |
| EPRE ratio of PSS to SSSSSS\_beta | | dB |  | | |
| EPRE ratio of PDSCH DMRS to SSS PDSCH\_beta | | 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 on RLM-RS | Config 1 | dB | 1 | 1 | -15 |
|  | Config 2 |  | 1 | 1 | -15 |
|  | Config 3 |  | 1 | 1 | -15 |
|  | Config 1 | dBm/15kHz | -98 | | |
|  | Config 2 |  | -98 | | |
|  | Config 3 |  | -98 | | |
| goodServingCellEvaluationRLM | |  | configured | | |
| offset in goodServingCellEvaluationRLM | | dB | Not configured | | |
| 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 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: Measurement gap configuration is assigned to the UE prior to the start of time period T1.  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 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.7.1-1.  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 specified in clause A.3.6.1.1. | | | | | |

****

**Figure A.6.5.1.X5.1-1: SNR variation for CSI-RS out-of-sync testing**

A.6.5.1.X5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

------------------------------------------------ End of 5th Change ------------------------------------------------

---------------------------------------- Beginning of 6th Change -------------------------------------------------

#### A.7.5.5.X6 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode for UE fulfilling relaxed measurement criterion

##### A.7.5.5.X6.1 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 serving cell requirements in clause 8.5.3.4 for UE fulfilling good serving cell quality relaxed measurement criteria. The test parameters are given in Tables A.7.5.5.X6.1-1, A.7.5.5.X6.1-2, A.7.5.5.X6.1-3, and A.7.5.5.X6.1-4 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.7.5.5.X6.1-1 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.7.5.5.X6.1-1 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 5ms. 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.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for both low mobility and good serving cell quality defined in clause 5.7.13.2 in TS 38.331 [2]. At the beginning of T1, the UE has fulfilled the good serving cell quality relaxation measurements criterion and is performing relaxed measurements for beam failure detection.

* *goodServingCellEvaluationBFD* [2] criterion is configured according to the parameters listed in Table A.7.5.5.X6.1-2;
* *lowMobilityEvalutationcConnected* [2] criterion is configured according to the parameters listed in Table A.7.5.5.X6.1-2.

Table A.7.5.5.X6.1-1: Supported test configurations for FR2 PCell

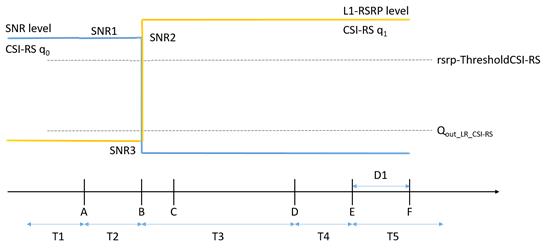
|  |  |
| --- | --- |
| Configuration | Description |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |

Table A.7.5.5.X6.1-2: General test parameters for FR2 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 |  | Cell 1 |  |
| RF Channel Number | | 1 |  | 1 |  |
| Duplex mode | | 1 |  | TDD |  |
| TDD Configuration | | 1 |  | TDDConf.3.1 |  |
| BWchannel | | 1 |  | 100: NRB,c = 66 |  |
| Data RBs allocated | | 1 |  | 66 |  |
| PDSCH/PDCCH subcarrier spacing | | 1 | kHz | 120 |  |
| DL initial BWP configuration | | 1 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | 1 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | 1 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | 1 |  | ULBWP.1.1 |  |
| PDSCH Reference Channel | | 1 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1 |  | CR.3.1 TDD |  |
| Dedicated CORESET Reference Channel | | 1 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1 |  | OP.1 |  |
| CP length | | 1 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1 |  | TCI.State.0 |  |
| CSI-RS for tracking | | 1 |  | TRS.2.1 TDD |  |
| SSB Configuration | | 1 |  | SSB.1 FR2 |  |
| SMTC Configuration | | 1 |  | SMTC.3 |  |
| PRACH Configuration | | 1 |  | FR2 PRACH configuration 4 | A.3.8.3.4 |
| DRX configuration | | 1 |  | DRX.3 | A.3.3.3 |
| CSI-RS configuration for BFD/CBD/RLM | | 1 |  | CSI-RS.3.2 TDD | A.3.14.2 |
| CSI-RS index assigned as BFD RS (q0) | | 1 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) | | 1 |  | 1 |  |
| CSI-RS index assigned as RLM RS | | 1 |  | 0,1 |  |
| Beam failure detection transmission parameters | DCI format | 1 |  | 1-0 |  |
| Number of Control OFDM symbols | 1 |  | 2 |  |
| Aggregation level | 1 | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 1 | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 1 | dB | 0 |  |
| DMRS precoder granularity | 1 |  | REG bundle size |  |
| REG bundle size | 1 |  | 6 |  |
| Gap pattern ID | | 1 |  | N/A |  |
| rlmInSyncOutOfSyncThreshold | | 1 |  | absent | Value 0 is applied. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1 | dBm/SCS | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1 |  | n1 | see TS 38.321 [7], clause 5.17 |
| beamFailureDetectionTimer | | 1 |  | pbfd4 | see TS 38.321 [7], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1 |  | CSI-RS.3.1 TDD | A.3.14.2 |
| reportConfigType | | 1 |  | periodic |  |
| reportQuantity | | 1 |  | cri-RI-PMI-CQI |  |
| CSI reporting periodicity | | 1 | slot | 40 |  |
| CSI reporting offset | | 1 | slot | 4 |  |
| T310 | | 1 | ms | 1000 |  |
| N310 | | 1 |  | 1 |  |
| offset | | 4 | dB | N/A | *offset* in goodServingCellEvaluationBFD |
| s-SearchDeltaP-Connected | | 1 | dB | 6 | Used to determine if low mobility relaxed criterion is fulfilled |
| t-SearchDeltaP-Connected | | 1 | s | 5 | Used to determine if low mobility relaxed criterion is fulfilled |
| T1 | | 1 | s | [6] | The UE shall be fully synchronized to cell 1 during T1. UE is performing relaxed measurements for BFD. |
| T2 | | 1 | s | [3.6] |  |
| T3 | | 1 | s | [9.64] |  |
| T4 | | 1 | s | 0 |  |
| T5 | | 1 | s | 0.31 |  |
| D1 | | 1 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

Table A.7.5.5.X6.1-3: Cell specific test parameters for FR2 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 | dB | 5 Note 11 | 5 Note 11 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | 0.2 | 0.2 | 20.2 | 20.2 | 20.2 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS | -104.5 | -104.5 | -84.5 | -84.5 | -84.5 |
|  | Config 1 | 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.7.5.5.4.1-1.  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 | | | | | | | |

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**Figure A.7.5.5.X6.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

##### A.7.5.5.X6.2 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, and exit from relaxed measurements. 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%.

------------------------------------------------ End of 6th Change ------------------------------------------------